Energy Populism and Household Welfare

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Abstract

We study a cycle of subsidized energy prices and estimate its welfare impact on households in the Buenos Aires Metropolitan Region. A simple framework explains its emergence in terms of the preference of a median household (voter) for receiving transfer gains followed by a future flow of transfer losses. We evaluate actual transfers and welfare effects that a departure of prices of natural gas and electricity generation from opportunity costs since 2003 had on households and explore the impact of a way back to opportunity cost pricing.

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1. Introduction

Energy subsidies may be, without apology, transitory or permanent components of actual policy in many countries, both developing and developed. In some cases the decision to subsidize energy may come from an objective to cushion economies from external shocks.[1] In others it may be a byproduct of macroeconomic crises that require some muddling through of domestic prices for a while, such as the case of Argentina in 2002 or in many previous episodes.[2] Yet in other cases, energy price interventions may be part of a non-transitory policy that exploits price departures from opportunity costs in order to make transfers to consumers (voters) at the expense of firms' previous sunk investments. Shortermism and political opportunism to extract economic quasi-rents, and so to set unsustainable transfers through low prices, are ingredients of what we label energy populism. The economic view of this policy is usually skeptical, to say the very least.[3] The economy is only transferring the bill of adjustments to the future and the consequences may not just be returning to higher break-even prices but rather jump at higher opportunity cost if production efficiency and policy credibility are damaged. Second, generalized transfers through (usually uniform) energy prices will have a poor distributional incidence as will imply large transfers to the non-poor. This second fact has made so-called populist policies rather puzzling, in terms of the dissonance between discourse and consequences.

Argentina post 2003 seems to perfectly fit in the last case. Within a policy of repressed energy prices in general, even with clear signs of cumulative imbalances in its main energy product –natural gas- and soaring international energy prices, wholesale markets of natural gas and electricity generation (heavily dependant on natural gas) were severely intervened, implying prices that depart from long run sustainable opportunity costs (LRSOC).[4] In the case of natural gas, the (so far very competitive) sector could perhaps have sustained production plans with a wellhead price below the import parity (which relevant value is the import price from Bolivia) before the consolidation of the interventionist policies. However, after intervention, sustainable wellhead prices would have to move towards import prices. Although the origin and magnitudes in this example can be subject to discussion, the important fact for the sake of our argument is their qualitative evolution, i.e., ex-post-intervention LROC are higher than ex-ante-intervention costs.[5] As a consequence, the legacy of energy populism is not only that policies need to be reverted some time in the future but also that economic agents will face a future efficiency loss due to higher ex-post prices, at least, for a number of years until domestic market conditions return to normal.

A great deal of debate in Argentina has been focused on energy subsidies in terms of their fiscal short run consequences. But in this paper we look at the role of subsidies from a long run economic viewpoint. The difference is important since fiscal transfers are actual disbursements made by the government to energy producers to account for the difference

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[1] See for example, Bacon and Kojima (2006) and Artana, Catena and Navajas (2007).

[2] See Navajas, (2006) for analysis of public utilities tariff structures in the Argentine case.

[3] Books and papers on populism within economics have been traditionally directed at macro-economic policies. See for instance Edwards (2010).

[4] In the argentine case, we submit that this policy took shape since at least 2003. We give room for year-2002 policies to attend a transitory phenomenon of coping with a severe macroeconomic crisis. The legal tenants to certify (and give a permanent status to) this policy are Presidential Decrees 180 and 181 issued in February 2004 and Resolution 240 issued by the Secretary of Energy in September 2003, for natural gas and electricity generation, respectively.

The case of electricity generation is very similar. On the one hand there is the effect through the price of natural gas (which is the primary energy input), while on the other there is an increase in capital costs (due to inefficiencies and higher interest risk premium that follows interventionism).

between costs (or producer prices) and end-user prices. However, this gap will not represent the true resource-cots gap to the economy. Economic subsidies are the difference between end-user prices and opportunity costs represented by border prices or long run incremental costs in the case of tradable and nontradable goods, respectively.

In this paper we asses the consequences of a movement in energy prices that fits into a populist policy cycle. End-user prices of natural gas and electricity in Argentina went severely down in real terms after a macroeconomic crisis and a devaluation of the peso in 2002, were kept frozen for many years in an inflationary context and then started to be partially or selectively unfrozen since 2008 with the introduction of multi-block (quantity dependant) prices. In section 2 we made more precise the setting of the energy populism and explore some requirements for this to arise as equilibrium. We see energy populism as a policy of subsidies designed to gain secure support from the median voter. Then we move to our main empirical enquiry, developed in section 3 and implemented in section 4, which is to provide a measurement of the transfers and welfare consequences for households in the Buenos Aires Metropolitan Region (AMBA) of the fall and rise of natural gas and electricity prices. Section 5 concludes the paper and comments on further issues that deserve future research.

2. Energy populism

Consider an economy that lasts for two periods t_1 and t_2 (in an infinitely-lived-agents-economy, t_1 may cover a number of "present" years, while t_2 may cover the remaining "future" years). Each household h (h=1,…,H) has an indirect utility function that is strongly separable in energy goods (e, with en user prices or tariffs q_e^h), non-energy goods (ne, with prices q_{ne}) and monetary income (m^h, which includes all forms of income including government transfers): $V^h = V^h(q_e^h, q_{ne}, m^h) = V_e^h(q_e^h) + V_{ne}^h(q_{ne}, m^h)$. We further assume without loss of generality that a higher h corresponds to higher income; i.e. $m^1 < m^2 < …. < m^H$.

