

Water Subsidy Policies: A Comparison of the Chilean and Colombian Schemes

Andrés Gómez-Lobo and Dante Contreras

Analysis of two water subsidy schemes—a means-tested subsidy in Chile and a geographically targeted subsidy in Colombia—shows that the means-tested system is better able to identify poor households than the geographically targeted scheme. However, the overall distributive impact of both schemes is quite similar, at least for the three lowest income deciles, because the amount of benefits per household in the geographically targeted Colombian scheme are differentiated by the socioeconomic classification of household. Despite the relative merits of the Chilean means-tested scheme, targeting errors are still quite large. More than 60 percent of subsidies accrue to households that are above the third decile of the income distribution. If the policy objective in Chile is to benefit a significant proportion of households in the lowest income deciles, then either the targeting mechanism must be improved or the number of subsidies has to increase to take into account these targeting imperfections. In Colombia almost all households receive some kind of benefit, implying an unnecessarily high fiscal cost. An improvement in the targeting mechanism could lower this cost without jeopardizing benefits to lower-income households. Some suggestions for additional research and for improving both schemes are discussed.

In recent years many countries have undertaken important reforms of their electricity, gas, water, and telecommunications industries to increase productive and allocative efficiency and promote higher levels of investment. However, the reforms have sometimes created new social and distributive concerns. For example, the need to guarantee the financial viability of firms usually entails an increase in household utility bills. Reforms usually aim to improve the commercial efficiency of providers, which, if successful, reduces the level of nonpayment by certain groups of customers. Reforms normally include an end

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to cross-subsidies. All of these policies, although recommended from an economic point of view, may increase the financial burden on poorer households.¹

Conventional wisdom indicates that such social and distributive effects should be tackled through the general tax and benefits system and not through sectoral reform programs. However, there are several reasons why this may not always be a wise strategy in developing economies. First, policymakers may be concerned that all households consume a minimum level of utility services as well as with the income effects of utility bills. This is especially so in the case of water and sanitation services, which involve public health issues. Second, many countries have no established welfare system capable of providing an income supplement to poorer households to compensate for rising utility prices. Finally, ignoring social issues in utility industries may introduce distortions in regulatory decisionmaking that, among other effects, may increase the risks faced by potential private operators in these industries.²

Thus, in developing economies general welfare payments that increase total disposable household income may not always be a good or viable policy substitute for programs designed to allow poor households to access and consume specific utility services. In these cases, welfare policies specifically designed for these industries may be warranted. However, there are several risks associated with such a sectoral approach. Perhaps the most important is that such subsidies may be poorly targeted.³ Informal subsidies benefiting mainly middle-class customers abound in utility industries throughout the developing world. Therefore, if a utility service is to be subsidized, the distributive effects of such a scheme need careful attention.

This article analyzes the distributive effects of two subsidy programs for water utility services applied in developing economies: a program introduced in Chile in the early 1990s and one adopted in Colombia after 1994. Both provide explicit subsidies targeted to vulnerable households, and both were introduced as part of wider sectoral reforms.

There are several reasons why these two programs are of interest to policymakers. First, they constitute two of the few examples in the developing world of formal subsidies for utility services. Both programs are national in coverage, benefit customers from different regional operators, and are grounded in an explicit legal and regulatory framework. Moreover, both programs tried to target benefits to poor people. As such, these schemes offer an interesting contrast to the informal and universal subsidies more commonly encountered

1. Estache, Foster, and Wodon (2002) present a comprehensive analysis of the potential links between infrastructure reforms and poverty.

2. In extreme cases, neglect of social considerations may lead to civil unrest—as in Cochabamba's (Bolivia) water concession process a few years ago—or the termination of existing concession contracts, as was the case of the water concession in Tucuman, Argentina, in the 1990s.

3. This will be the case, for example, when a significant proportion of poor households is not connected to a utility service whose consumption is being subsidized.

in many utility industries.⁴ The Chilean and Colombian experiences are often touted as examples of best practice in the design of subsidy schemes in infrastructure services.⁵ However, so far little empirical analysis has been undertaken to evaluate the results of these programs. This article is a first step in that direction.

Second, the Chilean and Colombian schemes use different targeting mechanisms. Chile uses individual means testing of households to determine eligibility, whereas Colombia uses a geographical targeting system. Because both targeting mechanisms are valid design options, policymakers may be interested in knowing how each type of scheme performs in particular applications.

Relative concentration curves typical of distributional analysis are used to show that these two very different targeting schemes have comparable results in terms of reaching poor households, at least for monetary transfers. However, if the number of beneficiaries rather than monetary transfers are used in the concentration curve analysis, the Chilean means-tested scheme performs better than the Colombian geographically targeted scheme. Therefore, there is some evidence that a means-tested subsidy, as applied in Chile, is better able to identify poorer households than a geographically targeted subsidy. However, because the Colombian system is more generous to comparably poor households than the Chilean system, the overall effect on poverty incidence is similar in both schemes.

An interesting contribution of this article is the use of an absolute beneficiary concentration curve to further analyze the targeting properties of these subsidies. With this curve it is straightforward to evaluate both the errors of exclusion (eligible households that do not receive a benefit) and the errors of inclusion (noneligible households that receive a benefit) associated with each program. The Colombian scheme provides benefits to almost all poor households but at a high fiscal cost because the program gives some benefits to almost all households in the country. The Chilean program, which is much smaller and targeted to a narrower group of households, misses many deserving households because of targeting errors.

