Mesa Redonda: Energía

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UNLP – UBA- FIEL

50º Reunión Anual de la AAEP

Universidad Nacional de Salta

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Papers recientes

- Barril D. and F. Navajas (2015) “Natural Gas Supply Behavior Under Interventionism: The case of Argentina” , *The Energy Journal*, Vol 36 Nº4.
- Hancevic P. y F. Navajas (2015) “Consumo residencial de electricidad y eficiencia energética: un enfoque de regresión cuantílica”, *El Trimestre Económico*, Diciembre .
- Hancevic P., W. Cont and F. Navajas (2015) “Energy Populism and Household Welfare”, revise and resubmit for *Energy Economics*.
- Navajas F. (2015)“Subsidios a la energía, devaluación y precios”, Documento de trabajo de FIEL Nº122, 2015.

Energy price cycles and welfare

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Energy subsidies without apology

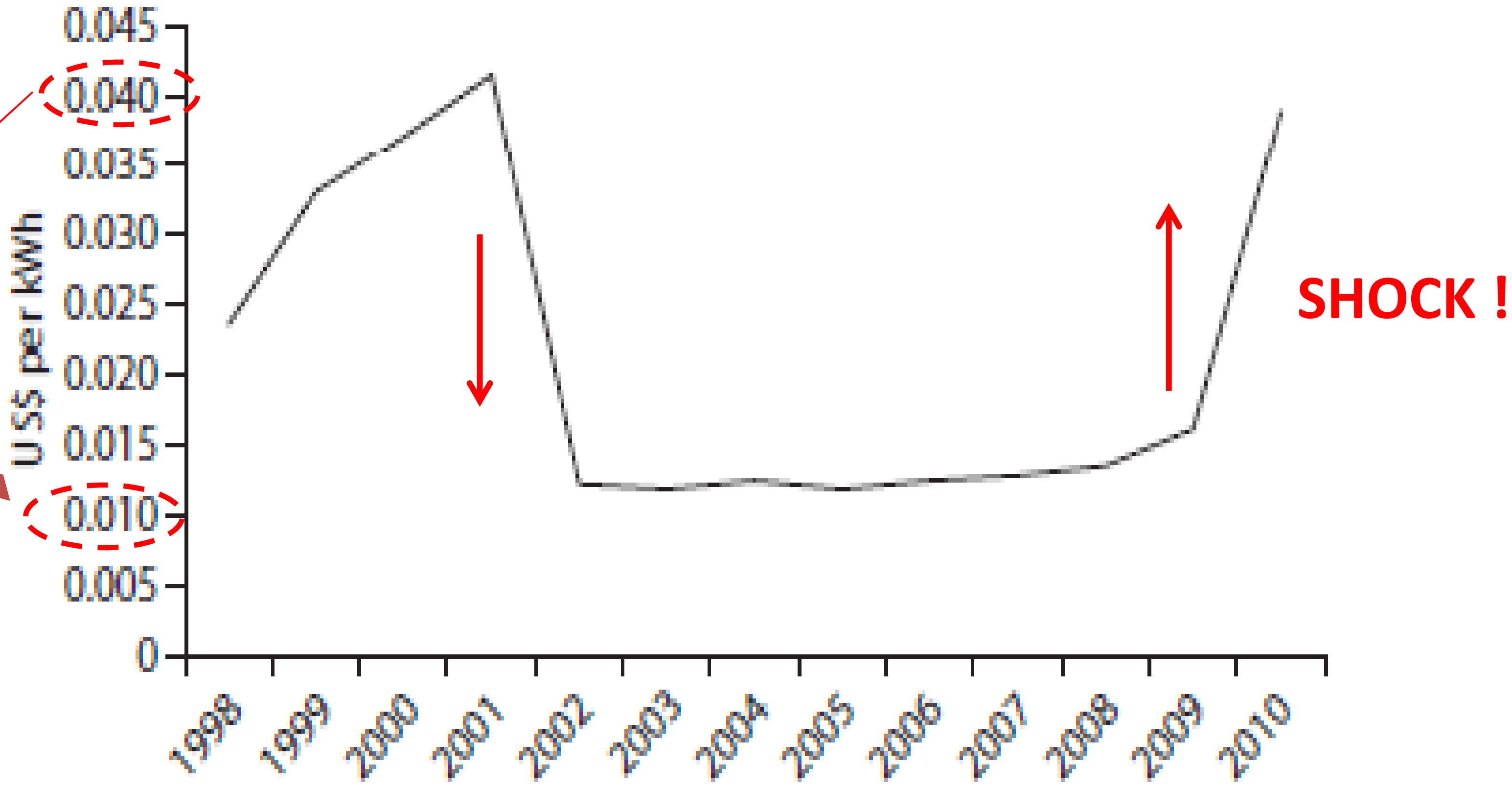
- Energy subsidies have been much criticized recently by multilateral agencies and ONGs, particularly from a global warming perspective
  - (IMF, 2013; OECD, 2013; ODI, 2013; Greenpeace, 2013). Most recently IMF (2015) for Latam and Coady et al (2015)
- But the fact is that they have been, without apology, transitory or permanent components of actual policy in many countries, both developing and developed
  - May come from an objective to cushion economies from external shocks
  - May reflect political economy of taxes and subsidies in developed macro-stable economies
  - May be a byproduct of macroeconomic crises that require some muddling through of domestic prices for a while,

