

A Household Energy Demand System: *Evidence from Mexico*

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STRUCTURE

- 1. Motivations**
- 2. Empirical Analysis**
- 3. Results**
- 4. Conclusion**

No previous studies, as far as we know, have attempted to estimate energy demand system in Mexico using recent micro-economic data.

Could be representative to other developing countries that have similar pattern (Energy subsidies, economic and population growth, inefficient carbon situation)

Motivations

Energy subsidies in Mexico entail environmental costs and may not be well-targeted or cost-effective

Phasing out ineffective subsidies and the implementation of environmental reforms free up funds which can be re-directed to areas with more pressing funding, increase economic efficiency and reduce greenhouse gas emissions over the long run

- We used data on household consumption expenditure from *National Households Income and Expenditure Survey* (ENIGH acronyms in Spanish, Encuesta Nacional de Ingresos y Gastos de los Hogares) for years 1994-2010. (representative+extensive information)
- AIDS model can be expressed as follow:

$$w_{it} = \alpha_i + \beta_i \ln \left(\frac{m_t}{P_t^*} \right) + \sum_{j=1}^N \gamma_{ij} \ln p_{jt} + \sum_{k=1}^K \varphi_{ik} R_{kt} + u_{it}$$

Where the subscripts, t indices time (t = 1, 2, . . . , T) ,while I and j indices different energy groups and public transport, that is, electricity, LPG, gasoline, Kerosene. w is the share of expenditure; m is the total expenditure; P* is the price ; m/ P* is referred to as the real total expenditure; p is the price of goods; R represent the variables corresponding to different demographic variables; α , β , γ , and φ are parameters to be estimated; and u is the disturbance term

Estimated Parameters from the Static Almost Ideal Demand System Model

Parameter	Electricity	LPG	Gasolina	P.Transport
(Intercept)	0.283*** (-48.529)	0.257*** (-56.355)	0.108*** (-15.907)	0.065*** (-6.977)
Urban	0.006** (-10.244)	0.014*** (-25.59)	0.001 (-1.441)	0.014*** (-13.458)
No older than 18 years	-0.002*** (-12.864)	-0.004*** (-23.655)	-0.001*** (-5.355)	-0.005*** (-16.672)
No younger than 18 years	0.001*** (-5.494)	-0.002*** (-16.700)	0.000*** (-2.709)	0.007*** (-25.055)
Householdoccupancy	0.015*** (-22.066)	0.010*** (-15.806)	0.003*** (-3.436)	0.007*** (-5.869)
Primaryschool	0.005*** (-9.3)	0.009*** (-17.375)	0 (-0.627)	0.012*** (-11.787)
High school	-0.001 (-0.893)	0.002** (-2.508)	0.004*** (-4.947)	0.017*** (-13.931)
Cars	0.002*** (-4.768)	-0.001*** (-2.699)	0.062*** (-122.084)	-0.036*** (- 47.140)
Van	0.004*** (-6.948)	0 (-0.805)	0.074*** (-122.089)	-0.033*** (-36.140)
Motorcycle	-0.002 (-1.508)	-0.003*** (-2.855)	0.020*** (-12.862)	-0.015*** (-6.277)
TV SET	0.003*** (-10.421)	0.003*** (-10.015)	-0.002*** (-5.451)	0.007*** (-12.712)
FAN	0.004*** (-14.821)	0.002*** (-9.097)	-0.002*** (-5.579)	-0.001** (-2.393)
Gas stove	-0.005*** (-6.308)	0.029*** (-43.254)	0.006*** (-6.654)	-0.008*** (-5.926)
Refrigerator	0.013*** (-21.577)	0.004*** (-7.351)	0.011*** (-15.107)	0 (-0.425)
North	0.030*** (-9.251)	0.015*** (-5.046)	0.014*** (-3.821)	0.005 (-0.8)
Center	0.011*** (-3.557)	0.021*** (-7.504)	0.006 (-1.477)	0.030*** (-5.237)
South	0.014*** (-4.368)	0.007** (-2.369)	0.005 (-1.357)	0.030*** (-5.321)

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❑ LR. Expenditure elasticity:

- ✗ Electricity, LPG, Gasoline and Public Transport are normal good
- ✗ LPG is the most-inelastic energy source, with rural households are more responsive to income changes than urban households. (Shift from firewood to LPG)

❑ Uncompensated (Marshallian) elasticity:

- ✗ Electricity, LPG and Gasoline are price inelastic with LPG having the lowest elasticity value.
- ✗ Rural households are more responsive to electricity price changes than urban households (larger budget share in rural areas)
- ✗ Urban households tend to be more responsive to gasoline price changes in comparison with rural households (The option of Public transport)

❑ Cross-price elasticities:

- ✗ Electricity and LPG are substitutes in both urban and rural zones
- ✗ Evidence of substitutability between the use of personal vehicle and public transport in urban areas

□ Price elasticities respective to household's level of income:

- ✗ Households with very low income levels ($\approx 50\%$ of rural households) are sensitive to price changes of electricity and public transport. (Firewood+only 16% of the rural households have vehicles)
- ✗ The own-price elasticities of electricity decrease proportionally with income increase.
- ✗ In contrast, LPG is more price inelastic for low income than high income households

Year : 2010

Electricity

LPG

Gasoline

Public Transp

Simulation 1:

Removal of 100 % of the subsidies of Electricity, LPG, Gasoline

Price Change (%)

150

0.92

17.33

0

Simulation 2:

**Electricity price unchanged+ Carbon tax (25US\$ /ton CO2) is added to the
Unsubsidized prices of LPG and Gasoline**

Price Change(%)

0

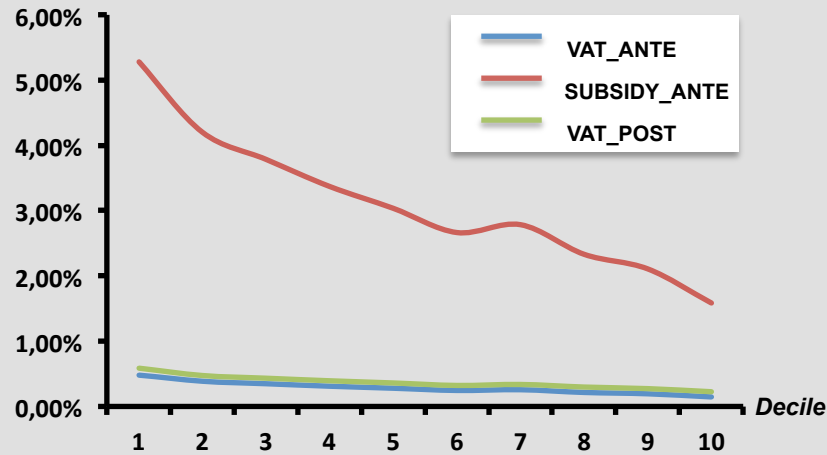
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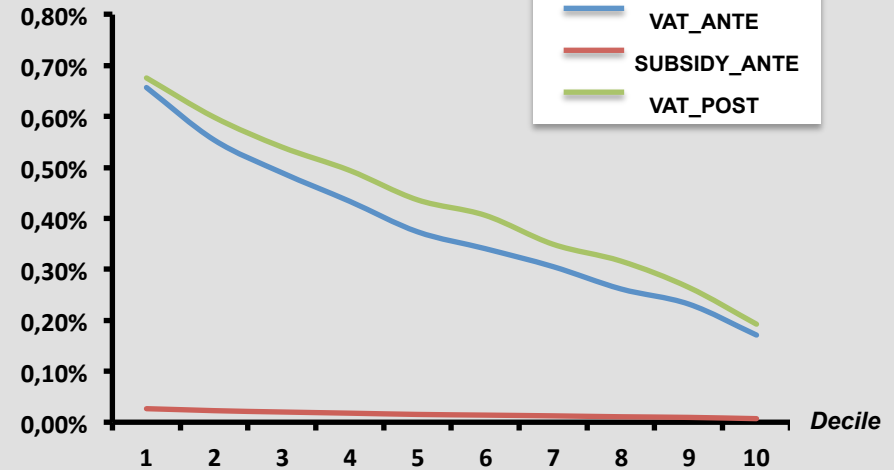
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Simulation 1