The next two sections provide a brief overview of the main features of each subsidy scheme. This is followed by a comparison of the targeting properties of each subsidy using relative and absolute concentration curve analysis of the total monetary transfers and the total number of beneficiaries. Some policy implications are also drawn from the analysis.

4. These subsidies usually take the form of direct transfers from local or national governments to loss-making public utilities. According to the World Bank (1994), the average ratio of revenues to costs for public utilities across the world was 0.8 for gas, 0.6 for electricity, 0.3 for water, and 1.6 for telecommunications. Thus, except for the telecommunications sector, informal universal subsidies of questionable distributional impact were very common, at least at the beginning of the past decade.

5. The Chilean water subsidy was positively reviewed in a recent book on the design of subsidies for public services (Brook and Smith 2001). Both experiences are presented as best practice in a popular training course for regulators at the University of Florida and sponsored by the World Bank. The Latin American version of this course, undertaken by the Centre for the Economic Study of Regulation in Buenos Aires, also presents these experiences as best practice in this field.

I. THE CHILEAN WATER SUBSIDY SCHEME

The water consumption subsidy in Chile is one of the few means-tested subsidies (households are individually screened for eligibility based on their socioeconomic circumstances) applied in the utility industry of a developing country. The subsidy scheme, which became operational in 1990, was designed to counter the adverse social impacts of rising water charges.⁶

The subsidy program is administered by the Ministry of Social Planning along with municipal governments. The ministry determines the number of subsidies that will be offered to each region the following fiscal year and the value of each subsidy by region. Municipalities are responsible for administering the subsidies.

The subsidy program gives eligible households the right to consume water at a lower price (expressed as a percentage of the full tariff) up to a certain limit.⁷ Beyond this limit additional consumption is charged at the full tariff. Thus for eligible households the subsidy operates like a rising block tariff structure that subsidizes the first block of consumption. The Ministry of Social Planning determines the consumption ceiling that the subsidy will cover (currently 15 m³ per month in all regions) and the percentage discount for this first block (which varies by region).

The number and value of each subsidy by region are determined yearly, and the aggregate projected expenditure of the program is included in the national budget each fiscal year. The subsidy is funded entirely from general tax revenues, and the water regulator—responsible for setting tariffs—is not involved in determining subsidy levels or in the operational aspects of the scheme. Thus there is complete separation between the welfare policies applied in the water sector and the economic regulation of the industry.⁸

To be eligible for a subsidy, a household must apply for the benefit at its municipality.⁹ Eligibility is then determined by socioeconomic need, based on the Communal Social Assistance Committees (CAS) point score. The CAS score is the main instrument used in the Chilean welfare system to gauge the socioeconomic condition of households. A household's CAS score is based on information gathered during a personal interview conducted at the household's dwelling. The interview consists of 50 questions divided in nine sections: general information, environmental conditions, overcrowding conditions, health conditions, identification of family members, occupation and earning, monetary subsidies, education, and wealth. Personal interviews are conducted at the household's dwelling so that the interviewer can verify some of the answers,

6. Between 1989 and 1998 water charges more than doubled for each of the 13 regional water companies—and more than tripled in some regions, such as the water-scarce northern regions.

7. By law the percentage of the bill that the subsidy will cover can vary between 20 percent and 85 percent.

8. However, there is some dependence in the other direction. A tariff revision process will have a direct impact on the design and projected budget of the subsidy program in the following years.

9. To qualify for a subsidy, a client cannot have arrears with the service provider.

such as the size and materials of the dwelling and durable goods ownership, key variables in the CAS score calculation.

A household's CAS score is valid for two years. Although this lowers the administrative costs of the welfare system in general, it also reduces the efficiency of the CAS score as a targeting instrument because a household's socio-economic condition may change in the course of two years.

The municipalities must award water subsidies (as well as other public subsidies) based on the ranking of CAS scores of all new applicants and current beneficiaries. The total number of subsidies awarded is capped by the total number assigned annually to the region by the Ministry of Social Planning and later distributed to each municipality by the regional governor. If all subsidies have already been assigned and a new applicant has a lower CAS score than the best-off current beneficiary, the mayor must redistribute benefits in favor of the new applicant.

Once a household is awarded a subsidy, the service provider is notified and the client's subsequent monthly water bills will be net of the subsidy. Once a month water companies bill municipalities in their service area to recover the subsidies given to beneficiary households in the last billing period.

Data on the number of assigned subsidies by region, the percentage of connected households covered, and the average value of subsidies in 1998 show that nearly a third of households are subsidized in some regions (table 1). The absolute monthly value of the subsidy is highest in the northern regions (I to III), where

TABLE 1. Number and Value of Assigned Water Subsidies by Region in 1998, Chile

| Region | Number of assigned subsidies | Share of regional households covered ^a (%) | Average value per subsidy ^b (US\$/month) |
|--------------|------------------------------|---|---|
| I | 18,836 | 20.7 | 15.74 |
| II | 24,576 | 22.9 | 17.94 |
| III | 16,869 | 28.3 | 13.41 |
| IV | 21,793 | 17.9 | 9.14 |
| V | 63,034 | 17.3 | 6.36 |
| VI | 17,108 | 10.7 | 5.95 |
| VII | 28,380 | 16.3 | 7.45 |
| VIII | 68,314 | 17.9 | 7.10 |
| IX | 36,637 | 25.1 | 9.20 |
| X | 31,277 | 17.7 | 8.11 |
| XI | 6,002 | 29.9 | 11.71 |
| XII | 6,013 | 14.9 | 8.24 |
| Metropolitan | 105,114 | 7.0 | 4.28 |
| National | 443,953 | 13.3 | 9.59 |

^aCalculated as the ratio of the number in the first column to the total number of households with shared or own water connections in each region estimated using the expansion factors of the CASEN survey data.

