

The Evolution of Price and Income Elasticities of Electricity Demand in Latin American Countries: A Time Varying Parameter Approach

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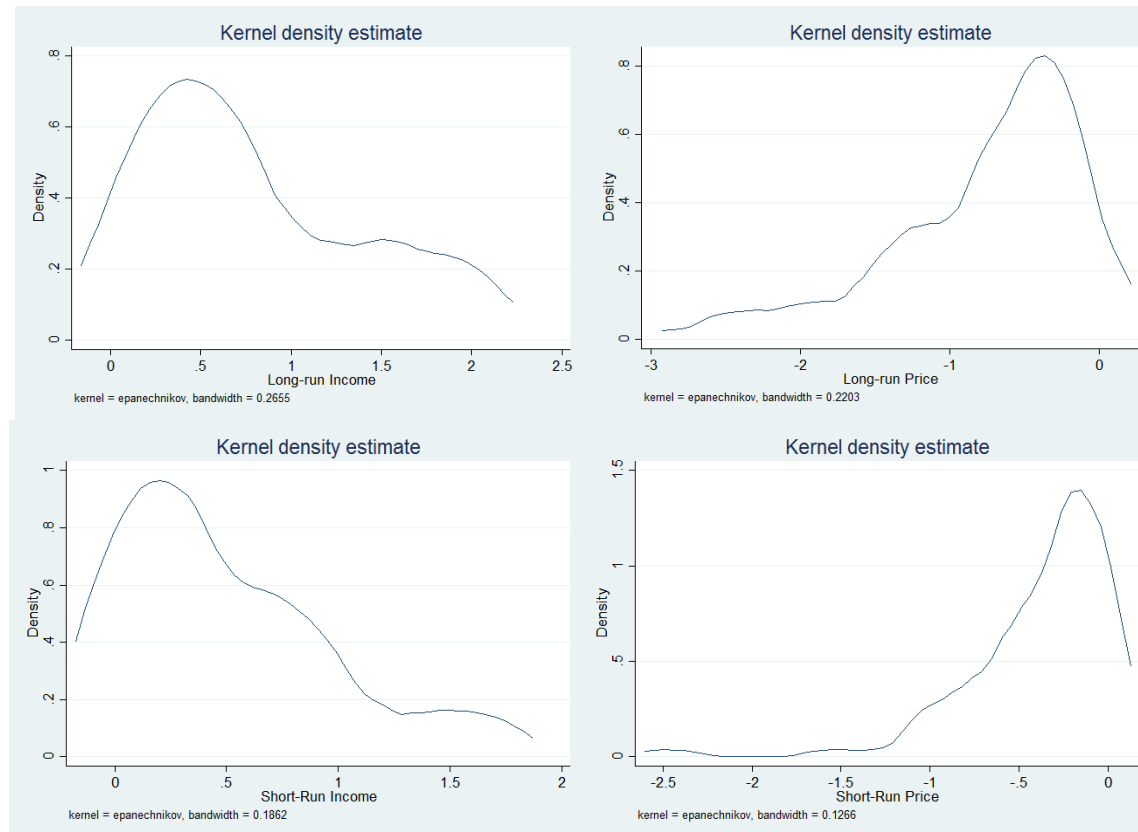
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Price and income elasticities: Literature Review

According to the literature review: **electricity price** and **income** are the key elements. However, its value of elasticity is not agreed on.

- 100 academic documents
- 40 countries
- 73% are using survey data (micro), 27% with detailed national-level data, e.g. seasonal and geographical variations.
- Price and Income (appear in all of the lit. rev)



For example....

Autor(s)	Period	Country	Methodology	Income Elasticity	Price Elasticity
Dilaver and Hunt (2011)	1960-2008	Turkey	Structural time series model	1.57	-0.09
Dergiades and Tsoulfidis (2011)	1964-2006	Greece	ARDL	0.795	-0.606
Nakajima and Hamori (2010)	1993-2008	Japan	Panel cointegration	0.602	-1.127
Amusa et al. (2009)	1960-2007	South Africa	ARDL	0.217	-0.298
Atakhanova and Howie (2007)	2994-2003	Kazakhstan	Panel GMM	0.75	-0.12
Al Faris (2002)	1970-1997	Saudi	Johansen Cointegration	(0.05, 1.094)	(-0.04, -1.09)

Motivation

Consensus has not been reached on the most appropriate methodology to model electricity demand, and more importantly, almost all of the studies assume a constant consumption sensitivity to price and income changes.

