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THE INCIDENCE OF SUBSIDIES TO RESIDENTIAL PUBLIC SERVICES IN ARGENTINA:

THE SUBSIDY SYSTEM IN 2014 AND SOME ALTERNATIVES

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The Incidence of Subsidies to Residential Public Services in Argentina: The Subsidy System in 2014 and Some Alternatives

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I. Introduction

More than a decade of energy and transport subsidies have weakened Argentina's fiscal capacity. Following the 2001 crisis, public services tariffs were frozen in an attempt to offset the negative effects on households' real purchasing power. However, these subsidies steadily increased over the years, particularly since 2006, becoming a significant fiscal burden.[2]

Though subsidies can be a tool to protect the poor, in Argentina they led to distortions and a large share have been absorbed by upper classes and non-residential consumers. In 2015, electricity bills reflected less than 10% of production costs (Bidegaray, 2015), and lower tariffs have led to an increased demand of public services. Not only have energy and transport subsidies distorted both demand and supply, they have also not been efficiently targeted to the poor; instead, they have been distributed across all income groups, with the non-poor receiving the largest shares (Castro and Barafani, 2015; Lombardi et al., 2014; Marchionni et al., 2008; Navajas, 2015; Puig and Salinardi, 2015). For a recent discussion of the distortionary aspects of subsidies in Argentina, see Coppola et al. (2016).

This report starts by analyzing the incidence of the 2014 system of residential federal subsidies to residential public services (defined as electricity, gas, water and transport) building on the work by Puig and Salinardi (2015).[3] Figure 1 is a summary of the main results that will be explained in more detail in Section II. The left panel of Figure 1 shows the share of each subsidy going to the various quintiles of the income distribution. The public subsidies are in decreasing order of the share received by the poorest quintile which we have used here to describe targeting. It is clear that the subsidies to trains, piped gas and airlines benefit the richer segments disproportionally more. Electricity appears relatively neutral which still means that it could be targeted better. *Programa Hogar* is included in our incidence analysis, even if it was not introduced until 2015, since it will be used for the baseline of the simulation.

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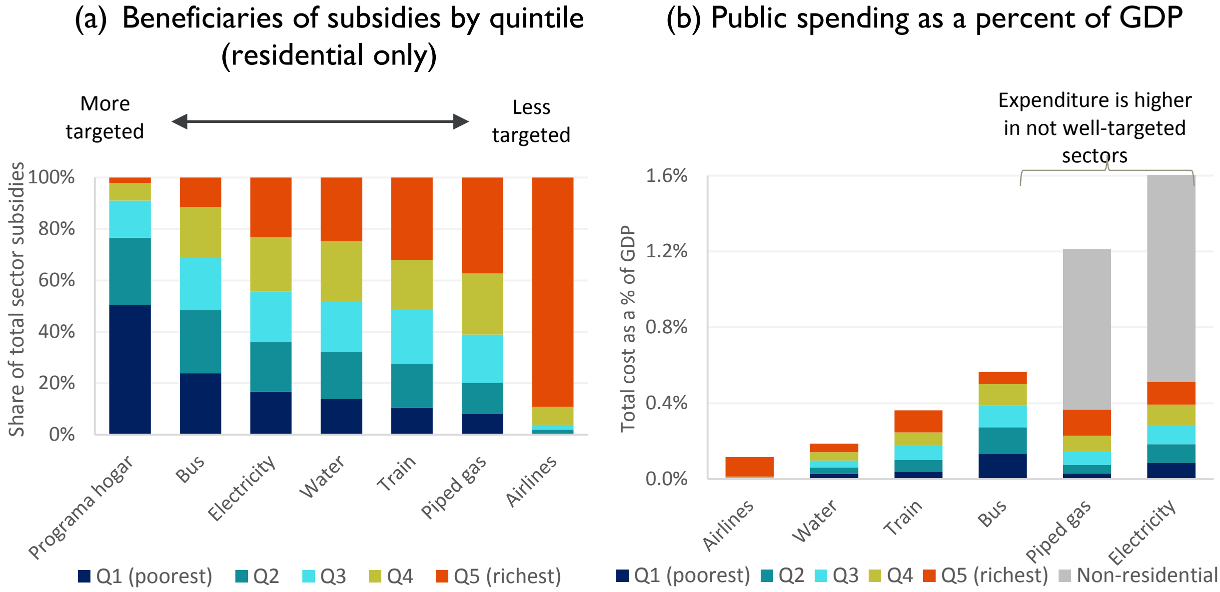
[1] *Poverty and Equity Global Practice, World Bank; #CEDLAS, Universidad de La Plata. The authors are indebted to Leonardo Gasparini and Fernando Navajas for many useful discussions and for sharing data. We would also like to thank Andrea Coppola, Bernardo Díaz de Astarloa and Jeronimo Montalvo. The findings, interpretations, and conclusions expressed in this paper are entirely those of the authors, and do not necessarily represent the views of the World Bank and its affiliated organizations.

[2] Between 2006 and 2014, energy and transport subsidies grew from less than 1% of GDP to about 5% of GDP. According to Argentina's Association for Public Finance Administration and Budgeting (ASAP) 61% of the total government subsidies in 2013 (135,000 million pesos) were directed to the energy sector.

[3] This no longer includes subsidies to the Buenos Aires subway. The subway accounted for a significant share of federal transport subsidies in 2010 (Castro and Szenkman, 2012) but was since transferred from the federal government to the City of Buenos Aires. Since 2013 there were no more federal subsidies to the subway. In general, subsidies by sub-national governments are excluded from the analysis because they are not reported by ASAP.

Figure 1. Incidence of federal subsidies and public spending in 2014



Source: 2012/13 ENGHo & ASAP. Note: Left: "targeting" is defined according to the share of the subsidy received by the poorest quintile of the distribution of per capita household income. Right: GDP, fiscal costs and non-residential share from Coppola et al. (2016) and Navajas (2015). Subsidy to electricity is defined as transfers to CAMMESA, while piped gas subsidies are the transfers to ENARSA. Fiscal cost for *Programa Hogar* (subsidy to bottled gas) is not available for 2014.

The right panel of Figure 1 shows two main aspects of subsidies to public services. First, it shows the large fiscal costs of subsidies. For instance, the subsidies to electricity accounted for around 1.6% of GDP in 2014. While airline subsidies almost exclusively go to the top 40% of the income distribution, they represent only a small share of GDP. Second, the figure shows that an overwhelming majority of the subsidies to electricity and piped gas are absorbed by non-residential consumers. For instance, just over half of electricity subsidies go to non-residential consumers. It is important to clarify that in this report we only analyze residential subsidies – for a brief discussion of non-residential subsidies see Coppola et al. (2016). Residential federal subsidies are only a small part of the overall subsidies to public services, but nevertheless these subsidies tend to be more important for the poor.

In Section III, we simulate the distributional effects of some alternative subsidy systems using the incidence of 2014 system as a baseline. First, for residential electricity subsidies, a simple lifeline tariff does not improve targeting of subsidies much. Targeting can be improved using beneficiaries of social programs, although around 30% of households in the poorest quintile might remain uncovered if the main flagship programs are used. Second, we consider a very similar scenario for piped gas. The subsidy is almost completely eliminated under the targeted lifeline tariff because few households that have access to piped gas also benefit from flagship social programs. Third, our transport simulations focus on the *Tarifas Diferenciales* of the SUBE smart card used to pay for buses, subway and trains in Greater Buenos Aires. We show that the *Tarifas Diferenciales* (as existing in early 2016) are not well targeted to the poorest households. Our simulations indicate that the coverage of the poor can be improved markedly by including a broader set of social programs to define eligibility.

The paper consists of six main sections. Section II presents the results on the incidence of subsidies to public services. Section III simulates the distributional impacts of alternative systems for electricity, gas and transport subsidies. Section IV concludes. The methodological Appendix provides full details of the methods and data used in this paper.

II. The System of Subsidies in 2014

We refine the methodology of Puig and Salinardi (2015) to estimate the incidence of the residential subsidies structure in 2014. Like Puig and Salinardi, this study uses data from the 2012/13 Argentina household expenditure survey (ENGHo) for the whole country and on subsidies from national fiscal accounts (ASAP).[4] While the methodological Appendix offers a detailed description of each sector and how each subsidy was allocated to households, we briefly summarize the main differences with Puig and Salinardi here.

First, we use a newer set of public service tariff schedules paid by consumers (by regions) to estimate the incidence as of 2014.[5] Second, in the cases of electricity and piped gas, we do not use the consumed quantities as reported by households in the survey because the total quantities in the survey underreport quite substantially when compared with administrative data.[6] Instead, quantities are imputed from the reported expenditures (after deducting taxes) and using the companies' tariff charts by region. The incidence analysis is then performed by taking the distribution of consumed quantities and calculating the amounts paid by households with and without subsidy. Third, given that tariff structures differ by region, the amount of subsidy per quantity consumed will vary across households depending on their location; for instance, households in Cordoba pay more than twice for electricity than those in Greater Buenos Aires. For each region, we select a representative tariff chart among the provinces.[7] Fourth, *Programa Hogar* (the subsidy to bottled gas) was imputed to households based on the official program description and targeting mechanism. The program is an unconditional direct transfer which replaced the producer subsidies on gas cylinders in 2015.[8] Fifth, in the case of train subsidies, only few observations in the ENGHo report expenditures in this category, so the results should be interpreted with caution.[9]

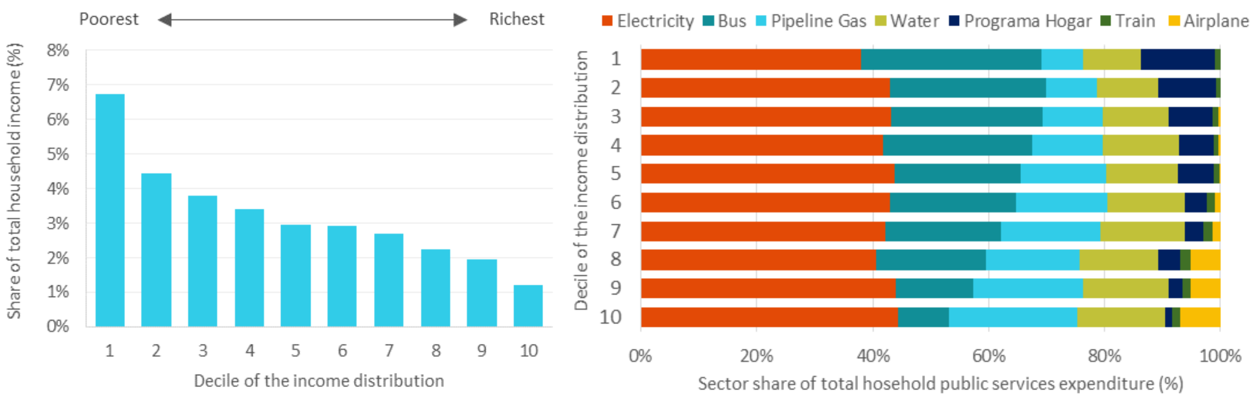
Figure 2 reports the budget shares obtained from the household survey for each component. Poorer households spend a significantly higher share of their total household incomes on public services. Therefore, a reduction in subsidies without compensatory measures would tend to affect them disproportionately.[10] Additionally, richer households spend a higher share of their expenditure on electricity and flights. On the other hand, poorer household spend a higher share on bus transportation and *Programa Hogar*.

