Socioeconomic impacts of transition policies

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Outline

- A framework for analyzing the socioeconomic impacts of transition policies
- Illustration 1: The ”green” price premium, a repeated multicountry study of households
- Ilustration 2: The impacts of electricity prices on energyintensive firms: illustration with Swedish data
- Illustration 3: Economywide impacts of energyprice changes for the Swedish economy. CGE_CERE, ver 0.9

Electricity and gdp/cap of non-European nations

R2=0.84
dy/dx=
+$5 /kwh
Source: euanmearns.com

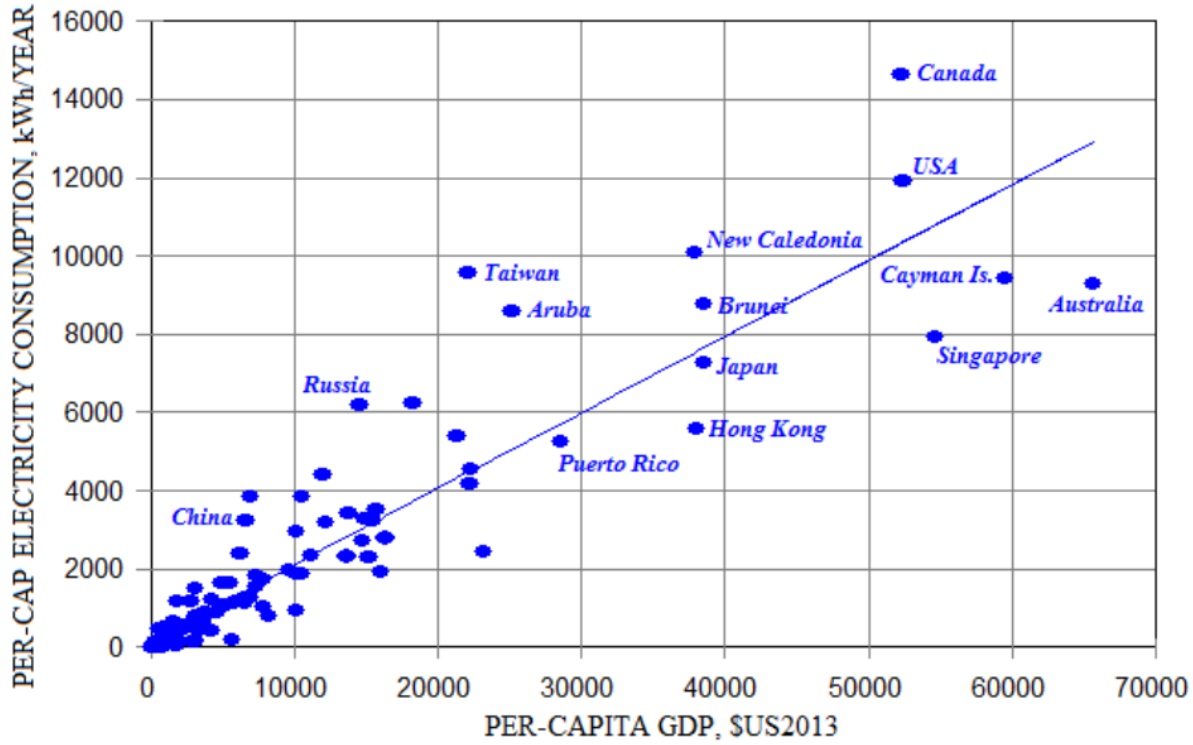
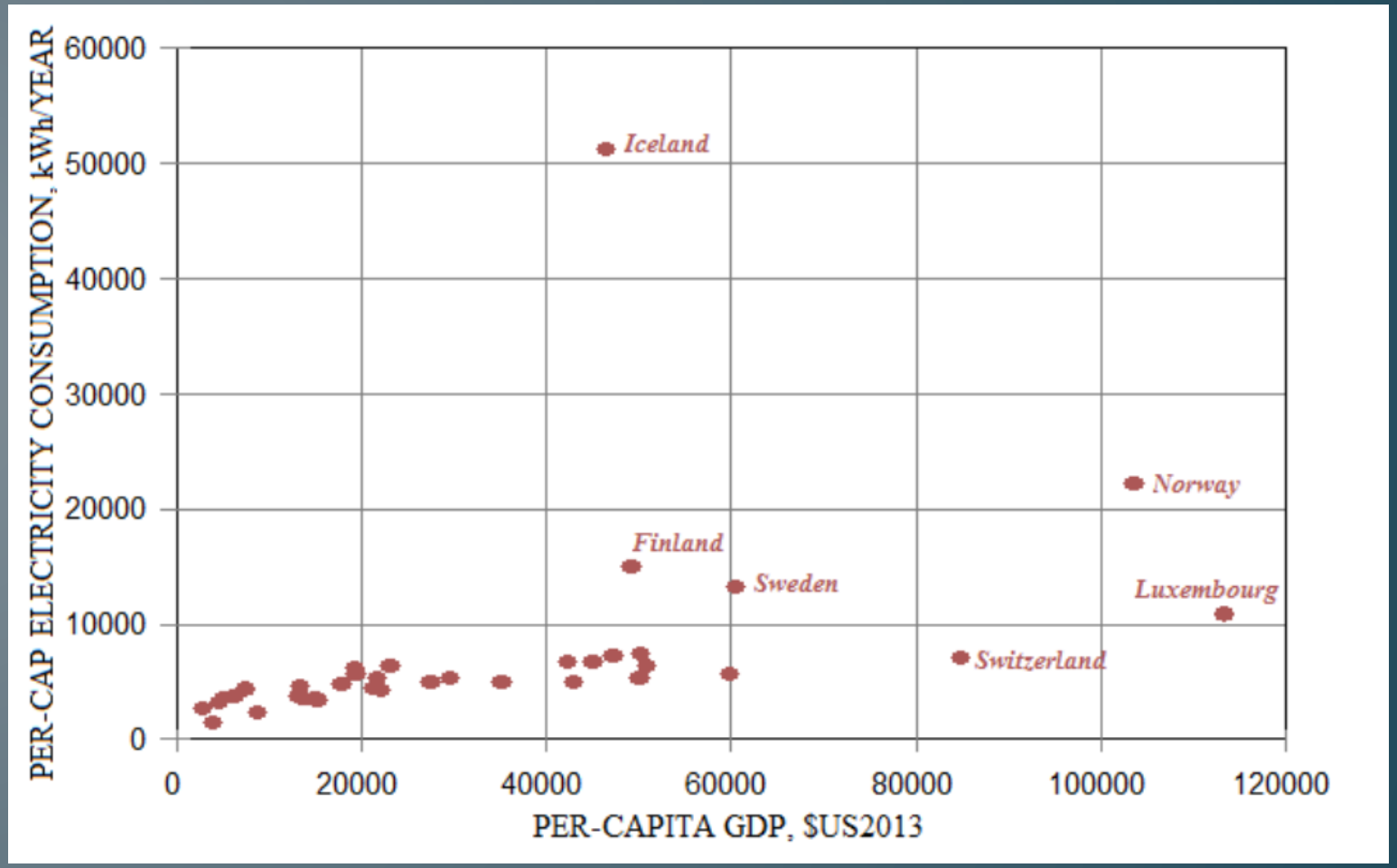