Question of interest:

1. If both prices and electricity consumption change over time, as do economies growth, **why elasticities must remain constant?**

METHODOLOGY

- We opted to employ a Kalman Filter following the approach of Arisoy et al. (2014) and the procedure of Inglesi-Lotz (2011) for Turkey and South Africa, respectively.
- One advantage of the Kalman Filter is that time varying coefficients (i.e. elasticities) can be permitted in the model. Also, it has been proved that in the case that the estimated coefficients do not vary over time, the Kalman filter and the least squares approach produce similar results (Morrison and Pike, 1977)
- The Kalman Filter technique is based on the estimation of state-space models. (Kalman 1960, Wiener, 1949, Currie and Hall 1994, Cuthbertson, 1988, Lawson, 1980).
- **How we proceed?** First, we need to establish the possibility of existing parameter instability. For doing this, we selected Hansen's (1992) test for the null hypothesis will confirm or reject the assumption of the time-varying price and income elasticities before estimating them. Therefore, if the estimated coefficients are proven to vary over time, then the Kalman Filter is the most appropriate method (Inglesi-Lotz, 2016).
- Second, we estimate the following equation:

$$\ln Cons_t = \alpha_t \ln price_t + \beta_t \ln gdp_t + \varepsilon_t$$

- Using Eviews notation:

$$\ln Cons_t = sv1 \ln price_t + sv2 \ln gdp_t + sv3$$

$$sv1 = sv1(-1)$$

$$sv2 = sv2(-1)$$

$$sv3 = c(2)sv3(-1) + [\text{var} = \exp(c1)]$$

DATA

- To apply the Kalman Filter in our sample of 21 countries, regional and international sources of data were used.

Variable	Unit	Period	Source	Comments
Electricity Consumption	GWh	1980-2015	International Energy Agency (IEA)	- SUR (00-15)
Electricity Price	Usc/kWh	1980-2015	Organización Latinoamericana de la Energía (OLADE)	Some countries have a lack of data (Caribbean)
GDP	Billion constant 2010 US\$	1980-2015	World Development Indicators (WB)	- VLZ (1980-2013)

Sample

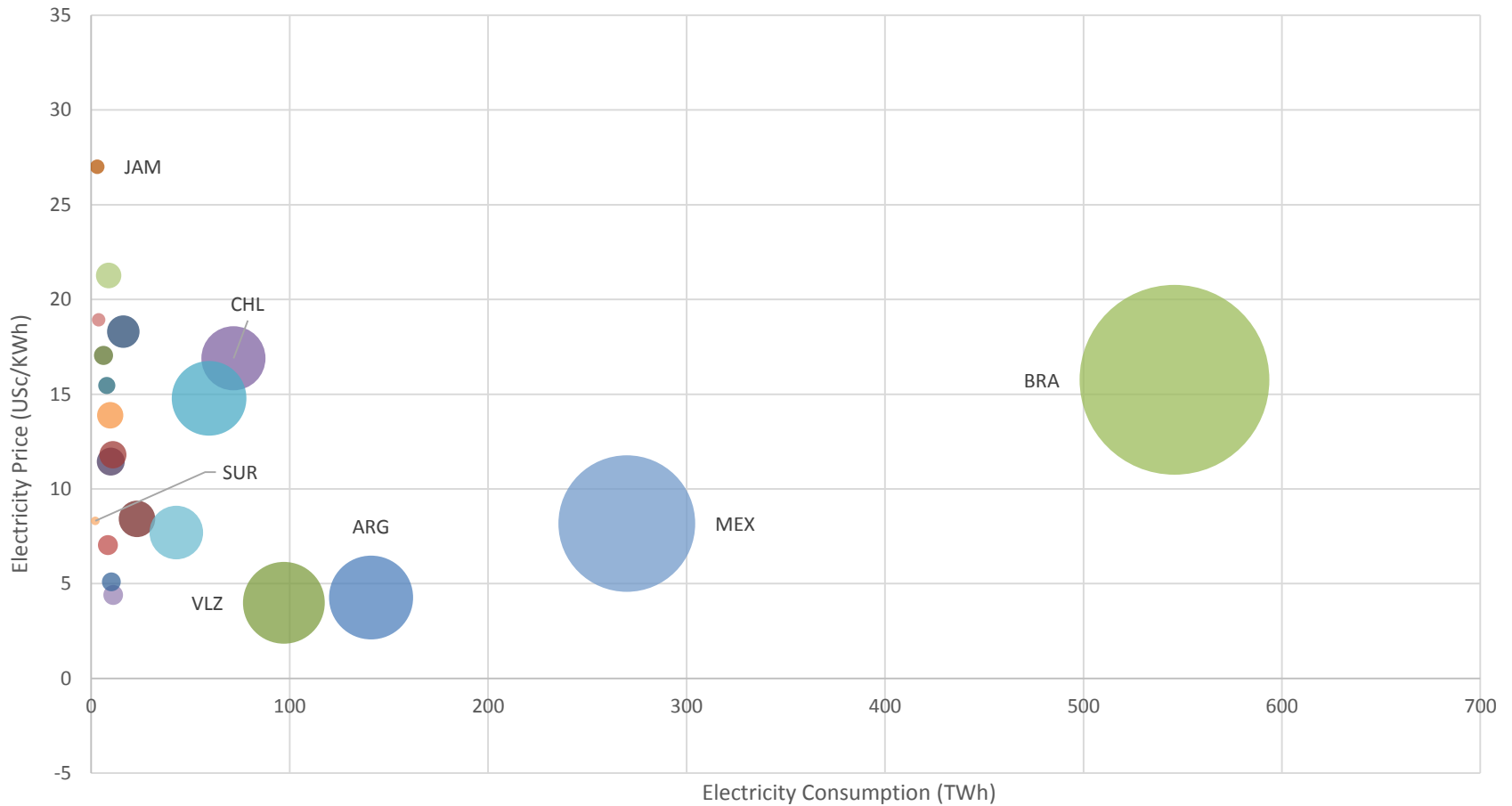
- As a region Latin America is composed by a variety of countries with different income levels and stage of development

