POLICY RESEARCH WORKING PAPER 2868

Universal(ly Bad) Service

Providing Infrastructure Services to Rural and Poor Urban Consumers

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The World Bank
Development Research Group
Regulation and Competition Policy
July 2002

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Abstract

Until recently, utility services (telecommunications, power, water, and gas) throughout the world were provided by large, usually state-owned, monopolies. However, encouraged by technological change, regulatory innovation, and pressure from international organizations, many developing countries are privatizing state-owned companies and introducing competition. Some observers worry that even if reforms improve efficiency, they might compromise an important public policy goal—ensuring "universal access" for low-income and rural households.

Clarke and Wallsten review the motivation for universal service, methods used to try to achieve it under monopoly service provision, how reforms might affect these approaches, and the theoretical and empirical evidence of the impact of reform on these consumers. Next, using household data from around the world, they investigate empirically the historical performance of public monopolies in meeting universal service obligations and the impact of reform.

The results show the massive failure of state monopolies to provide service to poor and rural households everywhere except Eastern Europe. Moreover, while the data are limited, the evidence suggests that reforms have not harmed poor and rural consumers, and in many cases have improved their access to utility services. Nevertheless, because competition undermines traditional methods of funding universal service objectives (cross-subsidies), the authors also review mechanisms that could finance these objectives without compromising the benefits of reforms.

This paper—a product of Regulation and Competition Policy, Development Research Group—is a background paper for the Policy Research Report on *The Regulation of Infrastructure*. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Paulina Sintim-Aboagye, room MC3-422, telephone 202-473-8526, fax 202-522-1155, email address psintimaboagye@worldbank.org. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The authors may be contacted at gclarke@worldbank.org or swallsten@worldbank.org. July 2002. (54 pages)

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I. INTRODUCTION

Although much of the discussion about regulatory reform and privatization of infrastructure has focused on efficiency, distributional issues have strongly influenced public policy towards infrastructure in both developed and developing economies. Most countries specify universal access to certain infrastructure utilities, including telecommunications, electricity, and piped water and sewerage, as a public policy goal. Specific laws and objectives differ by country and by industry, but the general goal is to ensure access for all people at affordable prices. Most universal access laws and regulations have a geographic component meant to promote service in rural areas and a targeted component meant to help the poor afford service. At least in theory, countries traditionally financed these obligations through cross-subsidies: low-cost and high-income consumers paid prices above cost to subsidize high-cost and low-income consumers, who paid prices below cost.

Some observers have worried that even if privatization and competition in infrastructure utilities increase efficiency and improve average consumer coverage, such reforms could hurt the poor in at least two ways. First, new market structures, including competition, make cross subsidies difficult to maintain and raise the possibility that private firms will "cream skim"—serve the most profitable customers and ignore the unprofitable ones (i.e., poor and rural consumers). Second, reforms often necessitate "tariff rebalancing"—increased prices in order to cover costs. Even if such rebalancing is necessary to ensure viable service over time, higher prices could make service increasingly unaffordable for the poor.

This paper reviews the evidence on universal access in developing countries. We first discuss the rationale for universal access laws and review the different ways subsidies can be financed and allocated, along with the implications of those various methods. We then evaluate the historical effectiveness of monopoly enterprises in providing service to the poor and how privatization has affected coverage.

We find, overall, little evidence that subsidies have, in fact, been used to meet universal service goals under monopoly provision: outside of Eastern Europe, infrastructure connections to rural areas and the poor are distressingly low. Moreover, many mechanisms ostensibly intended

to help the poor end up helping only the wealthy. Subsidized *service* prices, for example, tend to benefit the wealthy since they are more likely to be connected to the network and consume the service, while poor households without direct connections receive nothing.

The empirical evidence on the effect of reforms on the poor, meanwhile, is limited. Nonetheless, case studies and data gleaned from household surveys reveal some important trends. First, there is no evidence that reforms tend to hurt poor or rural consumers, at least in terms of access to service. Even when *service* prices increase, the share of poor and rural residents with connections does not generally decrease. In many cases coverage even increases, possibly because actual *connection* fees decrease once service is no longer rationed. Case studies reveal that allowing entry and competition in infrastructure can dramatically improve service to the poor—competition brings a range of price and quality options, making service possible to regions and income levels that a monopoly provider would never have considered.

However, it is also clear that laws and regulations must be carefully considered to ensure access to the poor. In particular, rules that appear to help the poor at first glance may, in fact, only help maintain monopoly profits. Firms (public and private), for example, often claim that they need some form of monopoly rights in order fund universal service obligations. Often these claims are self-serving, meant simply to block competition and bolster profits, not to help the poor. Competition, on the other hand, *does* break down the ability to cross-subsidize service. Countries therefore must turn to other methods to fund those who simply cannot afford service priced at cost when society believes everyone must be connected. If funding through general tax revenues is too difficult or costly, countries may consider, for example, universal service funds to which all firms contribute and from which they all may draw when providing service to the poor or to high-cost areas.

II. WHY DO COUNTRIES PROMOTE UNIVERSAL SERVICE?

Universal service policies are typically justified through a combination of three factors (Cremer *et al.* 1998a; b). First, externalities related to the consumption of infrastructure services might make it economically efficient to subsidize prices for low-income consumers. Second, infrastructure services might be 'merit' goods. Finally, political factors or regional development

goals may induce government to transfer resources to rural or low-income constituents. This section discusses these issues in turn.

Externalities

The most common justification for subsidizing infrastructure is that there are positive externalities associated with consuming some services. Positive externalities imply that the total benefits to the service exceed the benefits to the individual who receives the service. In other words, society benefits by more than does the individual recipient. If the private marginal cost of service exceeds the private marginal benefit, then individuals will consume less than the optimal amount since the *total* marginal benefit may exceed the costs. The externalities argument for subsidies is stronger in some infrastructure sectors than in others, with sewerage and piped water the most likely candidates, telecommunications less so, and only weakly, if at all, in electricity and gas.

The case for positive externalities necessitating subsidies is probably strongest for sewage removal and treatment. Improperly treated sewage can pollute the environment and spread disease to people other than those who produce the waste—especially if households dispose of their waste in public facilities (e.g., public waterways, parks, or roads). Further, if society values the individual health benefits associated with improved sewerage more than the individuals do—either because individuals underestimate the cost that communicable diseases have on the rest of society or because they are unable to fully assess the health risks associated with poor sewerage—there might be additional scope for subsidies.

It is also plausible that access to piped water has health benefits.[1] If society as a whole benefits more from an individual's improved health than does the individual, the individual may

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[1] In practice, the evidence for this is somewhat mixed. For example, Esrey (1996) finds that health benefits (in terms of diarrhea, child health and child weight) from improved sewerage are greater than the health benefits of improved water in Africa, Latin America and Asia. Further, although he does find some benefits associated with on-site (i.e., in house or compound) piped water, he finds no benefit from access to 'intermediate' facilities (i.e., public taps, hand pumps or wells). Jalan and Ravillion (2001) find that piped water reduces the prevalence and duration of diarrhea for children in India. However, they found that the benefits largely bypassed poor families and families with poorly educated women. They interpret their results to suggest that public action to promote health knowledge and reduce poverty should be combined with subsidies for infrastructure access.

undervalue piped water.[2] Consequently, if piped water is a normal good and the health benefits associated with piped water are greatest for low levels of consumption (e.g., water for drinking and cleaning), it would probably be reasonable to focus these subsidies on low income households by subsidizing basic access (e.g., through public standpipes or single household taps either indoors or in courtyards). However, if, as suggested by Esrey (1996), piped water only improves health outcomes when combined with improved access to high quality sewerage (i.e., flush toilets or water-seal latrines) then subsidies for basic access might have only modest health externalities.

In telecommunication services, "network externalities" mean that the benefits a new consumer accrues from connecting (the private benefits) are less than the total benefits to society, since everyone on the network benefits when an additional person connects. Because the private benefits from subscribing are less than the total benefits, individuals may not face a strong enough incentive to subscribe, thus requiring subsidies to induce subscription. However, ignoring for now the crucial question of whether subsidies actually successfully promote access, the argument that network externalities justify subsidies does not necessarily hold up under closer inspection.[3] First, even if the benefits to the new subscriber are less than the total benefits, the private benefit may still exceed the cost. Second, because its services become more valuable when more people are connected, the firm can capture some of the benefits from network externalities. Consequently, although network externalities are external to the individual, they are not necessarily external to the firms providing the service, potentially removing the need for subsidies. In other words, network externalities by themselves do not necessarily imply telephone under-subscription and a need for subsidies.

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[2] Note that to the extent that health benefits are internalized (i.e., that the costs of poor health are primarily borne by the individual or household that becomes sick) and that individuals are informed about the potential health costs of consuming untreated water, the health externalities associated with access to piped water are likely smaller than the total health benefits.

[3] See Cremer (1998b) for a more complete discussion of this issue.

Merit Goods

Even if infrastructure services generated no externalities, some services might be 'merit goods'—goods and services that society simply believes everyone should have. A policy decision that certain goods and services are more important than others for people to consume may come from a belief that society functions better when everyone has access to a minimum set of services or a concern that individuals are unable to accurately assess the private benefits of consuming these services.[4] If society is more concerned about consumption of merit goods than it is about the overall level of utility attained by poor individuals, subsidies for these goods might be preferable to direct monetary transfers (since people may choose to spend cash transfers on something other than the service society intended).

That some infrastructure services are merit goods and that society must ensure their provision is easily justified—people in cold climates will die without heat, for example. But the justification is less clear in other sectors, and it is not at all clear why universality is legally mandated in some sectors but not others. For example, why do so many countries have laws mandating universal access to telecommunications but not, say, health care? Universal service laws in telecommunications, it turns out, do not have their roots in the desire to ensure telephone access to all people: instead, they originated with a desire by the Bell company in the United States in the early twentieth century to stifle competition. "Universal service" did not mean that everyone should have a telephone, but that everyone who did should have a Bell telephone (Mueller 1997). In other words, in telecommunications universal service was meant to preserve monopoly profits, not to ensure service to everyone. As a result, laws to promote universal service in telecommunications have tended to benefit monopolists instead of consumers. Understanding the origins of these laws in the various sectors can lead to a clearer understanding of where universal service laws are justified and, where they are justified, the best ways to achieve their goals.

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[4] For example, it is sometimes argued that people might not fully appreciate the benefits of consuming clean water if they are unaware of the costs associated with consuming polluted water or unable to fully assess the risks associated with doing so (Shirley and Ménard 2002).

Nonetheless, economics has nothing to say about what *should* be a merit good, and a good deal of evidence suggests that many countries consider some goods and services provided by network industries, most notably heat and clean water, to be merit goods. Estache *et al.* (2001) note that pressure groups often demand access to utility services, suggesting that they believe those demands might have more political resonance than would demands for cash transfers. These groups appear to perceive that society values consumption of infrastructure services more than it values alternate uses of income by low-income households. In addition, vulnerable groups are often guaranteed access to utility services, suggesting that society wants to ensure some level of access independent of income. Federal health legislation from the 1930s prevents water companies in Mexico, for example, from completely disconnecting non-paying residential customers (Haggarty *et al.* 2001). In the telecommunications sector, many countries have explicit policies of promoting 'universal access' to telecommunication services—although these policies often remain unenforced.[5] For example, Madagascar has a policy of providing a phone in each village, Zambia has a policy of providing telephone booths in public places (e.g., schools and clinics), and Kenya has a policy of providing a phone within walking distance of all residences (International Telecommunications Union 1998, Table 4.5).[6] Legal requirements and explicit policies designed to guarantee or promote access to specific services suggests that utility services (especially water) are seen as more important than other goods or services.

Politics and regional development strategies

Government might wish to subsidize poor or rural consumers for political reasons or as part of a development strategy. For example, it may wish to subsidize service to the urban poor or to rural consumers because these groups have disproportionate political influence or to transfer resources to their supporters. To the extent that this promotes either efficiency or equity for the reasons outlined above, these transfers might appear relatively attractive. However, if subsidies are driven primarily by political reasons, they can end up hurting rural and low-income

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[5] International Telecommunications Union (1998, Table 4.5) lists universal access policies in 22 developing and transition economies.