Unsustainable energy subsidies

- Yet in other cases, may be part of a non-transitory policy that exploits price departures from opportunity costs in order to make <u>unsustainable</u> transfers to consumers (voters).
- Argentina post 2003 seems to perfectly fit in the last case.
  - But is not alone in describing a cycle of unsustainable prices
  - Vagliasindi (2012): at least 8 cases including Argentina
- Few modeling/measurement of these cases.

The Iranian experience

Figure 15A.6 Average Electricity Price in the Islamic Republic of Iran, 1998–2010



Source: Tavarin annual reports.

Note: Average residential and industrial price. kWh = kilowatt-hour.

Vagliasindi, M. (2012). Implementing energy subsidy reforms: Evidence from developing countries. World Bank Publications

HCN (2015): Two main motivations

- Study a (populist) cycle of energy prices
  - How do they emerge?
  - Why society “vote” for a huge energy price freeze and <u>generalized</u> (uniform) subsidies?
  - How did we come into this equilibrium if the future costs of a reversion are so high?
- Estimates of actual transfers and welfare effects
  - Magnitude of transfers?
  - Who does really benefit? Pro-rich and Progressive?
  - What welfare impact over the full cycle? Instability?

Agents and preferences

- A 2 period economy
- Households (h=1…H) with indirect utility

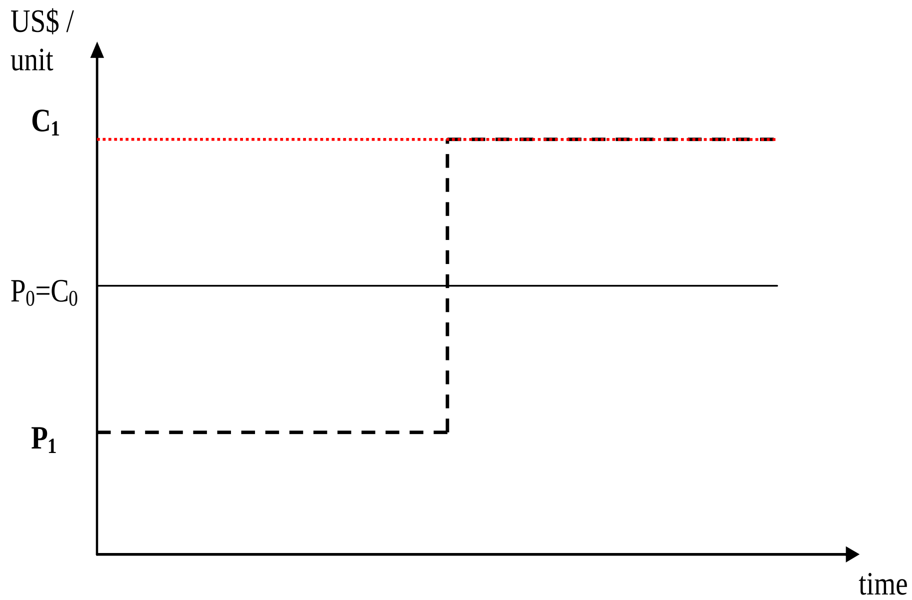
$$V^h = V_e^h(q_e^h) + V_{ne}^h(q_{ne}^h, m^h)$$