Andean Zone	Caribbean	Central America	Southern Cone
Bolivia (LMI)	Dominican Republic (UMI)	Costa Rica (UMI)	Argentina (UMI)
Colombia (UMI)	Jamaica (UMI)	Guatemala (LMI)	Brazil (UMI)
Ecuador (UMI)	Trinidad and Tobago (HI)	Honduras (LMI)	Chile (HI)
Peru (UMI)	Suriname (UMI)	Nicaragua (LMI)	Paraguay (UMI)
Venezuela (UMI)		Panama (UMI)	Uruguay (HI)
		El Salvador (LMI)	
		México (UMI)*	

Note: HI (High Income), Lower Middle Income (LMI), Upper Middle Income (UMI)

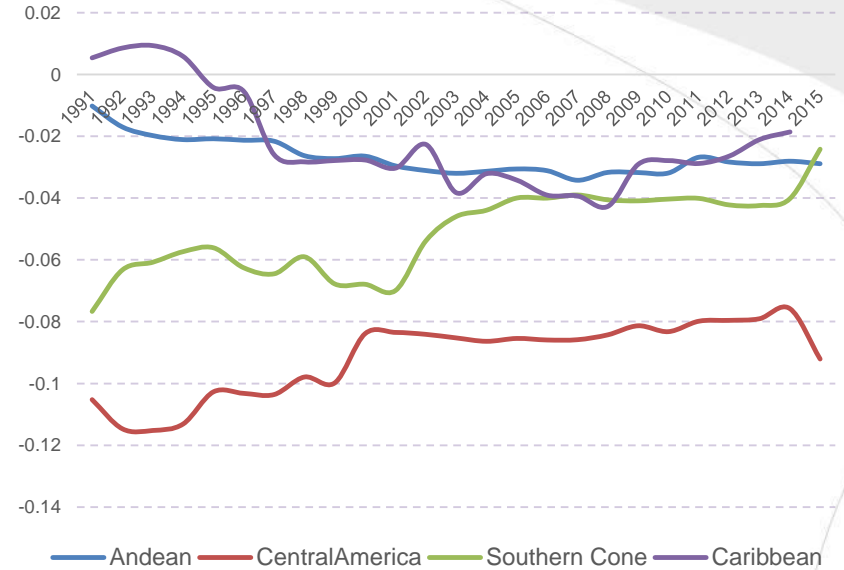
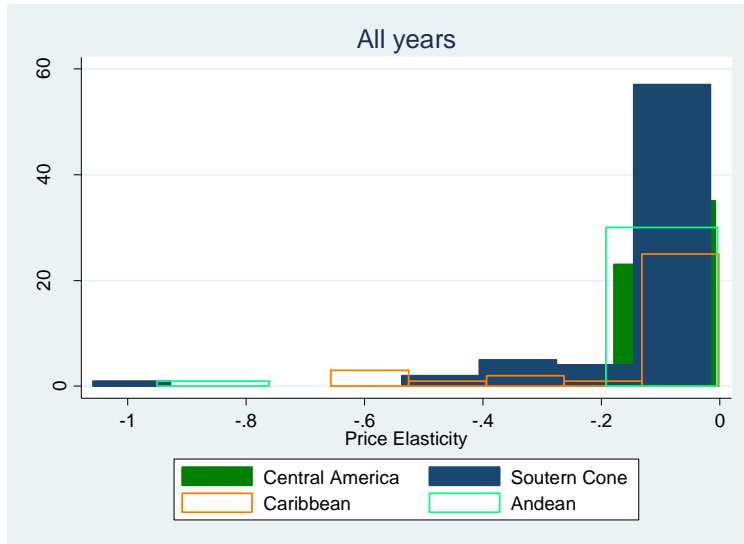
LAC 2015...