[4] By contrast, Castro and Barafani (2015) concentrate on the Metropolitan Area of Buenos Aires.
[5] We use the 2012/13 expenditure survey together with fiscal data for 2014 and recent tariff schedules.
[6] Note that the survey reports both expenditures and quantities consumed.
[7] Our results are very similar to other papers that make alternative assumptions about the within-region variability of the tariff charts. For example, Puig and Salinardi (2015) use tariff charts by province, while Lombardi et al. (2014) use only one tariff chart for the entire country.
[8] In April 2015 the government launched *Programa Hogar* in an effort to reform the subsidy structure of LPG (Liquefied petroleum gas, or bottled gas). Traditionally, like with most public services, LPG subsidies were channeled to the producer. *Programa Hogar* is a direct transfer to households with incomes below two minimum salaries and no access to piped gas. It is paid as part of the social assistance benefits by the National Social Security Administration (ANSES). The level of the transfer per household depends on household size and the province of residence and includes a seasonal adjustment.
[9] We also cleaned up a few outliers to produce a stable set of results.
[10] The main exception is the subsidy to airline transportation, which represents a negligible share of income for the two poorest deciles, and a relatively small share for households in deciles 3 to 5.

Figure 2. Level and composition of household expenditure on public services

a) Expenditure on public services by decile

b) Composition of expenditure by decile



Source: Based on 2012/13 ENGHo. Public services include electricity, pipeline gas, *Programa Hogar*, water and transport. Expenditures on subway transportation are included with train expenditures, but since subways do not receive a federal subsidy, we exclude them in the rest of the analysis. Deciles based on per capita household income.

In 2014, subsidies to public services with the exception of bus transportation, tend to be concentrated amongst the richer deciles of the income distribution (see Figure 3). This is most visible for the subsidies to *Aerolineas Argentinas*, which almost exclusively go to the top 20%. For piped gas, about 37% of the (residential) subsidies go to households in the highest quintile, while the poorest quintile receives only 8%. This is not surprising because poorer households tend to live in areas that are not connected to the gas network. Electricity, train and water subsidies are mildly pro-rich in the sense that the upper income groups receive a higher share of the subsidies than the lower income groups.[11] For example, the richest quintile received about 23% of electricity subsidies, compared with 16.8% for the poorest quintile. Although these subsidies were only mildly pro-rich, the need for targeting public expenditures more effectively remained.

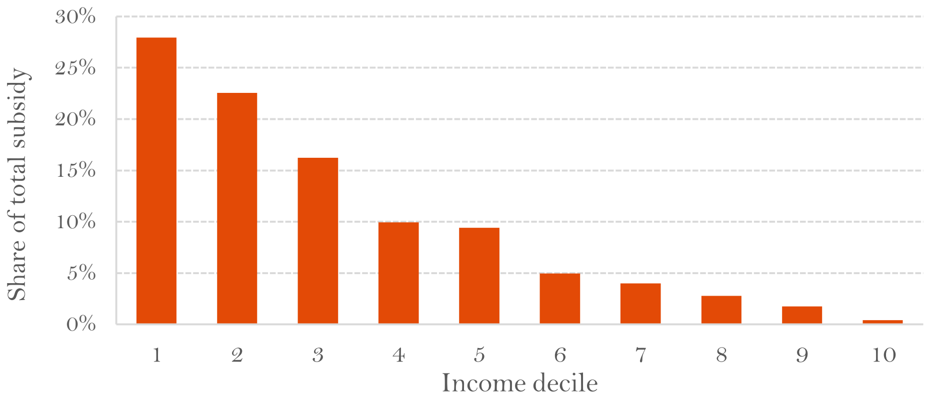
[11] Lindert et al. (2006) (p. 10) distinguish between absolute and relative progressivity. We use the terms progressive/regressive in the relative sense, i.e. whether the concentration curve is above or below the Lorenz curve for income (see below). We follow Wagstaff (2012) and use pro-poor/pro-rich to refer to the absolute meaning of the terms.

Figure 3: Incidence of federal subsidies to residential public services in 2014 (by income decile)

Source: Based on 2012/13 ENGHo and ASAP.

Programa Hogar displays a very different incidence (Figure 4) with 50.5% of subsidies going to the poorest quintile compared with 2.2% for the top quintile. This is not surprising given its targeting criteria, which include only households without access to piped gas and below an income threshold (see Appendix).[12]

Figure 4: Incidence of benefits of Programa Hogar (bottled gas)

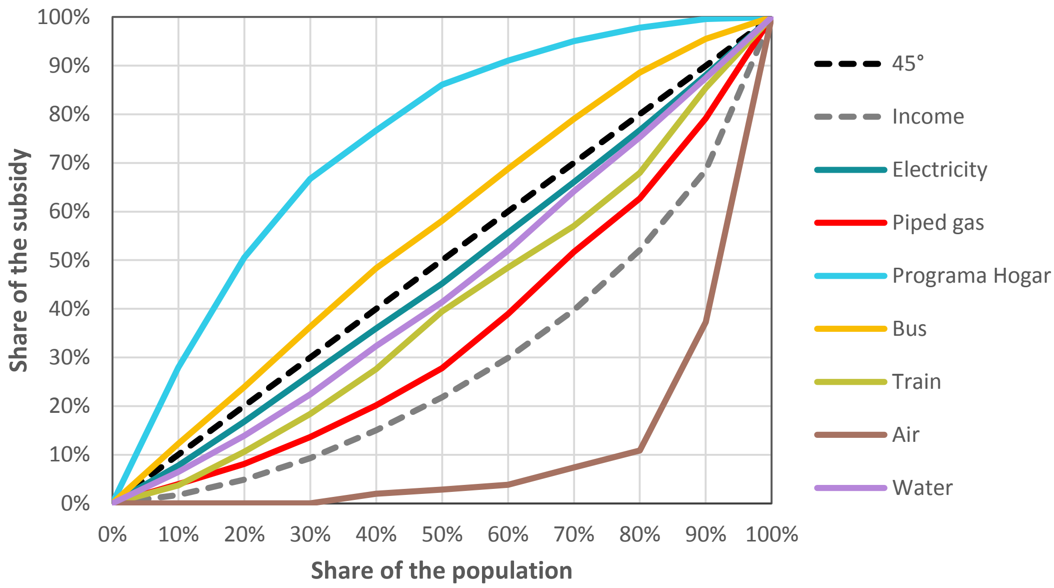


Source: Based on 2012/13 ENGHo and ASAP.

Figure 5 shows the concentration curves for each subsidy together with the Lorenz curve for household income and the 45° line. The concentration curve shows the share of the subsidy going to each share of the population, where the population is sorted by their household per capita income. Airline subsidies are the only instance of a regressive subsidy, in the sense that these subsidies are distributed more unequally than income. All other subsidies are progressive since their concentration curves lie above the Lorenz curve. From least to most progressive these are: piped gas, train, water, electricity, bus, and *Programa Hogar*. The concentration curves for *Programa Hogar* and for bus subsidies lie above the 45° line, which means that they are progressive in an absolute sense. In other words, the share of the subsidy received by the poorest deciles exceeds their population share.

[12] Because the threshold is applied to total household income, a *single* household with the *Programa Hogar* threshold income would be in the top decile of household per capita income (as shown by Figure 4). This is because the 2013 threshold exceeds the minimum (per capita) income of the 10th decile in the distribution of household per capita income. Therefore, any single household that receives this minimum income would both be eligible for *Programa Hogar* and in the richest decile of our distribution.

Figure 5: Concentration curves, by subsidy



Source: Based on 2012/13 and ASAP.

III. Alternative Subsidy Systems

This section presents results from simulating three alternative subsidy structures using the results presented in the previous section as a baseline. The scenarios consider replacing the general price subsidy with a social tariff targeted at specific groups. While such policies are often used, they are not necessarily first-best. As argued by Ruggeri-Laderchi et al. (2013), a targeted, non-earmarked cash transfer, such as *Programa Hogar*, is potentially the least distortionary mechanism. The main issue with a social tariff is that it distorts the consumption decision and could lead to over-consumption.[13]

In all simulations we use a social tariff for which eligibility is defined according to receipt of social programs. From the survey we can identify beneficiaries only for some programs, but not all, given the absence of specific questions in the questionnaire. Furthermore, for some programs, such as the *Asignación Universal por Hijo* (AUH), the number of beneficiaries we observe in the survey is much smaller than what administrative records suggest. Therefore, we have assumed perfect implementation and take-up, and imputed beneficiary status based on official eligibility criteria and observed characteristics.