Strong separation allows us to neglect the indirect impact of energy prices through the level (and structure) of the rest of prices in the economy. End-user energy tariffs are formed from commodity-energy prices (P_e^h), transmission and distribution margins and taxes. We deal with commodity energy prices (referring to them as energy prices) that may or may not change across households (see section 3).

We study a sequence of energy prices (e.g., natural gas as an illustration) that departs from long run sustainable opportunity costs (LROC). The departure comes from the implementation of an unsustainable policy that we label "energy populism" and make more precise below. The basic idea of what we are addressing can be shown with the help of Definition 1.

Definition 1: Throughout the paper we define an "intervention policy" in domestic energy markets as a reduction in current prices below LROC and a later increase to cover a (higher, due to intervention) future LROC.

At the starting point (before the beginning of t_1) the price of natural gas –P_0, measured in dollars per MMBTU– equals the LROC –C_0–, and is the energy component in residential tariffs (uniform across users). At the beginning of t_1 a policy is implemented so that the price is set at $P_1 < P_0$ (with P_1 presumably above short run marginal cost)[6], exploiting an opportunistic situation to engineer transfers to society. However, this opportunistic policy

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[6] We do not consider fiscal transfers set to sustain production at prices below short run marginal costs. Empirical evidence in Argentina shows this to be the case for electricity generation since 2004 and also more recently for natural gas.

affects LROC, which increases to C_1 (for example, because it affects the incentives for producers to invest in new production wells, not modeled here), and can be sustained for at most one period, and then reverts to cover LROC at time t_2. So, prices P_2 in t_2 must reflect LROC (i.e., $P_2=C_1$).
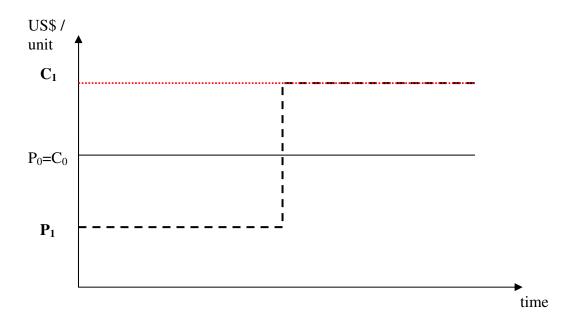
Figure 1: Example of evolution of opportunity cost and prices

This policy has income transfers perceived by voters and welfare impacts upon society that need not be identical. In fact, we exploit theses differences by first exploring voting decisions by households on perceived transfers and then move to compute welfare transfers to society depending on prices and opportunity costs. In this section, we explore some strategic decision structure related to the emergence of the subsidy policy (stated in Definition 1) as equilibrium. In the voting decision considered below households face a sequence of prices $\{P_0, P_0\}$ or $\{P_1, \theta^h.P_2\}$ where θ^h is a parameter affecting expected future prices by household h. Instead, in our welfare impact measurement in the next section, society receives transfers that are parametric to the difference between C_1 and P_1, i.e., the monetary transfer after intervention damage to efficient production is done.

Before proceeding further we take an explicit definition of energy populism.

Definition 2: Energy populism is a policy (consistent with a discourse or "narrative")[7] that, while claiming to support "the people" versus "the elites", seeks the secure support of the

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[7] Some political science rationalizers of populism have emphasized the fundamental role of the "narrative" in the emergence and implementation of populist policies (see for instance Laclau, 2005). We have no possibility to capture such a (rather vague) dimension in our framework. We are aware that the point may call the attention on the fact that policies (as substance) need necessarily to be consistent with discourse (as forms) which in the populist antagonist strategy means identifying the winners and losers of policies. When we later say that a populist policy is one that seeks the support of a large fraction of the population, in a voting sense, we perhaps should avoid meaning any fraction, but one that can be shown to necessarily favor low income and low middle class voters, as the fundamental groups in a broader coalition behind populist policies. Regardless of the existence of an equilibrium in voting terms, the coalition supporting the transfers need be close to "friends" (low income groups) rather than "enemies" (high income groups), above any position regarding policy preferences.

median voter to implement unsustainable transfers through lower energy prices, heavily interfering with efficient energy price formation in a non-transitory manner.

An almost canonical vision to analytically deal with problems like the one described above has been to resort to either political opportunism and/or to myopic behavior (i.e. high or hyperbolic discounting). In this vein, decision makers or society prefer (in net present value) transfer of gains in period t_1 and of losses in t_2 rather than a sequence of equilibrium prices. While we cannot disagree with this view, we prefer to re-phrase the argument looking at more structural-like elements behind the implementation of energy populism as equilibrium.

Intervention affects households' utility positively[8] in t_1 given by $\Delta_1 V_e^h = V_e^h(\mathbf{q_e^h}(P_0)) - V_e^h(\mathbf{q_e^h}(P_1)) > 0$. As for (negative) transfers in t_2 we further assume that households may anticipate that the price increase will be shifted to "outsiders" (the "elites" in Definition 2 terminology), represented by large user tariffs (such as industrial customers), intra-marginal producers that will face (ricardian) quasi-rents under P_2, or the government (through taxes or implementing cross subsidization).