➤ The Brazil's electricity consumption is 270 times bigger than Suriname's.

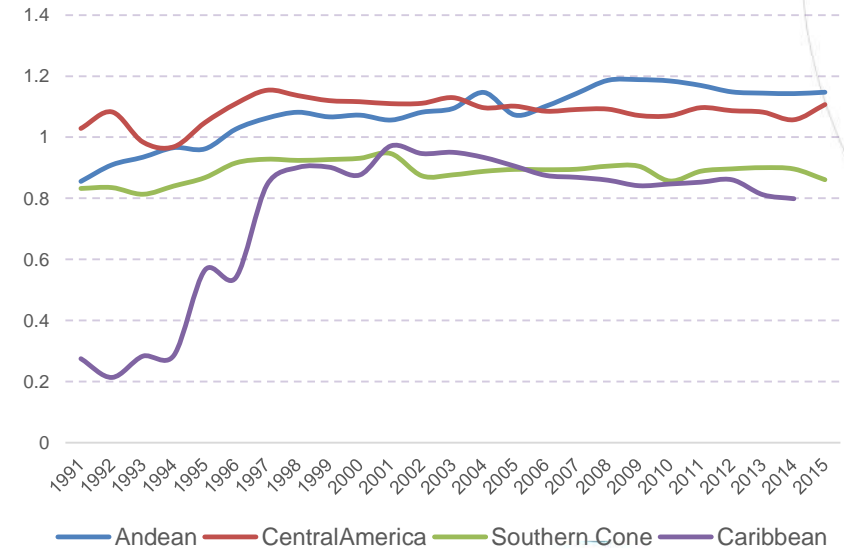
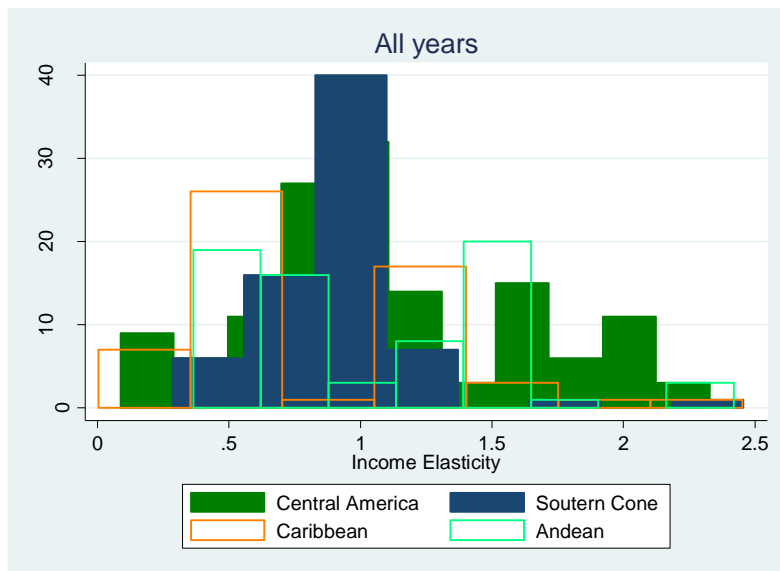