A. Electricity

We consider three alternative subsidy structures for the electricity sector:

> ***Scenario 1*****:** A complete elimination of federal subsidies (i.e. transfers to CAMMESA) without any mitigating measure.

[13] Targeted, earmarked lump-sum transfers, such as discounts on utility bills, are an intermediate case. Compared with a non-earmarked transfer they might face less resistance as poor households see smaller increases in their effective utility bills.

***Scenario 2*:** A lifeline tariff[14] consisting of granting the first 150kWh (per month) free of charge for all households, while charging cost-recovery prices for any consumption above that level.

Scenario 3: A targeted lifeline tariff: granting the first 150kWh (per month) free of charge but only to the poorest households (defined as the current eligible beneficiaries of social programs (AUH, *Progresar*, and *Programa Hogar*)[15], while everyone else would pay cost-recovery prices (on their entire consumption).

Throughout our simulations, we assume that households do not adjust their consumption in response to the price changes, i.e. the price elasticity of electricity consumption is zero. We would argue that this is a reasonable approximation especially for the poorest parts of the distribution that have limited capacity to respond to price hikes in the short term. For instance, these households may not be able to afford energy-efficient appliances. However, it is clearly an upper bound on the welfare loss. Furthermore, our simulations only capture the first-order effects on household consumption. For instance, it is highly plausible that an elimination of non-residential subsidies (not considered here) would impact households' incomes through the employment channel. We consider the distributional implications of some of these general equilibrium effects in a forthcoming micro-macro simulation paper.

The simulations indicate that the targeting element is crucial for achieving fiscal savings while mitigating the effects on the poorest households. The untargeted lifeline tariff (scenario 2) reduces the fiscal cost only marginally, from 0.74% to 0.65% (Table 1). On the other hand, the targeted lifeline tariff (scenario 3) cuts the fiscal cost to one third (0.18% of GDP).[16]

Table 1: **Fiscal cost of electricity subsidy scenarios**

	Baseline*	Scenario 1	Scenario 2	Scenario 3
		complete elimination	lifeline tariff	targeted lifeline tariff
Fiscal cost (% of GDP)	0.74%	0%	0.65%	0.18%

Note: Fiscal costs and GDP for 2014. * As described in Section II, the baseline corresponds to the distributional incidence in 2014.

[14] Lifeline tariffs are subsidized rates for a first block of consumed quantities (enough to cover basic needs). We simulate a special case where the first block of consumed quantities is given for free. They have been used in many countries, and could be an important part of a reform in the short-term, though they lead to substantial leakages. Given the relatively low correlation between electricity consumption and income in Argentina (e.g. Figure A.3), the leakage of this type of subsidy to higher-income households could be substantial.

[15] Eligibility for AUH is imputed because the number of beneficiaries is underestimated in the survey. Eligibility for *Progresar* is defined as individuals of ages 18-24 that are enrolled in school and are either not working, working informally or earning less than three minimum wages. Finally, eligibility for *Programa Hogar* is determined based on not having piped gas in the dwelling, and having household incomes totaling less than 2 minimum salaries. The program also includes households with at least one disabled member (and less than three minimum wages) but the ENGHo does not allow us to distinguish these households in the data, so they are excluded from this exercise.

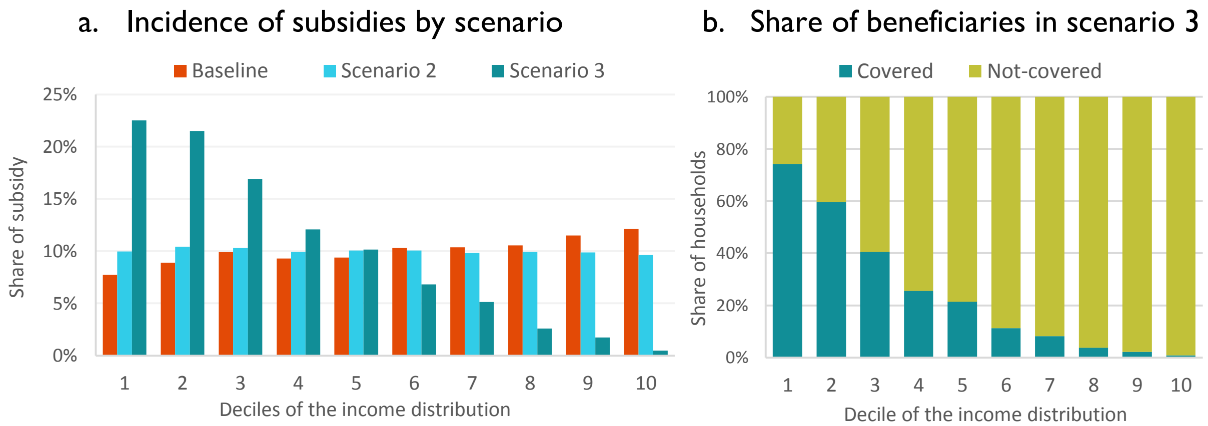
[16] Using a distribution-neutral scaling factor to match total subsidies from administrative records, as discussed in the Appendix.

Under the untargeted lifeline tariff (scenario 2) the electricity subsidy would be distributed very evenly across the income distribution, i.e. it is somewhat better targeted than the 2014 subsidy structure (see Figure 6). This is because households that consume less than 150kWh on a monthly basis are relatively evenly distributed across the distribution. 52% of household in the poorest decile, compared with 40% in the richest decile consume 150kWh or less per month.

On the other hand, the targeted lifeline tariff (scenario 3) is substantially more pro-poor. The amount of subsidy a household receives under this scenario depends on their amount of consumption and the participation in social programs (in their current form). To improve coverage at the bottom and reduce leakage it is thus important that these social programs are well-targeted and inclusive. Although the targeted tariff is substantially more pro-poor, the targeting formula as defined here excludes around 30% of households in the poorest quintile (Figure 6b). Households that are not covered by the lifeline tariff would see a strong increase in their electricity bill.

The lifeline tariff (scenario 2) leads to consumption gains, which is the result of making the first 150kWh of electricity per month free of charge. Figure 7a shows the change in welfare as a percent of expenditures.[17] On average, households across all deciles are better off with the untargeted lifeline tariff, i.e. the price reduction on the first 150kWh compensates for the price increase for consumption above this threshold. Targeting the lifeline tariff to beneficiaries of social programs leads to a dramatic change with welfare losses in all deciles except the first two.

Figure 6: Electricity subsidy scenarios



Source: Based on 2012/13 ENGHo and ASAP. Note: Simulations assume a zero price elasticity of consumption.

Although the bottom quintile is better off on average as a result of the targeted lifeline tariff, a substantial share of the poorest quintile sees a reduction in welfare. Figure 7b shows the distribution of welfare changes for the poorest quintile. It is clear that a substantial share of households in the poorest quintile is worse off even under the targeted lifeline tariff. For example, in the first three deciles, the share of households that spend more than 10% of their income on electricity more than doubles from 1.8% in the baseline to 4.3% with the targeted

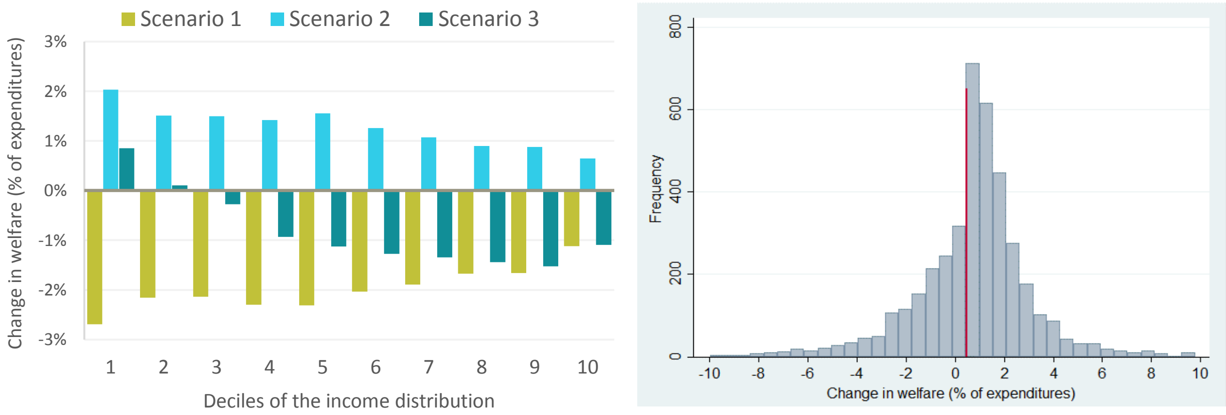
[17] See the methodological Appendix B of Ruggeri-Laderchi et al. (2013) for the formula.

lifeline tariff, assuming that there is no change in their consumption pattern given the tariff increase.[18]

Figure 7: Changes in welfare relative to baseline

a. Average change in welfare (by decile)

b. Distribution of welfare changes from baseline to Scenario 3 for the poorest 20% of households



Source: World Bank (2015). Figure 7b: Showing only values between -10% and +10%. Red line shows the average welfare change.

B. Piped gas

We also provide a brief simulation for the piped gas tariff along very similar lines as the preceding electricity scenario. Given that access to piped gas is far from universal, we might expect somewhat different distributional consequences than in electricity. As before, we assume a zero elasticity. We use the following three scenarios: (i) complete elimination of subsidies; (ii) lifeline tariff which provides the first 100m^3 for free (average consumption is 156m^3 per month); (iii) a targeted lifeline tariff which provides the first 100m^3 for free but only to households that receive AUH or *Progresar*, or both. Note that the set of beneficiaries for the social tariff is different from the electricity simulations because the latter also included *Programa Hogar*. Given that households are eligible for *Programa Hogar* only if they do not have access to piped gas, it would be superfluous to include them in the simulation for piped gas.

As with electricity, the targeting component is crucial for both fiscal saving and the pro-poor incidence. While the simple lifeline tariff would cut subsidies by around 40%, restricting it to beneficiaries of social programs virtually eliminates the subsidy (see table 2). This suggests that among the households that consume piped gas, very few receive AUH or *Progresar*.