Households know they are receiving a subsidy in t_1 and that prices will have to go up again in t_2, but they are unaware of the magnitude of the jump. Let $\theta^h.P_2$ with $\theta^h \epsilon [P_0/P_2,1]$ be the price expected by household h for period 2. Then the differential utility in t_2 after transfers becomes $\Delta_2 V_e^h (\theta^h) = V_e^h(\mathbf{q_e^h}(\theta^h .P_2)) - V_e^h(\mathbf{q_e^h}(P_0))$. Parameter θ^h can be also seen as affected by the "policy" (definition 2) chosen by the incumbent government in a way to communicate or signal voters.[9] The incumbent will attempt to convince a large fraction of households that "exit" conditions from current policy are such that prices will not overshoot P_0 or even stay close to P_1 for some households. However, many households may realize that an unfreezing will inevitably occur in t_2 and that $\theta^h > P_0/P_2$, i.e. that P_2 will overshoot P_0. We further assume that this perceived "exit" is an increasing function of household income; i.e. $\theta^h = \theta^h(m^h)$; $\Delta\theta/\Delta m > 0$; as high income households will perceive being part of the "outsiders" and that they will have a higher share in paying the bill later on.[10]

A household h prefers the intervention scenario at t_1 if

$$\Delta_1 V_e^h + \delta \Delta_2 V_e^h \geq 0 \qquad\qquad (1)$$

where we have assumed that all households have the same discount factor. Given this condition for every h, we define a "critical discount factor" $\delta^{h*} = -\Delta_1 V_e^h / \Delta_2 V_e^h$, if an interior solution for δ (between 0 and 1) exists, or else $\delta^{h*}=1$. It is clear that δ^{h*} depends on h since the ratio of current to future utility transfers depends on θ^h. Thus, δ^{h*} is a decreasing function of θ^h and, by assumption, a decreasing function of income. We can therefore have households ordered by δ^{h*} where $\delta^{1*} > ... > \delta^{H*}$. We can submit the following

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[8] Recall that end user prices or tariff that enter into the indirect utility depend on energy prices, so the notation q(P).

[9] We do not model a strategic behavior by the incumbent and rather assume that he is interested in gaining support in period 1. See Acemoglu et.al. (2010), who develop a model of populism where an incumbent signals voters a single dimension policy so as to secure the support of the median voter. In their model the voters are afraid of being cheated by right wing politicians promising a populist policy and not delivering it ex-post. This gives rise to policies chosen (by a center left politician) to the left of the median voter so as to secure support.

[10] The vector of θ^h may actually depend on the available "policy-technology". A very rich set of instruments may allow the incumbent to discriminate among households. After all he is interested in a large proportion, but not in all households. Given this, one of the puzzles of populist policies is why they are so uniform across households. Also, one can imagine an θ^h higher than 1 for some households if future policy is based on heavy cross-subsidization. Finally, the policy-technology may be endogenous or be subjected to time inconsistencies.

Proposition 1: A necessary and sufficient condition for energy populism to arise as equilibrium is that the median household expects to receive higher gains in t_1 than losses in t_2, i.e., $\delta \leq \delta^{M*}(\theta^M)$

Proof: From the condition that $\delta^{M*} > \delta$ is an equilibrium.

This proposition states that if the median household perceives a net benefit of the intervention policy on her utility, the policymaker will have room to implement the interventionist policy. In assuming that those h to the left of the median voter, i.e. all h such that $\delta^{h*} > \delta^{M*}$ have lower income tan the median voter we have assumed that populist policy is consistent with "discourse or narrative" (see definition 1 and footnote 8). This need not be the case if the perceptions about the exit conditions in t_2 are such that θ^h is not increasing in income. For this to occur one could imagine a set of transfers heavily focalized to a supporting group (low income and low middle class) that later on are going to be financed by an adjustment that also relies on other (non supporting) agents. In other words, focalization of subsidies to "supporters" cum rebalancing against "other" agents could in principle implement an interventionist policy. However, focalization requires well functioning and efficient institutions on social policy, a fact that cannot be taken for granted in most interventionist environments. With an imperfect relationship between θ^h and income m^h, the incumbent may have to capture a larger fraction of voters (not just the median) to keep policy aligned with discourse or narrative. Nevertheless, a somewhat puzzling fact of energy populism for many observers has always been the dissonance between policy, consequences and discourse. This is so, in the first place, because results in the next section indicate that transfers in t_1 suffers from focalization in general, and to the poor or low-income in particular. Secondly, while the evidence suggests that the "exit" from the repressed energy price regime has been based on some differential adjustment across agents, the change observed is very far from a well focalized scheme. Absence from focalized policies at the beginning and at the end of a populist cycle suggest that, beyond an explanation based on a cultural aversion to focalized policies, the costs of transferring income to supporters end up being too high.

3. Household welfare

While the previous discussion motivated the analysis of the trade off faced between present value "gains" and "losses" of the implementation of energy populism as an equilibrium policy, in this section we try to measure and evaluate actual income transfers and welfare effects to households.

In empirical terms, we seek to measure the consequences of a sequence of prices of natural gas and electricity faced by argentine households. Prices of both energy goods were decoupled from long run sustainable opportunity costs (LRSOC)[11] since 2003 and started to converge, slowly on average and located in high increases for for some households. For LRSOC values we take reference prices assuming that in 2003 energy populism has been "consecrated" and that Argentina is since then facing higher opportunity costs of natural gas and electricity. In the case of natural gas, the cost of imports from Bolivia, while for electricity we construct a spot price that is formed from the natural gas price given before.

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[11] The term sustainable refers to the fact that there is an expansion of supply (natural gas and electricity generation capacity) to sustain. This applies in particular to natural gas where reserves to production have been falling and require a dynamic response. In other words, LRSOC are signals that will assure a sustainable supply of energy.