[6] In practice, however, many of the countries included in the table had not put any legal obligations upon the operator to actually provide access in line with the stated policies (International Telecommunications Union 1998).

urban households, who may have little political influence. In this situation, wealthy households might benefit from tariffs set below cost, while poor households, who often remain unconnected, get nothing. As discussed below, studies from several developing countries have found that subsidies often benefit middle class and rich households while having little impact on low-income groups.

Politics often affect the distribution of subsidies even when subsidies were originally intended to promote equity. Once subsidies are introduced, they are often expanded to cover increasingly large portions of the population. For example, Boland and Whittington (2000) note that most water supply utilities subsidize much higher levels of water consumption than is necessary to meet basic needs. They note that although a household with five members would only need to consume between 4 and 5 cubic meters per month to meet internationally cited standards for basic water use, 15 of the 17 water utilities in Asia for which they had data subsidized more than this level of consumption, and five utilities subsidized over 20 cubic meters per month. In other words, the biggest beneficiaries of the subsidies were large consumers, who are more likely to be wealthy. Further, they note that users reach the highest tariffs at only very high rates of consumption—for example, about 80 times basic needs for a family with five members in La Paz, Bolivia (Boland and Whittington 2000).

In summary, efficiency, equity, and politics all explain the common practice of subsidizing infrastructure services to low-income and rural consumers, though the strength of these arguments varies considerably across services and countries. Justifying universal service, however, is usually easier than implementing it. The next sections detail methods of financing and distributing universal service subsidies.

III. Financing Universal Service Objectives

When society believes that everyone is entitled to a minimum set of services, subsides may be necessary. This section reviews methods of funding universal service obligations. These methods include cross-subsidies—the most common approach when a single firm provided service—and newer methods more consistent with competition and liberalization, such as universal service funds and auctions.

Cross Subsidies

Under monopoly provision (whether state- or privately-owned), cross-subsidies were the primary way of funding universal service obligations. Cross-subsidies imply that some users are charged prices above cost in order to subsidize other users who are charged prices below cost. Cross-subsidies have several problems. First, they are inherently inefficient—by separating price from cost they distort consumption and investment decisions. Second, they are typically not transparent, making it difficult to determine who receives subsidies and who funds them. Third, they do nothing to encourage service to high-cost regions or to the poor since the existence of monopoly profits from one group does not induce the firm to provide service to another group (Brook and Smith 2000). Whenever any class of users is charged prices below cost, suppliers will have little incentive—or, if the enterprise has cash-flow problems, ability—to serve these users. Consequently, although subsidies will increase users' incentives to obtain service, they decrease the suppliers' incentives to serve them. Fourth, to make matters worse, most cross-subsidy programs were not carefully designed to meet expansion goals in the first place (Chisari *et al.* 1999), and therefore it is not surprising that, as we will see below, they have been largely ineffective.

Even when subsidies can, in principle, promote efficiency, using *cross-subsidies* to pay for them may not be efficient. In fact, if positive externalities are present at all consumption levels, it might be inefficient to cross-subsidize service to low-income consumers by charging high-income consumers prices above cost. Although this policy would encourage low-income consumers to consume more of that service—if infrastructure services are ordinary goods—the higher prices would discourage high-income consumers from consuming the same service. Depending upon the relative price elasticities, cross-subsidies might therefore either increase or decrease total consumption of that service, with a similar impact on efficiency.

Despite the problems of cross subsidies, it is possible that they could be more efficient than other methods of raising funds in many developing countries. While lump-sum transfers from general tax revenues are, in theory, the most efficient means of subsidizing the people society wishes to help, the tax and transfer systems in developing and transition economies are themselves often distortionary and inefficient. For example, if countries rely heavily on tariffs or

export taxes, redistribution through cross-subsidizing infrastructure prices might not be less efficient than redistributing income through the tax and transfer system (Cremer *et al.* 1998a; b).

Despite the possibility of the relative efficiency of cross subsidies in certain circumstances, to the authors' knowledge no general equilibrium studies of developing countries have compared the relative inefficiency of the two methods of redistribution and, therefore, it is difficult to assess these claims. Further, despite this uncertainty, some policies such as restricting competition in telecommunications, a service used by relatively few low income households in most developing countries (see Table 1), in order to allow a monopoly provider to cross-subsidize consumption, are likely to be highly distortionary even in relative terms. Nonetheless, we will return to this issue below when discussing universal service funds—a method of funding service to the poor in the presence of competition.

An elusive goal: non-distortionary, inexpensive, and competitively neutral financing mechanisms

The disadvantages of cross-subsidies, however, do not change the fact that—even where competition is likely to reduce prices—some sort of intervention is probably necessary to achieve full coverage of low-income households, especially in high cost areas. For example, demand in some villages might be too low to support the cost of installing a payphone without subsidization. If low-income households are unwilling to pay the full cost of infrastructure services, subsidies might be required to ensure full coverage of vulnerable groups. Given that the empirical evidence that suggests that some low-income households in some countries appear to have limited willingness-to-pay for some infrastructure services, and that competition will make internal (firm-level) cross-subsidies difficult to maintain, governments will need to find new ways of financing service to low-income and rural households if universal service is to be a goal of public policy. Financing mechanisms should strive to be non-distortionary, inexpensive, and competitively neutral; that is, they should not distort consumption and investment decisions, should keep the cost of raising the funds low, and should not benefit one firm at the expense of others.

Mechanisms to support universal service are competitive neutral when one or several firms do not benefit or suffer relative to others in the industry. Non-neutrality would arise if one firm were obliged to provide universal service and raise funds for it while others were exempt

from these requirements. For example, in some cases, incumbent firms may end up with an advantage over potential competitors if they receive subsidies or are allowed to maintain monopolies over certain services (e.g., international service in the telecommunications sector) or in certain regions in order to meet universality conditions. In other cases, the incumbent could be disadvantaged if it is required to serve high-cost areas or low-income people while new entrants can choose to serve the most profitable customers without having to serve other less attractive customers.

Unfortunately, these policy goals are not entirely consistent with each other and present a difficult policy problem. It is not possible to simultaneously minimize distortion, expense, and ensure absolute competitive neutrality. And the point of universal access is not those three objectives; it is to maximize the number of people connected to the network. Regulators and policymakers should thus think of the problem as maximizing access subject to some maximum acceptable level of consumption and investment distortions and expense.

Two methods are typically proposed as ways to finance universal service obligations: through the country's general taxation system or through a universal service fund (USF). Economists typically suggest that subsidies should be financed through the general tax and transfer system and several developing countries have developed programs along these lines. For example, Argentina provides tariff subsidies to pensioners—a direct payment of $13.50 to each person who receives the minimum pension in order to pay for gas, electricity, and water (Chisari and Estache 1999). Although in theory this is the most efficient way to provide subsidies, there are practical problems associated with it. Taxation and redistribution systems in developing countries tend to be notoriously inefficient and ineffective; raising and distributing money through those systems are thus likely to be expensive relative to other methods (Chisari *et al.* 1999). Consequently, when this is the case, it may make more sense to fund service to low-income households and high-cost areas through the firms that provide service.

While taxing some services and firms to support others is another form of cross-subsidy, competition requires mechanisms that support multiple firms. Universal Service Funds (USFs) are just such mechanisms. All firms can be required to contribute to a universal service fund, and all firms that provide service should be eligible to receive funds from it. In theory, a USF

provides a wider tax base and potentially reduces the potential for 'cream skimming'(Cremer *et al.* 1998b). USFs also make the financing mechanism more transparent, less costly, and more competitively neutral than cross-subsidies (Intven and Tetrault 2000). A practical problem with these mechanisms, of course, is that someone must still determine who is eligible to receive subsidies and how large they should be.

How large should subsidies be?

One approach for determining the appropriate level of subsidies is to auction them; that is, firms can competitively bid for subsidies. In a fair bidding process with multiple bidders, firms will end up the smallest subsidy necessary for them to provide service. Auctions can be especially useful in rural areas with little or no existing service. Chile and Peru were among the first to implement this method, giving license to the operators that agreed to serve areas for the smallest subsidy (Cannock 2001). In Chile, the average winning subsidy from 1995-1999 was about half the maximum subsidy offered, while in Peru it only about one-quarter the subsidy offered (Intven and Tetrault 2000). These experiences have two important implications. First, the idea of auctioning subsidies is not merely a theoretical pipe dream—it has been successfully implemented in developing countries. Second, they reveal that the subsidies necessary to serve remote locations are probably far lower than monopolists had previously claimed. As long as regulators lack information on the true costs of providing service to remote areas—and regulators will always have less information than the firms—auctions can be an effective way to determine the true costs of providing service.

IV. WHO RECEIVES SUBSIDIES?

An important issue once funds are raised is how to distribute them most effectively to those in need. Another related question is how to identify who should benefit from the subsidies. As discussed above, universality laws typically have two components: subsidies to high-cost (typically rural) areas and to the poor. Each objective presents its own challenges and, as it turns out, each mechanism to achieve the goal has its own unintended consequences.

Rural areas

In developed countries, subsidies have tended to focus more on high cost, mainly rural, areas, with less emphasis on supporting the poor. Crandall and Waverman (2000) estimate that in 1998, the United States spent close to $2 billion subsidizing telecommunications in rural areas and only about $400 million subsidizing telecommunications for the poor ("lifeline" and "link-up" programs). Subsidies for high-cost urban and rural areas are also common in developing countries. For example, geographic price averaging—mandating uniform prices across the country—is common in telecommunications and postal services almost everywhere in the world.

Although these subsidies are sometimes explicit (e.g., direct subsidies for providers in rural areas), subsidies are often implicit, with a single company provide service and charging a uniform price across different regions regardless of cost. For example, in Côte d'Ivoire, a single (private) monopoly provides water services to over 400 towns, charging a uniform tariff. The main justification for this arrangement is that, in theory, it allows the company to subsidize service in high-cost small towns through the profits it earns in Abidjan, the largest city in Côte d'Ivoire (Ménard and Clarke 2002a).[7] Similar arrangements are relatively common in the water supply and sanitation sectors in Africa: Water Utilities Partnership (2000) reports that out of 48 countries where information was available, a single national company provided water supply services in 26 countries and a single company provided sanitation services in 25 countries.[8]

As discussed above, one problem with subsidizing service in high cost areas by keeping prices below cost is that while low prices will generally increase demand in these areas, they will simultaneously reduce providers' ability and incentive to serve those regions.[9] Even worse, potential competitors have no incentive to serve high-cost areas if they are forced to charge low prices to everyone who happens to live there regardless of their willingness and ability to pay.

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[7] Estimates from the late 1980s suggest that the long-run marginal cost of a cubic meter of water was about four times higher in the rest of the Côte d'Ivoire than in the largest city, Abidjan (World Bank 1990).

[8] Of course, cross-subsidies are possible between high and low-cost areas even with regional companies and some national companies charge different prices in different regions. However, in general, cross-subsidies are harder to observe and easier to provide when there is a single company providing service to the entire country.

[9] Note that this will be true for both cash-strapped state-owned utilities and profit maximizing regulated private

The result of a policy of geographic price averaging can easily be no service or only limited service.

There are many examples from developing countries where cross-subsidies have had this effect. For example, Wellenius (2000) notes that in the 1980s nearly 400,000 Brazilian farmers and rural cooperatives were willing to pay the full cost of obtaining telephone service, but the monopoly provider was not allowed to charge them more than it charged urban customers, with the result that the firm provided no service in these areas. Similarly, Ménard and Clarke (2002a) note that the national water supply enterprise in Côte d'Ivoire expanded service in the low-cost area (Abidjan) far more rapidly than it expanded service in higher cost secondary centers in the late 1980s and early 1990s.

Subsidies for high cost areas are problematic for both efficiency and equity reasons. Any program that redistributes wealth between groups will increase the welfare of the group receiving the subsidy at the expense of the other group. Cremer *et al* (1998a; 1998b) show that traditional methods of universal service provision in the telecommunications sector have been net welfare reducing. In addition to being inefficient, mechanisms to support high cost areas do not necessarily promote equity. Unless low-income households happen to be concentrated in high-cost areas and have infrastructure connections, they will not benefit from subsidies for high-cost areas. For example, in a study of universal service in the telecommunications sector in the United States, Rosston and Wimmer (2000) find that cost-based programs do a poor job of targeting subsidies to low-income households. Even though rural poverty is a serious problem in many developing countries, the extremely low level of infrastructure coverage in rural areas (see Table 2) makes it highly unlikely that poor households will be the main beneficiaries of redistribution to rural areas.