[18] Ruggeri-Laderchi et al. (2013) refer to households that spend more than 10% of their expenditure on total energy (i.e. not only electricity) as "energy poor".

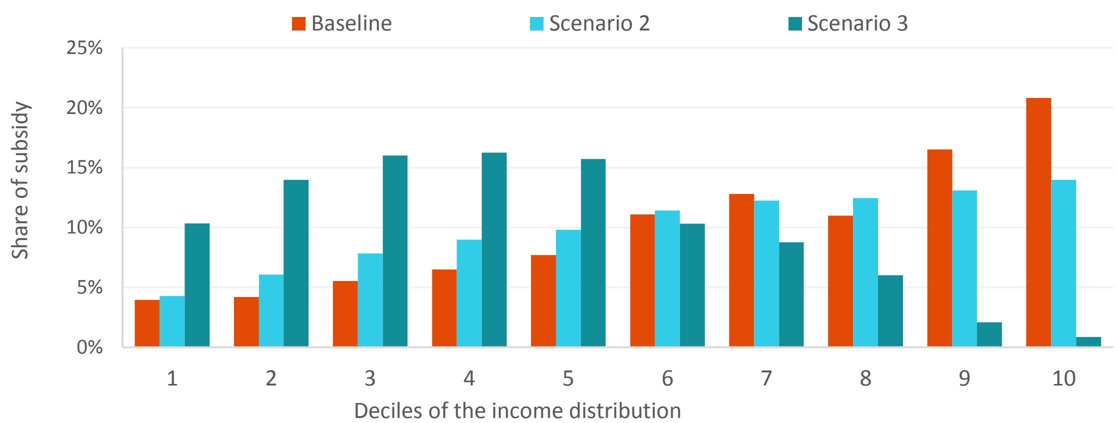
Table 2: Fiscal cost of piped gas scenarios

	Baseline	Scenario 1	Scenario 2	Scenario 3
		complete elimination	lifeline tariff	targeted lifeline tariff
Fiscal cost (% of GDP)	0.37%	0%	0.14%	0.01%

Note: Fiscal costs and GDP for 2014.

The lifeline tariff (scenario 2) by itself somewhat improves the incidence relative to the baseline with the share of subsidies going to the top two deciles declining (figure 8). This is because average consumption is substantially greater than the lifeline cut-off for the top two deciles – for instance average consumption in the top decile exceeds 200m^3 per month compared with less than 150m^3 for the bottom quintile. As with the electricity simulations, using beneficiaries of social programs (scenario 3) further reduces the share of subsidies going to the top. However, in contrast to the electricity case, the poorest decile does not appear to benefit very much, which is probably explained by the fact that they do not have access to piped gas.

Figure 8: Incidence of piped gas subsidies, by scenario



Source: 2012/13 ENGHo and ASAP. Note: Simulations assume a zero price elasticity of consumption.

C. Tarifas Diferenciales in Transport

All fares paid by users of buses, subway and train are subsidized to some extent, especially in the Buenos Aires Metropolitan Area (AMBA). In AMBA, most residents have access to an integrated transport system card (SUBE), that provide a subsidized fare, relative to separate tickets. In addition, some individuals (potentially, the most vulnerable) have access to the SUBE *Tarifas Diferenciales*, which allow them to pay even lower fares (at 40% of the SUBE fare). Six groups are currently eligible for this special tariff: Pensioners, domestic workers, AUH recipients, recipients of *Progresar*, recipients of the pregnancy benefit and Malvinas veterans.[19] As explained above, we impute eligibility for the special tariff using the information available in the ENGHo. We are unable to identify recipients of the pregnancy benefit or Malvinas veterans. The beneficiary status is defined slightly differently depending on whether the program is individual- or household-based.[20]

In this section of the paper, we analyze the distributive incidence of *Tarifas Diferenciales* under the assumption that everyone who qualifies is enrolled. We also explore whether the coverage of the poorest households could be improved by including additional social programs. The existing SUBE *Tarifas Diferenciales* are underused, which might be explained by low incentives to enroll due to a relatively low standard price level. As in the case of social programs, our results assume that everyone who is eligible would obtain the *Tarifas Diferenciales*. Throughout the analysis we present results for both Buenos Aires Metropolitan Area (AMBA) and the country as a whole. Of course, the SUBE card only exists in AMBA. Therefore, the national results show what would happen if the system of SUBE cards were to be extended nationally.

Figure 9 shows where the (potential) beneficiaries of the SUBE *Tarifas Diferenciales* are in the national distribution of income – for AMBA (panel a) and nationally (panel b). Throughout, households are ranked according to their position in the per capita *national* household income distribution.[21] It is clear that the SUBE *Tarifas Diferenciales* are not particularly pro-poor. Furthermore, 54% of the poorest decile are uncovered in AMBA, suggesting that coverage of the poor is lacking. This may be, in part, because targeting to all retirees is not a good tool in a country like Argentina.

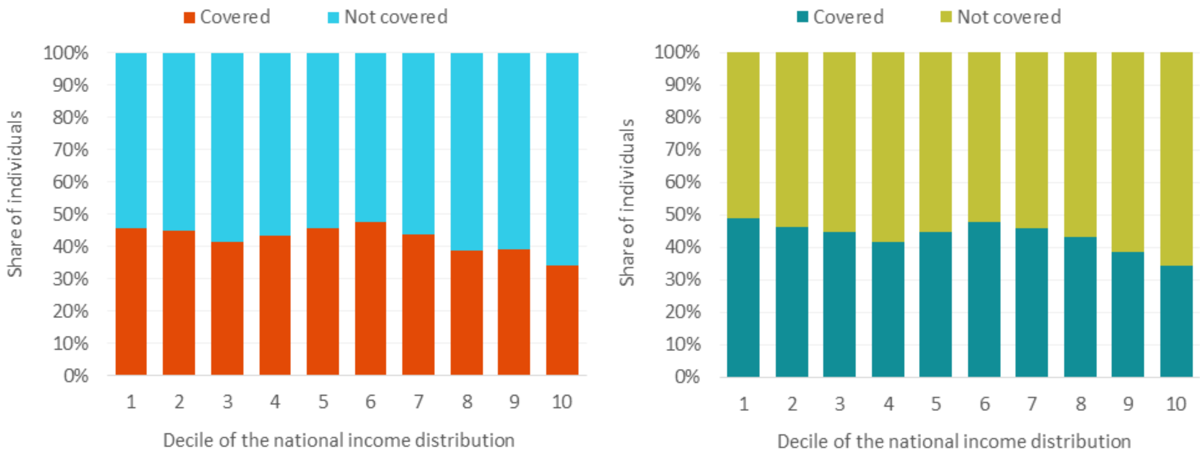
[19] These simulations reflect the eligibility criteria and discounts in early 2016. For example, *Progresar* was only included in the SUBE *Tarifas Diferenciales* in early 2015. Similarly, *Programa de Jefes de Hogar* was included at the time of ENGHo, but has since been discontinued and absorbed by other programs. Note that the eligibility criteria given on the official website are not necessarily updated to reflect official resolutions (e.g. https://www.sube.gob.ar/TarifaDiferencial.aspx, accessed January 14, 2016). The discounted program is currently named "*Tarifas Sociales*", which gives beneficiaries a higher discount than in early 2016 (55% of the SUBE fare) for bus trips, and expands the eligibility criteria to include other programs such as (Argentina Trabajan y Ellas Hacen, Monotributo Social, non-contributory pensions) –see https://www.sube.gob.ar/tarifa-social.aspx on May 26, 2016.

[20] AUH, *Progresar*, and *Programa Hogar* are treated as household-based programs, although only one person is the beneficiary of the additional subsidy (for AUH it is the parent). Therefore, if any household member receives any of these three programs, all household members are counted as beneficiaries for the *Tarifas Diferenciales*. This is to allow for leakage of the *Tarifas Diferenciales* within the household, e.g. SUBE cards are often shared amongst household members. For pensioners and domestic workers, we treat them as individual-based programs. That is, the *Tarifa Diferencial* goes only to pensioners and not to everyone who is living in a household with a pensioner.

[21] In other words, even if the *Tarifas Diferenciales* were targeted towards the poorest households within AMBA, these might not be poorest in the national distribution. Our figures attempt to reflect this.

Figure 9. Potential coverage of SUBE *Tarifas Diferenciales* beneficiaries

a. AMBA b. Nationally

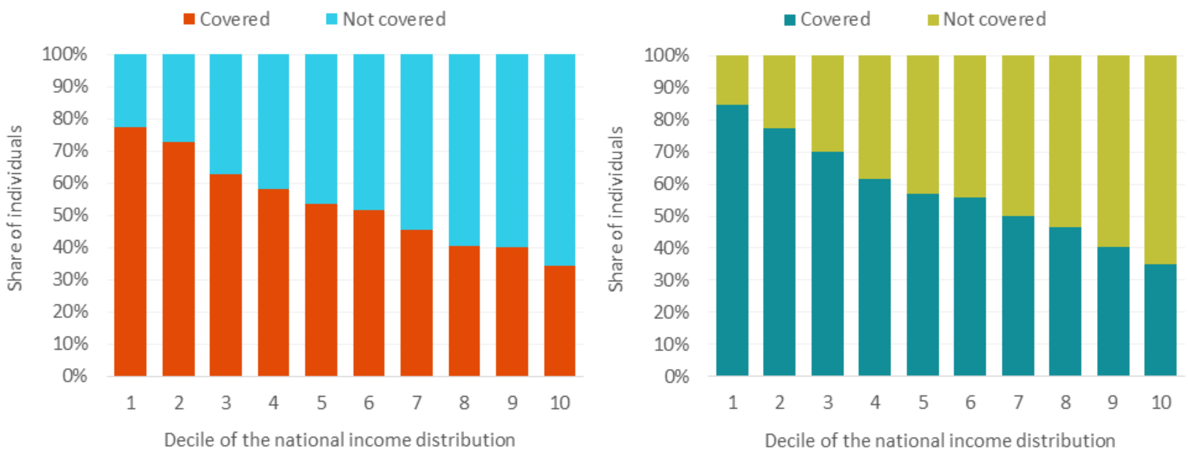


Source: 2012/13 ENGHo

Expanding the set of beneficiaries by including *Programa Hogar*, markedly improves the targeting of the *Tarifas Diferenciales* and its coverage of the poor, although 25% of the poorest quintile remain uncovered in AMBA. Figure 10 replicates Figure 9 for the *Tarifa Diferencial "expandida"*. The incidence of this extended social tariff is clearly more pro-poor.