RESULTS

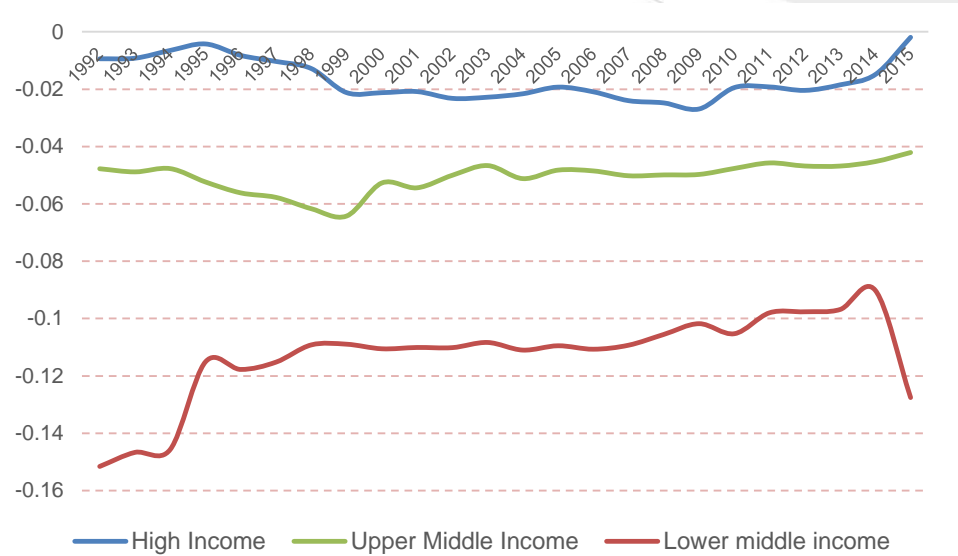
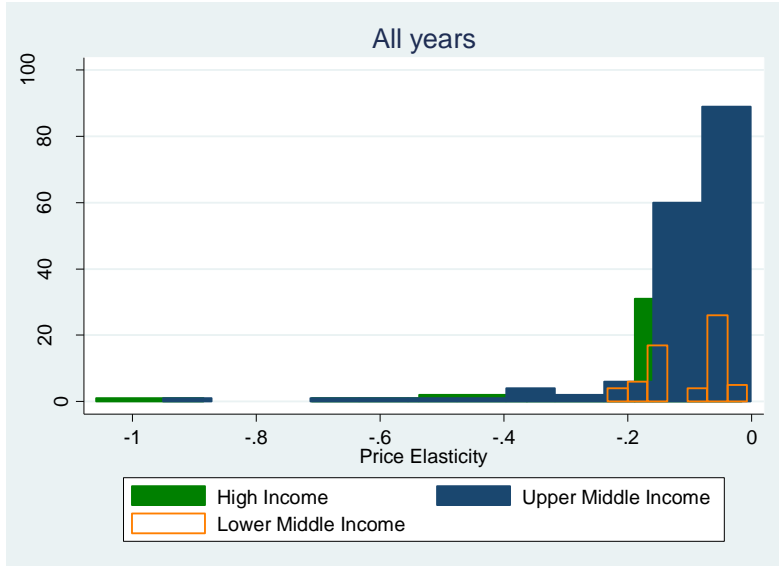
Price Elasticity (by region)