^bCalculated using data from Mideplan (1999) deflated by the average exchange rate from the Central Bank of Chile for that year.

Source: Mideplan 1999 and CASEN 1998.

production costs are high. The national average benefit is close to US\$10 per beneficiary household per month.

The aggregate budget for the subsidy reached \$42.5 million in 2000. As Serra (2000) points out, the cost of the subsidy is well below the cost of the universal subsidy given to loss-making providers before the reform. In 1998 water and sewerage companies had net profits of \$107 million, more than twice the cost of the subsidy scheme (not considering administrative costs).

One important point to make is that subsidies are normally awarded to a family for a three-year period (although benefits accrue to the household monthly). This means that a large fraction of the budget for a given year is already determined by the number of ongoing subsidies that were distributed in previous years.

II. THE COLOMBIAN WATER SUBSIDY SCHEME

Unlike Chile, Colombia has opted for a scheme based on cross-subsidies between different clients, although in practice benefits are mostly funded from general tax revenues.¹⁰ Colombia is not unique in the use of cross-subsidies. These subsidies are ubiquitous in water tariffs across the world. What makes the Colombian system interesting is that the cross-subsidies are explicitly laid out in the Public Residential Services Law of 1994, and a geographic targeting system is used to determine whether a client pays a surcharge or receives a subsidy from the tariff structure. The objective of the 1994 reform was to unify criteria for the application of cross-subsidies across utility industries and to guarantee consistent application of the scheme across the country. Another motivation for the reform was to reduce the magnitude of cross-subsidies, which had grown to extremely inefficient levels in some cases.

In each municipality dwellings are classified into six socioeconomic categories. Households are eligible to receive a subsidy of up to 50 percent of the average service cost if they live in dwellings classified as level 1 (low-low) and of up to 40 percent if they live in dwellings classified as 2 (low). Households living in level 3 dwellings (medium-low) may also receive a subsidy of up to 15 percent of the average service cost. The decision on whether to grant a subsidy to this middle group is up to the regulatory commission in each case.

Subsidies are funded through a variety of sources. First, a surcharge can be applied to clients in dwellings classified as 5 or 6 and to industrial and commercial customers.¹¹ These surcharges are capped at a maximum of 20 percent of the water and sewage bill. When these surcharges are not sufficient to fund the subsidies to the first three socioeconomic groups, the difference can be financed by transfers from the national and provincial budgets.

10. In cross-subsidy schemes, some clients pay a tariff greater than the cost they impose on the service provider to finance lower tariffs for other clients.

11. Hospitals, schools, and other nonprofit organizations are exempt from paying surcharges or receiving subsidies. These clients must pay the full tariff.

TABLE 2. Tariffs Paid as a Proportion of the Cost-Recovery Tariff for 15 Companies, by Socioeconomic Classification of Dwellings, December 1997, Colombia (percent)

| Range of tariffs paid | Socioeconomic classification | | | | | |
|-----------------------|------------------------------|------------|-------------------|---------------|--------------------|-------------|
| | 1 (low-low) | 2 (low) | 3 (medium-low) | 4 (medium) | 5 (medium-high) | 6 (high) |
| Minimum | 13 | 27 | 41 | 44 | 60 | 75 |
| Average | 35 | 48 | 57 | 74 | 87 | 114 |
| Maximum | 92 | 94 | 91 | 109 | 117 | 150 |

Note: Data were available for companies in Bogotá, Cali, Medellín, Barranquilla, Cartagena, Bucaramanga, Pereira, Manizales, Pasto, Armenia, Valledupar, Popayan, Girardot, Magangué, and Santa Rosa.

Source: Sánchez Torres and Núñez Méndez 1999, based on data from Unidad de Política Regional y Urbana, Departamento Nacional de Planeación.

Data on the tariffs for each group as a proportion of the cost-recovery tariff for the 15 water companies for which information was available at the end of 1997 indicate that despite the residential services law there was still an element of universal subsidy in water charges (table 2). Even consumers living in dwellings classified in groups 5 and 6 received a subsidy in some regions, although on average across regions consumers in the highest socioeconomic classification paid a surcharge. It is also apparent that for most of the water companies the subsidies accruing to the first three groups are higher than the 50 percent, 40 percent, and 15 percent reduction allowed in the law. Thus actual tariffs did not conform to the surcharge and subsidy limits imposed by the residential services law. This is explained by the fact that there was an initial five-year transition period for implementing the new limits, and in 1997 this transition was still incomplete.¹²

The municipalities are responsible for classifying dwellings according to the six socioeconomic categories, following the guidelines and methodology provided by the National Planning Department. The basic classification unit is a geographic area with homogeneous characteristics according to criteria set by the National Planning Department. All dwellings within this unit are classified in one socioeconomic group, although particular dwellings that have different characteristics within the unit can be individually classified in another group. A dwelling's category is the same for all utility services. Individuals can request a revision of their dwelling's classification.