For this purpose we follow a simple methodology to evaluate aggregate welfare from final outcomes on individual utility assuming some aggregation (social welfare) function. Recall from Section 2 that each household h has an indirect utility function $V^h = V^h(\mathbf{q_e^h}, \mathbf{q_{ne}}\ m^h)$, strongly separable between energy and non-energy goods. Social welfare is represented by an aggregation of individual utilities, that is, $W = W(V^1, ..., V^H)$. As explained before, end-user prices depend on energy-commodity prices p_e^h that are the object of change and analysis.

For the empirical implementation we make auxiliary assumptions on the shape of the social welfare and individual utility functions. A simple parametrization (see for example Newbery (1995); and Navajas (1999, 2004) for an application to Argentina)[12] assumes that the social welfare function is additive in utility levels U, that is $W = \sum U^h/H$ and that individual agents have iso-elastic utilities on consumption or real expenditure of the type $U^h \equiv (g^h)^{1-v}/(1-v)$ for 0<v and v≠1, or $U^h \equiv \log g^h$ for v=1, where g^h is household expenditure (per equivalent adult) and v is interpreted as a coefficient of inequality aversion. Under these assumptions the social marginal utility of income of h can be computed by the expression $\beta^h=(g^h)^{-v}$, that is, the inverse of expenditures per equivalent adult raised to the coefficient v.

For measurement purposes, the importance of assuming this specification, is the result (Newbery, 1995) that under an additive-cum-isoelastic utility specification, i.e., $W= \sum [(g^h)^{1-v}/(1-v)]/H$ social welfare can be approximated by the (socially) weighted sum of expenditures per equivalent adult [13], i.e.,

$$\Delta W/W = \sum\beta^h.\Delta g^h/.\sum\beta^h. g \qquad (2)$$

Suppose now that a policy gives rise to a change in the vector price of energy price $\mathbf{q_e^h}$ that in turn has welfare marginal impact given by the partial derivative

$$\partial W/\partial q_e^h=\sum_h(\partial W/\partial V^h).(\partial V^h/\partial q_e^h) = -\sum_h \beta^h.x_e^h \qquad (3)$$

where $\beta = (\partial W/\partial V_h).(\partial V_h/\partial m^h)$ is the marginal social utility of h-household income; x_e^h is the quantity of electricity or natural gas consumed by household h and Roy's identity has been used. Welfare impacts of discrete changes in energy prices can be approximated by[14]

$$\Delta W = -\sum_h \beta^h.x_e^h.(p_1^h-p_0^h) \qquad (4)$$

Thus we approximate the total transfer received by household h by $x_e^h.(p_1^h-p_0^h)$, the percentage of the transfer in terms of total income as $x_e^h.(p_1^h-p_0^h)/g^h$, the total welfare by (4) and the percentage welfare change, using (2), as

$$\Delta W/W = -\sum_h \beta^h.x_e^h.(p_1^h-p_0^h) / \sum_h \beta^h.g^h \qquad (5)$$

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[12] An alternative specification that assumes a weighted welfare function of indirect utility functions comes to the same results without need to specify the form of utility functions. The adopted specification facilitates the computing of percentage welfare changes from household expenditures.

[13] Using the definition of $\beta^h=(g^h)^{-v}$ we obtain $W=(1/H.(1-v))\sum\beta^h g^h$. Thus, the percentage variation in welfare is given by $\Delta W/W = \sum\beta^h.\Delta g^h/.\sum\beta^h. g^h$.

[14] In expression (4) x_e^h can be approximated, from a Taylor series expansion, by $x_e^h(p_0).[1+\eta_{x,p}.(p_1^h-p_0^h)/ p_0^h]$, where $\eta_{x,p}$ is the direct price-elasticity of demand (for electricity or natural gas). In the empirical evaluation below we do not exploit this loop given that the magnitude of the jumps in prices are very large and would imply large quantity corrections even with very low elasticity values (as those reported for natural gas and electricity in various papers).

This expression can be computed for alternative values of income inequality aversion (v) giving rise to different results.

4. Measurement

We use different data from several sources and make assumptions and estimates. The basic ingredients relate to prices and quantities.

Prices

Concerning energy prices actually paid by households we use prices of the commodity (energy) component (i.e. not to be mistaken with end-user tariffs that include transmission and distribution costs as well as ad-valorem taxes) for natural gas and electricity. Natural gas prices were taken from ENARGAS data for the companies (Metrogas and Gas Ban) that serve in the AMBA region.[15] Electricity prices are seasonal monomic prices for residential demand and for companies serving the area (EDENOR and EDESUR)[16].

As for long run sustainable opportunity costs, i.e. prices that can sustain an expansion of supply so as to meet demand, we make different but related assumptions for natural gas and electricity. In the case of natural gas we take border prices with Bolivia as reference wellhead prices that would sustain an expanding natural gas supply. These values were checked from different sources such as unitary import prices implicit in the Secretary of Energy data set (which has some problems concerning these values) and reference values from public and private Bolivian sources. In the case of electricity we assume a generation cost of a combined-cycle plant that has variable costs related to the cost of natural gas from Bolivia and high fixed costs related with a high discount rate.[17]

Tables A.1 and A.2 in the Appendix show the series of actual prices, estimated opportunity costs, and estimated subsidies of natural gas and electricity generation paid by households in the AMBA region from 2003 to 2010. The implicit subsidy in natural gas has started in 1.3 dollar per MMBTU in 2003 and moved upwards to a range from about 5 to almost 7 dollars (according to the tariff block) per MMBTU in 2010. In 2003, the price actually embedded in natural gas tariffs was about 27% of the assumed opportunity cost, while in 2009 this figured had moved down to less than 10% for households that faced no increases (about 60% of households) and to about 32% for the households with the

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[15] We take the cost of gas embedded in the final tariff as presented by ENARGAS in its resolutions for Metrogas and Gas Ban. This component has been differentiated since 2008 as residential tariff categories were opened in various blocks. Further we include in the cost of gas the charge created by Decree 2067/09 and applied to different tariff blocks through resolution 566/09 of ENARGAS. We consider that this charge should be taken as part of the price of gas, since it was created to finance the imports of natural gas. The formal (legal) way it was introduced has led many critics to refer to it as a tax, but in our view this is not a correct economic interpretation.