Figure 2: *Per-capita electricity consumption vs. per-capita GDP with European countries and outliers deleted*

Electricity and gdp/cap of European nations



Source: euanmearns.com

Economic framework for analyzing the social impacts of transition policies: A wishlist

- Unit of account: Welfare
- Holistic yet detailed (cons/firm/market/sector/economy/region)
- Dynamic
- Economic and ecological systems interplay
- Heterogeneity explicitly accounted for
- Physics of electricity
- Analysis of both efficiency and distribution, including priced and non-priced goods and services
- Johansson & Kriström (2015), Cambridge UP, General Equilibrium CBA.

Illustration 1: The ”green” price premium

How much do OECD households want to pay for an energy system based solely on renewables?

General motivation

- Household energy consumption roughly 30% of total final consumption and 20% of end-use sectors CO_2 emissions in OECD.
- Electricity about 1/3 and growing share (industry share is reducing)
- Most OECD countries have had energy policies in effect since 1970s. Varying success.
- "New" ideas have gained credence in eg social science, ie the power of norms and softer policy measures in general.
- Survey used to support policy measures. General conclusions is that both soft and hard policies are useful, but soft policies (information) must be tailored in a smart manner. "Turn off the lights" does not really work.

The OECD studies

- Objective: To review empirical evidence to better understand the determinants of household environmental behaviour in five key areas of environmental policy (energy, food, transport, waste and water)
- N about 1000 per country. Webpanel.
- **Australia**, **Canada**, *Czech republic*, **France**, *Italy*, **Korea**, **Netherlands**, *Norway*, *Mexico*, **Sweden** (2008)
- **Australia**, **Canada** **Chile**, **France**, *Israel*, *Japan*, *Korea*, **Netherlands**, *Spain*, **Sweden**, *Switzerland*. (2011)
- 17 Countries in total, 22000+ observations. Unique in its focus. Repeated measurement.

Residential electricity consumption

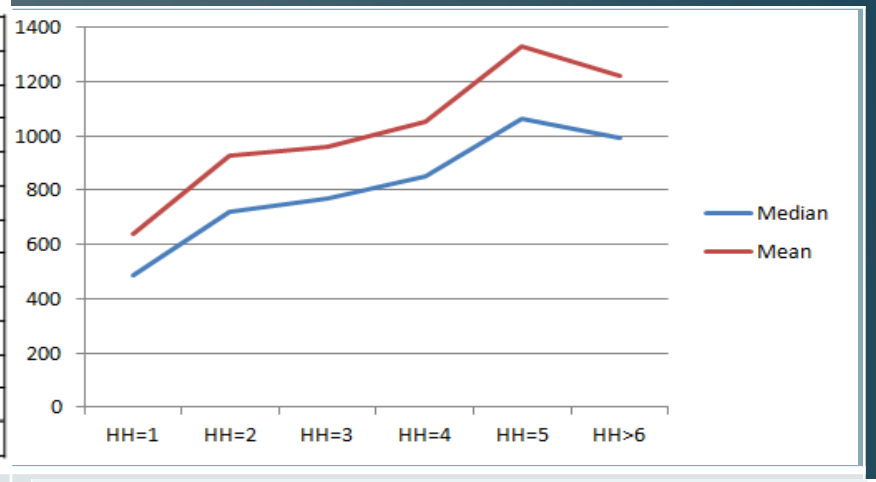
- Demand for energy is generally quite price-inelastic. Short-run price-elasticity 0.3. The long-run price elasticity 0.7.
- Demand for energy responds to income, but the response varies substantially across studies. Perhaps close to unity and lower in the short-run. More recent estimates tend to push these figures downwards.
- Estimated price- and income elasticities vary across datatypes used
- Energy policy tends to have regressive impacts, because energy budget-shares decrease with income