A municipality can hire public or private institutions to undertake the classification study on its behalf. It can also count on the technical assistance of national and regional entities. Municipalities within a larger metropolitan area can also undertake the classification jointly. Finally, the same classification used by

12. To date, tariffs have not been fully adjusted to meet the surcharge and subsidy limits, and the transition period for meeting these limits has been extended for another five years.

municipalities to differentiate property taxes can be used for differentiating utility charges.

III. COMPARISON OF THE DISTRIBUTIONAL IMPACTS OF THE CHILEAN AND COLOMBIAN WATER SUBSIDIES

This section evaluates the targeting results of the two subsidy programs using the traditional tools of distributional analysis (see the appendix for some data issues and sources). However, besides the distributional impact, there are other complementary issues that should be considered when making an overall evaluation of a particular subsidy scheme. The administrative costs of a program, the relative efficiency of the funding mechanism used, and the possible distortions generated in other markets are also relevant. In this article, however, the focus is exclusively on the distributional impact of these subsidies.¹³

Estimating the Distributional Impact of the Chilean Program

There are two difficulties in estimating the distributional impacts of the Chilean subsidy. First, determining the target population is difficult because the aim of the program is to benefit poor households that without the subsidy would spend more than 5 percent of their income on water and sewage services. Therefore, the target population will be a function of water tariffs as well as household income and will be different for each region. In some regions close to 30 percent of households are eligible for the subsidy, whereas in other regions the share is much lower (see table 1). Because the total number of subsidies for each region is further differentiated among municipalities, a poor household in a municipality with low tariff rates might not receive a subsidy, and a relatively better-off household in another municipality with higher water charges does receive a subsidy. This should not constitute a targeting error in light of the declared objectives of the subsidy. However, extensive work for this study reveals that analysis at the regional or local level does not improve the targeting results compared to a national income stratification (results available on request).

The second difficulty relates to the fact that the survey data used, the 1998 Chilean National Characterization Survey (CASEN), is able to identify only 221,821 households that receive the subsidy, whereas Ministry of Social Planning records show 443,953 beneficiary households (see appendix for more information on the survey). If the raw survey data are used, there may be important biases in the estimated distributional impacts. To control for this, the missing subsidies were distributed across deciles according to the proportions recorded in the survey. This is the only reasonable option because it assumes that the underreporting of water subsidies was random. Conversations

13. A wider assessment of the two subsidy programs discussed here is provided in Gómez-Lobo and Contreras (2000).

TABLE 3. Share of Households Receiving the Water Subsidy by Deciles of per Capita Household Income, Chile (percent)

| Decile | Raw data | Adjusted data ^a |
|--------|----------|----------------------------|
| 1 | 14 | 27 |
| 2 | 12 | 23 |
| 3 | 10 | 21 |
| 4 | 9 | 19 |
| 5 | 7 | 14 |
| 6 | 7 | 14 |
| 7 | 4 | 7 |
| 8 | 3 | 5 |
| 9 | 1 | 2 |
| 10 | 0 | 0 |

^aThe difference in subsidies between CASEN and Ministry of Social Planning records was distributed across deciles in the same proportions as recorded in CASEN; see text and appendix for details. Includes households with shared or own water connections only.

Source: CASEN 1998.

with professionals linked to the design and application of CASEN uncovered no reason to believe that underreporting was biased among income groups.

According to the raw survey data, only 14 percent of households in the lowest decile of the income distribution receive the water subsidy (table 3).¹⁴ In the second lowest income decile only 12 percent receive the subsidy. That the majority of households in the first quintile do not receive a subsidy implies a very high error of exclusion—households that in principle should be eligible for the subsidy do not receive it. The results improve once the data are corrected for underreporting (all further results are based on the corrected data). About a quarter of households in the first quintile receive the benefit. Many undeserving households also receive the subsidy, although most subsidies are concentrated in the first two income quintiles.

Estimating the Distributional Impact of the Colombian Program

In Colombia the vast majority of households that have water connections are in socioeconomic groups 2 and 3. Nearly 83 percent of households are classified in the first three groups eligible to receive a subsidy. This means that the tax base (households that are liable to pay a surcharge) on which to finance the subsidy is quite small, suggesting that there are not enough richer households to fund transfers to poorer ones.¹⁵ In fact, according to the 1997 data only 1 percent of

14. Deciles were based on per capita household income. Using an equivalent income measure that takes into account the demographic composition of households does not change the results.

15. This problem is compounded by the fact that the cross-subsidies are internal to service suppliers. Thus, in a poor region, where more funds are required given the number of dwellings in the lowest socioeconomic categories, there are fewer rich dwellings to tax.

TABLE 4. Distribution of Socioeconomic Classification by Deciles of Household per Capita Income, Colombia (percent)

| Decile | Socioeconomic classification | | | | | | Total |
|--------|------------------------------|------------|-------------------|---------------|--------------------|-------------|-------|
| | 1 (low-low) | 2 (low) | 3 (medium-low) | 4 (medium) | 5 (medium-high) | 6 (high) | |
| 1 | 18.8 | 47.3 | 31.4 | 1.6 | 0.7 | 0.3 | 100.0 |
| 2 | 15.3 | 45.6 | 33.8 | 2.5 | 2.0 | 0.8 | 100.0 |
| 3 | 16.2 | 38.7 | 39.2 | 2.8 | 2.0 | 1.1 | 100.0 |
| 4 | 14.5 | 40.4 | 38.4 | 4.5 | 1.7 | 0.5 | 100.0 |
| 5 | 8.8 | 43.4 | 40.4 | 5.3 | 1.7 | 0.4 | 100.0 |
| 6 | 7.9 | 32.5 | 49.6 | 6.5 | 2.7 | 0.8 | 100.0 |
| 7 | 5.7 | 30.9 | 44.5 | 13.1 | 4.7 | 1.1 | 100.0 |
| 8 | 1.4 | 27.0 | 44.4 | 20.1 | 6.5 | 0.6 | 100.0 |
| 9 | 0.5 | 20.5 | 46.5 | 16.4 | 11.8 | 4.4 | 100.0 |
| 10 | 1.2 | 8.6 | 31.7 | 26.6 | 23.1 | 8.7 | 100.0 |