[16] The source here is the wholesale electricity market operator CAMMESA. Until Resolution 1169/08 of Secretary of Energy (that began to unfreeze electricity generation prices for households with adjustments unevenly distributed across households according the quantities consumed) electricity generation prices were uniform for all households. After that Resolution (and Resolution 356/2008 of ENRE) there has been big differences in generation prices paid by households (leading to a nine-part tariff) to accommodate the increasing use of liquids in generation. We estimate prices for each tariff block from CAMMESA data (sanctioned prices and the declaration of transactions of distribution companies).

[17] We assume that the marginal cost equals the generation cost of a combined cycle generator, running on natural gas valued at opportunity cost. This cost is US$ 62.1 in 2009, equal to the sum of a variable cost of fuels US$ 37.4/MWh (with the price of natural gas in US$ 5.88/MMBTU) and fixed cost cum non-fuel variable cost of US$ 24.7/MWh (which covers investment costs at a discount rate of 15%). We index variable cost with the price of imported natural gas and fixed cost by Producer Price Index of USA to obtain marginal cost figures between 2003 and 2009.

largest increases. In the case of electricity, the implicit subsidy has moved from 30% of opportunity costs in 2003 to a mere 10% in 2009 for household with frozen tariffs (71% of total households) and to 41% for households with the largest increases.

Quantities

Aggregate annual quantities (2003-2010) of natural gas consumed by households in the AMBA are taken from ENARGAS, and refer to cubic meters sold to residential customers in the Metrogas and Gas Ban areas. Aggregate annual quantities (2003-2010) of electricity consumed by households in the AMBA are taken from the Secretary of Energy. Adjustment in quantities in response to increases in prices after 2010 (stated as a figurative year 201X) were not estimated with a price-elasticity of demand but rather assumed as a sensitivity analysis for different cases (see below).

Quantities used for the evaluation of incidence and welfare impact of household transfers were taken from the National Household Expenditure Survey for the AMBA. Following a method used in Navajas (2009) we were able to "retrieve" the quantities of natural gas and electricity consumed by each household in the survey. We are therefore able to implement the formulas of the previous section from observed quantities. We also use the distribution of consumptions across households along with household data on income and total expenditure that allow us to compute the social marginal income utility of each household so as to implement welfare weights $\beta^h = (g^h)^{-v}$ of the previous section.

Household transfers

Subsidies received by households during 2003-2010 are measured by $x_e^h.(p_1^h - p_0^h)$ in the expressions of the previous section, where x_e^h is the quantity of natural gas or electricity consumed by household h and $(p_1^h - p_0^h)$ is the unit subsidy (the difference between actual prices and opportunity costs) estimated in Tables A.1 and A.2 commented before.

Tables 1 and 2 show the estimates of household transfers for natural gas and electricity. Numbers are expressed in millions of dollars per year, for each decile of income (arranged according per capita household income) and separated in the periods of full freeze (2003-2007), partial adjustment (2008-2010) and an hypothetical return to full cost pricing (in the figurative year 201X) under two assumptions of no demand correction (i.e. valuated at the same quantities) and a 10% demand correction. The difference between the subsidy periods (2003-2007 and 2008-2010) and the full adjustment period is that while the former are actual estimates for a given period the later is a hypothetical estimation of an annual flow in the future.

Table 1				
Natural Gas: Estimated Annual Transfers to Households in the Metropolitan Region of B.A.				
Millions of US Dollars				
			Without Demand Correction	10% Demand Correction
Decile	2003-07	2008-10	201X	201X
1	10.5	27.9	-32.1	-28.9
2	17.9	45.9	-52.5	-47.3
3	22.0	56.0	-64.0	-57.6
4	26.3	66.4	-76.0	-68.4
5	31.8	78.9	-90.0	-81.0
6	37.9	93.4	-106.6	-95.9
7	41.2	98.2	-111.8	-100.6
8	45.0	107.5	-122.3	-110.1
9	45.4	107.6	-122.4	-110.2
10	44.5	102.5	-116.9	-105.2
Total	322.5	784.3	-894.7	-805.2

Source: own elaboration based on ENGH micro-data

Table 2				
Electricity: Estimated Annual Transfers to Households in the Metropolitan Region of B.A.				
Millions of US Dollars				
			Without Demand Correction	10% Demand Correction
Decile	2003-07	2008-10	201X	201X
1	24.9	52.2	-55.4	-49.9
2	30.1	63.7	-67.9	-61.1
3	36.2	75.5	-80.1	-72.1
4	35.1	74.4	-79.2	-71.3
5	36.6	76.9	-81.6	-73.4
6	39.1	83.1	-88.5	-79.6
7	39.7	84.7	-90.1	-81.0
8	40.3	85.2	-90.5	-81.4
9	42.7	90.9	-96.5	-86.8
10	49.3	104.3	-110.3	-99.3
Total	373.9	790.8	-840.0	-756.0

