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THE FISCAL COST AND DISTRIBUTIONAL IMPACT OF MEXICO´S POOR DESIGN AND POOR IMPLEMENTATION OF RESIDENTIAL ELECTRICITY TARIFFS

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Overview

In Mexico, the regulation of residential electricity tariffs (RET) has been widely criticized on efficiency and equity grounds ever since the sector's nationalization in the 1970s (López-Calva and Rosellón, 2002). Currently, RET underperform in terms of efficiency because they only cover about 40 percent of the supply's cost, and in terms of equity because they determine that better-off households receive a proportionally greater share of a complex mix of direct and cross-subsidies that cost about 1 percent of GDP. Both, cost-recovery and equitable subsidies' distribution are explicit goals of the regulatory framework.

At the centre of these distributional and efficiency issues are both the design and implementation of RET's complex architecture. In Mexico, seven different types of increasing-blocks tariffs (IBT) apply. Tariffs with wider and less expensive blocks apply to hotter regions. Accounting for both aspects as they are interrelated, this paper pursues the objective of measuring the fiscal cost and distributional impact of Mexico´s RET as applied between 2010 and 2016. This paper argues that central to the fiscally expensive and regressive distribution of electricity subsidies is the poor design and poor implementation of IBT. The poor design leads bigger-sized but income-poor households to consume at higher and more expensive consumption blocks. The poor implementation applies more subsidized IBT-types than those that correspond to the location's past temperature profile, as the regulatory procedure dictates. Tackling both issues simultaneously, this paper looks into the consumption pattern of households by their poverty-status to estimate the fiscal cost and distributional impact of applying the right IBT-type, that is, the one that adequately reflects the location's temperature.

The paper is organized as follows. Section 2 presents the consumption pattern of households across the different IBT-types and income-thresholds and it also highlights the central issues of the Mexican RET design and implementation. Section 3 reviews the mismatches that occur between the designated IBT type and the adequate one that emerges from the locations' past temperature registries. In section 4, I estimate both the fiscal cost and distributional impact of applying the adequate IBT-type to the consumption pattern. Section 5 concludes.

Methods

On one hand, the design consists of seven different types of increasing-block tariffs (IBT), each with three to four blocks and variations regarding consumption volume and seasonality. In total, about 40 different prices can apply at any month, but only a fraction of these ensure-cost-recovery. Only one additional linear tariff (LT) for high-volume users does, but it applies to less than 2 percent of the users. As the IBT-types fail to account for any household attribute other than its consumption level, the tariffs' design interacting on the population's consumption patterns creates inefficiencies from both a distributional and cost-recovery perspective.

On the other hand, in what refers to the implementation of RET, the regulatory procedure is to use a moving average of past-temperatures to apply more generous IBT-types to hotter locations in the country. The hotter the location, the more generous the IBT-type applied to that specific location. More specifically, IBT-types with wider blocks at lower marginal prices are applied to hotter areas. The rationale behind this scheme is to compensate households for greater refrigeration needs during summer time.

In this paper I construct my own two datasets to estimate the fiscal cost and distributional impact of applying the adequate IBT-types on the actual consumption pattern.

First, to estimate the consumption pattern I combine the geographical distribution of users across tariffs as found in administrative data with the webscrapped prices of IBT and LT to obtain month- and location-specific price schedules. I use those schedules in the cross-sectional household budget surveys of 2010, 2012, 2014 and 2016 to recursively estimate household-level heterogeneous consumption patterns across: time, tariff, season and income-poverty status, conditional on the IBT blocks when applicable. This consumption pattern includes the discrete and mutually exclusive distribution of users across IBT-types and IBT-consumption blocks. It also includes the continuous distribution of users across actual consumption levels, measured in kWh.

Second, I use the monthly mean-temperature registries of more than 5000 weather stations to build all municipalities' past-temperature profile. This information is crucial to determine what IBT-type should have been applied, that is, to determine the adequate tariff. I contrast the adequate tariff with the applied one to identify the degrees of mismatch

that exist between these two. Mismatches, of course, can occur in both ways: applying an "excessively subsidized" IBT-type instead of the adequate one or, the way round, applying a "too stringent" one.
Once estimated both the consumption pattern and the adequate IBT-types, I apply the latter to the former to measure the distributional and fiscal impact of applying the right price schedule.
Under the assumption of price-inelastic consumption, the indicators to measure the distributional impact are: i) a headcount ratio that measures the number of income-poor users whose expenditure level drops relative to the number in the total population (HRg) or relative to the number of income-poor (HRp); ii) two depth indicators that separately measure the positive and the negative impact in terms of the expenditure's change with respect to the ex-ante expenditure (Da+,Da-) and with respect to the non-income poor in the same municipality (Dr+,Dr-); iii) the Entropy (Theil) indicator and its decomposition (E); and iv) assuming an utility-additive social welfare function, a measure of welfare change at different levels of inequality aversion (Newbery, 1995) (W). I report these indicators at the national level but the replacement of the designated tariff with the adequate tariff is performed at the municipality level.
The fiscal cost is measured in real terms and as a share of the utility's revenues. It is also benchmarked against expenditures in social, education and health policies to illustrate the opportunity cost of the poorly implemented generalized electricity subsidies.
The effect of applying the adequate tariff instead of the designated tariff is analogous to the removal of the virtual income created by IBT schemes (Olmstead et al, 2007). The removal of the virtual income represents the savings in the fiscal cost of subsidies.

Results

The most striking characteristic that emerges from the consumption pattern is that poorer households (income deciles 1 and 2) consume half as much as better-off households, but, relative to their household budget, they spend three or more times more than better-off households. Lower deciles spend as much as 10 percent of their budget on electricity. In what refers to the implementation about 30 percent of the municipalities analysed in the period between 2010 and 2016 have been designated an IBT-type that does not correspond to their past-temperature profile. In a universe of about 2,500 municipalities and seven years, that 30 percent corresponds to about 5,000 mismatches in a total of 17,500 cases. Of these 5,000 mismatches, about 4,200 correspond to cases where the actually designated tariff is more subsidized than the adequate one that emerges from the temperature profile.
In real terms (December 2016), the fiscal cost of the implicit subsidy amounts MXN 34 billion (about USD 1.9 billion). The opportunity cost of this misallocation is huge. As a reference, in 2016 Mexico's flagship social assistance program, Prospera (formerly known as Oportunidades) cost MXN 80 billion. Accounting for both plausible directions of mismatches, "too heavily subsidized" and "too stringent tariffs", the fiscal cost represent MXN 17 billion, or 20 percent of Prospera's budget.
Preliminary results on the distributional impact suggest that a rather small number of poor users benefit from the right implementation of electricity tariffs. HRg and HRp are rather small, on average less than 1 percent. The depth of the income-poor's benefit relative to their non-poor peers (Dr+) is also offset by the depth of the negative impact (Dr-) when applying the right tariff. On average the Gini indicator shows an insignificant inequality decrease, and, finally, at different inequality aversion levels, welfare drops between 3 and 5 percent.

Conclusions

The mismatches between the applied IBT-type and the adequate one that emerges from the past-temperatures profile corresponds to an implicit subsidy that has not yet been documented at a national level in the literature on price regulation. These mismatches have both distributional and fiscal implications. The latter amount to about 20 percent of the country´s key social assistance program. However, the distributional impact of applying the adequate IBT-types severely hits the income-poor. A priori this raises a note of caution in correcting the situation as other compensatory mechanism need to be identified to compensate the income-poor with other support programs that offset the additional outlays created by the right application of the tariff.

References

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