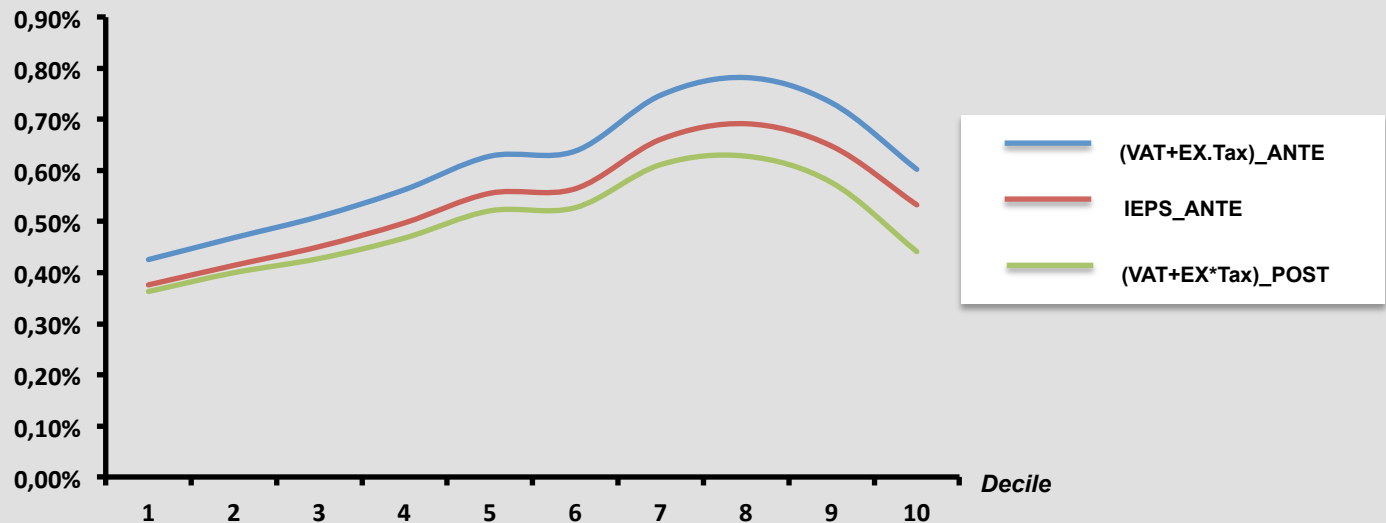
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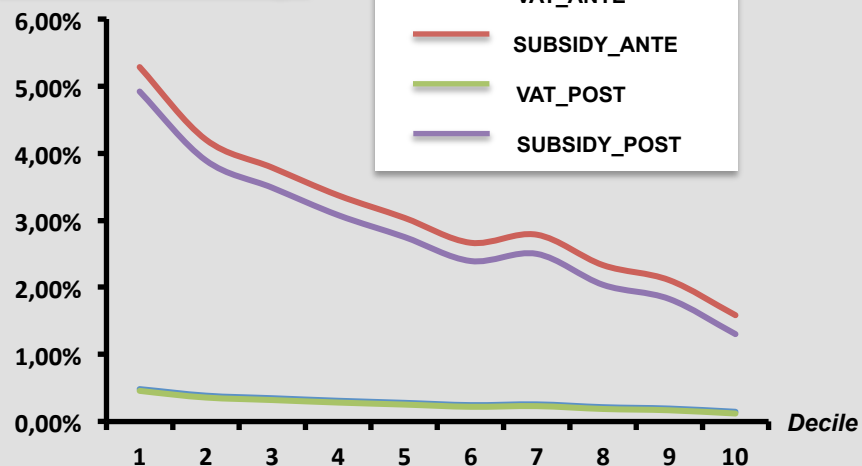
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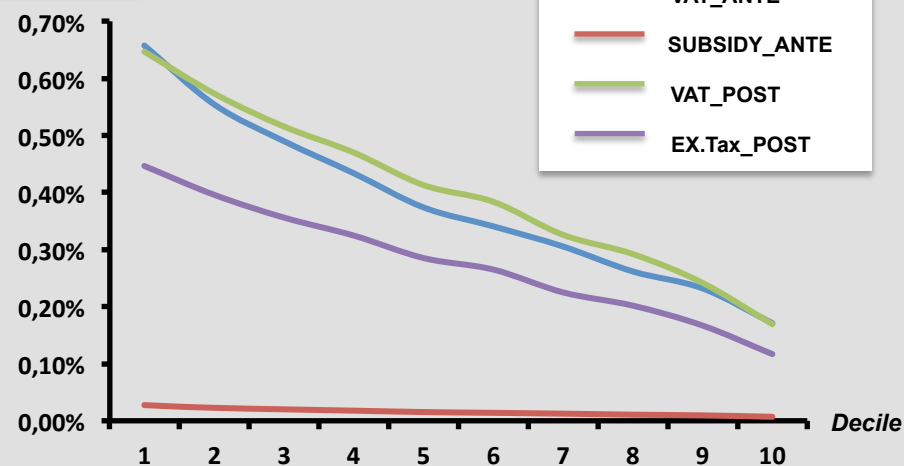
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Simulation 2