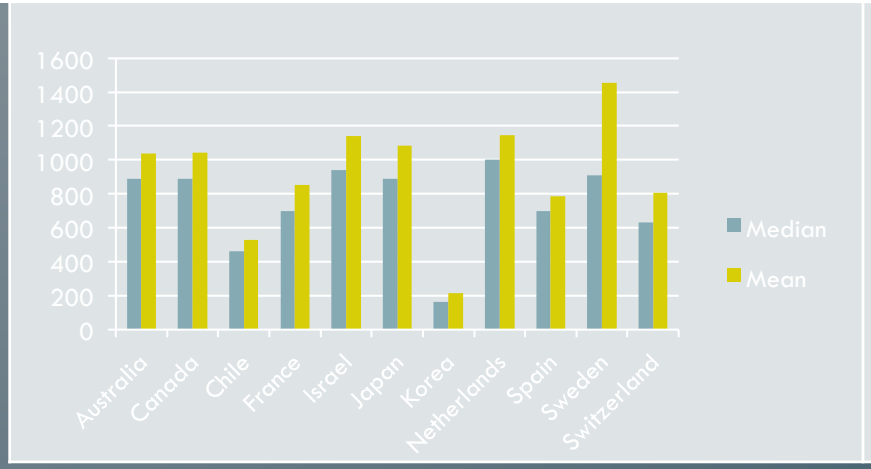
Study on green price premium

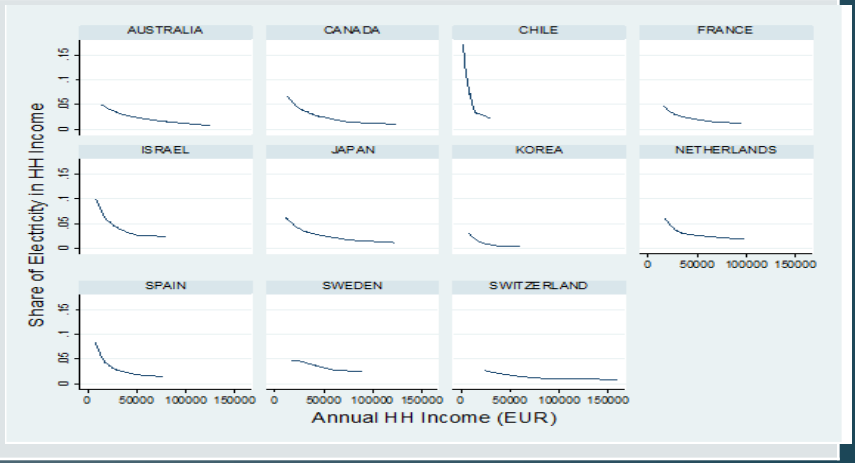
- Issue: how much do households want to pay for a having electricity completely based on renewables?
- (very) hypothetical question, but from a welfare economics point of view this is the key question
- Very large number of studies on this issue, essentially using stated preference methods
- While hypothetical, many are used to buying ”green” electricity in the market.
- Note that the scenario entails ”the whole system”, not, somehow, your personal ”green” electrons.

Electricity Spending 2011 (Residential)

Country	N	Electricity price
Australia	131	0,22
Canada	133	0,13
Chile	189	0,28
France	177	0,16
Israel	142	0,16
Japan	208	0,22
Korea	70	0,05
The Netherlands	241	0,30
Spain	136	0,28
Sweden	294	0,17
Switzerland	158	0,16
OECD 11	1879	0,20





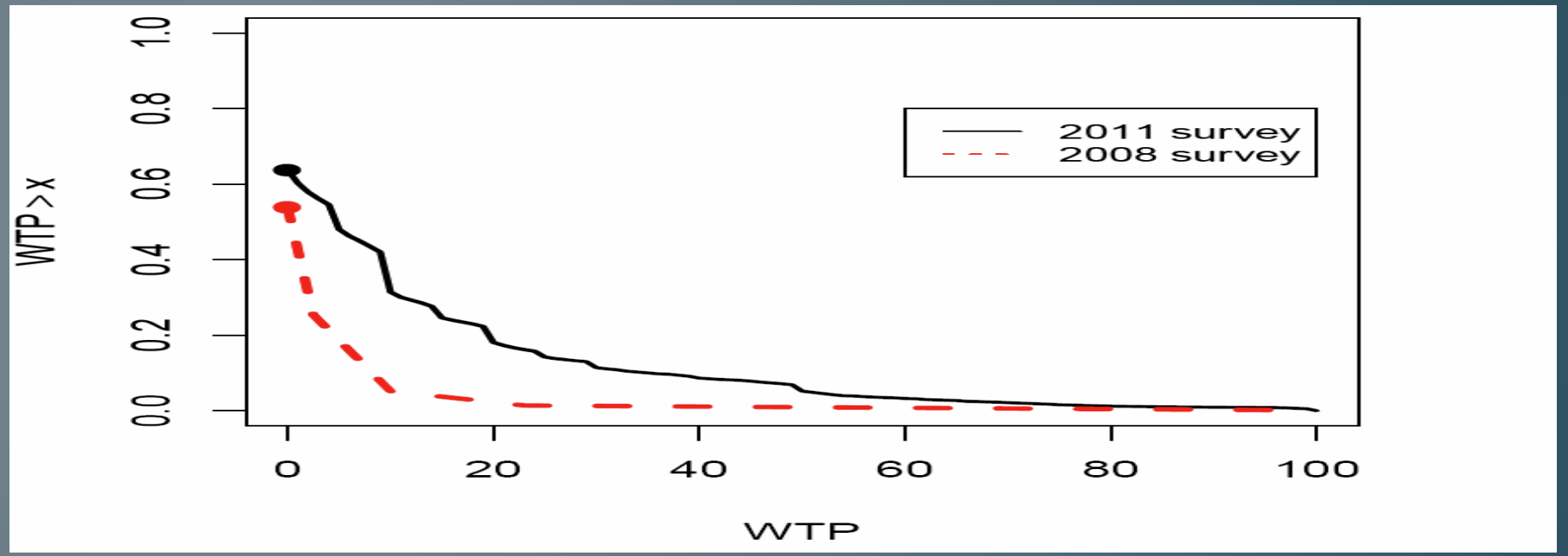


the reported mean electricity spending is about 962 EUR per year
and the average budget share is about 3.5%

What is the maximum % increase in your Annual bill your are WTP to buy renewable energy from your electricity provider? (2008)

	Zero	< 5%	5−15%	16 − 30%	> 30%	Do not know
Canada	0.33	0.23	0.16	0.03	0.01	0.24
Netherlands	**0.64**	**0.16**	**0.07**	**0.00**	**0.00**	**0.13**
France	0.43	0.26	0.11	0.02	0.01	0.16
Mexico	**0.20**	**0.28**	**0.29**	**0.10**	**0.03**	**0.10**
Italy	0.37	0.26	0.18	0.04	0.01	0.15
Czech Republic	0.30	0.27	0.19	0.02	0.01	0.22
Sweden	0.47	0.13	0.16	0.03	0.01	0.22
Norway	0.43	0.17	0.19	0.03	0.02	0.16
Australia	0.37	0.27	0.18	0.03	0.01	0.15
Korea	0.29	0.34	0.17	0.02	0.01	0.16
OECD-10	0.38	0.24	0.17	0.03	0.01	0.17

What is the maximum % increase in your Annual bill your are WTP to buy renewable energy from your electricity provider?



Average: 5-12 %. Pr(WTP>0) about 50%.
Reasons WTP=0: ”Should not pay”, ”Cannot afford”, ”Not interested”
Drivers: Membership in env. Organization+Env attitude
Countries: Netherlands consistently low WTP

The OECD studies on ”Greening Household Behavior”

Publication dedicated webpage
www.oecd.org/environment/households/greeningbehaviour
More information on OECD work available at:
www.oecd.org/environment/households

The Questions

- 1a. How much are households willing to pay to use only renewable energy?
- 1b Does willingness-to-pay (WTP) vary significantly across household groups?
- 2. How do general attitudes towards the environment (environmental awareness; membership in environmental organization; …) influence demand for renewable energy?