Source: ENCV 1997. Observations with zero income were dropped.

distributed benefits were funded through negative transfers from people living in dwellings classified in groups 5 and 6.

The classification system shows some correlation with poverty (table 4), but the correlation is quite imperfect, a result consistent with earlier work on the distributional effects of residential utility service subsidies in Colombia (see Vélez Echavarría 1993; Sánchez Torres and Núñez Méndez 1999). Most households in the poorest five income deciles live in dwellings classified in socioeconomic groups 1 to 3.¹⁶ However, errors of inclusion are large. More than 75 percent of households in income deciles 6 to 9 fall into one of the three lowest socioeconomic groups. Only for the richest decile are most households classified in the highest three socioeconomic groups, but even in this case less than 32 percent of households are classified in the top two categories, making them liable to pay surcharges.

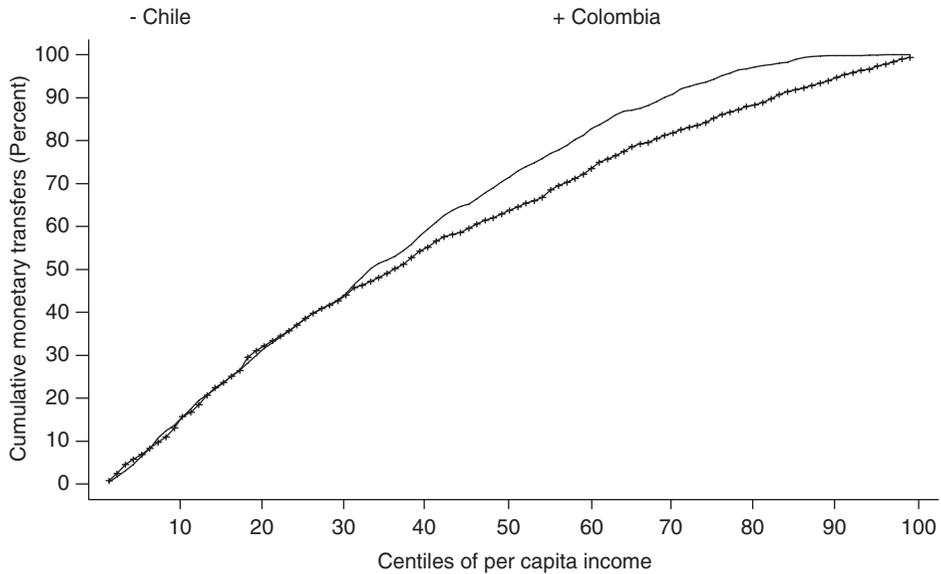
Relative Concentration Curves

Examination of the relative concentration curves for monetary transfers and total number of beneficiaries permits a more detailed comparison of the distributional impacts of the Chilean and Colombian water subsidy schemes.

The relative monetary transfer distribution curves for each country show the percentage of total monetary transfers that accrue to households that are at or below a certain range of the income distribution (figure 1). The horizontal axis measures centiles of income distribution, from poorest to richest, and the

16. Income was defined as primary income plus rental values of any dwelling owned by the household. Secondary income, such as lottery money, loans, property sales, and other infrequent revenues, were not considered.

FIGURE 1. Cumulative Monetary Transfer Curve per Centile of per Capita Income



Source: Authors' computations based on CASEN 1998 and ENCV 1997.

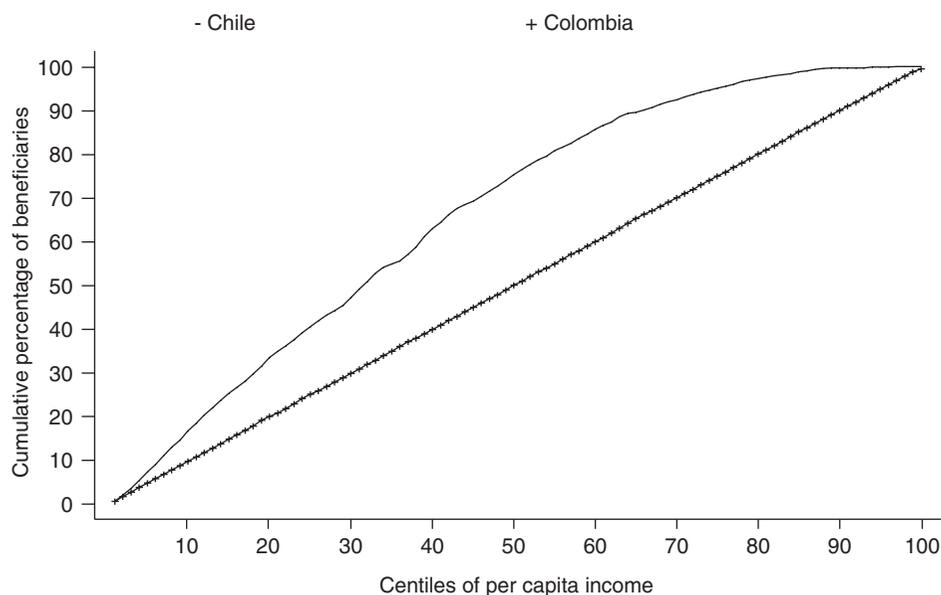
vertical axis measures the accumulated percentage of total transfers.¹⁷ The higher and more concave the curve, the better the targeting property of the subsidy. Up to the 30th income centile (the third income decile) the effects of monetary transfers are almost identical in both countries. Roughly the same percentage of transfers, close to 45 percent, accrue to the poorest 30 percent of households. Above the third income decile, however, the Chilean scheme performs better, transferring more income to middle-income groups rather than to higher income groups.