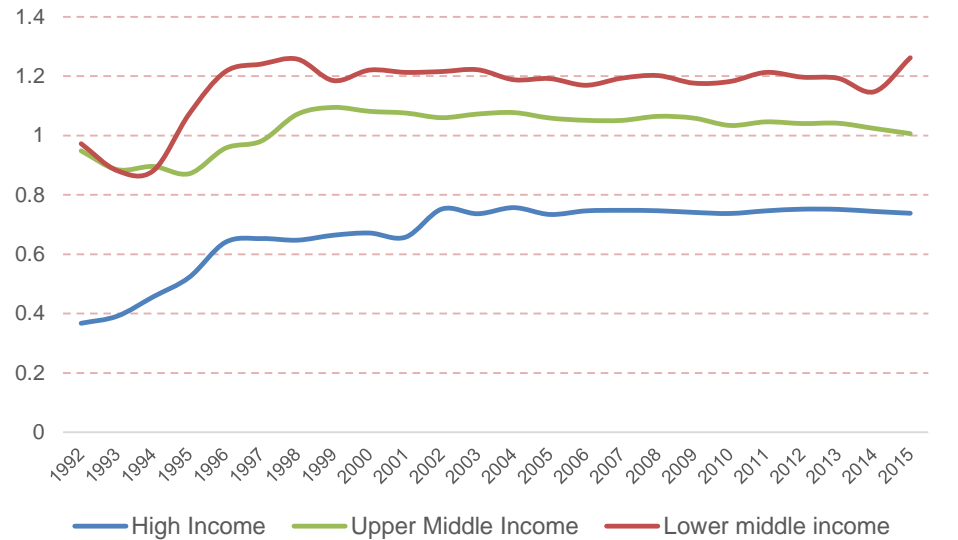
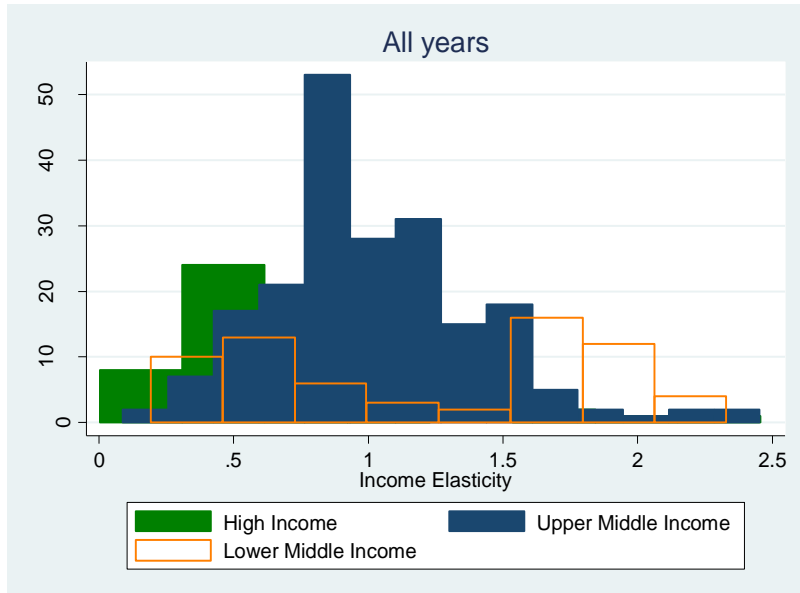
Income Elasticity (by region)



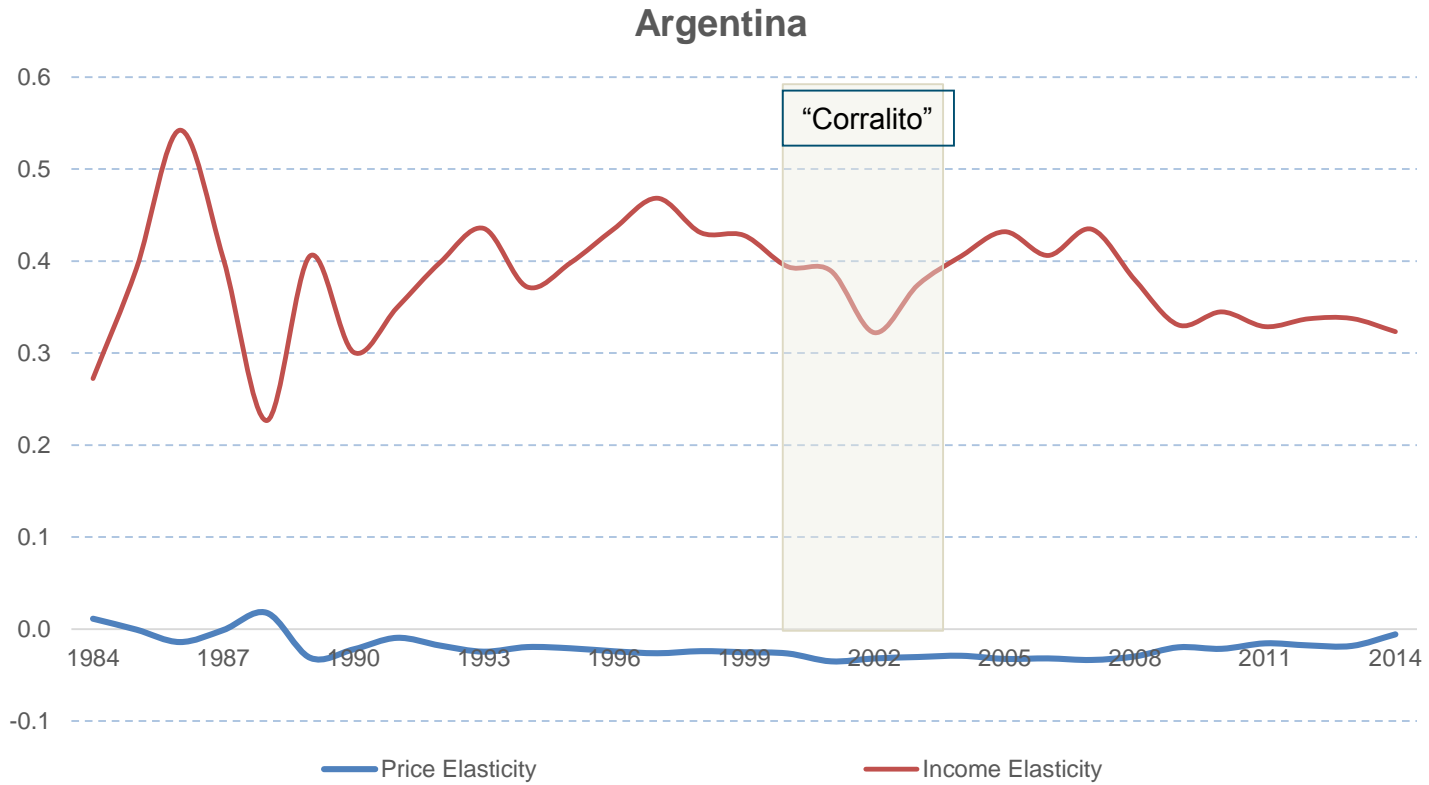
Price Elasticity (by income group)