The Answers 2008 survey

- 1a) [**how much?**] WTP 4-7% of current electricity bill to switch to renewable.
  -- 4% (include zeroes)
  -- 7% (conditional on WTP>0)
  -- Differences between (and within) countries
  -- Consistent w literature
- 1b) [**Household variation?**] Yes, heterogeneity. Difference drivers of conditional WTP and market entry. Income: enter decision, but not level.
- 2. [**Attitudes:how?**]
  env concern +
  Membership in environmental organizations+

Energy behavior

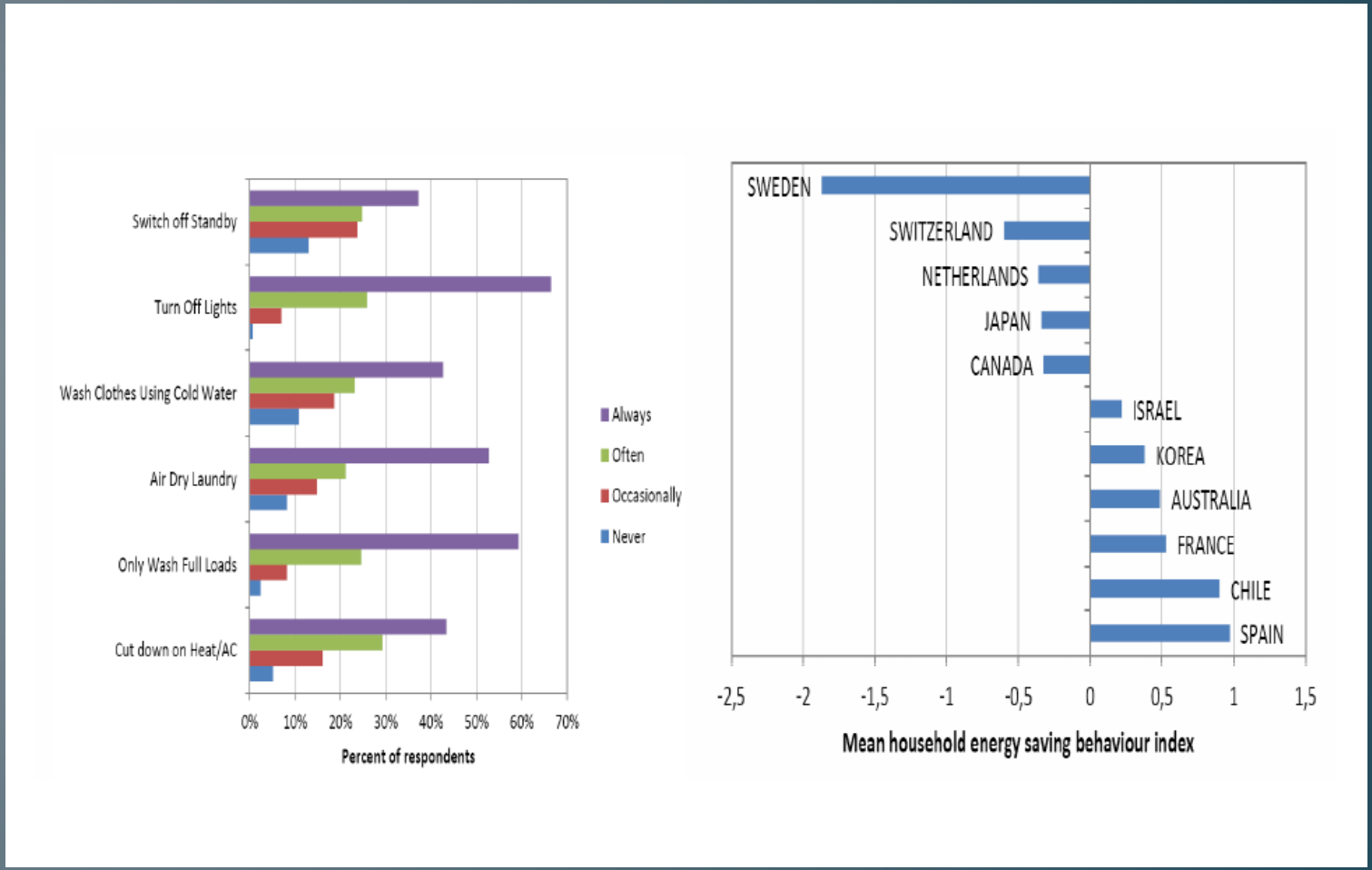
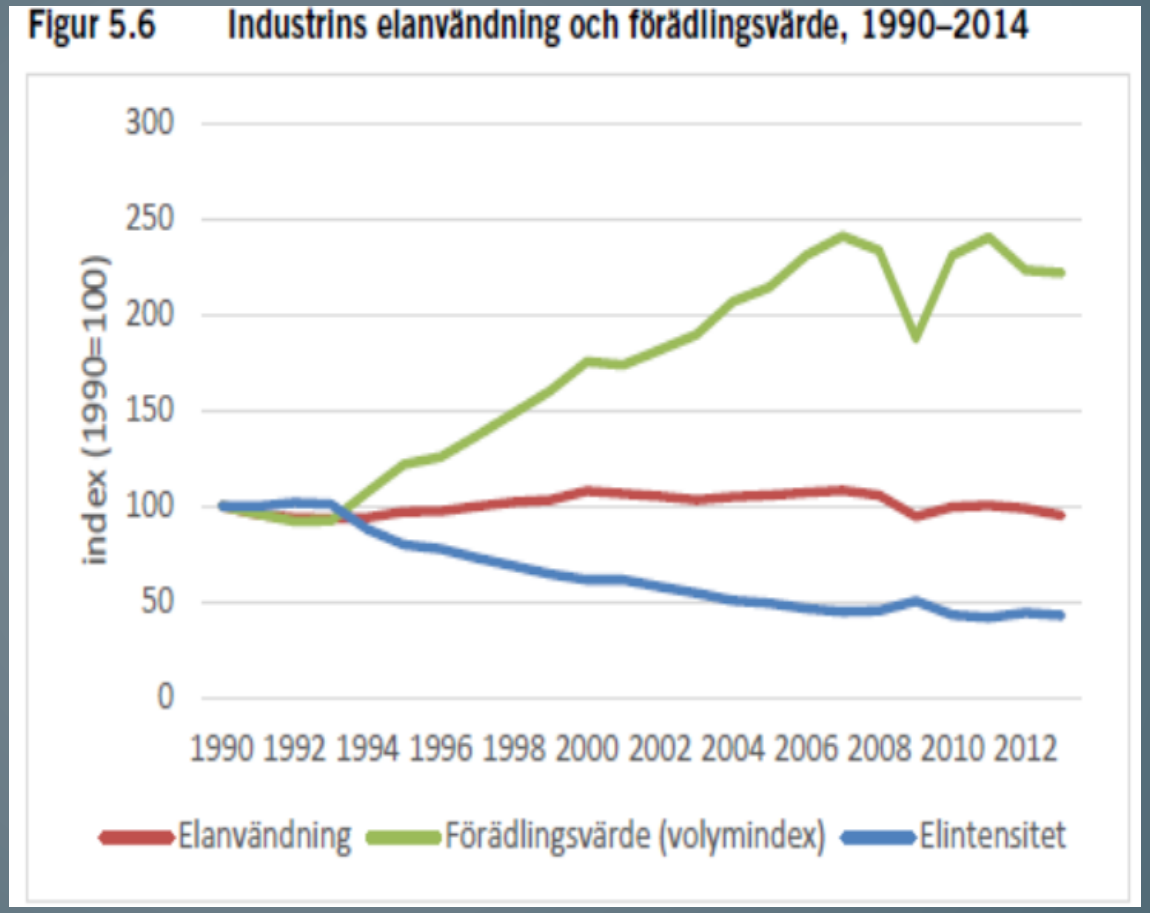