The relative concentration curves with respect to the number of beneficiaries is another source of information on the targeting performance of each subsidy scheme (figure 2). Again, the horizontal axis measures the centiles of the income distribution and the vertical axis is the accumulated percentage of the total number of beneficiaries. For a given point in the income distribution the graph shows the percentage of beneficiaries that have incomes at or below that point. Once again, the higher and more concave the curve, the better the targeting property of the subsidy. Although in Chile close to 45 percent of beneficiaries have incomes in the first three deciles of the distribution, in Colombia only 30 percent do.

The beneficiary concentration curve suggests that the Chilean means-tested subsidy scheme is more efficient in identifying poor households. Indeed, the

17. The surcharges (negative transfers) for higher income categories are omitted as they are considered part of the funding mechanism of the subsidy. This issue is discussed later.

FIGURE 2. Cumulative Number of Beneficiaries per Centile of per Capita Income



Source: Authors' computations based on CASEN 1998 and ENCV 1997.

Chilean concentration curve lies above the Colombian curve at each centile of per capita income. This result suggests that the means-tested subsidy performs better than the geographic system in identifying needy households, confirming expectations about the relative efficiency of means-tested benefits. However, because the Colombian scheme is more progressive, providing larger transfers to the poorest households, the overall poverty impact of both programs is very similar, at least for the poorest 30 percent of households. Thus in the overall poverty impact of the scheme, the differentiation of benefits among different socioeconomic categories in Colombia compensates somewhat for the failure of the geographical targeting system in identifying the poor.

Thus a program that combines the targeting properties of a means-tested subsidy, as in Chile, with the progressiveness of monetary transfers per household, as in the Colombian scheme, would have a greater impact on poverty than either program as they are currently designed. In Chile this change could easily be accomplished by calibrating the amount of the water subsidy to each household's CAS score.

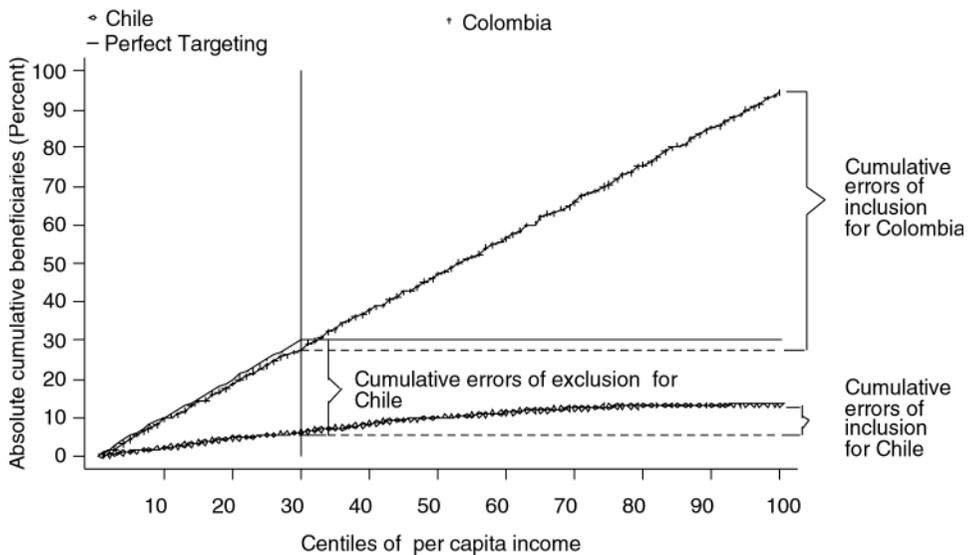
The Colombian scheme also has the potential to be made more progressive. Tightening the classification of dwellings to make the subsidy more targeted (by transferring more dwellings to the two highest classifications) would increase the tiny fraction of benefits (1 percent) funded by households in these two groups, improving not only the distributional effects of the scheme by focusing resources on more needy households but also the progressivity of the scheme by taxing higher income households.

The extent of the errors of inclusion that occur in both countries is striking when the target population is assumed to be the first few deciles of the income distribution (see figure 2). Although the Colombian scheme has no explicitly declared targeting objective, the Chilean subsidy law defines beneficiary households as households in the first two income deciles. Yet close to 70 percent of beneficiaries are not in this group.