- q_e^h are end-user prices of electricity and natural gas that decompose in energy; transport/distribution and tax components.
- q_{ne}^h are non-energy prices
- We further assume without loss of generality that a higher h corresponds to higher income; i.e. $m^1 < m^2 < \ldots . < m^H$.

Intervention policy {P1,P2}

- An intervention is a sequence of prices {P1,P2} that initially deviate from opportunity costs and then return to higher (due to intervention) future costs.
- 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.
- Actual ex post measurement looks at 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.

Figure 1: Example of evolution of opportunity cost and prices



Low prices today, higher prices tomorrow

- Sequence {P1,P2} provokes large transfers to households (voters)
- Gains (generalized) in period 1 and “expected” losses in period 2
- While gains are perceived now, losses are transferred to the future and depend on a perceived probability that “others” will pay or that the adjustment will be diluted among
  - Tax payers
  - Large users (households) “seemingly rich”
  - Industrial or commercial users
  - Intra-marginal (efficient) suppliers with “old” capital, either public or private.

Voting $\{P_1,P_2\}$

Gains in period 1

$$\Delta_1 V_e^h = V_e^h(q_e^h(P_0)) - V_e^h(q_e^h(P_1))$$

Expected losses in period 2

$$\Delta_2 V_e^h = V_e^h(q_e^h(\theta^h . P_2)) - V_e^h(q_e^h(P_0))$$

$\theta^{\mathrm{h}} \in [P_0 / P_2, 1]$ is a fraction that h perceives he will face

Asumption : θ^{h} is increasing in m^{h} (income)

Consumer h prefers (votes) $\{P_1, P_2\}$ if

$$\Delta_1 V_e^h + \delta . \Delta_2 V_e^h \geq 0$$

δ : discount rate

Voting $\{P_1, P_2\}$

Definition : δ^{h*} : "crítical" discount rate of h

$\delta^{h*} = -\Delta_1 V_e^h / \Delta_2 V_e^h (\theta^h)$

since δ^{h*} is decreasing in $-\Delta_2 V_e^h$ and this is increasing

in θ^{h}, which is by assumption increasing in h,

then δ^{h*} is decreasing in h, i.e. income m^h.