Targeting the poor

In addition to subsidies for rural areas, universal service laws typically also aim to make connections to the poor affordable. One problem with reaching this goal is finding ways to identify those eligible for subsidies. Several mechanisms can be used to target the poor, ranging

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utilities.

from the very precise to the very broad.[10] Each has its own advantages and disadvantages in terms of precision, cost, and unintended consequences. Common methods include identifying households and neighborhoods, and using "block tariffs" where initial usage is charged at lower rates than higher usage. Subsidies targeted at the poor can be much more effective at increasing the number of people connected than subsidies for entire regions. Eriksson *et al* (1998), for example, find no evidence that geographically based subsidies affect telephone coverage in the United States. In contrast, they find that targeted programs—that is, programs meant to help people who would have trouble paying for service—seem to positively affect coverage. They conclude that targeted programs are much more effective at increasing network connections than are geographically based subsidies. The next sections discuss various methods to target the poor.

Targeting Households

One common method of providing subsidies is to base them on the socio-demographic characteristics of the household. For example, in Chile, households receive subsidies based on the size and composition of the household, occupation and education of household head, household assets, income, and characteristics of the dwelling.[11] Although using household characteristics to target subsidies can precisely identify the poor, the mechanism has several drawbacks. First, it is expensive. Foster *et al.* (2000) estimated that it could cost about US $10/household to have social workers collect adequate information to identify low-income households in Panama.[12] This could become very expensive in low-income countries since these interviews would need to be performed every few years. The cost of data collection depends, of course, on the detail of the information collected—for example, it would be far less costly to rely on observable characteristics of the house (especially since characteristics of the house might change less frequently than socio-economic characteristics of the occupants of the house) rather

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[10] Foster *et al.* (2000) discuss this issue in greater detail.

[11] The actual process of assigning subsidies, which are paid directly to the water companies within each region who then subtract the amount from household bills is complicated, involving allocating subsidies first between regions based on household income in the region and then, within regions, between municipalities based on a points system. See Shirley *et al.* (2002) for a complete description.

[12] The criteria they identified included education level of household head, materials for housing construction and the presence of other infrastructure services.

than on details that would necessitate a household interview.[13] The drawback is that less data collected decreases the precision of the targeting. Second, it might be difficult to collect accurate data on household characteristics when interviewees know that their answers will affect the price they pay for infrastructure services. Problems with collecting accurate data are likely to be magnified in countries where corruption is a problem.

Targeting Neighborhoods

An alternative to basing subsidies on the socio-economic characteristics of the household is to base them upon the socio-economic characteristics of the neighborhood as a whole. Although this method relies upon some knowledge of socio-economic characteristics of households within the neighborhood, it could often be applied using data from a census or other household survey without having to perform household interviews. Even if recent census data or other household level data is not available, this method will still generally be less data intensive than interviewing every household applying for connections. Although in principle the approach could be used for both metered or unmetered connections, in practice it has generally been used for unmetered households.[14]

One drawback of this approach is that it will generally target households less precisely than would household surveys—some wealthy households living near poor neighborhoods will receive subsidies while some poor households living in wealthy neighborhoods will not (Foster *et al.* 2000). For example, Foster *et al.* (2000) found that if subsidies were targeted towards urban households in Panama in extreme poverty by paying subsidies for water use to all household in zones where more than 50 percent of the population were in extreme poverty and where telephone coverage was below 30 percent of the population, only 6 percent of households in extreme poverty would receive subsidies and that 31 percent of subsidies would be paid to

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[13] For example, in the 1990s in Buenos Aires, Argentina, unmetered residential households (which accounted for most households) were billed for water and sewerage based upon the location of the property, the area of the property, the area of property with construction on it, the type of construction (six categories) and the age of the property (Alcázar *et al.* 2002a).

[14] For example, this approach was used for water supply for unmetered properties in Mexico City in the early 1990s (Haggarty *et al.* 2001) and in Dar es Salaam, Tanzania.

households not in extreme poverty.[15] Further, targeted subsidies based on census data become more imprecise between censuses, especially when they take place infrequently. This source of imprecision is likely to be an especially large problem in fast-growing cities in developing countries. A second problem is that subsidies based upon geographic location are often opaque. This makes it easy to manipulate subsidies for political reasons, a problem that might also be problematic in countries where corruption is high.

Block Tariffs

A final way of subsidizing infrastructure services, at least when service is metered, is through block tariffs. Under this system, users are charged a low rate for the first units of consumption and progressively more for additional consumption. For example, users might be charged a low rate for initial units of electricity each month, but progressively more for additional kilowatts. The idea is that if infrastructure services are normal goods (i.e., poor users tend to consume less than wealthier users), then block subsidies will be targeted to low-income households. Although used in many sectors, these tariffs are especially common in the water sector in developing countries. For example, 20 of 28 utilities in Asia that used volumetric charges used block tariffs.[16]

While block tariffs are inexpensive to administer and benefit poor people who are connected to the network, they face many problems. First, *everyone* who is connected—poor and rich—receives the low rate on initial usage, meaning that some portion of the subsidy will go to high-income households. Further, when the initial block is large, middle-income households might actually benefit more than low-income households. Consider, for example, a two-part block tariff with the initial rate set below marginal cost and the higher rate set above marginal cost. Under this scenario, households that consume the full allocation at the initial rate will

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[15] Foster *et al.* (2000) note that changing eligibility criteria would increase the number of households in extreme poverty that receive subsidies but would also increase the households not in poverty receiving subsidies. Similarly, Estache *et al.* (2002) found that most beneficiaries of a similar plan in Colombia were middle class, not poor.

[16] Data from Asian Development Bank (1993) cited in Boland and Whittington (2000). Boland and Whittington (2000) suggest that one of the main reasons for the popularity of block tariffs is that multilateral donors, international financial and engineering consultants, and water sector professionals encourage their use.

receive the largest subsidy. Since, in practice, the initial blocks are often quite large (as discussed above), low-income households who consume relatively modest amounts might actually receive smaller subsidies than middle-income households who consume the full amount.

Second, these tariffs can, perversely, even hurt the poorest households (Boland and Whittington 2000; Whittington 1992). In the water sector, households not connected to the piped water grid often buy water from neighbors who are connected. These neighbors, because they supply many households, purchase large amounts of water, meaning that they are likely to far exceed the initial, subsidized, block. They will pay a high average price for water, and will charge non-connected families who buy from them accordingly. As a result, the poorest households, who are more likely to share connections or buy water from neighbors, can end up paying the higher rate while high-income users with single house connections pay the lower rate.

The possibility that block tariffs end up hurting the poorest is not merely theoretical. Whittington (1992) found that relatively high-income users in Kumasi, Ghana paid the lowest average price for water (0.25-0.29 cedis per gallon in 1989), while relatively poorer households paid higher average prices (0.32-0.36 cedis per gallon). Finally, large households will tend to pay a higher average price than small households, since they generally consume more. To the extent that household size is a poor proxy for per capita income, subsidies will be misdirected.

V. Incorporating Universal Service into Reforms: Regulation, Privatization, and Access

When low-income households have low willingness-to-pay for infrastructure service, especially in sectors where externalities arise from universal coverage (e.g., public health externalities associated with water supply and sewerage), it is important to consider ways to boost coverage among low-income households and in high cost areas without losing the efficiency benefits associated with privatization and increased competition. In this section we discuss several issues including the privatization process, the role of regulators in setting quality standards, ways to encourage service providers to provide services that are affordable for low-income households, and how to cross-subsidize service after the introduction of competition.

Incorporating universal service in the privatization process

Although privatization itself could help or hurt low-income households, the privatization process can be designed to positively impact access. Most notably, licenses sold to private investors can mandate certain types of investment, including to increase access in low-income or rural areas. Although additional obligations included in the license will reduce the price an investor is willing to pay for a once state-owned firm, these price reductions need to be weighed against the positive impact on policy goals. Further, price reductions arising from such obligations, assuming a fair bidding process, would be the implicit subsidy that would have been necessary to achieve the policy objective. For example, in Mexico, Telmex was required as part of its privatization to install payphones in 20,000 rural areas over a five-year period to meet the policy goal of ensuring some telephone access in all villages with at least 500 residents (Wellenius 2000).

Although price regulation is one important aspect of regulation, many regulations also target quality. Although quality standards typically exist when public operators provide service, private operators might be more affected by quality regulation both because privatization is often associated with the establishment of new regulatory authorities and because private operators are less able to ignore quality standards. Regulators and policymakers are generally tempted to promote very high quality standards and engineering and design specifications are typically imported from advanced industrialized countries (Baker and Trémolet 2000; Smith 2000). As a result, service may be costly, and affordable only to the elite. Further, since the existing infrastructure may have focused on large-scale operations, providers, especially foreign owners from developed countries, might not offer low-cost options. While high-income households probably value high quality service (i.e., service similar to standards in industrialized countries), low-income households might prefer more flexible quality standards, especially if they are unable to afford high-quality/high-cost service. For example, if postal regulations mandate daily delivery everywhere, then costs of service in rural areas will be higher than they would be otherwise (Cremer *et al.* 1998a), which will need to be financed either through higher prices or through general tax revenues. In sum, allowing people to decide the levels of price *and* quality should improve economic outcomes—for example, low-income households might prefer a low-

quality telephone line, or a telephone that only receives calls, to an expensive high quality digital line or to no service at all.

Rate rebalancing, subsidies and competition

Although reforms, especially those that increase competition, might lower the cost of service and, in so doing, reduce the need for subsidies, it also makes it more difficult to cross subsidize service. If competitors entering the market generally try to serve the most profitable customers first ("cream-skimming"), the profits needed to subsidize unprofitable areas will disappear and rates might need to be rebalanced, with some prices rising towards cost and others falling. Consequently, low-income consumers might be hurt even if reform leads to lower average prices.

Although this is a theoretical possibility, there are reasons to doubt that rate rebalancing due to increased competition will pose as serious a problem as some observers have suggested. For example, in the telecommunications sector, while tariff rebalancing has often led to increases in local residential tariffs, which were kept artificially low under monopoly provision, it is not clear that this has harmed low-income consumers. First, households benefit from low prices for local service only if they have a telephone—something that is relatively uncommon among low-income households in most developing countries. Even when penetration is high, it has not been demonstrated that the poor value local service more highly than long distance service. For example, in the United States, rate rebalancing seems to have positive benefits for the vast majority of households since long distance prices have fallen by far more than local prices have risen (Wolak 1996). Combined with evidence that competition substantially improved coverage, this suggests that the net impact on low-income households was positive even with rate rebalancing.

It is also important to consider the impact of technological change when thinking about the impact of competition on prices. Even if competition appears to negatively impact low-income households in the near-term due to rate rebalancing, competition can affect technological change and thus prices, in the medium- or long-term. New technologies provide new options for serving rural and remote locations, potentially lowering the costs of serving some high cost areas, reducing the need for subsidies. For example, while it may have been costly to string

wires over long distances, fixed wireless systems may allow rural telecom service at relatively low cost. Especially in the telecommunications sector, competition may allow creative entrants to provide service in ways the incumbent never imagined. Barring competition can prevent these advances from ever appearing.

One final point is that although many subsidies are focused on usage prices, it might be more appropriate to focus upon connection fees, especially in countries where coverage among low-income households is initially low. While usage prices were often low, connection prices have often been quite high—and in many cases, actual connection prices are much higher than listed prices when bribes are required to actually get service. While long waiting lists for service demonstrate that there is demand for service even at high prices, extremely high connection charges make a mockery of any policy intended to connect the poor. In Nigeria in 1999, for example, the connection charge for a telephone line was $210 (Onwumechili 2001), high even by standards for industrialized countries, and even higher considering that per capita income in Nigeria is about $260 (World Bank 2002a). Since coverage is generally far higher among high-income households, and considering that low usage prices (e.g., block tariffs) only benefit connected users, focusing on connection fees is attractive since it will benefit non-connected households, many of whom are relatively low-income.