Figure 10. Coverage of *Tarifa Diferencial expandida*

a. AMBA b. Nationally

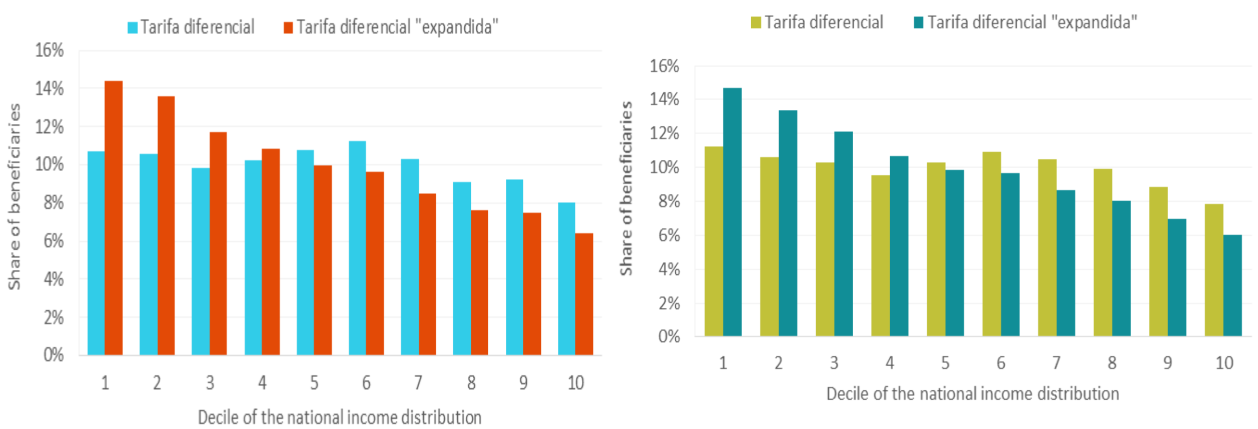


Source: 2012/13 ENGHo

The expanded social tariff is more pro-poor, with 50% of the beneficiaries in AMBA coming from the bottom 40% (a similar figure nationally) (Figure 11). However, there continues to be substantial "leakage" to the richer parts of the distribution, if the purpose were only to protect the poorest individuals.

Figure 11.b Incidence of beneficiaries

a. AMBA b. Nationally



Source: 2012/13 ENGHo

Increasing coverage among the poorest quintile could be achieved if additional eligibility criteria are added. An analysis of those households that are poor (poorest quintile) but remain uncovered by the *Tarifa Diferencial expandida*, shows that the uncovered poor households tend to have older household heads, are less likely to have an unemployed member, but more likely to be self-employed or informal wage employees, but much less likely to have young children (hence, do not qualify for the AUH).

Table 3. Comparison of household characteristics between coverage groups (among the poorest quintile of household per capita income)

	AMBA		National	
Household characteristic	Covered	Not covered	Covered	Not covered
Age of household head	40	52	41	53
At least one informal wage employee (%)	38%	44%	42%	45%
At least one self-employed (%)	26%	34%	27%	32%
At least one unemployment (%)	100%	78%	99%	76%
At least one child (under age 18) (%)	94%	40%	94%	33%
At least one NiNi (not in school, not in work) (%)	24%	30%	21%	25%

Source: 2012/13 ENGHo

IV. Conclusion

The simulation of alternative electricity subsidy structures suggests that targeting consumption levels through a simple lifeline tariff is not sufficient to achieve a pro-poor incidence of subsidies. Instead, explicit targeting is necessary (though not sufficient) and needs to ensure comprehensive coverage of the poorest households. Similarly, the analysis of the SUBE *Tarifas Diferenciales* shows that the existing tariffs are not well-targeted, but that an expanded set of social programs could improve coverage of the poorest. The gas subsidy simulations showed that a social tariff would virtually eliminate the subsidy, suggesting that there is little overlap between the receipt of social programs and access to piped gas.

More generally, our simulations have shown that for a social tariff to be effective at protecting the poorest, it requires a targeting mechanism that is carefully designed. To improve the targeting it is critically important to use the appropriate criteria or reasonable proxies to reach the most vulnerable groups, and consider challenges in implementation. For instance, the SUBE *Tarifas Diferenciales* (as defined in early 2016) can be improved markedly by including the beneficiaries of some social programs. Part of this was done in the newly defined system of *Tarifas Sociales*. However, even in this case coverage of the poorest quintile remains incomplete. This is because social programs such as the AUH or those from the Ministry of Labor, exclude some groups such as the self-employed/monotributistas, or informal and/or low-income workers who do not have school-aged children. In the short-term and in the absence of an expanded set of social programs, it is necessary to find alternative proxies and mechanisms to improve coverage of the poorest.

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VI. Methodological Appendix

A. 2012/13 household expenditure survey (ENGHo)

The 2012/13 National Survey of Household Expenditure (ENGHo, by its Spanish acronym) is representative of urban Argentina.[22] It provides detailed information of household expenditures on public services, as well as several demographic and socio-economic characteristics, including income. The welfare aggregate used throughout is per capita household income as constructed by the national statistics office (INDEC). Throughout, the household is used as the reference unit and person expansion factors are used. Puig and Salinardi (2015) find very similar results whether they use income or expenditure, so the results appear to be robust for alternative welfare aggregates.

The analysis of subsidy incidence, and particularly the simulation of alternative subsidy structures, requires information not only on household expenditure, which is readily available in the survey, but also on the quantities (or volumes) being consumed. For many public services, the ENGHo contains a variable that reports households' consumed quantities. However, the total quantities in the household survey are much smaller than those reported in administrative data. Therefore we need to make a number of adjustments to these quantities as described in the remainder of the Appendix. In the case of electricity and piped gas, we back out the quantities from household expenditure in combination with the tariff schedule, following Marchionni et al. (2008). Our approach implicitly assumes that the ENGHo collects reliable information about expenditures, while quantities are more problematic, which we would argue is plausible.

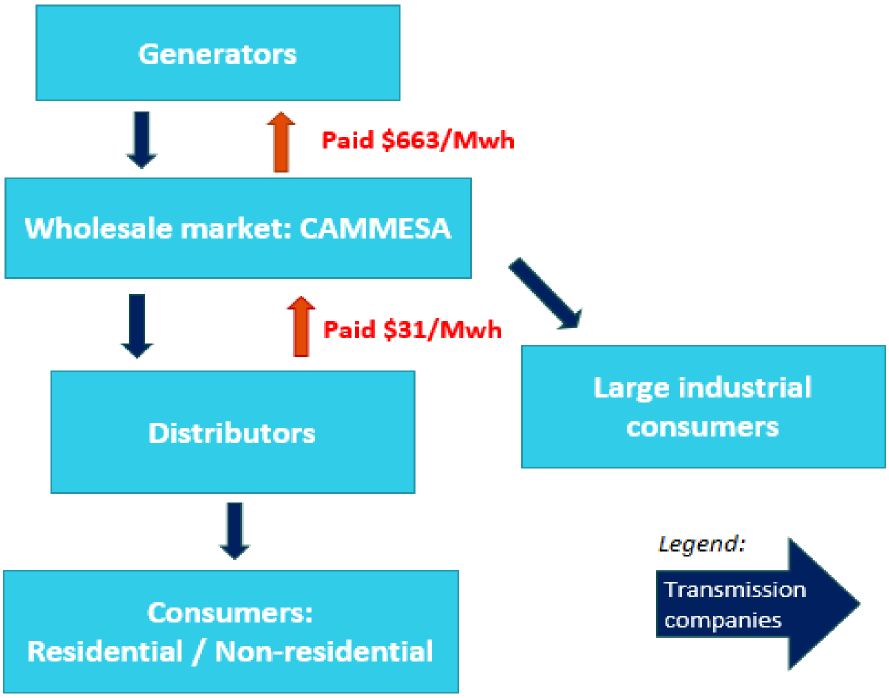
B. Electricity

Since 1992 the electricity sector in Argentina operates under an institutional arrangement known as the Wholesale Electricity Market (MEM, by its Spanish acronym), in which electric power is exchanged in wholesale transactions. The main actors in this market are the generation companies (the suppliers) and the distribution companies (the demand side). The intermediary responsible for managing the operation of this market is the Administrator Company of the Wholesale Electricity Market (CAMMESA, by its Spanish acronym). CAMMESA is owned by a number of minority shareholders – the Federal Government, and the MEM actors (generators, transmitters, distributors and large consumers) represented through civil associations. Figure A.1 summarizes the structure of the MEM in Argentina.

Originally, the creation of the MEM was intended to lead to efficiency gains and support the electricity sector by strengthening the market mechanism. For example, the hourly electricity price (spot price) reflects the generators' marginal cost of production, such that demand (composed of large industrial users and distributors) can respond in an efficient manner. Over the years, the distribution sector's rigidities and the strong variability of electricity demand led to the creation of a Stabilization Fund (SF) operated by CAMMESA. A seasonal price for distributors was established which was less volatile than the spot price. When during periods of strong demand generation cost exceeded the seasonal price, the SF covered the difference. On the other hand, the SF recovered in periods when the generation cost was lower.

[22] Urban towns with 5,000 or more inhabitants. Representative of about 87% of the population.

Figure A.1: Wholesale structure of electricity market in Argentina (as of 2014)



Note: Prices are in ARG pesos of 2014.