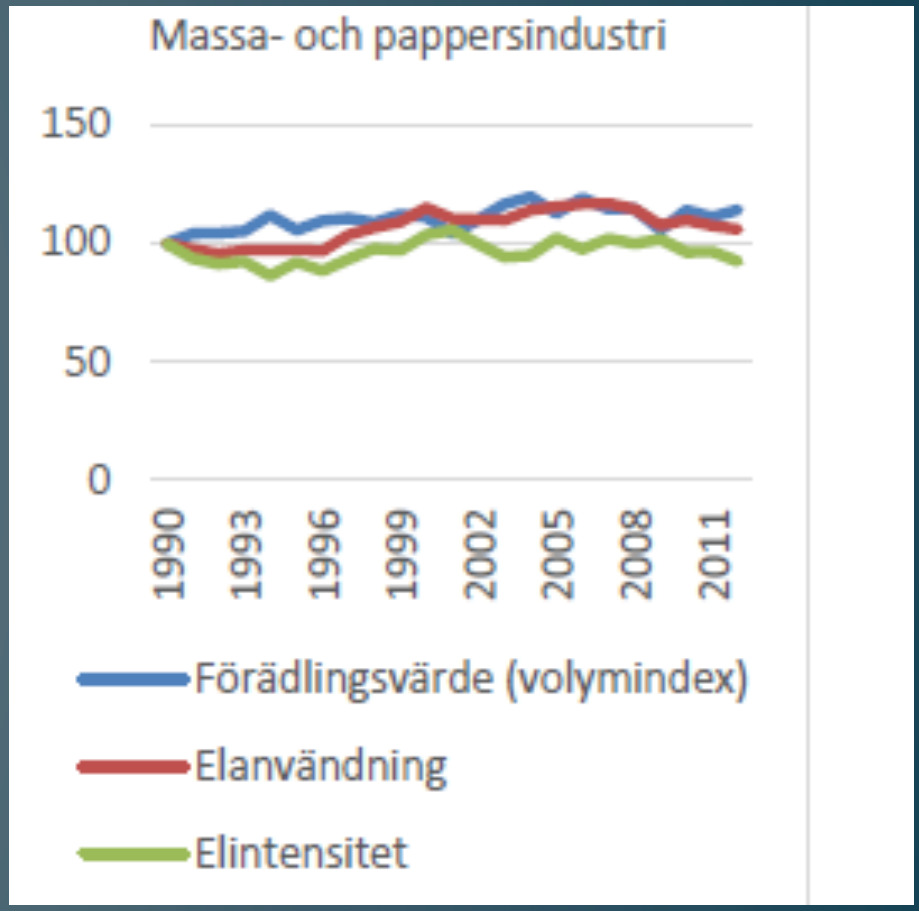
Illustration 2: The firm and electricity

The cost of electricity and impacts of elpricechange at the firmlevel

Illustration 2: Competitiveness and electricity: the Swedish case

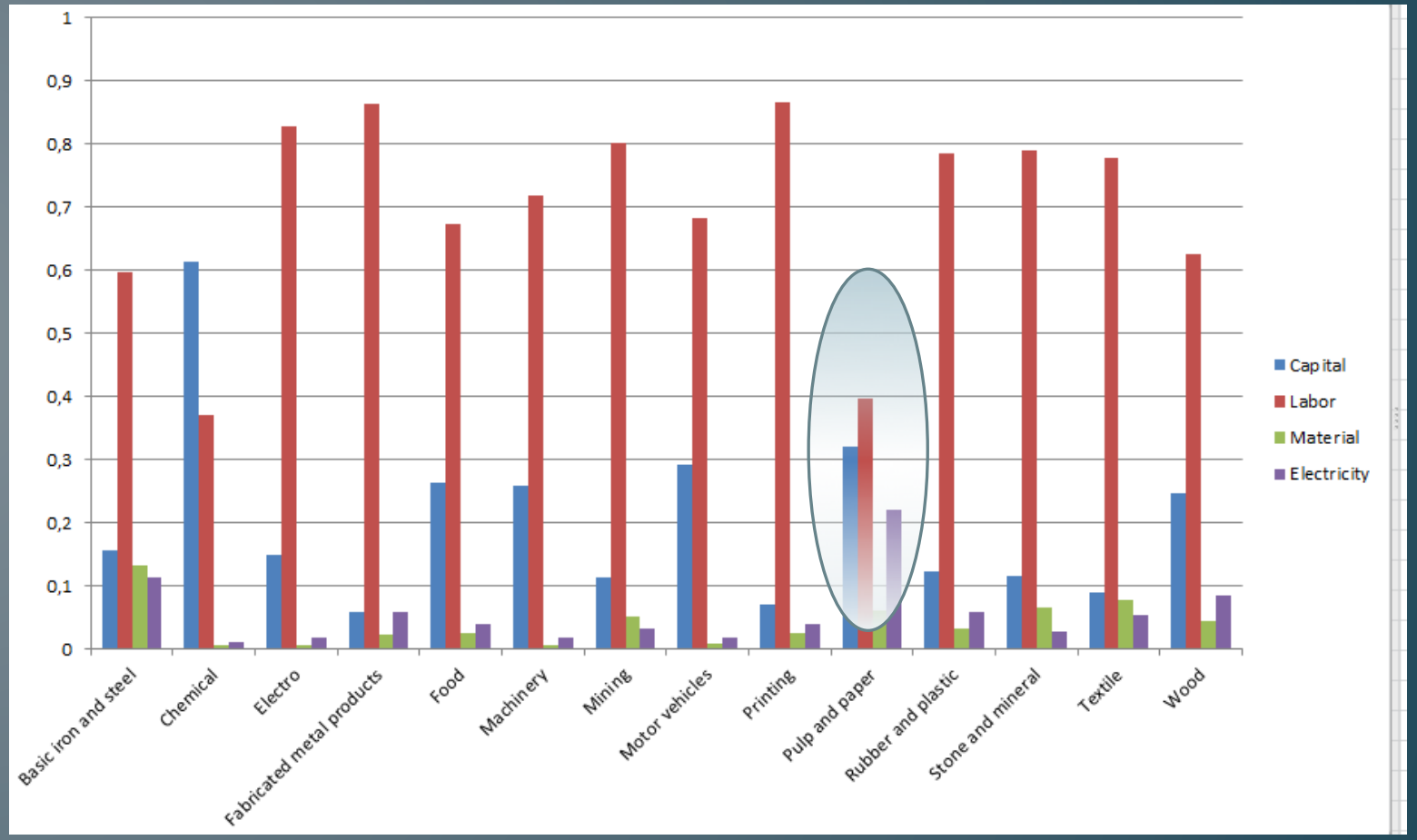
- Competitiveness: not an easy concept
- Balassa index 2011: (some) energyintensive industry **and** electricity generation is on the Sweden ”top ten” list. Comparative advantages.
- What happens if electricity prices +/- 10%?
- Focus on energyintensive industry
- Sufficient statistic: Cost-share
- Data: 2004 and 2008 complete for manufacturing (by production unit)
- Bottom-line: heterogeneity. Distribution of cost-share is substantially skewed (most 2-5%, but up to 33% cost-share)
- Averages can thus be misleading. The avérage price-elasticities are bound to be small
- Extreme case: Kubal 1 öre/Kwh is equivalent to the cost of roughly 10% of the cost of labor. 10 öre is very roughly the cost of the whole labor force (N=400).