Source: own elaboration based on ENGH micro-data

Total transfers, from 2003 to 2010, to households in the Buenos Aires Metropolitan Region amounted to 8.2 billion dollars or on average a bit more than 1 billion dollars per year. This is, on average, in the order of 0.3% of GDP per year. Under-pricing of electricity generation caused a bit more subsidies than under-pricing of natural gas. Despite the correction in 2008 to some households, actual subsidies went up due to a significant rise in opportunity costs that are related to international energy prices and to the restricted nature of price increases. As we have about 4 million households in this area, every household received, on average, an equivalent annual subsidy of about 250 dollars. But the distribution of the subsidies, given uniform prices until 2008, was not pro-poor or pro-low income households but rather benefited relatively more the higher deciles of income distribution (see Table 3). This is unsurprising given the fact that subsidies were uniform and proportional to consumption until 2008. In the case of natural gas, the unfair distribution against low income households is compounded by the fact that many of them do not receive a subsidy at all given that they are not connected to the natural gas network

(see Table A.3 in the Appendix) and use LPG at opportunity costs values.[18] Hence, the almost 4 to 1 ratio in 2003-10 subsidies received by the 10th decile compared to the 1st decile can be explained by a 1.5 to 1 ratio in average consumption and a 3 to 1 ratio in access to the network.

Table 3			
Distribution of natural gas subsidies and electricity subsidies across households between 2003-2010			
Decile	Natural Gas	Electricity	Total
1	3.4%	6.6%	5.1%
2	5.7%	8.1%	6.9%
3	7.0%	9.6%	8.3%
4	8.3%	9.4%	8.9%
5	10.0%	9.7%	9.9%
6	11.8%	10.5%	11.1%
7	12.6%	10.7%	11.6%
8	13.8%	10.8%	12.2%
9	13.9%	11.5%	12.6%
10	13.4%	13.2%	13.3%

Source: Table 1 and Table 2

A return to opportunity cost is a reversion of subsidies that will imply transfers in opposite directions to those observed in 2003-2010. Annual transfers will depend on demand correction but will surely –and given higher projected natural gas prices which impact on both estimates- be of a magnitude of about 1.5 billion dollars per year (or more than 0.3% of current GDP), a large figure considering that we are measuring only households and in the Buenos Aires Metropolitan Region, which means about 25% percent of total consumption of natural gas and electricity. Unlike the transfers in 2003-2010, they will imply a permanent flow with a correspondingly large amount in relation to the "floor" in which prices were at the end of the subsidy era.

Welfare impacts

Tables 4 and 5 present the estimated annual percentage welfare changes (expression (5)) estimated for the different sub-periods and for different degrees of inequality aversion (v=0.5, 1 and 2), assuming a 10% correction (to average those shown in Tables 1 and 2) in demand after price changes towards opportunity costs in 201X. The results show significant changes in welfare for households, but in particular for low income ones. As the impact of household transfers on utility (welfare) depends on the income or expenditure level of each household (along with the degree of inequality aversion), they are, as expected, decreasing in income. Thus the distribution of welfare gains has a higher impact on the poor, a fact that is only seemingly contradictory to the evidence that a large amount of subsidies go to the non-poor. The reason is that large subsidies to the well being are not as significant due to their high income levels, relatively to the poor.

One important element of the results shown in Tables 4 and 5 is that (by the very same reason that percentage welfare impacts to the poor are large) the variability of the impacts is correspondingly large. To the extent that subsidies will be followed by price hikes, the

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[18] This result is unsurprising in view of previous papers that assess the distributive incidence of subsidies in Argentina (see for example Marchionni, Sosa Escudero and Alejo (2008)). In their terminology (see also Angel-Urdinola and Wodon, 2005) the subsidy policy of natural gas and electricity is regressive when the ratio of the subsidies received by a target group (the poor or low income families) to the average subsidies is lower than one. In our estimates the "lower half" of households arranged by per capita income received a transfer of about 2,000 dollars for the period 2003-2009, while the average transfer was 2,500 dollars.

richest households will face variability in welfare of a relatively small magnitude, while the poorest suffer a large swing in utility and welfare.

Table 4								
Natural Gas: Average Annual Percentage Change in Welfare								
	Aversion coefficient (*v=0.5*)			Aversion coefficient (*v=1*)			Aversion coefficient (*v=2*)		
Decile	2003-07	2008-10	201X	2003-07	2008-10	201X	2003-07	2008-10	201X
1	12.0%	29.5%	-29.3%	12.9%	31.8%	-31.6%	16.1%	40.2%	-40.0%
2	8.2%	19.3%	-19.1%	8.2%	19.4%	-19.2%	8.3%	19.6%	-19.5%
3	6.0%	14.2%	-14.0%	6.0%	14.2%	-14.0%	6.0%	14.2%	-14.1%
4	5.0%	11.7%	-11.6%	5.0%	11.7%	-11.6%	5.0%	11.8%	-11.7%
5	4.6%	10.5%	-10.4%	4.6%	10.5%	-10.4%	4.6%	10.5%	-10.4%
6	3.9%	9.0%	-8.9%	3.9%	9.0%	-8.9%	3.9%	9.0%	-8.9%
7	3.7%	8.3%	-8.3%	3.7%	8.3%	-8.3%	3.7%	8.3%	-8.3%
8	2.8%	6.3%	-6.3%	2.8%	6.3%	-6.3%	2.8%	6.3%	-6.3%
9	2.2%	4.9%	-4.9%	2.2%	4.9%	-4.9%	2.2%	4.9%	-4.9%
10	1.4%	3.1%	-3.1%	1.5%	3.2%	-3.2%	1.5%	3.4%	-3.4%
Total	3.4%	7.7%	-7.7%	4.2%	9.9%	-9.9%	7.3%	17.7%	-17.6%

Note: Assumes a uniform 10% demand correction during the populist cycle reversion (year 201X).