Note that prices P_1 are uniform and that expected discrimination in P_2

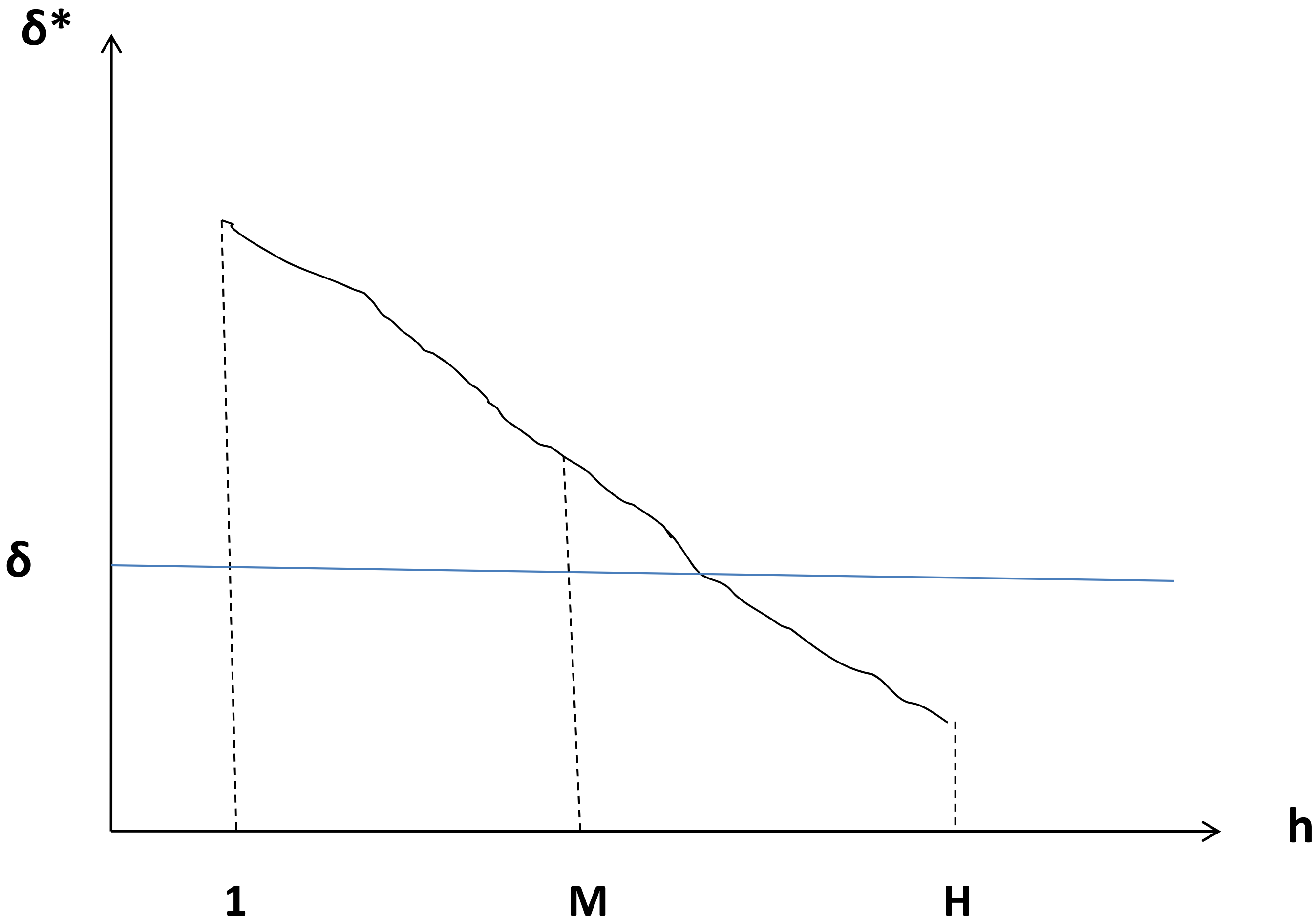
comes with θ^{h}

This allows to establish that a necessary and sufficient

condition for $\{P_1, P_2\}$ to become a voting equilibrium;

is that the median voter expects to receive net gains

i.e. $\delta \leq \delta^{M*}(\theta^M)$


δ*
δ
h
1
M
H

Actual transfers and welfare effects

Sequence $\{P_1, P_2\}$ generates actual transfers and welfare effects

Impacts of price changes are driven by

$$\partial \mathrm{W} / \partial \mathrm{q}_{\mathrm{e}}^{\mathrm{h}} = \sum_h (\partial W / \partial V^h) / (\partial V^h / \partial q_e^h) = -\sum_h \beta^h . x_e^h$$

$\mathrm{x}_{\mathrm{e}}^{\mathrm{h}}$ is energy consumed by h and β^h is the social marginal utility of income of h.