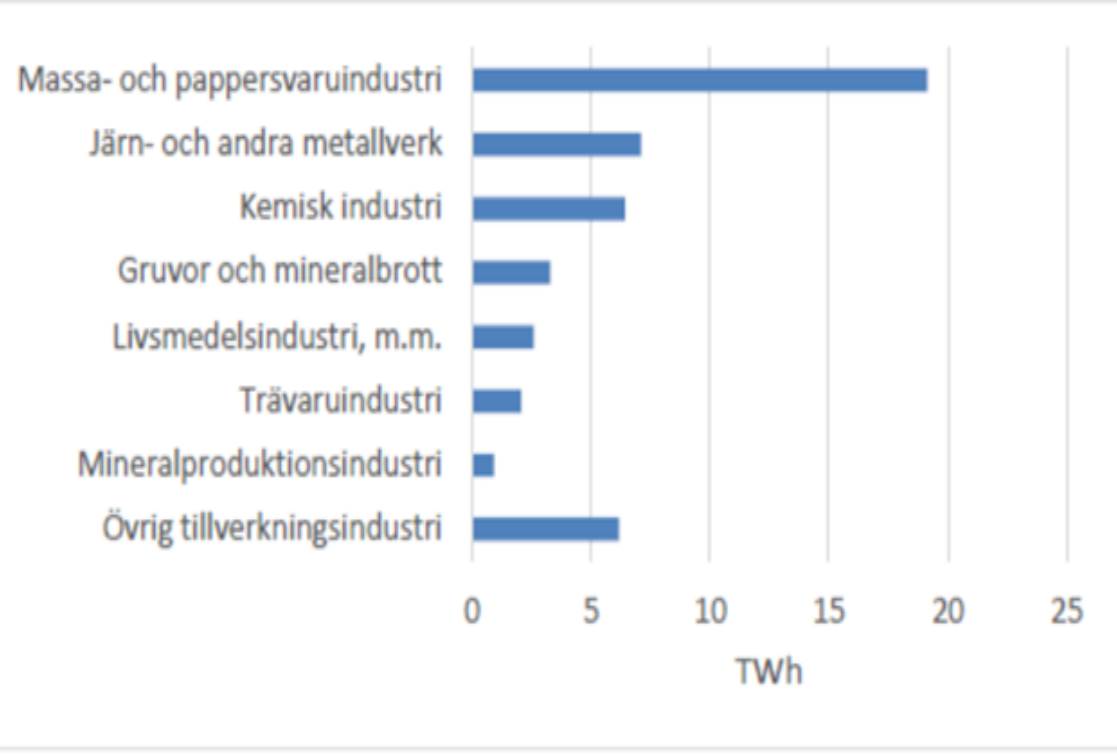
Source: SOU 2015:87

Cost-shares in Swedish manufacturing 2008



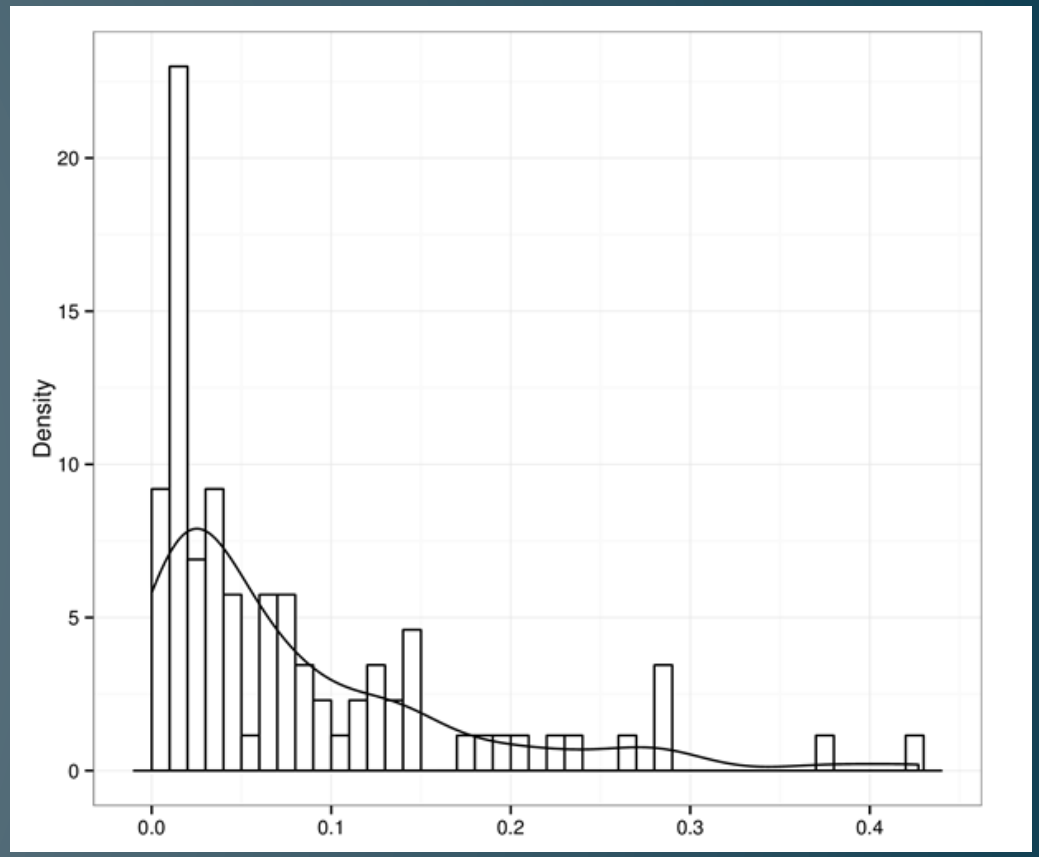
Source: SCB. Averages: Capital: 0.2, Labor: 0.7, Material: 0.04; Electricity: 0.06