Table 5								
Electricity: Average Annual Percentage Change in Welfare								
	Aversion coefficient (*v=0.5*)			Aversion coefficient (*v=1*)			Aversion coefficient (*v=2*)		
Decile	2003-07	2008-10	201X	2003-07	2008-10	201X	2003-07	2008-10	201X
1	11.2%	22.1%	-20.6%	12.3%	24.2%	-22.6%	18.5%	36.6%	-34.2%
2	6.9%	13.7%	-12.8%	7.0%	13.8%	-12.8%	7.0%	13.9%	-12.9%
3	6.2%	12.1%	-11.2%	6.2%	12.1%	-11.2%	6.2%	12.1%	-11.2%
4	4.9%	9.8%	-9.1%	4.9%	9.8%	-9.1%	5.0%	9.8%	-9.2%
5	4.2%	8.3%	-7.7%	4.2%	8.3%	-7.7%	4.2%	8.3%	-7.7%
6	3.7%	7.3%	-6.8%	3.7%	7.3%	-6.8%	3.7%	7.3%	-6.8%
7	3.1%	6.1%	-5.7%	3.1%	6.2%	-5.7%	3.1%	6.2%	-5.8%
8	2.6%	5.2%	-4.8%	2.6%	5.2%	-4.8%	2.6%	5.2%	-4.8%
9	2.1%	4.3%	-4.0%	2.2%	4.3%	-4.0%	2.2%	4.3%	-4.0%
10	1.6%	3.1%	-2.9%	1.6%	3.2%	-3.0%	1.7%	3.4%	-3.2%
Total	3.5%	7.0%	-6.5%	4.6%	9.1%	-8.5%	9.5%	18.7%	-17.4%

Note: Assumes a uniform 10% demand correction during the populist cycle reversion (year 201X).

5. Conclusions

In the last decade Argentina embarked on an interventionist energy policy, particularly concerning wholesale natural gas and electricity markets. This interventionism led to what is perhaps the largest tariff freeze in history particularly for households in the Buenos Aires Metropolitan Region, about 40% of the country's population and the historical stronghold of supporters of redistributive politics. If prices were below opportunity costs at the beginning of the freeze in 2002, they became astonishingly divorced since 2003 as international energy prices soared. The presence of visible imbalances did not trigger policy response up until 2008, as world energy prices soared. But the response was carefully designed to avoid being perceived as a policy reversal. On the contrary, energy policy in Argentina became quite committed to the freeze or real deterioration (as inflation picked up since 2007) for a significant percentage of households (with low to medium consumption levels). This was costly done through a multi-part tariff schedule that left many holes in particular in terms of inclusion errors (i.e., upper middle class or rich families with low to medium consumption levels included in the subsidy scheme).

In section 2 we labeled this policy "energy populism" and provided a simple analytical framework for explaining its emergence in terms of the preference of a median household-voter for receiving transfer gains followed by a stream of transfer losses. This depends on

a critical discount factor that in turn depends on a perception that the transfer losses will be somehow shifted away. A suggested line of future research is to polish the strategic behavior of the incumbent to implement (and of society to vote for) energy populism; in particular exploring the inconsistencies for choosing the populist path given that consequences may end up being quite different from discourse or narrative is an interesting topic. Another extension is the interplay between the adoption of energy populism and the policy-technology for dealing with transfers; in particular the absence of (or lack of incentives in) adopting focalization of subsidies, which will reduce the costs of policy. Exit conditions from heavily subsidized prices poses a problem for society given that at the new energy prices a larger proportion of agents will have serious difficulties in coping with the energy price shock.

Evaluating long run sustainable opportunity costs at what we believe are reasonable scarcity values for Argentina, we found that about 4 million households in the Metropolitan Region of Buenos Aires (about a 40% of population) received in total more than 8 billion dollars in subsidies between 2003 and 2010, or in annual terms about 0.3% of the (average) GDP of that period. The distributive incidence of these transfer gains is very weak, particularly for the case of natural gas, as incomplete access to the network means that 40% of the poorest 50% of households do not have natural gas and buy LPG at opportunity costs. For both natural gas and electricity, the distribution of subsidies is significantly biased towards the non-poor, as the share in the total subsidies of the richest 20% households doubles that of the poorest 20%.

Welfare impacts for society as a percentage of total welfare are quite significant (between 3.5% and 7% for gas and electricity, with an inequality aversion coefficient of 0.5 for an additive welfare-cum-isoelastic utility specification). As expected, percentage welfare gains for the poorest households are considerable larger compared to the equivalent gains for the well being, due to the large differences in income.

We do not elaborate on the transition from subsidized prices to a new equilibrium. This move has partially began, albeit slowly and with difficulties due to poor focalization associated with multi-part prices (associated with consumption levels) that implemented large price hikes for a small group of large consumers. We make a simple calculation of transfer losses on the assumption that the gap is closed and every household pays opportunity costs. These are distributed in a similar fashion as transfer gains, given the assumed proportional (to consumption) adjustment for all households. However, the same is true with percentage welfare losses, that is, the poor receives the largest negative impacts.