The SF and its mechanism for setting prices was abandoned in 2002. At the time, generation costs were increasing due to rising oil prices, while political actors decided to maintain electricity tariffs for final (especially residential) consumption. This led to a systematic gap between the energy price paid by distributors (the demand price) and the generation cost. The latter, also called the monomic price, is calculated by CAMMESA and published on its website.[23] This gap between the supply and demand prices of the MEM is covered by a transfer from the federal government, and it is this subsidy that we include in our electricity analysis (similar to Campoy, 2015 and Lombardi et al., 2014). We do not include other subsidies, for example by sub-national governments.

As shown in Figure A.1, the monomic price was ARS 663/MWh while the price faced by distributors (for residential consumers) was ARS 31/MWh in 2014 on average.[24] Table A.1 summarizes the subsidies in 2014 using administrative data.[25] In 2014, residential demand totaled 51,637,000 MWh. The administrative data on fiscal transfers do not differentiate between residential and non-residential consumption. However, it is straightforward to

[23] The monomic price is an average cost that includes a charge for the power reserve, i.e. the generation capacity (Galetovic and Muñoz, 2009).
[24] CAMMESA's annual report only publishes the average price of residential, commercial and industrial consumers which is ARS 100/MWh. We thank Fernando Navajas for sharing his estimates of residential prices based on administrative data from CAMMESA and the MEM.
[25] The sources of the particular numbers are as follows: Residential demand: Association of Electric Energy Distributors of Argentina (ADEERA, by its Spanish acronym) "Informe Annual 2014"; supply price: CAMMESA's annual report; demand price: correspondence with Fernando Navajas; total transfers to CAMMESA: Argentine Association of Budget and Public Financial Administration (ASAP, by its Spanish acronym) "Informe de Ejecución Presupuestaria de la Administración Pública Nacional", December 2014, p. 17.

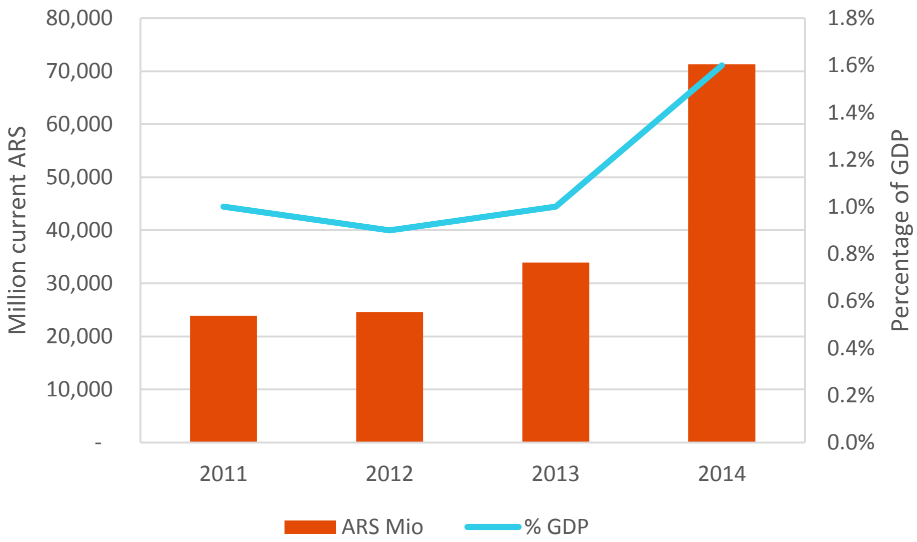
calculate from the per-unit subsidy (i.e. the difference between the monomic and demand prices) and total residential demand. Hence the total subsidy to residential electricity consumption was ARS 32,635 Mio. Meanwhile, CAMMESA received over ARS 70,000 Mio from the federal government in 2014, so residential consumers received 46% of total transfers. Figure A.2 shows the evolution of the federal transfers to CAMMESA. They increased in the last years and especially strongly in 2014.

Table A.1. Average electricity subsidies in 2014

Year 2014		
Residential demand	51,637,000	MWh
Supply price (monomic price)	663	ARS/MWh
Residential demand price	31	ARS/MWh
Residential subsidies	32,635	Millions ARS
Total transfers to CAMMESA	71,333	Millions ARS

Source: own calculations based on data from ADEERA, ASAP, CAMMESA and F. Navajas (see footnote)

Figure A.2. Transfers from the federal government to CAMMESA 2011-2014



Source: ASAP and INDEC

As explained above, we need to impute the consumed quantities from the expenditures observed in the household survey. Following Marchionni et al. (2008), this proceeds in three distinct steps. First, we need to derive the before-tax expenditure from the after-tax amounts reported in the survey. For each household h, the survey reports after-tax expenditures, E_h:

$$E_h = T_h(1+t) \qquad \text{for} \;\; h = 1, \dots, H$$

where T_h are before-tax expenditures and t is the sum of taxes and fees corresponding to the area of residence. This equation is easily rearranged to obtain T_h. The burden of federal taxes is estimated using VAT at a rate of 21%, and the Santa Cruz Provincial Fund at a rate of 0.6%, while we do not account for other taxes at the provincial or municipal level.[26]

[26] Cont (2007) explains in detail the configuration of the regional taxes.

Second, we split up the before-tax expenditures into fixed and variable tariffs (before taxes):

$$T_h = A_{R(h)} + B_{R(h),s}Q_h$$

where $A_{R(h)}$ is the fixed charge in region $R(h)$ where household h is residing; $B_{R(h),s}$ is the corresponding average tariff per unit of electricity consumed; and Q_h is the total quantity consumed. Therefore, we can define total before-tax expenditure excluding fixed costs as $\widehat{T_h} = T_h - A = B_s Q_h$. The tariff's fixed charge A is supposed to cover the generation capacity and the fixed distribution costs. The variable charge B_s pays for the fuel and the variable distribution costs.

Third, using information on the variable charge, we can back out the quantities consumed. However, there is an added complication because households face different charges depending on their level of consumption. The structure is as follows:

$$B = \begin{cases} B_1 & \text{if } Q_h \leq \tilde{Q}_r \\ B_2 & \text{if } Q_h > \tilde{Q}_r \end{cases}$$

where $B_1 < B_2$ and $\tilde{Q}_r$ is the cut-off level for region r. Note that once a household passes the cut-off level it faces the higher charge B_2 on its entire consumption. Of course we do not know the unit charge each household faces precisely because we do not know Q_h. Using the region-specific value for B_1 we calculate $\hat{Q}_h^1 = \frac{\widehat{T_h}}{B_1}$ and similarly estimate $\hat{Q}_h^2$. Finally, the consumed quantity for every household is obtained as

$$Q_h = \begin{cases} \hat{Q}_h^2 & \text{if } \hat{Q}_h^2 \geq \tilde{Q}_r \\ \hat{Q}_h^1 & \text{if } \hat{Q}_h^2 < \tilde{Q}_r \text{ and } \hat{Q}_h^1 \leq \tilde{Q}_r \\ . & \text{if } \hat{Q}_h^2 < \tilde{Q}_r \text{ and } \hat{Q}_h^1 > \tilde{Q}_r \end{cases}$$

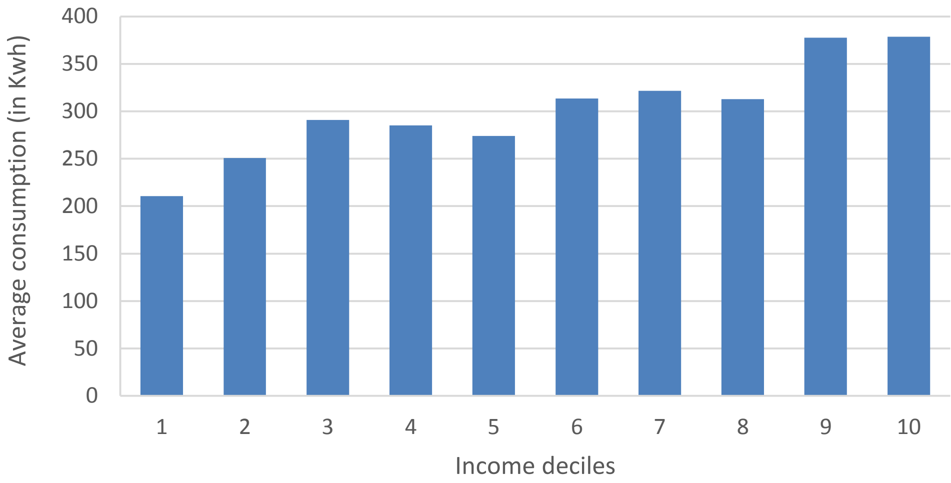
In the final case ($\hat{Q}_h^2 < \tilde{Q}_r$ and $\hat{Q}_h^1 > \tilde{Q}_r$) we have to exclude households from the analysis. Figure A.3 shows the distribution of electricity consumption obtained from the household survey in this way.

Figure A.4 compares the quantities obtained from the household survey in this way with those from administrative records. While the situation is better than when we use the quantities directly reported in the household survey (not shown in the chart), it is clear that even the imputed quantities continue to underreport relative to administrative records. This discrepancy appears to be greatest in AMBA.

We have decided to ignore this discrepancy. An alternative approach would have been to scale up all quantities, and hence also expenditures, to the levels observed in the administrative data. However, this could have led to quite substantial shifts in the expenditure shares relative to what is reported in the household survey. Given that the (unadjusted) expenditure shares are used for example in the CPI or setting poverty lines, we did not feel comfortable making such an adjustment. Furthermore, the incidence results are unaffected by such an across-the-board scalar adjustment.[27] The only part of the analysis where we use a (distribution-neutral) scaling factor is the calculation of fiscal savings in the simulation of alternative subsidy structures for electricity (Table 1) (and gas, see Table 2).