Electricity use 2014
Swedish industry



Source: SOU 2015: 87

El Costshare Pulp & paper 2008



Source: SCB, mean = 0.22

Econometric model results

These are average results
Next step: study the impact
At various points of the distribution, since heterogeneity Is important here.

	Elprice change -15%	Elprice change +12%
Mining	dQ=0.3%, dL=0.2%	dQ=-0.7% dL=-0.2%
Wood	dQ=0.1% dL=0.2%	dQ=-0.1% dL=-0.2%
Pulp&Paper	dQ=1.5% dL=6.4%	dQ=-1.5% dL=-6.6%
Chem	dQ=0.2% dL=-1.3%	dQ=-0.2% dL=+1%
Iron &Steel	dQ=1.4% dL=0.1%	dQ=-0.8% dL=-0.1%
Source:	Brännlund & Lundgren (2012)	Brännlund& Lundgren (2011)

Illustration 3: the bigger picture

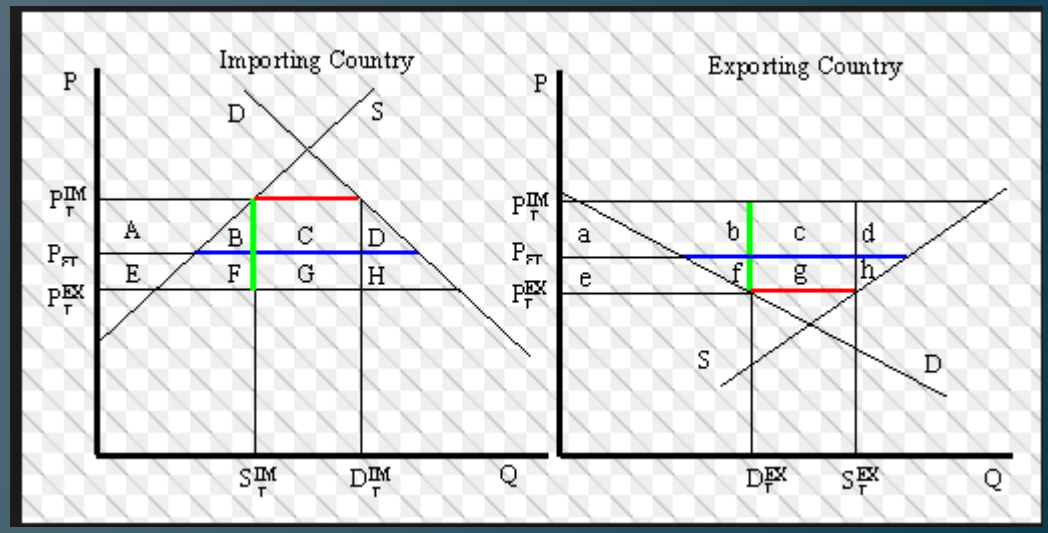
Economywide impacts of electricity price changes: Cheaper import

Illustration 3: the bigger picture

- Naturally, discussions about the future of electricity markets centers around what happens with that market.
- Holistic view forces us to look at the impact on the whole economy (and the ecosystems)
- Substantial number of models that are helpful here
- Will illustrate some preliminary work using GTAP 9 2011 data, CGE_CERE, ver 0.9.
- 57 sectors, national accounts + detailed carbon accounting (incl permits) (for now, SWE-ROW, but can have substantial multiregional detail)
- To Do: different sector disaggregation, detailed energy tax system, household types and more.
- Will illustrate using Top-Down version (Bottom-up is there, but needs further work)