From the previous results it is clear that one drawback of following interventionist policies is the transmission of income and welfare instability to society and in particular the poor. What else can we say, based on our measurement on AMBA households subsidies, about the costs of energy populism? The answer depends on auxiliary assumptions, in particular on what can be said on the magnitude and duration of excess costs to be borne as a consequence of a decade of interventionism. While it is clear that the energy-bill for the household sector in Argentina will rise substantially, the proper "excess cost" borne by households is the "premium" that Argentina had before embarking into energy populism, such as enjoying a competitive up-stream natural gas sector that could sustain supply with prices below border prices. For example, assuming that this gap is only 20% of the computed jump from current prices to opportunity cost values, and a discount rate of 5%, the present value of the excess cost borne by households in the AMBA can be estimated in about 6 billion dollars or more than 1.3% of current GDP.

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APPENDIX

Table A.1						
Residential Natural Gas: Commodity Gas Price (US dollars / MMBTU)						
Year	m3 / year	Opportunity cost	Price included in tariff		Implicit Subsidy	
			Bs As City	Greater Bs As	Bs As City	Greater Bs As
2003	all users	1.78	0.465	0.501	1.315	1.279
2004	all users	1.78	0.444	0.494	1.336	1.286
2005	all users	2.81	0.378	0.473	2.428	2.334
2006	all users	3.87	0.360	0.450	3.515	3.425
2007	all users	5.16	0.355	0.444	4.808	4.719
2008	0 - 500	8.54	0.350	0.437	8.190	8.103
	501 - 650	8.54	0.350	0.437	8.190	8.103
	651 - 800	8.54	0.350	0.437	8.190	8.103
	801 - 1000	8.54	0.386	0.458	8.154	8.082
	1001 - 1250	8.54	0.524	0.599	8.016	7.941
	1251 - 1500	8.54	0.645	0.721	7.895	7.819
	1501 - 1800	8.54	0.801	0.881	7.739	7.659
	1801 - more	8.54	0.915	0.996	7.625	7.544
2009	0 - 500	5.88	0.296	0.371	5.579	5.504
	501 - 650	5.88	0.296	0.371	5.579	5.504
	651 - 800	5.88	0.296	0.371	5.579	5.504
	801 - 1000	5.88	0.388	0.423	5.487	5.452
	1001 - 1250	5.88	0.880	0.933	4.995	4.942
	1251 - 1500	5.88	1.240	1.293	4.635	4.582
	1501 - 1800	5.88	1.999	1.958	3.876	3.917
	1801 - more	5.88	2.416	2.325	3.459	3.550
2010	0 - 500	7.27	0.283	0.353	6.990	6.919
	501 - 650	7.27	0.283	0.353	6.990	6.919
	651 - 800	7.27	0.283	0.353	6.990	6.919
	801 - 1000	7.27	0.370	0.404	6.902	6.869
	1001 - 1250	7.27	0.839	0.889	6.433	6.383
	1251 - 1500	7.27	1.183	1.233	6.090	6.040
	1501 - 1800	7.27	1.906	1.867	5.366	5.406
	1801 - more	7.27	2.303	2.217	4.969	5.056

Source: Own elaboration as explained in the text. Data from ENARGAS and Secretary of Energy and CBDH for Bolivian gas.

Table A.2				
Residential Electricity Prices in Generation Sector (USD / MWh)				
Year	kWh / two-month	Opportunity cost	Price included in tariff	Implicit Subsidy
2003	0 - 300	32.84	9.80	23.04
	301 - more	32.84	9.80	23.04
2004	0 - 300	34.25	9.96	24.29
	301 - more	34.25	9.96	24.29
2005	0 - 300	41.90	10.63	31.27
	301 - more	41.90	10.63	31.27
2006	0 - 300	49.23	10.11	39.13
	301 - more	49.23	10.11	39.13
2007	0 - 300	57.93	9.97	47.96
	301 - more	57.93	9.97	47.96
2008	0 - 300	80.14	9.80	70.33
	301 - 650	80.14	9.80	70.33
	651 - 800	80.14	9.80	70.33
	801 - 900	80.14	9.80	70.33
	901 - 1000	80.14	9.80	70.33
	1001 - 1200	80.14	12.18	67.96
	1201 - 1400	80.14	12.18	67.96
	1401 - 2800	80.14	14.47	65.67
	2801 - more	80.14	19.22	60.92
2009	0 - 300	62.08	8.25	53.83
	301 - 650	62.08	8.25	53.83
	651 - 800	62.08	8.25	53.83
	801 - 900	62.08	8.25	53.83
	901 - 1000	62.08	8.25	53.83
	1001 - 1200	62.08	13.55	48.53
	1201 - 1400	62.08	13.55	48.53
	1401 - 2800	62.08	18.58	43.50
	2801 - more	62.08	29.25	32.83
2010	0 - 300	72.06	7.87	64.20
	301 - 650	72.06	7.87	64.20
	651 - 800	72.06	7.87	64.20
	801 - 900	72.06	7.87	64.20
	901 - 1000	72.06	7.87	64.20
	1001 - 1200	72.06	13.36	58.70
	1201 - 1400	72.06	13.36	58.70
	1401 - 2800	72.06	18.62	53.44
	2801 - more	72.06	29.66	42.40

Source: Own elaboration as explained in the text. Data from CAMMESA for actual prices.

Table A.3

Decile	Natural Gas	Electricity
Access to Natural Gas and Electricity across households in the Metropolitan Area of BA		
1	36.6%	85.2%
2	50.1%	91.3%
3	62.0%	96.2%
4	68.9%	97.4%
5	77.6%	98.0%
6	85.7%	99.2%
7	84.6%	100.0%
8	94.4%	100.0%
9	95.7%	100.0%
10	98.0%	100.0%
Total	75.3%	96.7%

Source: ENGH micro-data