What these relative concentration figures do not capture is the extent of errors of exclusion (already discussed). The relative concentration curves (figures 1 and 2) show the relative targeting properties of both schemes, whereas errors of exclusion depend on the scale of each program. In other words, given the total number of subsidies offered in Chile and Colombia, the Chilean system does a better job of giving the subsidies to poorer households (see figure 2). However, the Colombian scheme covers a much larger share of the population, covering close to 95 percent of households compared with Chile's 15 percent (see table 1). Thus in Colombia most poor households will receive some benefit, whereas in Chile the errors of exclusion are much higher.

This difference can be seen by analyzing the absolute concentration curve of beneficiaries—the analogue of Shorrocks (1983) absolute Lorenz curves—which is constructed by multiplying the relative concentration curves by the percentage of the population that receives a subsidy (figure 3). The solid line in figure 3 represents perfect targeting under the assumption that the target population is the first three income deciles. It is a 45-degree line up to the 30th percentile of the income distribution and then flat afterward. It reflects the fact that perfect

FIGURE 3. *Absolute Beneficiary Concentration Curve*



Source: Authors' computations based on CASEN 1998 and ENCV 1997.

targeting in this case implies that only 30 percent of the population are beneficiaries (as reflected in the vertical axis) and that all 30 percent are concentrated in households in the first three deciles. Households above this limit are not intended beneficiaries and so the curve is flat afterward.

The empirical concentration curve will reflect targeting errors. The distance between the perfect targeting curve and the empirical curve at the kink point reflects the errors of exclusion. For example, in Chile the cumulative absolute beneficiary curve, which should include 30 percent of households at the perfect targeting level, includes only 5 percent, implying that about 25 percent of the population that should receive the subsidy under the targeting goal does not. In Colombia the errors of exclusion are close to zero, because all of the poorer households receive a transfer—because of the almost universal subsidy characteristic of the Colombian program rather than because of the efficiency of the targeting mechanism.

The distance between the empirical concentration curve at the 100th centile and the point where this curve crosses the 30th centile measures the errors of inclusion of each program—the percentage of the population that receives the subsidy but is not in the target population. In Colombia, nearly universal coverage reflects large errors of inclusion. That makes the program extremely expensive from a fiscal perspective. A better targeting mechanism would lower these costs without necessarily endangering the protection of lower-income households.

Thus although errors of inclusion are much higher in Colombia, errors of exclusion are much higher in Chile, even if the target population is limited to the first decile. These errors of exclusion may be worrisome from a policy perspective. If the objective of the water subsidy is to allow the whole target population to consume the service at lower rates, then clearly the chosen policy instrument is failing. Although the targeting mechanism is better in relative terms than the one used in Colombia, it still leaves many poor households without benefits. Unless the targeting mechanism is improved, the only way to benefit more of the target population would be to increase the number of subsidies.¹⁸

IV. CONCLUSION

This study analyzed and compared two water subsidy schemes. Chile's individual means-tested subsidy was expected to be more efficient in identifying needy beneficiaries, although it can be expensive to administer and requires sophisticated institutional capacity at the local government level. Colombia's scheme, based on a geographical classification of dwellings and cross-subsidies, was

18. In the summer of 2002 (January–February) the government decided to redistribute a substantial number of water subsidies based on an evaluation showing that the subsidy was not reaching the target population precisely enough. With data from the next CASEN (2003) it will be possible to judge whether this change improved the targeting results of the subsidy program.

expected to be less efficient in identifying needy beneficiaries but also less expensive to administer than a means-tested scheme.

This study bore out these expectations about the targeting ability of each scheme. Chile's means-tested system was better able to identify poor households than Colombia's geographically targeted scheme case, but because the Colombian scheme differentiates the amount of benefits per household according to the socioeconomic classification of its dwelling, the overall impacts of the two schemes are quite similar, at least for the first three income deciles.

However, both subsidy programs could be improved. In Chile the scheme could have a greater impact on poverty if the monetary transfers were differentiated by socioeconomic levels, as in Colombia. This could be done by conditioning the amount of transfers to eligible household on their relative CAS scores. The poverty impact could also be increased if targeting errors were reduced. More than 60 percent of subsidies go to households that are above the third decile of the income distribution. Because the number of subsidies available each year is determined without taking imperfections in the targeting mechanism into account, many poor deserving households are not receiving any benefits. If the policy objective in Chile is to reach a significant proportion of lower-income households, then either the targeting mechanism must be further improved or the number of subsidies given in a year has to increase to compensate for targeting imperfections.

In Colombia almost all poor households receive some benefit. However, this is achieved through an overly generous program that gives some benefits to almost all households. The high fiscal costs of this system could be reduced without jeopardizing the benefits given to poorer households by improving the targeting scheme by reclassifying more dwellings of higher income households into the top two socioeconomic categories. This would improve not only the distributional effects of the scheme, by focusing resources on more needy households, but also the progressivity of the scheme on the financing side, by taxing more higher income households.

Finally, the empirically imperfect targeting results in both countries found by this study should not be interpreted as a case against targeted welfare programs. The results are very likely better than they would have been had no special effort been made to reach vulnerable households. In addition, both governments have introduced changes to improve targeting performance. In 2002 the Chilean government decided to redistribute a substantial number of water subsidies based on an evaluation showing that the subsidy was not reaching the target population precisely enough. The changes, which generated some political opposition, should improve the targeting performance of the scheme. In Colombia the government is planning a new household classification effort that should also improve the targeting properties of the subsidies.

