Modeling Market Transformation in Lighting and Refrigerator Markets

Ken Tiedemann BC Hydro and Research 4 Results

Introduction

- A number of major electricity-related developments occurred in 2001, including first, the Change a Light, Save the World promotion; second, the California energy crisis; and, third, the Pacific Northwest drought induced hydro power shortage
- This note uses market analysis to understand the impact of post-2001 energy conservation policy developments on sales of energy efficient screw-type lamps and Energy Star refrigerators
- The basic approach is straightforward: first, publicly available information is used to build a database of sales and drivers of sales; second, econometric models are used to estimate the determinants of sales; and, third, the regression results are used to estimate the individual impacts of prices, GDP and energy conservation policies on sales

Method

- Let $quantity_{it}$ be the residential and small commercial demand for product i in year t, $price_t$ the average price of electricity in year t, GDP_t the gross domestic product in year t, $dummy_t$ a DSM dummy variable that takes on the value 0 for the years up to the energy crisis and the value 1 for the post-crisis years, ε_{it} an error term

$$(1)\ quantity_{1t} = \alpha_1 + \beta_1\ price_t + \gamma_1\ GDP_t + \delta_1\ dummy_t + \varepsilon_{1t}$$

- Using the estimated parameters from the regressions, we take first difference of (1) to decompose the change in sales in a given year into price-related, GDP-related and DSM-related components. Note that the first difference of a constant is zero and the first difference of the dummy variable is 1, so we have (2)

$$(2)\quad \Delta quantity_{1t} = \beta_1\ \Delta price_t + \gamma_1\ \Delta GDP_t + \delta_1$$

Regression Models

(sales in 000 units, standard errors for variables in parentheses)

	CFL	Incandescent	ES fridge	Non-ES fridge
Constant	-171,970** (72,430)	2,059,020*** (536,300)	-18,957*** (7,238)	-2,317 (3,994)
GDP	0.0056** (0.0025)	0.12*** (0.014)	0.00088*** (0.00018)	0.0011*** (0.00018)
Electricity price	15,396** (7,551)	-232,304*** (56,630)	1,552* (819)	66 (490)
DSM dummy	10,605** (4,950)	-78,336* (35,770)	1,065* (607)	98 (301)
Adj R-squared	0.86	0.70	0.90	0.85
F	14.6 (0.01)	6.4 (0.05)	22.6 (0.01)	13.7 (0.01)
Durbin-Watson	2.00 (0.01)	1.67 (0.46)	2.85 (-0.43)	2.25 (-0.13)

First Year Impacts (000 units)

	CFL	Incandescent	ES fridge	Non-ES fridge
Price effect	1,848	-27,877	186	19
GDP effect	885	18,960	139	174
DSM effect	10,605	-76,336	1,065	66
Total effect	13,338	-85,253	1,390	259

Conclusions

- First, an increase in GDP increases the sales of CFLs, incandescent lamps, Energy Star refrigerators and non-Energy Star refrigerators
- Second, an increase in electricity price increases sales of more energy-efficient CFLs and Energy Star refrigerators, decreases sales of less energy-efficient incandescent lamps but has an insignificant effect on non-Energy Star refrigerator sales
- Third, an increase in DSM activities increases sales of more energy-efficient CFLs and Energy Star refrigerators, decreases sales of less energy-efficient incandescent lamps but again does not have a significant impact on sales of non-Energy Star refrigerators
- Fourth, econometric analysis using interrupted time-series modelling appears to be a viable and useful alternative to traditional survey-based methods of estimating net effects.