Income Elasticity (by income group)

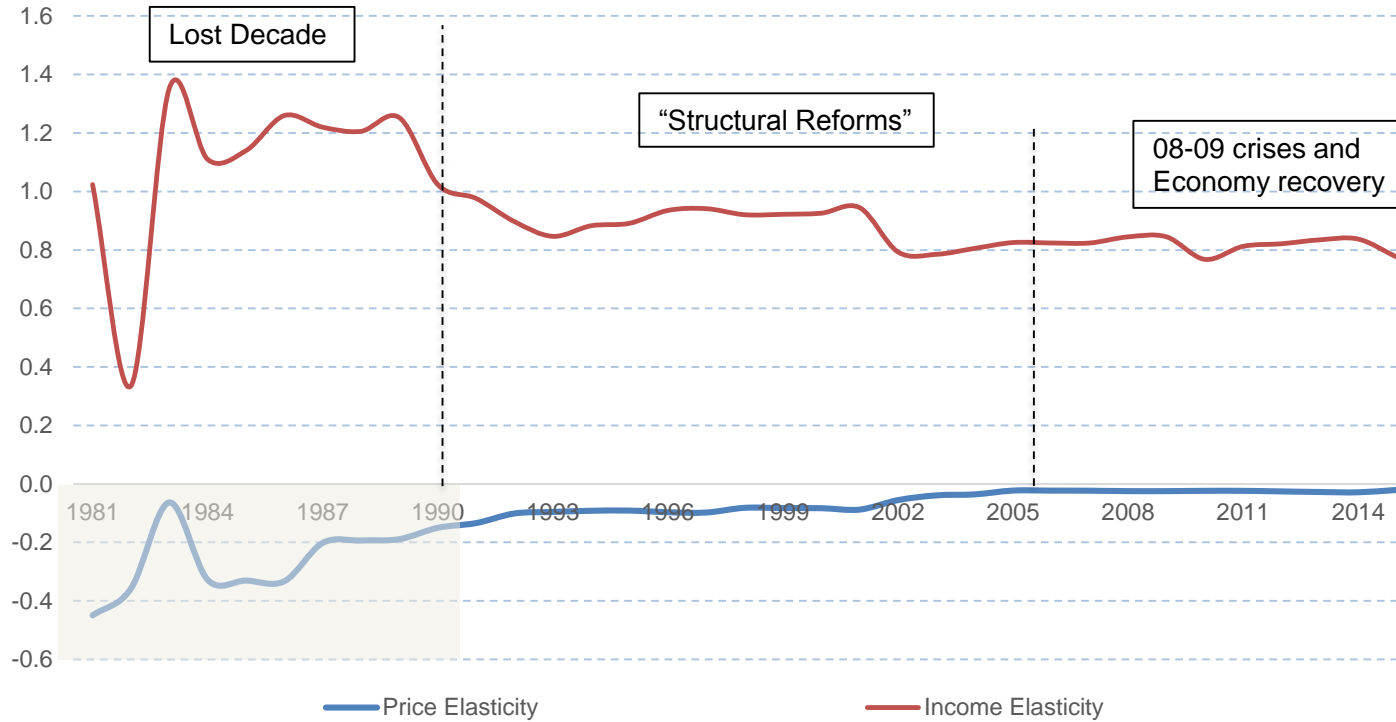


A closer look: Case Studies



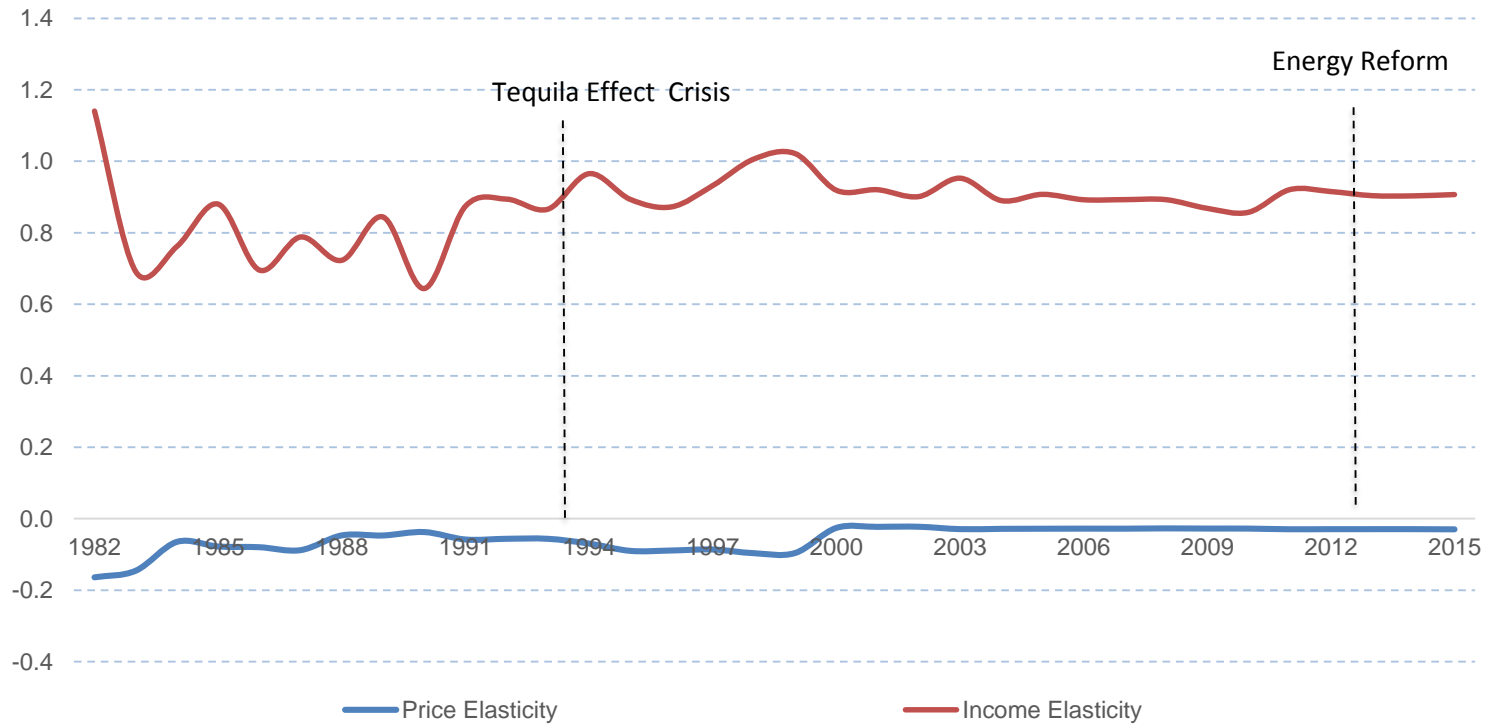
Author(s)	Price Elasticity	Income Elasticity
Casarin and Delfino (2011)	-0.1	-
Yepez et al. (2013)	-0.78	1.02

Brazil



Author(s)	Price Elasticity	Income Elasticity
Modiano (1984)	-0.118	0.332
Schmidt and Lima (2004)	-0.085	0.539
Irffi et al. (2006)	-0.2349	0.684

Mexico



Author(s)	Price Elasticity	Income Elasticity
Berndt and Samaniego (1984)	-0.47	0.73
Chang and Martinez-Chombo (2003)	-0.44	1.95
Yepez et al. (2013)	-0.76	1.28

CONCLUSIONS

How is related with energy security?

1. The energy situation is evolving in LAC countries as in the rest of the world (new technologies and new agents are participating in the system) and the concept of energy security is undergoing a rapid transformation.
2. In the last 35 years the price elasticity become less significant while income shows a higher impact in electricity consumption.
3. Policymakers must consider the variation of elasticity to develop efficient policies.

Grazie per l'attenzione!