Further research could help improve the schemes in both countries. In Chile it would be important to investigate why there are still large errors of inclusion and exclusion despite the relatively sophisticated targeting mechanism. Perhaps

targeting such a narrow segment of the population is difficult. Given the skewed nature of the income distribution, the average household in decile three is probably very similar in wealth, durable goods ownership, and family income compared with the average household in decile four. Any targeting mechanism will have difficulties distinguishing between them. Alternatively, it may be that the targeting mechanism works well at the time a subsidy is originally awarded. However, because subsidies are generally given for a three-year period, the socioeconomic conditions of households can subsequently improve, thus lowering ex post targeting effectiveness. These and other hypotheses should be explored in future research.

In Colombia there is an important aspect of the welfare system that merits further analysis. Water, gas, and electricity subsidies and property taxes are all linked to the socioeconomic classification of a dwelling. Because that classification is easily verifiable, it is reasonable to conjecture that some of the benefits of the scheme are capitalized into housing and rental prices. If this is the case, then some part of the benefit of the subsidies would go to the owner of a dwelling at the time the scheme was introduced rather than to the current occupier. Thus the distributive impact of the Colombian scheme measured in this article could well be biased.

APPENDIX. DATA ISSUES

The data for Chile came from the 1998 CASEN, a cross-sectional survey designed to collect information on the socioeconomic situation of Chilean families, including housing, education, subsidies, and labor characteristics. CASEN began to incorporate information on water subsidy benefits in 1996. The 1998 survey includes information on 48,107 households as well as on the individuals within each household.

CASEN accounts for only about half of the water subsidies distributed in the country. The Ministry of Social Planning is aware of this problem but assumes that the underreporting is random, so that the distribution of benefits from the sample can be extrapolated to the whole water subsidy program. Some evidence that this may be correct is provided by a comparison of the average subsidy per beneficiary, Ch\$3,280 (US\$7.1) per month according to program records, with the average subsidy per beneficiary from the 1998 survey, Ch\$3,137 (US\$6.8) per month.

The data used for Colombia came from the 1997 National Quality of Life Survey (ENCV), a household survey undertaken by the National Planning Department. The survey includes a wide range of socioeconomic variables, including the amount paid by a household for water and sewage services. It does not, however, register the amount of surcharge or subsidy for these services, only the actual amount spent. Therefore, subsidies must be estimated indirectly. Following Sánchez Torres and Núñez Méndez (1999), indirect information on the portion of costs covered by each tariff for different companies was used to infer the amount of the subsidy (details can be found in Gómez-Lobo and Contreras 2000).

This approach implies that only observations from the departments where information was available could be used. These included the Departments of Cauca, Nariño, Valle, Caldas, Risaralda, Quindío, Bogotá, Cundinamarca, Santander, Antioquía, Cesar, Atlantico, and Bolivar. In addition, all households without connections to piped water were dropped, because they would not receive services from the water companies. Finally, households without a socio-economic classification were dropped.¹⁹ Of the original 9,121 households in the sample, 4,094 remained in the analysis after these criteria were applied. Some observations do not register the water bill. Therefore, concentration curves were constructed using only observations with positive water charges.

REFERENCES

- Brook, P. J., and S. M. Smith. 2001. *Contracting for Public Services: Output-Based Aid and Its Applications*. Washington, D.C.: World Bank.
- Estache, A., V. Foster, and Q. Wodon. 2002. *Accounting for Poverty in Infrastructure Reform: Learning from Latin America's Experience*. WBI Development Studies. Washington D.C.: World Bank Institute.
- Estache, A., D. Leipziger, and A. Gómez-Lobo. 2001. "Utilities 'Privatization' and the Poor's Needs in Latin America: Have We Learned Enough to Get It Right?" *World Development* 29(7):1179–98.
- Gómez-Lobo, A., and D. Contreras. 2000. "Subsidy Policies for the Utility Industries: A Comparison of the Chilean and Colombian Water Subsidy Schemes." World Bank Institute, Washington, D.C.
- Mideplan. 1999. "Antecedentes Administrativos, Operativos y Legales del Subsidio al Pago del Consumo de Agua Potable y Servicios de Alcantarillado de Aguas Servidas." Documentos Mideplan, Ministerio de Planificación y Cooperación, División Social, Departamento de Información Social, Santiago.
- Sánchez Torres, F., and J. Núñez Méndez. 1999. "Decentralización, Pobreza y Acceso a los Servicios Sociales: ¿Quién se Benefició del Gasto Público Social en los Noventa?" Universidad de Los Andes, Centro de Estudios de Desarrollo Económico, Facultad de Economía, Santa Fe de Bogotá.
- Serra, P. 2000. "Subsidies in Chilean Public Utilities." Documento de Trabajo Serie Economía 70. Universidad de Chile, Centro de Economía Aplicada, Departamento de Ingeniería Industrial, Santiago.
- Shorrocks, A. F. 1983. "Ranking Income Distributions." *Economica* 50(197):3–17.
- Vélez Echavarría, C. E. 1993. *Gasto Social y Desigualdad, Logros y Extravíos: Estudio de la Incidencia del Gasto Público Social en Colombia*. Santa Fe de Bogotá: Departamento Nacional de Planeación.
- World Bank. 1994. *World Development Report 1994: Infrastructure for Development*. New York: Oxford University Press.

19. There were many observations with a classification of 0 (possibly an indicator of missing information) or 9 (possibly industrial or commercial premises). One household with no adults was also dropped from the sample.