VI. An Empirical Analysis of Historical Universal Service Provision and the Effects of Liberalization

Opponents of liberalization worry that reforms will hurt the poor even if they improve efficiency. If new entrants are interested in providing service only to profitable high-income and business consumers, competition might force the incumbent provider to either abandon cross-subsidies or be left serving only unprofitable low-income and high-cost consumers. Further, critics claim that competition will erode monopoly profits, forcing governments to find new sources of funds to finance access for high-cost and low-income consumers—something that could be very difficult in developing countries with inefficient and distortionary tax regimes.[17]

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[17] In line with this thinking, a recent report on liberalization in the telecommunications sector suggests, "as trends toward privatization and liberalization of basic telecommunications services accelerate worldwide, concerns about universal service, particularly rural service, are increasingly raised among policymakers, user groups and industry participants. This concern stems from the possibility that, when the state relinquishes ownership and management

The implicit assumption behind these arguments is that countries have successfully managed to promote access for vulnerable groups and to target cross-subsidies towards them prior to reforms. With the exception of Eastern Europe, the evidence suggests that monopolies have not used subsidies to serve the poor. In this section we use household datasets from around the world to investigate how well monopolies have served rural and low-income consumers and how those consumers have fared under liberalization.

Evaluating access by the poor to infrastructure utilities is difficult as there is little consistent data on the subject. Cross-country data on telecommunications and electricity (such as those from the International Telecommunications Union and the US Energy Information Agency, respectively), for example, do not track connections by income group or regions of countries. Databases kept by utility companies themselves do not generally provide the information needed to assess the impact of privatization on the poor (Gómez-Lobo *et al.* 2000b). Even if the companies are willing to make these lists available, they typically have information only on numbers of customers and do not collect detailed information on the socio-demographic characteristics of households.[18] Moreover, for obvious reasons, utility companies generally do not have detailed information on informal or illegal connections.

The only way to get a consistent picture of access by the poor to infrastructure is through household surveys. Such surveys will generally have greater information on the socio-economic characteristics of households and are less likely to omit individuals with informal or illegal connections. Unfortunately, household surveys are usually not designed to measure infrastructure use, meaning that they typically have limited information.[19] Further, it can be difficult to find household surveys with similar information for years both before and after

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of telecommunications networks, and when competing private operators seek to gain maximum profit, service requirements in costly areas will be overlooked" (Pyramid Research 1997).

[18] Gomez-Lobo *et al.* (2000b) note that this remains true even when the water company has a special tariff for vulnerable households, since the criteria for qualification rarely correspond closely to objective definitions of low-income or disadvantaged households.

[19] Gomez-Lobo *et al.* (2000a; 2000b) provide several recommendations that might make surveys such as the Living Standards Measurement Surveys [LSMS] more useful for analyzing infrastructure reforms.

reforms took place.[20] Consequently, even case studies often have only limited information on the impact of reform on the poor.

To address this gap in our empirical understanding of the subject, we exploit the MEASURE DHS+ Demographic and Health Surveys (henceforth called the "DHS survey") to glean relatively consistent cross-country information.[21] Since this survey provides comparable information on a relatively large number of countries over time, especially in Africa, it allows us to compare coverage among low-income households in reforming and non-reforming countries and to look at how coverage has changed after reform. The main drawbacks to these surveys are that they contain only limited information on coverage and, since data on income is not available, education level of the household head must proxy for income. In particular, we assume that households headed by someone with no education tend to be poor, while households headed by someone with at least a secondary education tend to be higher-income.[22]

Historical Evidence: Have cross-subsidies supported the poor?

Despite purported attempts to subsidize services to low-income and high-cost users and the maintenance of state-owned or regulated private monopolies to ensure that cross-subsidies are possible, there is little evidence that these attempts have been successful. In general, coverage of rural and low-income urban households is very low—considerably lower than higher income households—especially in low-income countries in Africa and Latin America. Figure 1 and Table 1

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[20] Since it often takes several years for surveys collected for other reasons to be made available to researchers other than the researchers who performed the survey, it can be difficult to analyze recent reforms using publicly available data. Further, there are relatively few easily accessible, publicly available household surveys with detailed data on infrastructure use for developing countries for recent years. Since most reforms are quite recent, this makes it difficult to get 'post-reform' data.

[21] These household surveys, funded by USAID, have been carried out around the world primarily as a tool for measuring changes in health status and the effectiveness of health-related initiatives. More information is available from http://www.measuredhs.com/.

[22] Although education of household is an imperfect proxy for household income or consumption, it tends to be highly correlated with the variable of interest. For example, in a simple regression of household expenditures on five education dummies representing education level of household head for a sample of households from Abidjan, Côte d'Ivoire, each dummy variable is statistically significantly different from the next level. Further, the difference in expenditure levels appears large—average household expenditures for households with heads with no education was CFAF 1.3 million, compared to CFAF 2.4 million for a households with heads with secondary education or higher.

show coverage for urban households headed by males with a secondary education or higher and no education in the late 1990s, while Figure 2 and Table 2 shows similar coverage data for urban and rural households.

Several patterns—generally consistent with those observed in Komives *et al.* (2001)—are evident.[23] First, urban households in Africa and Latin America were generally more likely to have electricity or piped water than they were to have a telephone or a flush toilet (see Table 2). In both regions (and in Europe and Central Asia), urban households were more likely to have electricity than piped water and more likely to have flush toilets than telephones. However, there was some variation from country to country—for example in 7 of the 21 African countries, households were more likely to have water connections—than electricity connections. Another pattern is that urban households in both low and middle-income countries in Eastern Europe and Central Asia were more likely to have infrastructure connections than households in Africa and Latin America. Although urban households in Europe and Central Asia were more likely to have electricity than other infrastructure services, the pattern for other services was less clear than for Latin America or Africa.

In general, households headed by individuals with secondary educations or higher were far more likely to have infrastructure connections than households headed by individuals with no education (see Figure 1), with the difference especially large in low-income countries in Africa and Latin America. In low-income countries in Africa, about 80 percent of urban households headed by an individual with a secondary education had access to electricity, 63 percent had access to piped water either in their house or yard, 20 percent had a telephone, and 38 percent had a flush toilet (see Figure 1). In comparison, only 32 percent of urban households headed by individuals with no education had electricity, 27 percent had piped water and only 10 percent had a flush toilet. Telephone coverage among urban households in Africa headed by individuals with no education was especially low—less than 2 percent on average and less than 1 percent in most countries (see Table 1). Although coverage was higher in low-income countries in Latin America, the basic pattern was similar. The differences in coverage were not due to differences in only a few countries. For electricity, piped water and telephones, coverage was lower—and in most cases

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[23] Komives *et al.* (2001) use data from 15 countries from the World Bank's Living Standards Measurement Study (LSMS) surveys.

much lower—for houses headed by individuals with no education than it was for households headed by individuals with a secondary education or higher in all low-income countries in Africa and Latin America for which data were available (see Table 1).[24]

In middle-income countries in Latin America, similar patterns were observed for electricity, flush toilets, and telephones, although, on average, urban households headed by individuals with no education were slightly more likely to have access to piped water than urban households headed by individuals with a secondary education or higher. Europe and Central Asia appears different, with higher overall coverage in most sectors and less noticeable differences between households with heads of different education levels.

Overall, this suggests that cross-subsidies have been relatively ineffective in targeting service for poor households. Several empirical studies this. For example, even the subsidy scheme used in Chile, which was based on household characteristics and has been perceived as quite successful (see, for example, Gómez-Lobo *et al.* 2000b) has failed to target low-income households very effectively. Only one-third of household receiving subsidies in 1996 were in the lowest quintile (Shirley *et al.* 2002) and about 23 percent of subsidies go to households with income higher than the median (Gómez-Lobo 2001). Similarly, Walker *et al.* (2000) estimated average monthly subsidies for piped water for consumers with different incomes in six cities in Nicaragua, Panama, El Salvador, and Venezuela, finding that the subsidies appeared to benefit rich and poor consumers to similar degrees in Nicaragua, Panama, and Venezuela. In El Salvador, they found that all consumers appeared to be overcharged, although poor consumers appeared to be less overcharged than high-income consumers. In addition, Whittington (1992) found that an increasing block tariff for water in Kumasi, Ghana resulted in the poor paying higher average prices than better-off households.[25] Finally, Waddams-Price (2000) lists several examples, including kerosene subsidies in Ecuador and Indonesia, electricity subsidies in

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[24] In three (of twenty-one) countries in Africa, households headed by individuals with no education were about as likely to have flush toilets as households headed by individuals with a secondary education.

[25] One reason for this is that under the block tariff scheme used in Ghana, poor households tended to share single connections meaning that they ended up paying the highest rate, while wealthier households had their own connections putting them in lower consumption brackets.

Yemen, and public transport and water subsidies in Hungary, where subsidies failed to effectively target the poor.

Historical evidence: Have cross-subsidies supported rural areas?

The data presented above only demonstrate that coverage of the poor is very low for most infrastructure services, suggesting that subsidies have not been effectively targeted. We can explore somewhat more directly the question of whether subsidies have benefited rural areas. In this section, we first compare urban and rural coverage rates across countries, and then compare by sector structure.

In addition to differences in coverage for low and high-income households, there are similar differences between coverage in urban and rural areas in most developing countries (see Figure 2). Once again, rural coverage was generally lowest in low-income countries in Africa. For example, about 47 percent of urban households in Africa had electricity, 37 percent had piped water, 18 percent had flush toilets and 6 percent had telephones. In comparison, only 7 percent of rural households had electricity, 4 percent had piped water, 1 percent had flush toilets and 0.3 percent had telephones. In almost half of the countries in Africa, less than 1 in 1000 rural households had a telephone and in only one country (Zimbabwe) did over 1 in 100 rural households have a telephone. Although some households might have access to telephones outside of their home, it is highly likely that many of households do not have any access to telephones—it was estimated that by 1999 nearly 75 percent of the world's population had never made a telephone call (Onwumechili 2001).

Although coverage rates were higher among rural households in Latin America than they were in Africa, the basic patterns were similar (see Figure 2). Very few rural households in the two low-income countries in Latin America for which data was available had electricity, piped water, telephones or flush toilets, with coverage especially low for telephones and flush toilets. Although coverage appears higher in middle-income countries in Latin, especially for electricity where over 50 percent of rural households had coverage (see Figure 2), coverage among rural households is far lower than among urban households.

Once again, the countries in Europe and Central Asia for which data were available generally appeared to have significantly higher coverage for rural households than similar countries in Latin America and Africa (see Figure 2). In particular, coverage for electricity was higher than 90 percent in rural areas for all three countries for which data were available compared to close to 100 percent for urban areas. However, coverage for other services—although generally higher than in similar countries in other regions—was far lower in rural areas than in urban areas.

We can also test somewhat more directly whether cross-subsidies tended to be used to fund high-cost areas. In particular, we know in which countries a single firm provides water in all urban areas and in which countries service is provided at the local or state level. Moreover, in these countries the capital city tends to be the largest city with the highest concentration of high-income consumers.[26] If cross-subsidies were used to support coverage in high-cost areas, we would expect to see less variation in coverage between the capital and other urban areas in countries with a single water firm since that firm would be able to use income from the capital to fund water provision elsewhere.

Table 3 shows coverage in African capital cities and all urban areas by sector structure when service is provided by one firm throughout the country and organized at the sub-national level. The table yields two interesting results. First, coverage—in the capital and in all urban areas—in countries with a single provider is, on average, lower than in countries where provision is organized at the sub-national level. This result is consistent with the notion that competition improves service, even if it is only benchmark competition. Second, coverage outside of the capital city relative to coverage in the capital is not, on average, higher in countries in Africa where the water supply is organized at the national level than it is in countries where the water supply is organized at the local level.[27] This result suggests that cross-subsidies have not been used to support service provision in high-cost areas.

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[26] In every sector and for almost all the countries for which DHS data were available, infrastructure connections were more common in the capital than they were in urban areas outside of the capital.

[27] The mean difference in coverage between the capital city and other urban areas is statistically insignificant for the countries for which data is available (see Table 3). This remains true when Nigeria, where state governments are

In summary, although maintaining public (or regulated private) infrastructure monopolies is often justified by suggestions that this is necessary in order to ensure than low-income and rural households can obtain connections, there is little evidence that it has been successful in most developing countries. In the late 1990s, coverage for households headed by individuals with no education and for rural households was generally significantly lower than for households headed by individuals with secondary education and for urban households in most developing and transition economies for which data was available. These patterns were especially noticeable in low-income countries in Latin America and Africa.