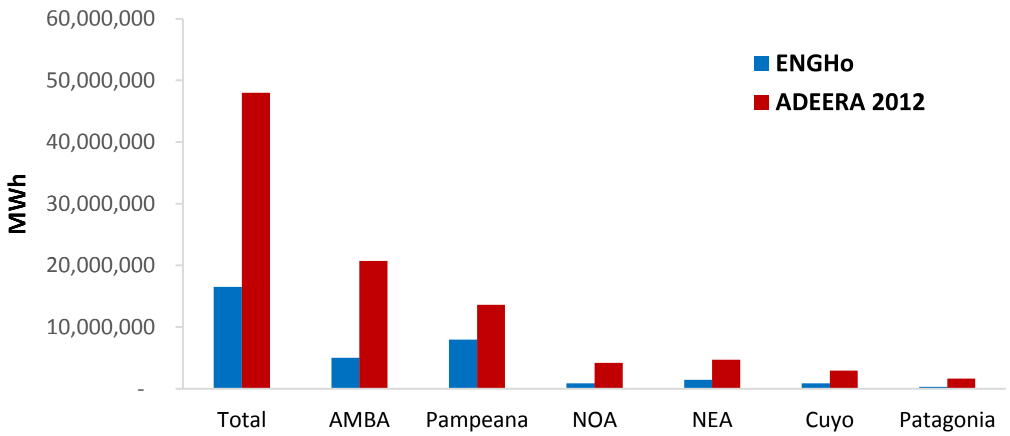
[27] Of course the true discrepancy need not be distribution-neutral. But we are not aware of any model that would produce distributional variation in the adjustment factor.

Figure A.3. Average electricity consumption (in kWh per month per household) by decile



Note: deciles imputed into ENGHo as explained in the text.

Figure A.4. Amount of residential electricity demand (MWh) by region



Note: Quantities imputed into ENGHo as explained in the text.

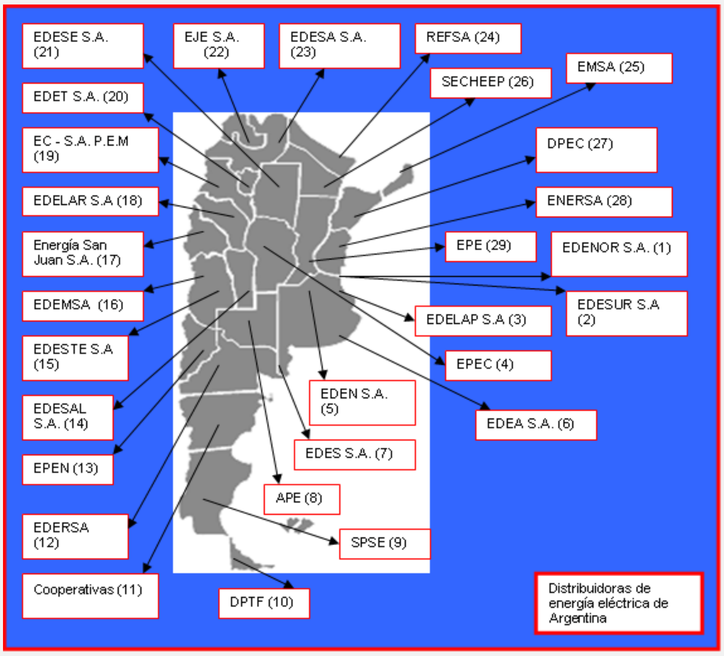
The final step in the analysis involves the calculation of the subsidy per household. As explained above, the intervention by the federal government in the MEM generates an implicit subsidy to consumers. Figure A.1 showed the average supply (ARS 663/MWh) and demand (ARS 31/MWh) prices in the residential wholesale market, and the average per unit subsidy is the difference between the two. However, the subsidy is not assigned directly to users, but instead it is channeled through distributors. There are different distributors by province (see Box A.1) and they use different tariff schedules. Furthermore, in these tariff schedules, final consumers face different prices depending on their level of consumption. As a result, the subsidy each household receives will depend on their province of residence and their level of consumption.[28]

[28] The incidence is very similar when we use the average per unit subsidy or equivalently subsidies are assigned in proportion to consumption. Compared with the results presented in Figure 3, the incidence becomes slightly

Box A.1: Regional aspects

It is important to highlight that there exist differences across the various regions of Argentina, both in terms of the specific tariffs and the tax treatment. The map below shows the distributor in each province. Furthermore, provinces differ in whether they are subject to federal or provincial regulation: In the areas served by companies Edenor, Edesur and Edelap the regulation is federal through the National Electricity Regulatory Authority for Electricity (ENRE, by its Spanish acronym). In the rest of the country regulation is controlled by the respective provincial electricity regulatory entities (EPREs).

Distribution company by province



Source: Secretaria de Energía de la Nación

Specifically, subsidies are allocated to households in the following way. First, we take the distribution of consumed quantities that have been imputed into the ENGHo as explained above. Second, we use the applicable tariff schedule depending on the region of residence (see Box A.1). We use a representative tariff chart for each region, given that the tariff amounts do not vary significantly across bordering provinces.[29] These tariff charts provide the tariff with and without the subsidy, so the subsidy amount for each household is simply the difference between the two. Table A.2 gives an example of such a tariff chart from EDELAP, a distribution company serving the Province of Buenos Aires.[30]

less pro-poor with the subsidy share of the bottom decile falling and the share of the top decile increasing. This suggests that the distributors' tariff schedules actually have a pro-poor effect.

[29] The tariff charts of EDEN, EDESUR, Formosa, La Pampa, Mendoza, Rio Negro and Tucuman were used.

[30] The tariff charts used to allocate subsidies are different from the tariff schedules used above in the imputation of consumed quantities. The former are more detailed and it was not possible to use them to impute the quantities. Therefore, in the imputation step we followed Marchionni et al (2008) and used the simpler tariff charts.

Table A.2. Example of tariff chart with and without subsidies (in 2014)

Range of total household consumption (Q_h)	Fixed charge	Variable charge (per kWh)	
		Actual (with subsidy)	Without subsidy
$Q_h \leq 150$kWh	9.01	0.107	0.435
$Q_h > 150$kWh & $Q_h \leq 325$kWh	22.53	0.058	0.389
$Q_h > 325$kWh & $Q_h \leq 400$kWh	26.04	0.066	0.399
$Q_h > 400$kWh & $Q_h \leq 450$kWh	37.89	0.070	0.405
$Q_h > 450$kWh & $Q_h \leq 500$kWh	43.55	0.079	0.416
$Q_h > 500$kWh & $Q_h \leq 600$kWh	76.72	0.171	0.440
$Q_h > 600$kWh & $Q_h \leq 700$kWh	93.10	0.192	0.456
$Q_h > 700$kWh & $Q_h \leq 1400$kWh	160.23	0.293	0.469
$Q_h > 1400$kWh	184.47	0.471	0.470

Note: The example refers to the 2014 tariff chart for EDELAP (Cuadros Tarifarios, Resolución SSP No. 4/2014). The values are per month and in current 2014 ARS.

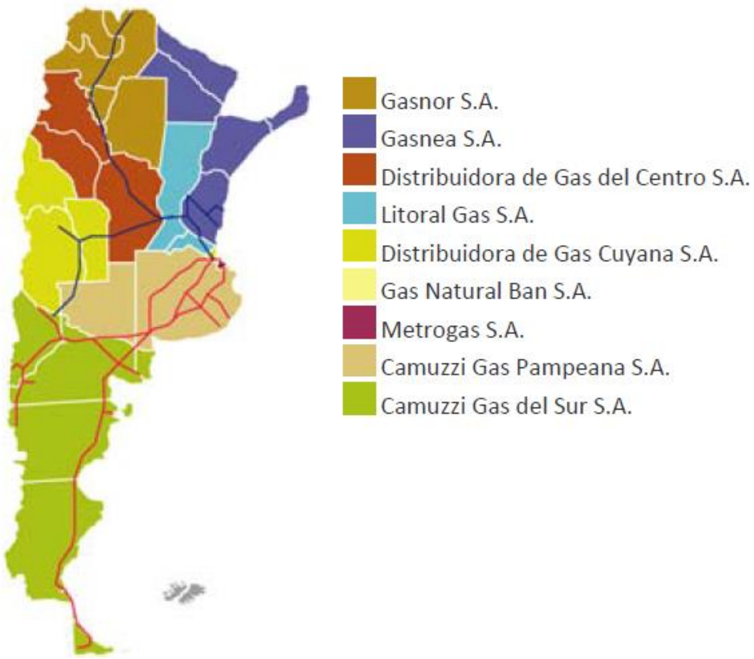
C. Piped gas

In Argentina, after extraction or import, gas is transported by two large companies, *Transportadora de Gas del Norte SA* and *Transportadora de Gas del Sur SA*, which divide the country between themselves.[31] As shown by Figure A. 5, these two companies (shown by blue and red lines) transport the gas to nine licensed distribution companies.

Figure A.6 shows the strong increase in transfers from the federal government to Energia Argentina S.A. (ENARSA, by its Spanish acronym). Gas subsidies are allocated through three trusts (*fideicomisos*) that are regulated by the National Gas Regulatory Body (ENARGAS, by its Spanish acronym). These trusts are dedicated to the import of gas (the largest amounts), the residential consumption in Patagonia and Malargüe, and the consumption of bottled gas (which is covered as part of Programa Hogar below). Subsidies to gas imports are intended to finance the purchase of imported gas so as to meet the domestic needs and in order to ensure domestic supply. The difference between the import cost paid by ENARSA and the price paid by the distributors is financed with funds from the federal government. While part of that cost is met by consumers through a fee for gas imports, the bulk comes from state coffers. The subsidy for residential consumption in Patagonia and in the Malargüe Department is financed by a surcharge on the price of natural gas levied at the entry point to the transportation system. It is collected by gas producers (Lombardi et al., 2014).