A discrete change approximation is

$$\Delta \mathrm{W} = -\sum_h \beta^h . x_e^h . (q_e^h(P_i) - q_e^h(P_j)) \quad \text{para i, j} = 0,1,2$$

$$\Delta W / W = \sum_h \beta^h . \Delta g^h \Big/ \sum_h \beta^h . g^h$$

Actual transfers and welfare effects

Actual (impact) money transfers for h are $x_e^h.(q_e^h(P_i) - q_e^h(P_j))$

Assuming a welfare function of the form

$$W = \sum_h \left[(g^h)^{1-v} / 1 - v \right] / H$$

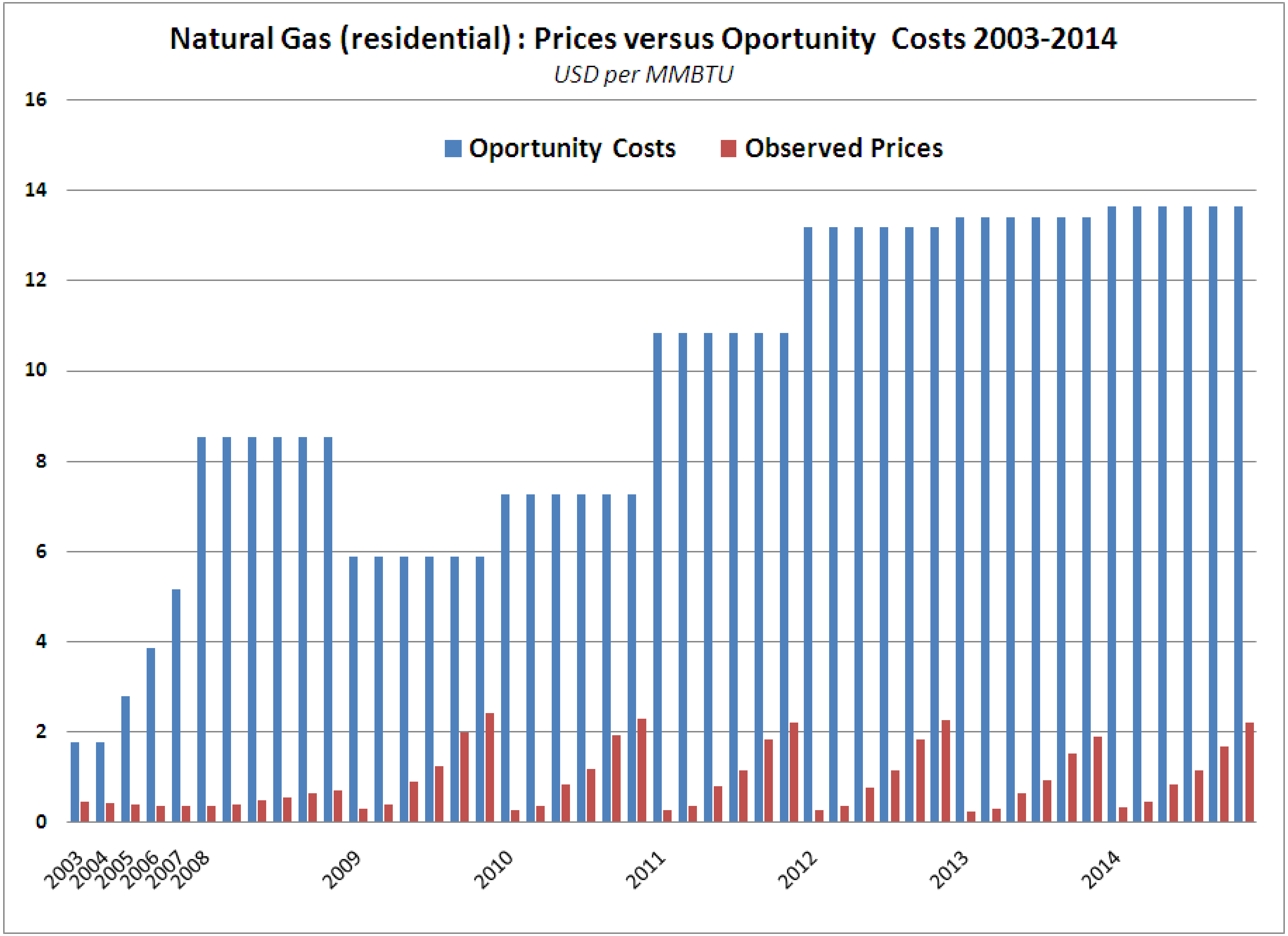
g is expenditure, "v" a coeficient of inequality aversion $\beta^{\mathrm{h}} = (g^h)^{-v}$.