Export/import price of electricity

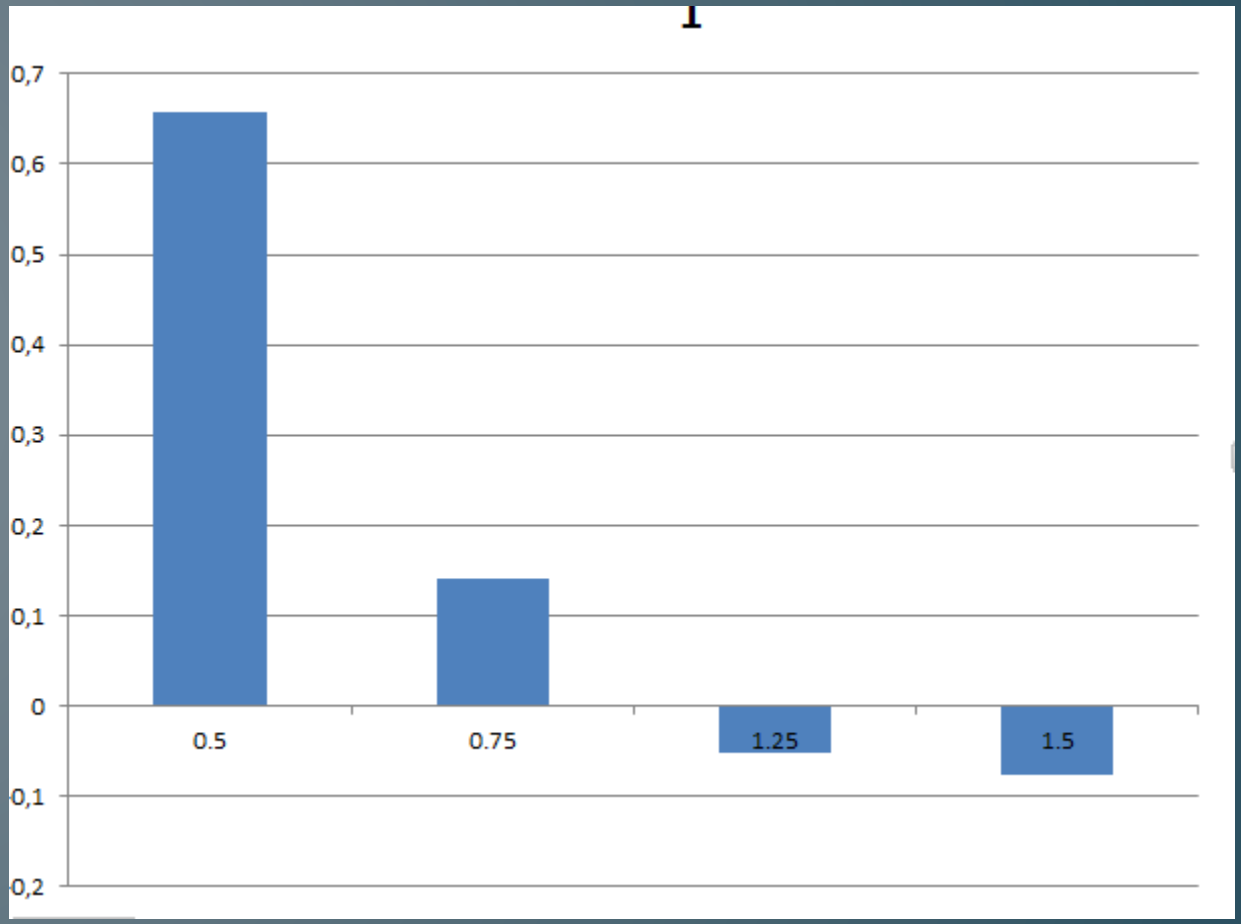
- Assume that current integration of grid affects prices of electricity in Sweden.
- Will treat electricity as any other good (technically the Armington assumption. Not ideal, but has useful interpretation via capacity constraints on trade flows)
- How will this affect ”competitiveness”?
- Is Sweden a net winner or loser on lower import electricity prices?
- Textbook partial equilibrium case
- Take into account economywide effects of an importprice change
- First-round effects
- Second-round effects….



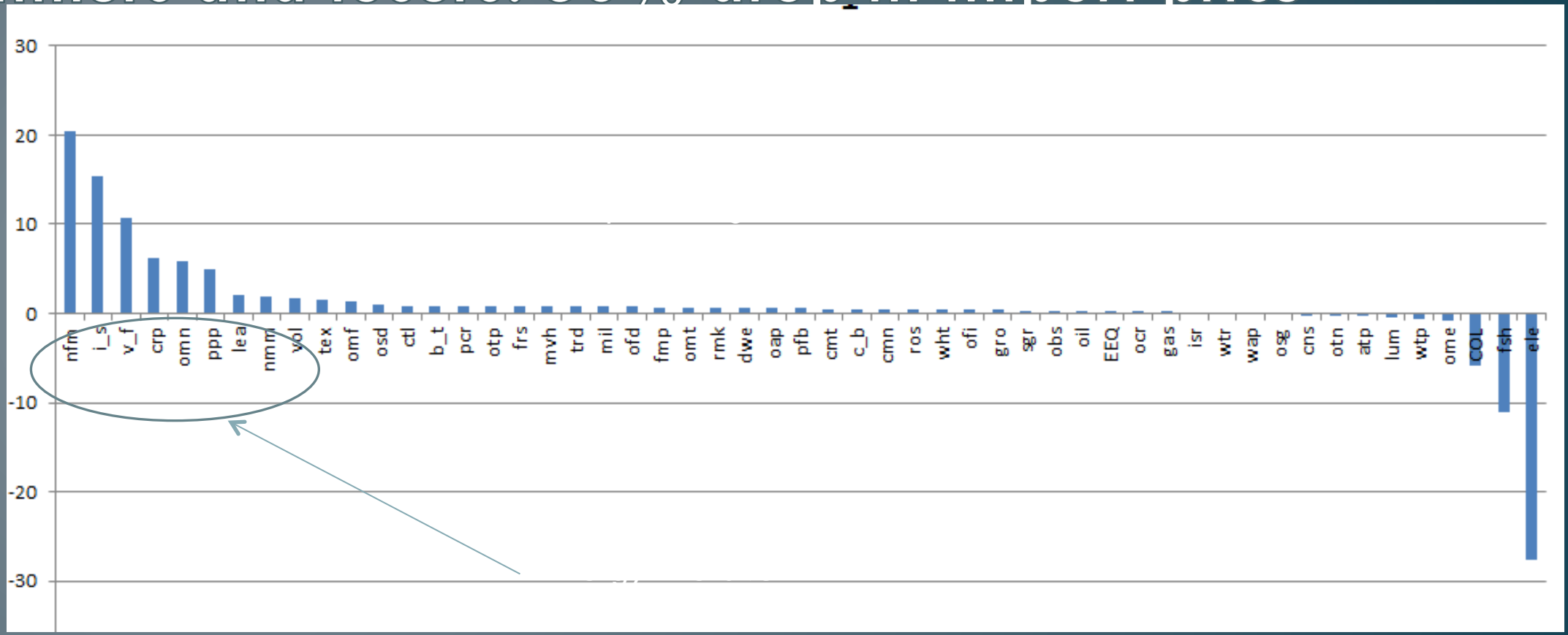
Intuition

- Marshall's law: the importance of being unimportant (for approximating general equilibrium repercussions)
- IF no other prices are affected, all repercussions can be measured in one market (assuming a competitive economy), even though there will be many effects in many markets.
- IF many prices are affected, CGE model is needed.
- Consider lower electricity prices for forest industry, by far the biggest consumer in industry (and ignore that they also generate electricity)
- Pulpwood/sawnwood, forest owners, sawmills, district heating plants…reasonable to assume we will have price-effects outisde of electricity

Real income changes of import price changes (0.5*base, 0.75*base and so on)



Winners and losers: 50% drop in import price



Conclusions

- A comprehensive framework to analyze the socioeconomic impacts of the transition appears useful, even though we are far away from an empirical version now
- Consumers: their role may change over time, and the framework needs to be flexible enough to handle ”prosumers”
- Firms: need to remember the heterogeneity, to describe impacts with better tools (such as quantile regression)
- Markets: have described electricity as ”just another good”, is a richer representation called for?
- Constraints: environmental goals, energy-efficiency goals, EU-directives, energy tax (and subsidy) system… a challenge to represent all these effectively
- Need to develop the tools for welfare analysis. EFORIS.