Effects of Privatization and Competition

The fact that subsidies did not appear to serve rural and poor consumers does not by itself imply that reforms will automatically benefit these groups. Although on the one hand case-study evidence suggests that public monopolies have often been overstaffed, inefficient and lacked the resources needed for investment, on the other hand tariffs have often been heavily subsidized from general government revenues and companies have often cross-subsidized certain consumers or services. The net impact that reform has on coverage will therefore depend upon whether it removes constraints on investment (supply) and how it affects prices paid by low-income consumers (demand). If coverage is low because enterprises in developing countries lacked the resources needed to expand the system, then low-income consumers might benefit from reforms even if they result in higher prices. If coverage of low-income households is low because the poor have low willingness-to-pay rather than because service is rationed, however, then, ignoring any impact that reform has on quality, reform will benefit the poor only if it results in lower prices.

Prior to reform, water utilities in developing countries, which were mostly publicly owned, often charged prices far below costs (see, for example, World Bank 1994). Many case studies have noted that the poor financial performance of many public utilities, combined with poor fiscal situation of governments, resulted in utilities having insufficient financial resources to

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responsible for water supply, is excluded from the group of countries where local governments are responsible for water supply.

finance investment and maintenance. As a result, utility companies heavily rationed service.[28] When services are rationed (i.e., when many households want service but are unable to get it), low-income households might be especially unlikely to get service as several market and non-market mechanisms direct service towards relatively wealthy and politically-connected individuals.

First, houses connected to the system will generally command higher sales prices or rents that non-connected households. People willing or able to pay the highest sales prices or rents (i.e., high-income households) will be more likely to acquire residences with connections. Second, bribes and other side payments are often necessary to get a connection when service is rationed. Again, wealthier individuals will be the ones most likely to get a connection regardless of the official tariff rate. Although these is little empirical evidence at this household level, Clarke and Xu (2002) find evidence for enterprises that is consistent with this hypothesis.[29] Finally, high-income households will generally have greater political power than other households and might be more willing to make campaign donations or informal payments to politicians to ensure that infrastructure services are provided in high-income neighborhoods first. Consequently, when services are rationed, we might expect low-income households to be less likely to receive service even if they are willing to pay official tariffs and connection fees.

Addressing the question of why the poor tend not to be connected to infrastructure utilities is crucial since full cost recovery has been a cornerstone of infrastructure reforms. Cost-recovery, it was hoped, would allow utilities to become self-supporting rather than having to rely on government subsidies. In fact, given the poor performance of many governments in providing subsidies in a consistent way—and in many countries of even paying their own utility bills—full

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[28] For example, on water supply, see the case studies in Shirley (2002), especially Ménard and Clarke (2002b) and Alcazar *et al.* (2002b), and the case studies in Savedoff and Spiller (1999).

[29] Clarke and Xu (2002) find that firms that are more profitable pay higher bribes to infrastructure enterprises than less profitable enterprises do. They note that this is consistent with the 'speed money' hypothesis, which suggests that bribes operate as a price mechanism ensuring that those most willing to pay gain access to infrastructure services. There is a large literature on hedonic pricing that suggests that rents are higher for houses with infrastructure connections (see, for example, North and Griffin 1993).

cost recovery was often seen as a pre-condition for introducing private sector participation.[30] If low-income households are generally willing and able to pay for infrastructure connections then, even if prices increase, reforms that remove constraints on investment and allow non-connected households to connect to the system will benefit non-connected households who were previously unable to get connections. In contrast, if low-income households are only willing to pay relatively modest prices, full cost recovery might not be consistent with universal service goals without massive cross-subsidization.

In the telecommunications sector, the sector on which most cross-country empirical work has focused, there is strong evidence that reforms that increase competition and privatize state-owned utilities increase service availability.[31] Almost without exception, cross-county empirical research in both developed and developing countries has found that competition increases the number of telephone connections (Li and Xu 2001; Petrazzini 1996; Ros 1999; Wallsten 2001a). The evidence on privatization is less conclusive, with some studies finding that privatization is associated with improved coverage (see, for example, Ros 1999) and others finding that it has little impact (see, for example, Wallsten 2001a).[32] The evidence from cross-country studies is generally consistent with the experience documented in country case-studies, which have often found that reform increases penetration and reduces retail prices (see, for example, Galal and Nauriyal 1995; Wellenius 1997).

These results are not surprising when considered in historical context. In the late 19th and early 20th century in the United States, Mueller (1997) found that telephone service expanded at five percent per year under a Bell monopoly and 40 percent per year under competition. Similarly, Wallsten (2001b) found that telephone penetration and rural service in early 20th century Europe increased more quickly under competitive regimes than under monopoly provision. The recent experience following reform has been similar. Mueller (1997) found that

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[30] See, for example, Ménard and Clarke (2002a; 2002b) and Clarke, Ménard and Zuluaga (2002).

[31] In part the large amount of research on telecommunications reflects the better availability of cross-country data for developing countries. For example, several studies have used the data collected by the International Telecommunications Union.

[32] Li and Xu (2001) find that share-issue privatization appear to have a positive impact on coverage, but find no evidence for other types of privatization.

the telephone penetration increased after the 1984 AT&T divestiture, and that the growth rates were highest among low-income groups and in regions with low telephone densities.[33]

When privatization and liberalization result in price decreases and service expansion, low-income households should benefit from reform; low-income households with connections will benefit from lower prices and low-income households who connect to the system either due to price decreases or to decreased rationing will also benefit.[34] Even non-connected households might benefit indirectly if the drop in tariffs affects prices charged by resellers (e.g., prices charged by water vendors or at payphones).[35] In contrast, when privatization and liberalization results in price increases or the regularization of unofficial or illegal connections (which effectively increases prices for these consumers from zero to the official tariff), the impact on low-income households is less clear. Although price increases will generally hurt low-income households that already have connections, increases in coverage will benefit those households who are able to get connections. That is, if privatization and sector liberalization remove constraints on investment that were the result of either the poor performance of a public utility or of prices being set below cost, those households who were unable to get connections under public ownership might benefit despite price increases.

However, it is important to note that increases in coverage following reform might not benefit consumers of all income levels. If the price increases cause some households to disconnect, something that might be common among low-income households with low willingness-to-pay, disconnected households will lose from reform.[36] If many middle- or high-income households willing to pay high prices for utility services are able to connect due to the removal of investment constraints, while a smaller number of low-income households disconnect due to the price increases, low-income households might suffer even if total coverage increases

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[33] Mueller (1997) and Gillet (1994) both cited in Barros and Seabra (1999).

[34] Households might also benefit from changes in service quality.

[35] Water vendors on-sell water from the piped system in many countries (see, for example, Collignon and Vézina 2000).

[36] For example, nearly one-third of water connections in Conakry, Guinea, were inactive due to non-payment five years after large price increases that followed the introduction of private sector participation in 1989 (Brook Cowen 1996).

(i.e., if more middle and high-income households connect than low income households disconnect).

While household data that covers countries and times where reforms have occurred is rare, the DHS data allows us to test the effects of reforms in several sectors, countries, and time periods. In particular, we compare access in African countries with public and private water operators, public and private telecommunications providers in Africa and Latin America, and time-series comparisons of the effect of private sector participation in the electricity sector in Latin America.

Cross-country evidence from the DHS+ surveys comparing countries with public and private operators does not generally support the assertion that public operators are better at serving low-income households than private operators. Table 4 compares coverage for low-income households in the mid-late 1990s for countries with public enterprises in the water supply sector, countries that had recently introduced private sector participation (within two years of the survey date) and countries that had had private sector participation for many years. On average, coverage among households headed by an individual with no education appears slightly lower in countries with public operators (25.4 percent) than it is in countries with established private operators (30.6 percent). Coverage for households headed by individuals with no education was higher in Côte d'Ivoire than in 11 of 17 countries with public operators and higher in Guinea than in 9 of 17 countries. Conclusions are similar when comparing countries based upon the share of connected households with no education as a percentage of the share of connected households with a secondary education (i.e., essentially controlling for the general development of the sector).

Cross-country evidence on access to telecommunications services in Africa and Latin America leads to similar conclusions (see Table 5). Coverage for households headed by individuals with no education is similar in African countries with public operators and privatized operators. In Latin America, coverage actually appears lower in countries with public operators than it is in countries with private operators; coverage among households headed by individuals with no education is lower in both countries with public operators than in any of the four countries with privatized operators. In summary, there is little evidence that public ownership

benefits low-income households in terms of coverage and in some cases coverage appears lower among households headed by individuals with no education in countries with public operators.

Time-series evidence from the DHS+ surveys is also generally consistent with the hypothesis that private sector participation does not harm, and may actually help, low-income households. Figure 4 presents some evidence on the impact of reform in the electricity sector in Latin America on service to poor households for the four countries in Latin America for which pre- and post-reform data was available. In three of the four cases, Bolivia, Brazil and Peru, prices, which were significantly lower than similar prices in OECD countries before reform, increased significantly. In the fourth country, Bolivia, which had the highest prices before reform, prices fell slightly. Coverage for urban consumers, which was already high prior to reform, increased following privatization in all four countries. Since this occurred despite increased prices in three of the four countries, this suggests that capacity was constrained prior to reform. Coverage also increased for the poor in three out of four cases, despite large price increases in two of the three countries. Although total coverage increased slightly in Colombia—it was very close to 100 percent even before reform—coverage of households with heads with no education fell slightly.

These results are interesting for several reasons. First, despite large price increases in three of four countries, coverage actually increased in all four countries, suggesting that supply constraints played an important role in blocking service to the poor under public ownership. This is consistent with cross-country evidence from the telecommunications sector. In a recent paper, Ros (1999) found that higher residential subscription prices were correlated with *higher* coverage in a sample of 110 developed and developing countries. He interprets this as indicating that supply-side constraints were more important than demand-side constraints. Second, increases in coverage for the total urban population might not always imply increased coverage for the poor. In Colombia, although coverage in urban areas appears to have slightly increased overall following reform, coverage appears to have fallen slightly among households headed by individuals with no education.

Figure 3 presents similar evidence for the effect of private sector participation in the water supply in Africa. In December 1995, following an unsuccessful reform of the public

sector water utility in Senegal, the Senegalese Government signed a lease contract with Sénégalaise des Eaux (SDE), a private sector company with SAUR international as its majority shareholder, under which SDE would become responsible for operations of maintenance of water services in 54 towns in Senegal. Since the Government was concerned about the political sensitivity of transferring assets to a private operator, and believed that it would have been difficult to convince private sector companies to assume the risk associated with debt service, the Government opted for a lease contract (Kerf 2000).[37] Since one of the main goals of the reform was to make the utility financially self-sufficient, modest price increases of about 2.4 percent per year were planned between 1996 and 2003.

Following the introduction of private sector participation the number of connections in Dakar appeared to increase modestly—from about 135,414 in 1995 to 147,212 in 1997 to 157,429 by 1999.[38] The expansion was accompanied by modest price increases—due to social and political considerations prices were only increased by about 3 percent per year in the early years following reform (Kerf 2000). Despite the price increases, coverage appears to have increased for both high and low-income households. Between 1992 and 1997, coverage for urban households headed by a male with secondary education or higher increased by about 1.4 percent per year while coverage for urban households headed by a male with no education increased by about 3.2 percent per year (see Figure 3). These increases compare favorably with the annual increases observed in other African countries between the early and late 1990s. Of the eight countries with public utilities where similar data was available, coverage grew more slowly for low-income households in seven of the eight countries and more slowly for high-income households in all eight countries.

Although these results suggest that private sector participation can benefit the poor even when reform is combined with modest price increases, the benefits are not automatic. For example, in 1992, a thirty-year concession contract to supply water and sanitation services in Buenos Aires was awarded to a private company. The contract was awarded to the consortium

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[37] In addition, the private operator agreed to undertake some investment in the distribution network.