We use a formula (Newbery (1995) to evaluate welfare changes

$$\Delta W / W = \sum_h \beta^h . \Delta g^h \Big/ \sum_h \beta^h . g^h$$

Measurement: Argentina 2003-2014

- Is not an evaluation of $\{P_1,P_2\}$ since the cycle has not been completed. Rather we see how transfers have performed and who did get the transfers
- Natural gas and electricity. Households in the Buenos Aires Met Region (about 40% of population and 25% of total demand)
- Quantities aggregate market data and Household expenditure survey micro-data
- β^h estimated from HES for different "v".
- Actual prices versus estimates of opportunity costs
- Opportunity costs: Natural gas imports and an efficient CG electricity generator.



Natural Gas (residential) : Prices versus Oportunity Costs 2003-2014
USD per MMBTU
Oportunity Costs
Observed Prices
0
2
4
6
8
10
12
14
16
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014

Table 1. Natural Gas: Estimated Annual Transfers to Households in the Metropolitan Region of Buenos Aires (in millions of U.S. Dollars)

	Estimated transfers for sub-period		Without demand correction	10% demand correction
Decile	2003-07	2008-13	201X?	201X?
1	10.3	41.0	-58.9	-53.0
2	17.7	67.8	-99.0	-89.1
3	21.7	82.7	-121.0	-108.9
4	26.0	98.3	-144.0	-129.6
5	31.5	116.8	-173.6	-156.2
6	37.5	138.4	-206.1	-185.5
7	40.8	146.1	-221.2	-199.1
8	44.5	159.7	-242.3	-218.1
9	45.0	159.8	-244.8	-220.4
10	44.1	152.3	-239.8	-215.8
Total	319.3	1163.0	-1750.8	-1575.8

Source: own elaboration based on ENGH 2004-2005

Table 2. Electricity: Estimated Annual Transfers to Households in the Metropolitan Region of Buenos Aires (in millions of U.S. Dollars)

	Estimated transfers for sub-period		Without demand correction	10% demand correction
Decile	2003-07	2008-14	201X?	201X?
1	24.9	67.9	-87.1	-78.4
2	30.1	82.7	-105.7	-95.1
3	36.2	98.2	-126.1	-113.5
4	35.1	96.4	-123.0	-110.7
5	36.6	99.3	-127.1	-114.4
6	39.1	107.0	-136.2	-122.6
7	39.7	108.7	-138.2	-124.4
8	40.3	109.4	-139.6	-125.6
9	42.7	116.1	-147.5	-132.7
10	49.3	132.5	-168.4	-151.6
Total	373.9	1018.3	-1299.0	-1169.1

Source: own elaboration based on ENGH 2004-2005

Table 3. Distribution of natural gas and electricity subsidies across households between 2003 and 2014

Decile	Natural Gas	Electricity	Total
1	3.5%	6.7%	5.0%
2	5.8%	8.1%	6.9%
3	7.1%	9.6%	8.3%
4	8.4%	9.4%	8.9%
5	10.0%	9.8%	9.9%
6	11.9%	10.5%	11.2%
7	12.6%	10.7%	11.7%
8	13.8%	10.8%	12.3%
9	13.8%	11.4%	12.6%
10	13.2%	13.0%	13.1%