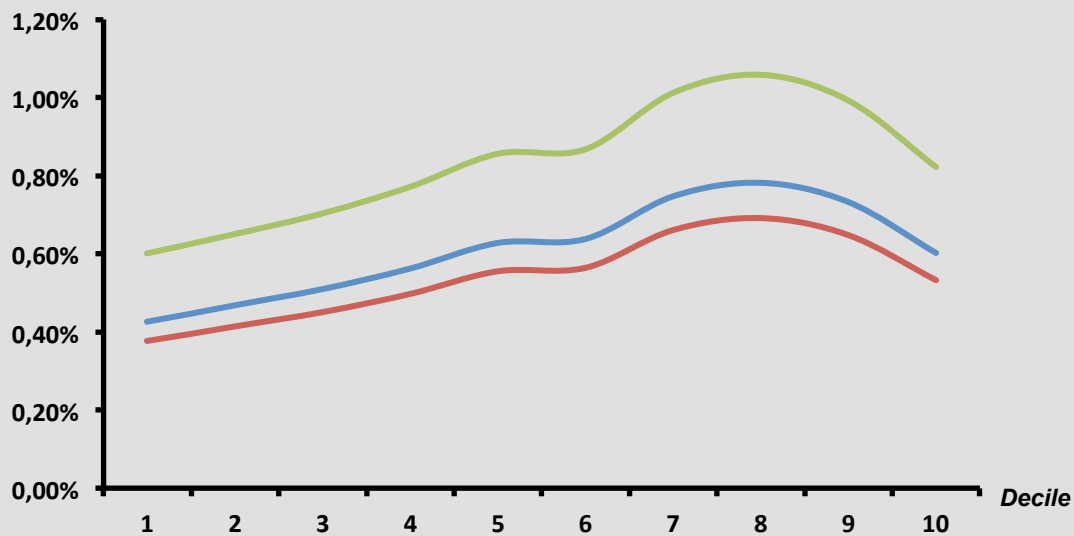
Electricity



LPG



Gasoline



Environmental Effects of the simulated reforms :

	<u><i>Simulation 1</i></u>		<u><i>Simulation 2</i></u>	
	Demand change(%)	Change in CO ₂ Emissions (tonnes)	Demand change(%)	Change in CO ₂ Emissions (tonnes)
<i>Electricity</i>	-45%		-12%	
<i>LPG</i>	14%		-5%	
<i>Gasoline</i>	-31%		-17%	
<i>Sub_total</i>		-24%		-12%

- **Estimation of residential energy demand system for Mexico.**
- **Household socio-economic, demographic, geographic, family attributes influence the total household energy requirements.**
- **Estimation of expenditure, own-price and cross-price energy elasticities**
- **Household response to energy price changes vary with household's income level. (Different reaction in electricity vs LPG)**
- **Some energy subsidies in Mexico are not well-targeted and benefit wealthier households**
- **Good information on the magnitude of subsidies and their economic and environmental impacts will help policy makers to foster efficient reforms.**

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**Thank you for your
attention**

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