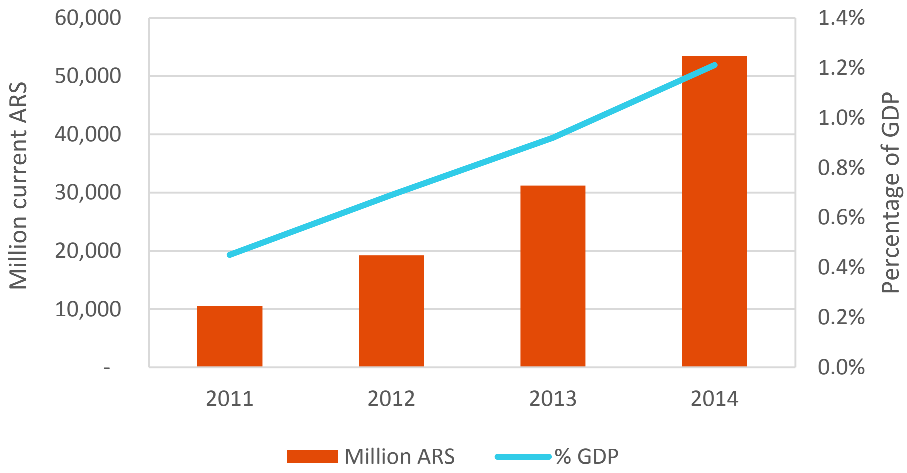
[31] The dividing line runs along the Northern boundaries of the provinces of Buenos Aires, La Pampa and Neuquen.

Figure A.5. Gas distribution companies



Source: ENARGAS

Figure A.6. Transfers from the federal government to ENARSA 2011-2014



Source: ASAP and INDEC

As with the other parts of this paper, we use the microdata from the ENGHo on the access, consumption and spending on residential piped gas. To obtain the consumed quantities of piped gas, we adopt a similar approach to that used for electricity described above. From the ENGHo we use the reported expenditure on piped gas but ignore the variable that reports consumption (in cubic meters) given the same issues as with the quantity variable for electricity.

Similarly to electricity, the gas tariff is composed of a number of components (see Box A.2). The structure of this tariff differs from electricity because the gas subsidies primarily happen directly on the gas imports (i.e. the generation costs) instead of the wholesale market for electricity. As in the case for electricity, we first take out the tax and fixed components in order to isolate the variable part of the tariff ($B_S Q$). Then we use the tariff structure to obtain the quantity consumed for each household. The gas tariff recognizes eight categories of consumption for residential customers, depending on the range of consumption.[32] An added complication is that in the determination of the relevant range of consumption, not only the consumption of the current period (i.e. the latest invoice) but also the five periods immediately before that are considered. Since we can only observe current consumption, we have to ignore this issue and basically assume that consumption remained stable since the past five periods. The resulting distribution of piped gas consumption across deciles of household income is given in Figure A.7.

Box A.2: Composition of gas tariff

$$\textbf{Tariff} = \boldsymbol{B_S Q} + \textbf{Transport} + \textbf{Distribution} + \textbf{Taxes} + \textbf{Fees}$$

$B_S Q$: Total production cost: Q is the volume of gas consumed. B_S is the average cost per unit which differs by region and level of consumption. The distributor passes on this component fully to the gas producer (generator).

Transport: Fixed charge imposed by carriers (*Transportadora de Gas del Sur* and *North*) to transport gas from the wellhead (in each producing basin) to the concession areas of each distributor. The distributor passes this on to the carrier.

Distribution: Fixed charge imposed for the gas distribution service.

Fees: Fixed charges (such as the Patagonian subsidy) imposed by the regulatory authority to be used for specific purposes. These charges are collected and passed on by the distributor.

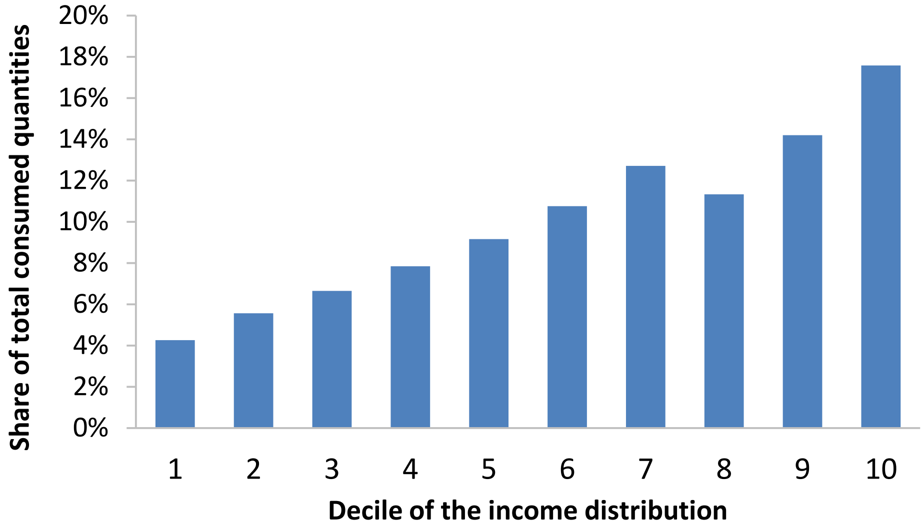
Using the quantities we can calculate the subsidy per household using the provincial tariff schedules with and without subsidy.[33] The distributors have three different tariff charts, which are based on the households' savings relative to the same two–month period (*bimestre*) in the previous year: a) consumption with savings higher than 20%, b) consumption with savings of 5% to 20%, and c) consumption with savings of less than 5%. Given that we have no information on gas consumption in the previous year, we randomly allocate one third of households to each group.[34]

[32] These are specified in ENARGAS Resolution I409.

[33] Source: ENARGAS Resolution I409. For each province, we use the tariff chart for the appropriate distributor (see Figure A.5).

[34] This structure of benefit receipt was also suggested here: http://www.ieco.clarin.com/economia/Gas-ahorro-20-por-ciento-sentir-impacto-suba-tarifas_0_1350465005.html

Figure A.7. Distribution of piped gas consumption (by decile)



D. Programa Hogar

As explained in the main text, producer subsidies on gas cylinders were replaced with an unconditional direct transfer in 2015. Since the household survey does not report beneficiary status for *Programa Hogar* (one reason being that the program did not exist at the time of the survey), we impute the benefit according to the official program description.[35] If poor households are less likely to sign up for the program (e.g. due to information barriers), then this would overstate coverage of the poor. For example, *Programa Hogar* is deposited through ANSES accounts, which might not cover the very poorest.

The eligible population includes households that reside in low-income areas without piped gas service or that are not connected to the residential gas distribution network. Furthermore, household income must not exceed two minimum wages (ARS 11,176 at present), or three minimum wages (ARS 16,764 at present) when a disabled family member resides in the household or the family resides in social housing.

The benefit level is calculated as the cost for the required number of gas cylinders (at ARS 77 per 10kg cylinder in 2014). This number of cylinders varies depending on (1) the number of household members (additional cylinders for households of more than five members); (2) the geographic location (additional cylinders for households residing in Tierra del Fuego, Santa Cruz, Chubut, Rio Negro and Neuquén); and (3) time of year (additional subsidies during the winter months). For instance, a household residing in the province of Buenos Aires or AMBA would receive the number of cylinders according to the following table.

[35] We estimate 2.9 million beneficiary households, which is quite similar to the 2.5 million households the program aims to cover (http://www.telam.com.ar/notas/201504/100362-programa-hogar-hogares-garrafa-pago-beneficiarios.html, accessed May 25, 2016).

Using the ENGHo, we can identify households that (1) do not have a connection to piped gas networks and (2) are below the corresponding income threshold in 2013.[36] We then simply assign the annual benefit level depending on household size and geographic location. We use the cost per 10kg cylinder in 2014 which is the year we have used in the rest of the analysis.

Example of number of cylinders per month (e.g. for AMBA) (by household size)

Household size ≤ 5													
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	**TOTAL**	**Total amount (annual)**
1	1	1	2	2	2	2	2	2	1	1	1	18	ARS 1,386
Household size > 5													
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	**TOTAL**	**Total amount (annual)**
1	1	2	2	2	2	2	2	2	2	1	1	20	ARS 1,540

E. Transport: Bus, trains, airline

According to data from ASAP, government transfers to the transport sector were about ARS 46,000 million or 1% of GDP in 2014 (including subsidies for capital expenditures). 54% of these subsidies go to bus transportation, followed by rail (35%) and airline (11%). Bus transportation subsidies are mainly channeled through the Transport and Infrastructure System Trust Fund, which is responsible for the compensation of buses and microbuses of mid- and long-distance. Allocations to rail transport are mainly channeled through two public companies – *Administradora RRHH Ferroviarios* and *Operador Ferroviario SE*. The companies are intended to meet the staff expenses of five of the seven rail lines, as well as the transfers to new concessionaires of the same five lines. We also take into account transfers to two private companies, *Ferrovías* and *Metrovías*, which are the concessionaires of the other two rail lines (Belgrano Norte and Urquiza, respectively). Finally, transfers to commercial air transport are mainly concentrated in *Aerolineas Argentinas SA*.

The ENGHo reports the expenditure for each means of transportation. For train and bus transportation, we obtain the total number of trips (quantities) by dividing the expenditures by the average fare of each mode of transport in 2012. These quantities, however, are very low when compared with the figures reported by the National Commission of Transport Regulation (CNRT). Therefore, instead of using the per-unit subsidy we take the observed distribution of quantities and distribute the total subsidies reported by ASAP according to this distribution. In other words, while we are concerned over the level of quantities reported in the survey, we are reasonably confident with their distribution.[37]

[36] The use of cylinder gas is identified by question CH09 ("Which energy source do you mainly use for cooking?"). Because we cannot identify households with a disabled member or those living in social housing, we would tend to understate the number of beneficiaries.

[37] It is also important to note that the budget shares (e.g. Figure 2) are unaffected by our approach.

F. Water

Water is charged according to two types of schemes: (1) A system which charges a variable cost per m^3 together with a fixed charge that depends on housing characteristics; (2) a system which charges a fixed cost (irrespective of consumption) that is assessed according the size of the property and also uses the cadastral value. We adopt the same approach as in Lombardi et al. (2014), which distributes subsidies proportionally with expenditure.

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