Source: Tables 1 and 2

Table 4. Natural Gas: Average Annual Percentage Change in Welfare

Decile	Aversion coefficient (*v*=*.5*)			Aversion coefficient (*v*=*1*)			Aversion coefficient (*v*=*2*)		
	2003-07	2008-14	201X?	2003-07	2008-14	201X?	2003-07	2008-14	201X?
1	1.9%	7.3%	-8.7%	2.1%	7.9%	-9.3%	2.6%	10.0%	-11.7%
2	1.3%	4.8%	-5.8%	1.3%	4.9%	-5.8%	1.3%	4.9%	-5.9%
3	1.0%	3.6%	-4.3%	1.0%	3.6%	-4.3%	1.0%	3.6%	-4.3%
4	0.8%	2.9%	-3.5%	0.8%	3.0%	-3.5%	0.8%	3.0%	-3.6%
5	0.7%	2.7%	-3.2%	0.7%	2.7%	-3.2%	0.7%	2.7%	-3.3%
6	0.6%	2.3%	-2.8%	0.6%	2.3%	-2.8%	0.6%	2.3%	-2.8%
7	0.6%	2.1%	-2.6%	0.6%	2.1%	-2.6%	0.6%	2.1%	-2.6%
8	0.5%	1.6%	-2.0%	0.5%	1.6%	-2.0%	0.5%	1.6%	-2.0%
9	0.4%	1.3%	-1.6%	0.4%	1.3%	-1.6%	0.4%	1.3%	-1.6%
10	0.2%	0.8%	-1.0%	0.2%	0.8%	-1.1%	0.3%	0.9%	-1.1%
Total	0.5%	2.0%	-2.4%	0.7%	2.5%	-3.1%	1.2%	4.4%	-5.3%

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

Table 5. Electricity: Average Annual Percentage Change in Welfare

Decile	Aversion coefficient (*v=0.5*)			Aversion coefficient (*v=1*)			Aversion coefficient (*v=2*)		
	2003-07	2008-14	201X?	2003-07	2008-14	201X?	2003-07	2008-14	201X ?
1	1.9%	4.6%	-5.0%	2.0%	5.0%	-5.5%	3.1%	7.6%	-8.3%
2	1.1%	2.8%	-3.1%	1.2%	2.9%	-3.1%	1.2%	2.9%	-3.2%
3	1.0%	2.5%	-2.8%	1.0%	2.5%	-2.8%	1.0%	2.5%	-2.8%
4	0.8%	2.0%	-2.2%	0.8%	2.0%	-2.2%	0.8%	2.0%	-2.2%
5	0.7%	1.7%	-1.9%	0.7%	1.7%	-1.9%	0.7%	1.7%	-1.9%
6	0.6%	1.5%	-1.6%	0.6%	1.5%	-1.6%	0.6%	1.5%	-1.6%
7	0.5%	1.3%	-1.4%	0.5%	1.3%	-1.4%	0.5%	1.3%	-1.4%
8	0.4%	1.1%	-1.2%	0.4%	1.1%	-1.2%	0.4%	1.1%	-1.2%
9	0.4%	0.9%	-1.0%	0.4%	0.9%	-1.0%	0.4%	0.9%	-1.0%
10	0.3%	0.6%	-0.7%	0.3%	0.7%	-0.7%	0.3%	0.7%	-0.8%
Total	0.6%	1.4%	-1.6%	0.8%	1.9%	-2.1%	1.6%	3.9%	-4.3%

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

Final remarks: Theory

- So, Why it happened?
  - Model suggests that society votes a populist cycle when the perception of the median voter is that others (i.e. “outsiders”) will help at diluting future costs.
  - 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.
- Even so, why targeted subsidies were not observed?
  - Policy-technology for dealing with transfers, particularly the lack of incentives to target energy subsidies to the poorest households accurately.
- What problems pose “exit”?
  - A large proportion of agents will encounter serious difficulties in coping with the energy price shocks.
  - It suggests a commitment problem to implement higher uniform prices after a down-cycle occurs, which validates a softer treatment of some households and bias voters towards subsidies now.

Final remarks: Metrics

- Solving an apparent puzzling assertion about energy subsidies: “progressive” but “pro-rich” at the same time.
  - The standard incidence test (where subsidies are progressive if they are, as a percentage of household income decreasing in income) is used to assert the former, while the measurement of the share of the non-poor in total subsidies is used to assert the latter.
- Welfare effects over the full cycle are better than standard incidence test of transfers
  - The percentage instability of welfare experienced by households is decreasing in income, this effect being larger the higher the degree of inequality aversion, adding another dimension to the distributive characterization of energy subsidies policies.

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