[38] Data is from World Bank files.

that agreed to the largest price reductions for connected customers.[39] Although it seems plausible that consumers would benefit when contracts are bid based upon price reductions, the benefits of the large price decreases accrued to mostly middle and upper income customers who were already connected at the time of reform. In contrast, connection fees, which included the cost of expanding the secondary network, remained high—between $1,107 and $1,528 (Alcázar *et al.* 2002a). Since average monthly income in the poorest sections of the city was only between US$200-245 per month, many poor households were unable to afford the high cost of a connection. Consequently, despite the decreases in monthly subscription rates and expansion targets based upon geographical location with poor areas prioritized, it appears that reform initially failed to benefit poor households as much as originally intended.[40] This eventually led to a renegotiation of the contract, under which the cost of new connections was passed onto both new and existing customers through an additional surcharge—the Universal Service and Environment Improvement Fee (SUMA).

In summary, the evidence from cross-country comparisons of reformers and non-reformers and from comparisons before and after reform fails to support the hypothesis that reform harms low-income consumers. In many cases the poor seem to benefit, at least in terms of being connected to the network. It is important to note, however, that the impact of reform will vary from country-to-country and city-to-city. In countries and cities where coverage is already very high among poor households, or where many poor consumers have informal or illegal connections, significant price increases and regularization of customer accounts might lead to a reduction in coverage among low-income households even if total coverage increases.[41] In contrast, in countries where service was heavily rationed prior to reform, privatization and

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[39] This discussion draws upon Alcazar *et al.* (2002a), which provides a detailed discussion of the political and economic factors concerning the Buenos Aires concession and the welfare impact on poor and middle class consumers.

[40] Water and Sanitation Program (2001) notes that the contract tried to enforce service provision to poor areas through geographical expansion targets.

[41] An additional point is that if low prices and high number of connections meant that the utility needed to subsidized from general tax revenues, the overall impact on low-income households would also depend upon how reform affected these subsidies.

liberalization might result in increased coverage for low-income households, even if prices increase.

VII. CONCLUSIONS

Most countries have an explicit policy goal of promoting universal access to certain infrastructure utilities. When service was provided by monopolies (typically state-owned, but occasionally private), these obligations were, in theory, funded through cross subsidies: high-income and low-cost consumers were charged prices above cost to finance service to low-income and high-cost consumers, who paid prices below cost. While this arrangement sounds simple, in practice it has not worked well. Cross-subsidies have often been poorly targeted and have typically failed to reach poor consumers. Although low prices might increase demand for infrastructure services from poor and rural consumers, they also lead to supply-side distortions that might lessen or nullify their impact. Moreover, the opaque nature of cross subsidies also makes it difficult to determine who pays and who benefits from them. In practice, there is strong evidence that public and private monopolies failed to ensure access for rural and low-income urban consumers, especially in Africa. Indeed, the relatively wealthy appeared to benefit from subsidies far more than the poor.

Despite these failings, many observers worry that reforms such as privatization and competition in infrastructure utilities could harm the poor, making cross subsidies unsustainable and raising prices beyond the reach of the poor. The limited evidence that exists suggests that overall this has not been the case. Most likely this is because, outside of Eastern Europe, state-owned monopolies did a miserable job of directing cross-subsidies to poor or rural consumers. Even when official tariffs rise under rate rebalancing, the real cost of connecting may fall, allowing more poor people to connect to the networks.

Moreover, entry and competition allows entrepreneurs to discover and try new methods of providing service to poor and rural areas, generating a wealth of service, price, and quality options. Maintaining state-owned (or regulated private) monopolies might stifle innovative solutions to providing access to the poor. In fact, if competitive entry and privatization increases efficiency, areas and customers that monopolists found unprofitable might either become profitable or, at least, require smaller subsidies. Some regions and users thought to be unwilling

or unable to pay for service have turned out to be profitable customers, as evidenced by creative entry mechanisms from new competitors.[42]

Nonetheless, not everyone is willing or able to pay the cost of utility services, meaning that some regions and users will require subsidies if society wants them to be connected. Reforms mean that new methods are necessary to raise subsidies, including competitively neutral financing mechanisms, such as universal service funds and subsidy auctions. While reforms present a challenge to ensuring access to the poor, in light of the almost complete failure of service provision to the poor under monopoly provision in many developing countries, reforms also provide an opportunity to completely rethink the role of subsidies and of how to ensure access by the poor.

[42] For example, condominial sewerage systems reduce costs over traditional systems by using smaller pipes, being installed in shallow trenches, and being installed under household yards rather than under roads (Komives and Brook Cowen 1998).

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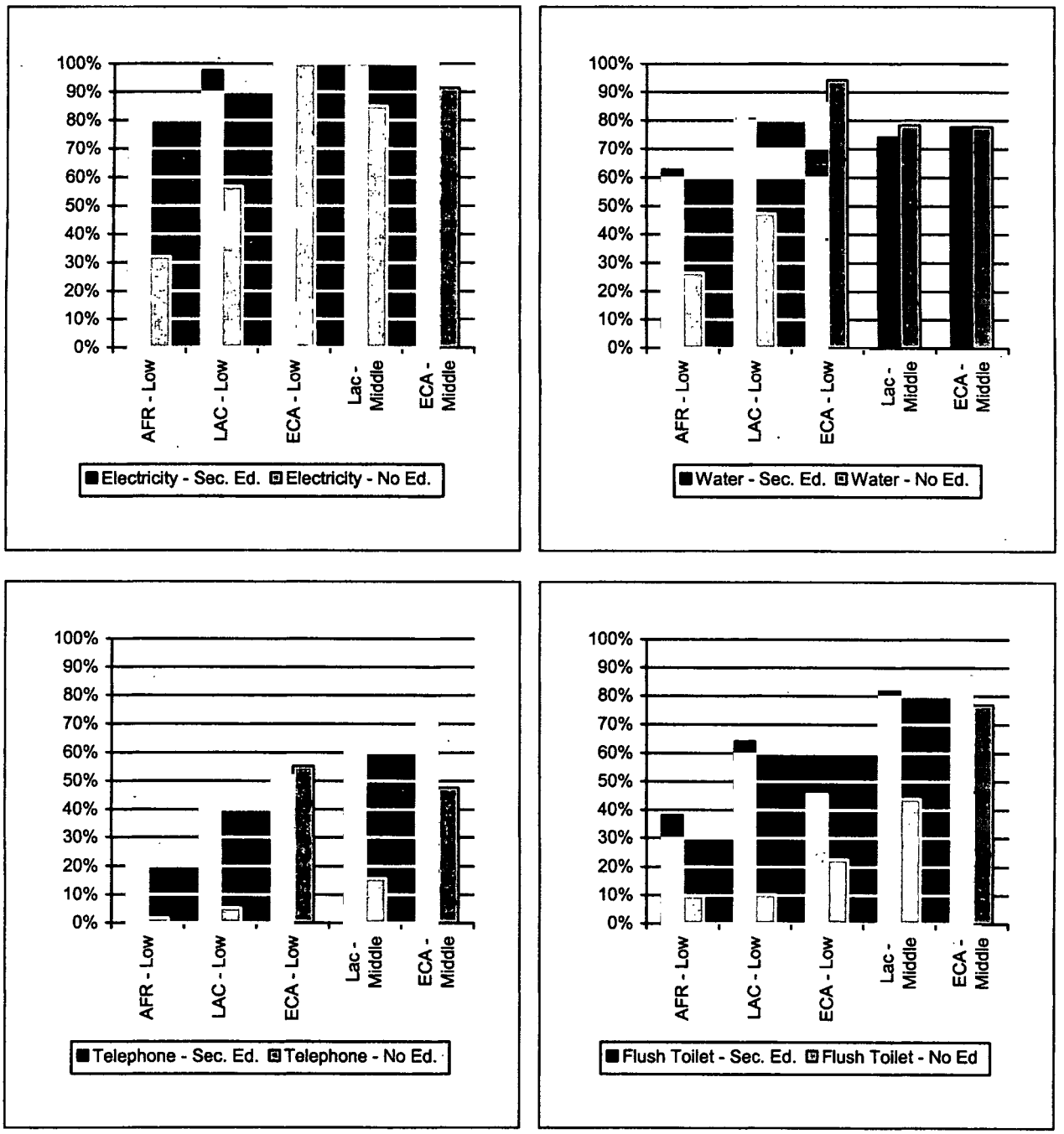
IX. FIGURES

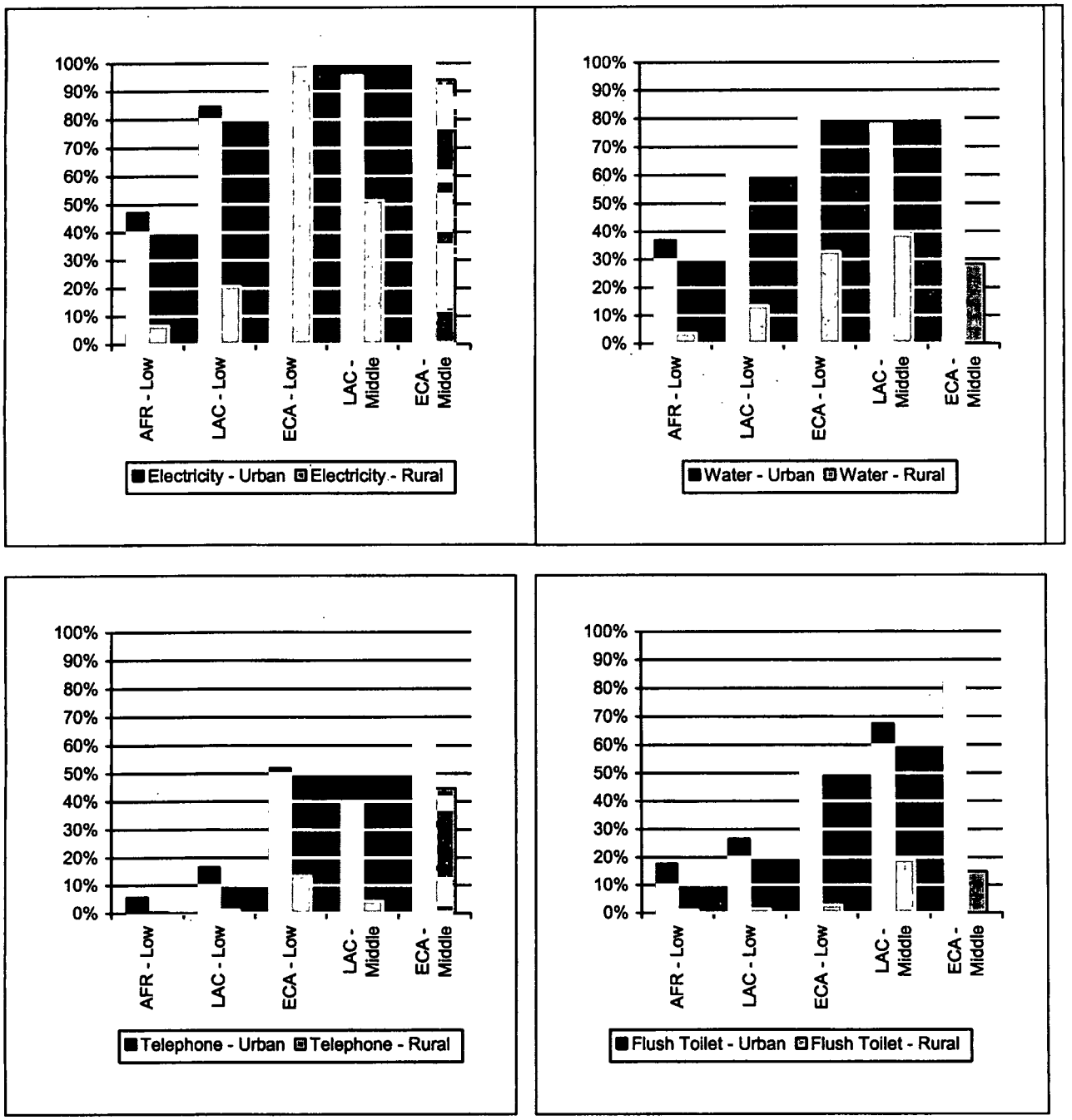
Figure 1 Infrastructure Access for Urban Households with Heads with Different Education Levels in 1990s.



Source: Authors' calculations based on raw data from MEASURE DHS+ Demographic and Health Surveys.

Note: AFR is Sub-Saharan Africa; LAC is Latin America and Caribbean; ECA is Europe and Central Asia. Low is low-income countries; Middle is Middle Income countries. Data are for urban households headed by males, which are classified based on educational level of household head. Coverage implies that the household has a connection to that service in their house (or yard for water). Regional average are computed as simple averages (i.e., no weighting). Income classifications for countries are based upon classifications in (World Bank 2002b). Data is for all countries in these regions for which data were available for various years between 1994 and 2000. See Table 1 for more information.

