

Electricity intensity patterns in G7 countries

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Outline

- 1 Motivation
- 2 Framework
- 3 Methodology and data
- 4 Results
- 5 Final Remarks

Motivation

- Need to forecast power consumption
- Power generation's role in GHG emissions
- Climate change and energy policy implications

OECD countries' CO₂ emissions shares by sector

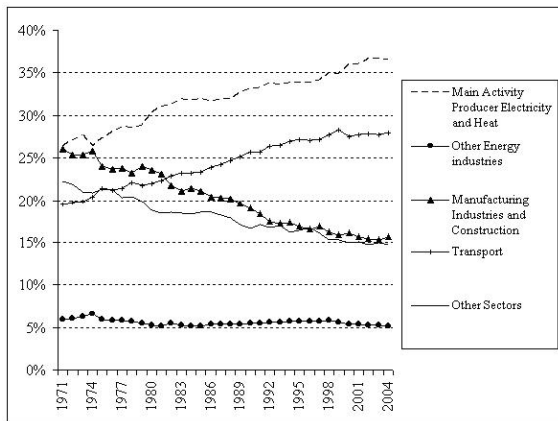
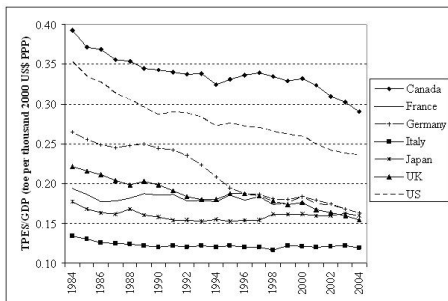


Figure: Source IEA, CO₂ emissions from fuel combustion (edition 2006)

Framework

Different patterns of electricity intensities

- Similar convergence for primary energy intensity
- Historical reasons (e.g. different ways to react to 1970s energy price increase)



- OLS regressions of electricity intensity over time (1960-2004)
- Comparison of linear vs. quadratic fit
- International Energy Agency data