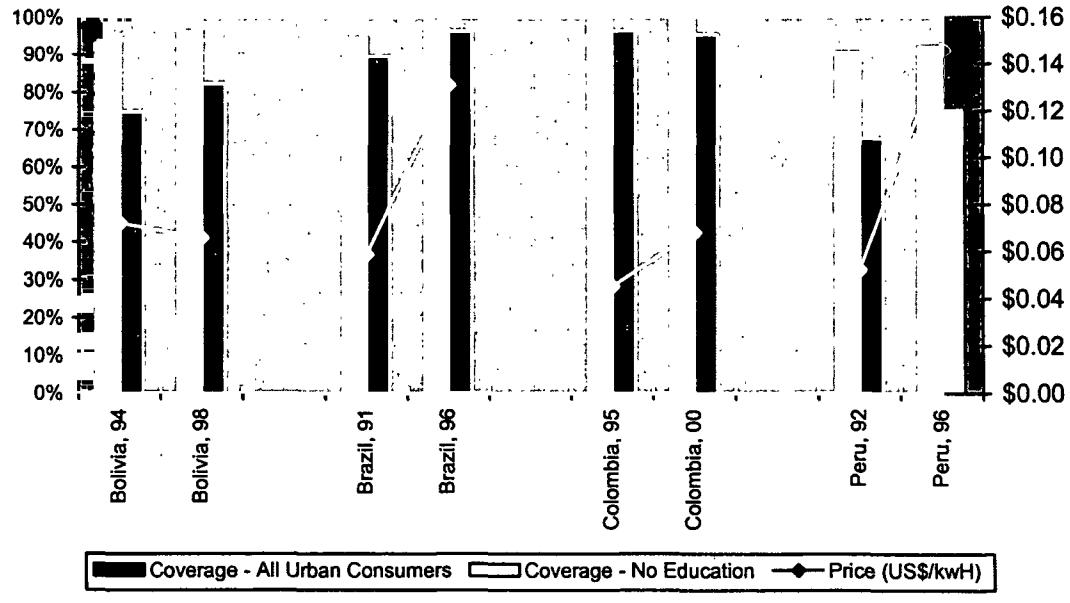
Figure 2: Infrastructure Access for Households in Urban and Rural Areas in 1990s.



Source: Authors' calculations based on raw data from MEASURE DHS+ Demographic and Health Surveys.

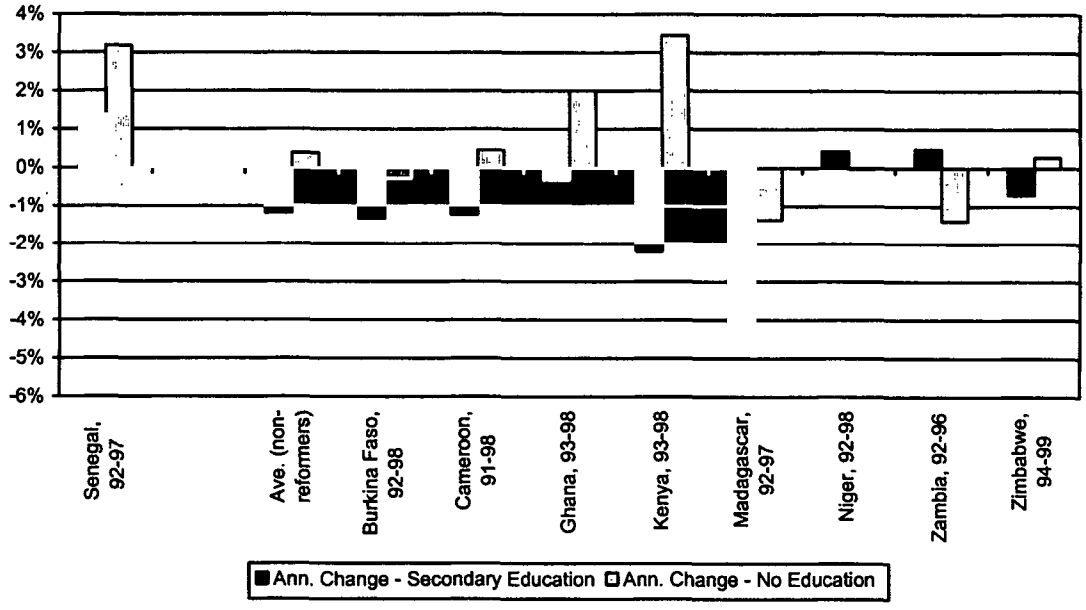
Note: AFR is Sub-Saharan Africa; LAC is Latin America and Caribbean; ECA is Europe and Central Asia. Low are low-income countries; Middle are middle income countries. Income classifications for countries are based upon classifications in (World Bank 2002b). Regional average are computed as simple averages (i.e., no weighting). Classifications of urban and rural households are based upon original classifications in the DHS+ datasets. Coverage implies that the household has a connection to that service in their house (or yard for water). Data is for all countries in these regions for which data were available for various years between 1994 and 2000. See Table 2 for more information.

Figure 4: Residential Electricity Prices and Electricity Coverage by educational attainment before and after privatization.



Source: Authors' calculations based on raw data from MEASURE DHS+ Demographic and Health Surveys and price data from OLADE. Note: Coverage is for urban households, which are classified based on educational level of household head. Comparable data was not available for non-reformers. Privatization is defined as privatization in any of generation, distribution or transmission. Similar data was not available for any non-reformers over similar periods.

Figure 3: Annual change in piped water coverage by educational level in Senegal and other non-reformers in Africa, early-late 1990s.



Source: Authors' calculations based on raw data from MEASURE DHS+ Demographic and Health Surveys.
Note: Changes are for urban households, which are classified based on educational level of household head. Coverage implies that the household has a piped connection in either their house or yard. Information on privatization is provided by the Water Utilities Partnership (http://www.wupafrica.org/).

X. TABLES

Table 1: Access to Infrastructure in Developing and Transition Economies for Urban Households with Heads with No Education and Secondary Education.

Country	Year	Per Capita Gross National Income (US $)	Access to Electricity		Access to Piped Water		Access to Telephone		Access to Flush Toilet	
			Secondary Education	No Education	Secondary Education	No Education	Secondary Education	No Education	Secondary Education	No Education
Africa - Low Income			**79.8%**	**32.1%**	**62.8%**	**26.6%**	**19.8%**	**1.7%**	**38.2%**	**9.8%**
Mozambique	1997	180	63.9%	6.8%	63.6%	11.8%	25.0%	0.4%	39.9%	2.4%
Niger	1998	200	88.0%	22.9%	70.5%	17.4%	14.6%	0.9%	22.6%	1.1%
Chad	1997	220	35.5%	5.8%	34.7%	9.6%	10.4%	0.3%	6.3%	0.5%
Burkina Faso	1998	240	85.2%	21.3%	62.2%	11.4%	34.9%	3.0%	17.8%	0.9%
Mali	1996	240	64.7%	11.1%	58.5%	9.7%	13.4%	1.0%	18.6%	1.1%
Madagascar	1997	250	83.9%	8.5%	52.3%	3.0%	9.9%	0.3%	30.7%	0.7%
Nigeria	1999	250	94.3%	67.3%	34.9%	18.3%	10.7%	0.9%	45.7%	5.3%
Uganda	1995	250	61.4%	15.5%	25.5%	3.5%	5.8%	0.0%	17.5%	0.8%
Tanzania	1999	260	91.9%	19.0%	65.9%	45.9%			35.0%	1.4%
Togo	1998	320	84.3%	21.1%	77.8%	39.5%			0.0%	0.0%
Benin	1996	350	85.5%	11.0%	86.1%	31.8%			0.0%	0.0%
Kenya	1998	350	60.9%	42.0%	71.6%	49.4%	15.4%	5.8%	58.7%	36.1%
Zambia	1996	360	87.0%	14.3%	81.4%	24.0%			82.8%	16.4%
Ghana	1998	390	94.2%	69.1%	64.7%	25.6%	14.7%	1.9%	40.4%	6.0%
Comoros	1996	410	89.6%	33.3%	52.1%	32.1%	35.4%	2.9%	33.3%	2.4%
Central African Republic	1994	440	40.4%	7.7%	31.7%	5.1%	29.9%	1.3%	27.9%	1.9%
Guinea	1999	490	76.5%	43.5%	47.0%	23.8%	14.8%	2.7%	24.7%	2.0%
Senegal	1997	530	97.7%	55.4%	91.2%	60.3%			67.4%	15.2%
Zimbabwe	1999	530	97.5%	80.8%	96.5%	85.8%	45.8%	0.0%	96.9%	97.0%
Cameroon	1998	610	97.8%	53.2%	66.0%	13.2%	16.4%	3.6%	57.4%	3.0%
Côte d'Ivoire	1994	660	95.3%	63.8%	84.4%	37.4%			78.0%	11.8%
Europe and Central Asia - Low Income			**100.0%**	**100.0%**	**86.1%**	**94.2%**	**51.9%**	**55.2%**	**45.7%**	**22.6%**
Kyrgyz Republic	1997	470	99.9%	100.0%	86.2%	100.0%	53.4%	57.7%	49.0%	38.2%
Uzbek	1996	620	100.0%	100.0%	86.0%	88.4%	50.4%	52.6%	42.5%	7.1%
Europe and Central Asia - Middle Income			**99.3%**	**91.4%**	**77.7%**	**77.8%**	**73.5%**	**47.7%**	**87.2%**	**77.0%**
Kazakhstan	1999	1290	99.3%	91.4%	85.2%	75.5%	58.1%	22.9%	79.7%	75.5%
Turkey	1998	3150			70.2%	80.1%	88.9%	72.6%	94.7%	78.5%

Country	Year	Per Capita Gross National Income (US $)	Access to Electricity		Access to Piped Water		Access to Telephone		Access to Flush Toilet	
			Secondary Education	No Education	Secondary Education	No Education	Secondary Education	No Education	Secondary Education	No Education
Latin America - Low Income			**97.6%**	**56.8%**	**80.6%**	**47.4%**	**39.5%**	**5.3%**	**64.2%**	**10.3%**
Haiti	1994	270	97.6%	56.8%	63.7%	15.5%			57.0%	0.6%
Nicaragua	1998	370	99.2%	80.0%	97.5%	79.4%	39.5%	5.3%	71.4%	20.1%
Latin America - Middle Income			**99.0%**	**85.1%**	**74.2%**	**78.4%**	**59.3%**	**15.8%**	**81.8%**	**43.9%**
Bolivia	1998	1010	99.4%	82.3%	93.5%	74.7%	56.1%	8.0%	64.2%	15.4%
Dominican Republic	1996	1550			37.5%	85.9%	60.5%	20.0%	84.1%	37.4%
Guatemala	1998	1650	100.0%	75.7%	49.0%	59.0%	60.8%	2.8%	97.8%	38.8%
Colombia	2000	2080	99.9%	95.4%	98.8%	94.9%	81.2%	39.4%	98.6%	84.1%
Peru	1996	2250	95.9%	76.1%	82.7%	74.6%	38.0%	8.6%	79.2%	50.1%
Brazil	1996	4320	99.6%	96.2%	83.5%	81.1%			67.1%	37.8%

Source: Authors' calculations based on raw data from MEASURE DHS+ Demographic and Health Surveys.

Note: Data are for urban households headed by males, which are classified based on educational level of household head. Coverage implies that the household has a connection to that service in their house (or yard for water). Income classifications are based upon classifications in (World Bank 2002b). Data is for all countries in these regions for which data were available for various years between 1994 and 2000. Regional average are computed as simple averages (i.e., no weighting).

Table 2: Access to Infrastructure in Developing and Transition Economies for Households in Urban and Rural Areas

Country	Year	Per Capita Gross National Income (US $)	Access to Electricity		Access to Piped Water		Access to Telephone		Access to Flush Toilet	
			Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Africa - Low Income			**47.3%**	**6.6%**	**36.9%**	**3.7%**	**5.7%**	**0.3%**	**17.6%**	**1.0%**
Mozambique	1997	180	25.9%	2.1%	23.4%	0.6%	5.4%	0.0%	12.3%	0.1%
Niger	1998	200	36.6%	0.2%	27.2%	0.1%	3.4%	0.0%	4.3%	0.3%
Chad	1997	220	9.4%	0.1%	11.6%	0.2%	1.4%	0.0%	1.0%	0.0%
Burkina Faso	1998	240	39.8%	0.2%	25.2%	0.1%	9.5%	0.1%	3.9%	0.0%
Mali	1996	240	21.6%	0.4%	15.8%	0.6%	2.4%	0.0%	3.0%	0.1%
Madagascar	1997	250	38.1%	2.1%	17.7%	2.2%	2.0%	0.1%	7.4%	0.7%
Nigeria	1999	250	85.0%	28.2%	24.4%	3.8%	5.5%	0.2%	31.1%	4.3%
Uganda	1995	250	40.2%	1.5%	12.9%	0.1%	2.4%	0.1%	9.4%	0.3%
Tanzania	1999	260	27.4%	1.1%	48.2%	4.1%			4.1%	0.6%
Togo	1998	320	41.2%	2.5%	51.6%	3.4%			0.0%	0.0%
Benin	1996	350	34.5%	2.0%	56.5%	7.1%			0.0%	0.0%
Kenya	1998	350	47.6%	4.3%	61.3%	12.5%	9.2%	0.7%	43.6%	2.1%
Zambia	1996	360	44.2%	1.5%	47.9%	1.7%			45.9%	1.2%
Ghana	1998	390	82.5%	20.9%	41.5%	3.5%	5.3%	0.2%	18.4%	2.1%
Comoros	1996	410	52.1%	19.7%	39.5%	15.1%	9.1%	0.9%	7.7%	1.6%
Central African Republic	1994	440	8.0%	0.3%	5.0%	0.0%	2.6%	0.0%	2.5%	0.1%
Guinea	1999	490	54.5%	1.5%	30.0%	1.2%	5.7%	0.1%	7.9%	0.2%
Senegal	1997	530	68.9%	6.0%	65.4%	7.4%			26.7%	0.8%
Zimbabwe	1999	530	87.5%	8.3%	91.0%	6.2%	16.7%	1.3%	94.1%	2.2%
Cameroon	1998	610	79.1%	22.0%	28.5%	2.9%	5.1%	0.1%	18.1%	1.3%
Côte d'Ivoire	1994	660	69.8%	13.7%	51.0%	4.1%			29.3%	2.3%
Europe and Central Asia - Low Income			**100.0%**	**99.5%**	**87.4%**	**32.7%**	**52.0%**	**13.3%**	**49.7%**	**2.8%**
Kyrgyz Republic	1997	470	100.0%	99.6%	87.4%	27.6%	53.9%	13.8%	51.6%	3.1%
Uzbek	1996	620	100.0%	99.3%	87.4%	37.8%	50.0%	12.7%	47.7%	2.5%
Europe and Central Asia - Middle Income			**99.4%**	**93.9%**	**79.9%**	**28.3%**	**67.8%**	**44.7%**	**85.1%**	**14.8%**
Kazakhstan	1999	1290	99.4%	93.9%	86.8%	23.6%	54.9%	19.6%	80.8%	4.9%
Turkey	1998	3150			72.9%	33.0%	80.7%	69.7%	89.5%	24.8%

Country	Year	Per Capita Gross National Income (US $)	Access to Electricity		Access to Piped Water		Access to Telephone		Access to Flush Toilet	
			Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Latin America - Low Income			**84.5%**	**20.7%**	**60.2%**	**13.5%**	**16.5%**	**1.1%**	**26.6%**	**1.4%**
Haiti	1994	270	76.7%	3.9%	30.1%	1.8%			11.6%	0.1%
Nicaragua	1998	370	92.4%	37.6%	90.3%	25.1%	16.5%	1.1%	41.7%	2.8%
Latin America - Middle Income			**95.6%**	**51.4%**	**78.0%**	**38.9%**	**39.7%**	**4.3%**	**67.4%**	**19.1%**
Bolivia	1998	1010	96.2%	29.0%	88.3%	31.0%	36.2%	0.6%	45.1%	2.4%
Dominican Republic	1996	1550			58.2%	43.6%	40.8%	4.1%	64.8%	9.4%
Guatemala	1998	1650	91.4%	54.0%	59.5%	51.2%	27.1%	6.1%	71.4%	24.2%
Colombia	2000	2080	99.5%	83.9%	98.1%	50.7%	66.7%	10.3%	96.3%	58.2%
Peru	1996	2250	92.1%	17.8%	78.4%	29.6%	27.7%	0.3%	70.9%	4.2%
Brazil	1996	4320	99.0%	72.4%	85.4%	27.2%			55.7%	16.2%

Source: Authors' calculations based on raw data from MEASURE DHS+ Demographic and Health Surveys.

Note: Classifications of urban and rural households are based upon original classifications in the DHS+ datasets. Coverage implies that the household has a connection to that service in their house (or yard for water). Income classifications are based upon classifications in (World Bank 2002b). Data is for all countries in these regions for which data were available for various years between 1994 and 2000. Regional average are computed as simple averages (i.e., no weighting).

Table 3: Access to Piped Water in Africa where Urban Water Supply Is Provided at National and Local Level.

Country	Access to Piped Water		Difference	All Urban as share of Capital
	Capital	All Urban		
Local or State	**52.40%**	**37.77%**	**14.6%**	**74.38%**
Kenya	82.6%	61.3%	21.3%	74.21%
Madagascar	31.7%	17.7%	14.0%	55.84%
Mozambique	28.6%	23.4%	5.1%	81.82%
Tanzania	78.8%	48.2%	30.6%	61.17%
Togo	67.5%	51.6%	15.9%	76.44%
Nigeria	25.2%	24.4%	0.8%	96.83%
National	**42.77%**	**30.88%**	**11.9%**	**74.08%**
Benin	98.1%	56.5%	41.7%	57.59%
Burkina Faso	27.3%	25.2%	2.1%	92.31%
Cameroon	43.1%	28.5%	14.6%	66.13%
Central African Republic	10.2%	5.0%	5.2%	49.02%
Chad	21.1%	11.6%	9.4%	54.98%
Côte d'Ivoire	63.8%	51.0%	12.8%	79.94%
Ghana	66.0%	41.5%	24.5%	62.88%
Guinea	39.6%	30.0%	9.6%	75.76%
Mali	17.4%	15.8%	1.6%	90.80%
Niger	33.9%	27.2%	6.7%	80.24%
Senegal	79.4%	65.4%	14.0%	82.37%
Uganda	13.3%	12.9%	0.4%	96.99%

Source: Authors' calculations based on raw data from MEASURE DHS+ Demographic and Health Surveys.
Note: Coverage is for urban households, which are classified based on educational level of household head. Access to piped water implies that the household has piped water in either their house or compound. If coverage for households with heads with secondary education and no education were equally likely to have connections, the final two columns would be 0% and 0 respectively. Information on decentralization is from Water Utilities Partnership (http://www.wupafrica.org/). Data is for all countries in these regions for which data were available for various years between 1994 and 2000. Nigeria has state-level provision of water supply.

Table 4: Piped Water Coverage for Urban Households headed by individuals with different levels of education in Africa.

		% of Households with Piped Water		*Difference*	*No education as share of secondary education*
		Secondary education	No education		
Public		**62.6%**	**25.4%**	**37.2%**	**40.58%**
Zimbabwe	1999	96.5%	85.8%	10.6%	88.91%
Kenya	1998	71.6%	49.4%	22.3%	68.99%
Tanzania	1999	65.9%	45.9%	20.0%	69.65%
Comoros	1996	52.1%	32.1%	20.0%	61.61%
Nigeria	1999	34.9%	18.3%	16.6%	52.44%
Togo	1998	77.8%	39.5%	38.3%	50.77%
Ghana	1998	64.7%	25.6%	39.1%	39.57%
Benin	1996	86.1%	31.8%	54.3%	36.93%
Zambia	1996	81.4%	24.0%	57.4%	29.48%
Uganda	1995	25.5%	3.5%	22.0%	13.73%
Cameroon	1998	66.0%	13.2%	52.8%	20.00%
Niger	1998	70.5%	17.4%	53.1%	24.68%
Burkina Faso	1998	62.2%	11.4%	50.8%	18.33%
Chad	1997	34.7%	9.6%	25.1%	27.67%
Mozambique	1997	63.6%	11.8%	51.8%	18.55%
Madagascar	1997	52.3%	3.0%	49.3%	5.74%
Mali	1996	58.5%	9.7%	48.8%	16.58%
Private Sector Participation (Recent)		**61.5%**	**32.7%**	**28.8%**	**53.17%**
Senegal	1997	91.2%	60.3%	30.9%	66.12%
Central African Republic	1994	31.7%	5.1%	26.6%	16.09%
Private Sector Participation (Established)		**65.7%**	**30.6%**	**35.1%**	**46.58%**
Guinea	1999	47.0%	23.8%	23.2%	50.64%
Côte d'Ivoire	1994	84.4%	37.4%	47.0%	44.31%

Source: Authors' calculations based on raw data from MEASURE DHS+ Demographic and Health Surveys.

Note: Coverage is for urban households, which are classified based on educational level of household head. Access to piped water implies that the household has piped water in either their house or compound. If coverage for households with heads with secondary education and no education were equally likely to have connections, the final two columns would be 0% and 0 respectively. Private Sector Participation includes lease contracts (Guinea, Côte d'Ivoire, and Senegal) and Management Contracts (Central African Republic). Senegal and Central African Republic had PSP for one year before survey was taken. Guinea had PSP for 10 years and Côte d'Ivoire for 35 years. Information on private sector participation is from Water Utilities Partnership (http://www.wupafrica.org/). Data is for all countries in these regions for which survey data were available for various years between 1994 and 2000.

Table 5: Telephone coverage for Urban Households headed by individuals with different levels of education in Africa and Latin America.

Country	Year	% of households with telephone		Difference	no education as share of secondary education
		Secondary Education	No Education		
Africa – Privatized		**13.1%**	**1.7%**	**11.50%**	**12.98%**
Guinea	1999	14.8%	2.7%	12.10%	18.24%
Ghana	1998	14.7%	1.9%	12.80%	12.93%
Madagascar	1997	9.9%	0.3%	9.50%	3.03%
Africa – Public		**21.5%**	**1.7%**	**19.80%**	**7.91%**
Uganda	1995	5.8%	0.0%	5.80%	0.00%
Kenya	1998	15.4%	5.8%	9.60%	37.66%
Nigeria	1999	10.7%	0.9%	9.80%	8.41%
Mali	1996	13.4%	1.0%	12.40%	7.46%
Niger	1998	14.6%	0.9%	13.70%	6.16%
Mozambique	1997	25.0%	0.4%	24.60%	1.60%
Zimbabwe	1999	45.8%	0.0%	45.80%	0.00%
Chad	1997	10.4%	0.3%	10.00%	2.88%
Cameroon	1998	16.4%	3.6%	12.80%	21.95%
Central African Republic	1994	29.9%	1.3%	28.60%	4.35%
Burkina Faso	1998	34.9%	3.0%	31.90%	8.60%
Comoros	1996	35.4%	2.9%	32.50%	8.19%
Latin America - Privatized		**58.9%**	**19.0%**	**39.90%**	**32.26%**
Colombia	2000	81.2%	39.4%	41.80%	48.52%
Dominican Republic	1996	60.5%	20.0%	40.40%	33.06%
Peru	1996	38.0%	8.6%	29.30%	22.63%
Bolivia	1998	56.1%	8.0%	48.20%	14.26%
Latin America - Public		**50.2%**	**4.1%**	**46.10%**	**8.17%**
Nicaragua	1998	39.5%	5.3%	34.20%	13.42%
Guatemala	1998	60.8%	2.8%	58.00%	4.61%

Source: Authors' calculations based on raw data from MEASURE DHS+ Demographic and Health Surveys.
Note: Coverage is for urban households, which are classified based on educational level of household head. If coverage for households with heads with secondary education and no education were equally likely to have connections, the final two columns would be 0% and 0 respectively. Privatization information is provided by International Telecommunications Union. All privatizations, other than in the Dominican Republic are recent (i.e., within past five years). Data is for all countries in these regions for which data were available for various years between 1994 and 2000.

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