The G7 countries divide: quadratic patterns

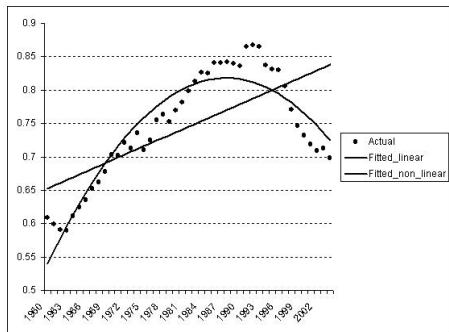


Figure: Canada

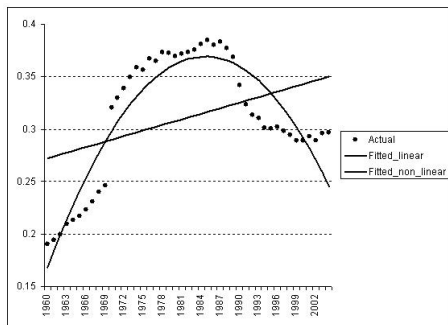


Figure: Germany

The G7 countries divide: quadratic patterns cont'd

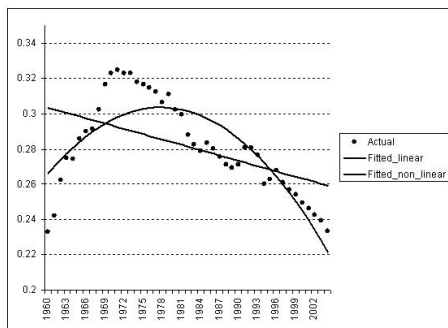


Figure: United Kingdom

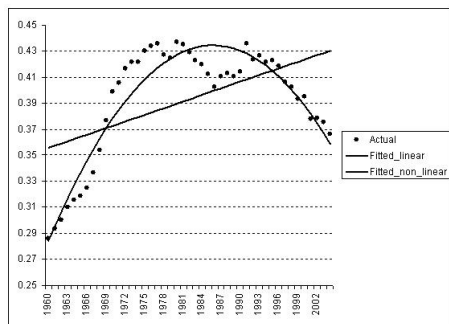


Figure: United States

The G7 countries divide: linear patterns

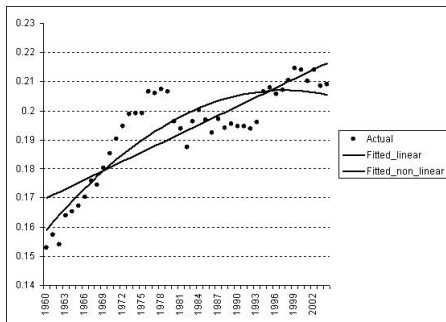


Figure: Japan

The G7 countries divide: linear patterns cont'd

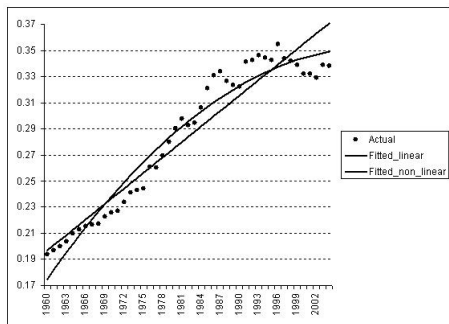


Figure: France

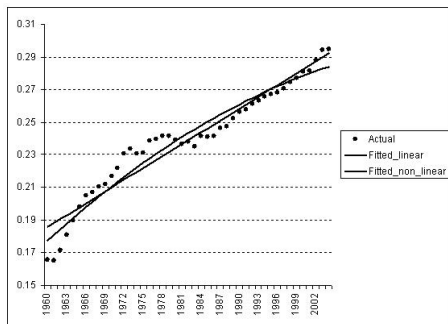


Figure: Italy

Parameters' Estimates

Linear estimation			
	a	b	R ²
Canada	0.6526	0.0042	0.44
<i>t-stat</i>	<i>35.48</i>	<i>5.85</i>	
France	0.1971	0.0039	0.91
<i>t-stat</i>	<i>41.74</i>	<i>21.37</i>	
Germany	0.2723	0.0018	0.15
<i>t-stat</i>	<i>16.48</i>	<i>2.73</i>	
Italy	0.1858	0.0024	0.93
<i>t-stat</i>	<i>71.57</i>	<i>23.78</i>	
Japan	0.1700	0.0011	0.69
<i>t-stat</i>	<i>61.41</i>	<i>9.70</i>	
UK	0.3034	-0.0010	0.25
<i>t-stat</i>	<i>44.20</i>	<i>-3.74</i>	
US	0.3558	0.0017	0.26
<i>t-stat</i>	<i>31.98</i>	<i>3.89</i>	

- Quadratic estimates are all between .71 and .95 R²
- Similar peak years for quadratic estimates

Why such a divide?

- Take $ecshare_{it}^c \equiv ec_{it}^c / ec_t^c$
where ec =electricity consumption, i =sector,
 c =country, t =time
- Consider Industry and Commercial and Public services
(weigh together as 70% ca. of ec on average over
1960-2004)

Parameters' Estimates

- Faster convergence, i.e. higher estimates slopes, for Japan, France, and Italy
- Closer to shares' steady state levels for the other countries
- Hockey stick?

		Industry	Commerce
Canada	Trend coefficient	-0.0046	0.0015
	T-statistic	-11.06	9.41
	R ²	0.74	0.67
France	Trend coefficient	-0.0088	0.0037
	T-statistic	-23.35	32.92
	R ²	0.93	0.96
Germany	Trend coefficient	-0.0046	0.0020
	T-statistic	-18.87	9.93
	R ²	0.89	0.70
Italy	Trend coefficient	-0.0052	0.0035
	T-statistic	-23.23	29.86
	R ²	0.93	0.95
Japan	Trend coefficient	-0.0108	0.0093
	T-statistic	-36.13	33.33
	R ²	0.97	0.96
UK	Trend coefficient	-0.0028	0.0032
	T-statistic	-14.37	24.29
	R ²	0.83	0.93
US	Trend coefficient	-0.0038	0.0035
	T-statistic	-17.49	24.15
	R ²	0.88	0.93

Hockey stick

Consider sub-samples 1960-1980 and 1980-2000 to see the hockey stick

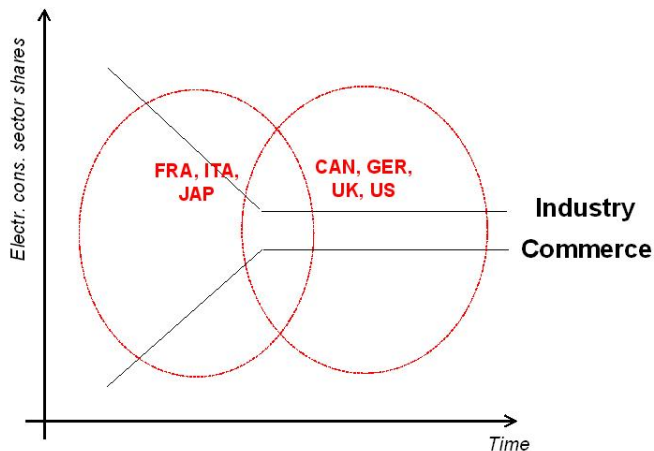


Figure: Stylized pattern of Industry and Commerce electricity consumption shares

Is it really quadratic vs. linear pattern?

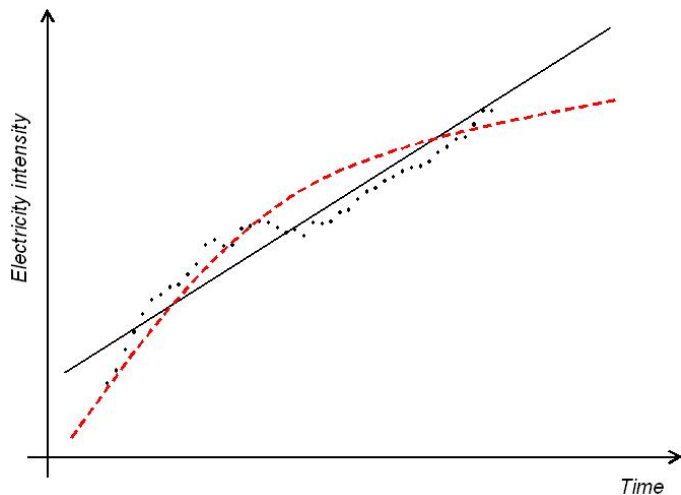


Figure: How the hockey stick hint would map into overall electricity intensity evolution

Final Remarks

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- Electricity consumption forecast implication
- GHG emission forecast and energy policy