

**Energy Demand Elasticities:
Empirical results in the Québec context**

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Order of Presentation

Introduction – the role of economic variable in demand forecast

1. Price and income demand elasticities: definition
2. A standard energy demand model
3. Elasticities estimates
4. Within sample forecast
5. Estimated trend level

Conclusion

- Price elasticity : demand response to price change

$$\equiv \frac{\% \Delta \textit{Quantity}}{\% \Delta \textit{Price}}$$

- Income elasticity: demand response to income change

$$\equiv \frac{\% \Delta \textit{Quantity}}{\% \Delta \textit{Income}}$$

- Difference between short run and long run elasticities

The model:

$$\ln X_t = \mu_t + a_1 \ln X_{t-1} + a_2 \ln P_t + a_3 \ln Y_t + a_4 \ln HDD_t - a_1 a_4 \ln HDD_{t-1} + \varepsilon_t \quad (1)$$

where X_t = total energy demand,

P_t = real price of energy,

Y_t = real income,

HDD_t = heating degree days,

μ_t = random trend,

ε_t = random error term which is assumed $NID(0, \sigma_\varepsilon^2)$

a_1, \dots, a_4 are structural parameters of interest.

The random trend:

$$\mu_t = \mu_{t-1} + \beta_{t-1} + \eta_t \quad \text{and} \quad \eta_t \sim NID(0, \sigma_\eta^2) \quad (2)$$

$$\beta_t = \beta_{t-1} + \xi_t \quad \text{and} \quad \xi_t \sim NID(0, \sigma_\xi^2) \quad (3)$$

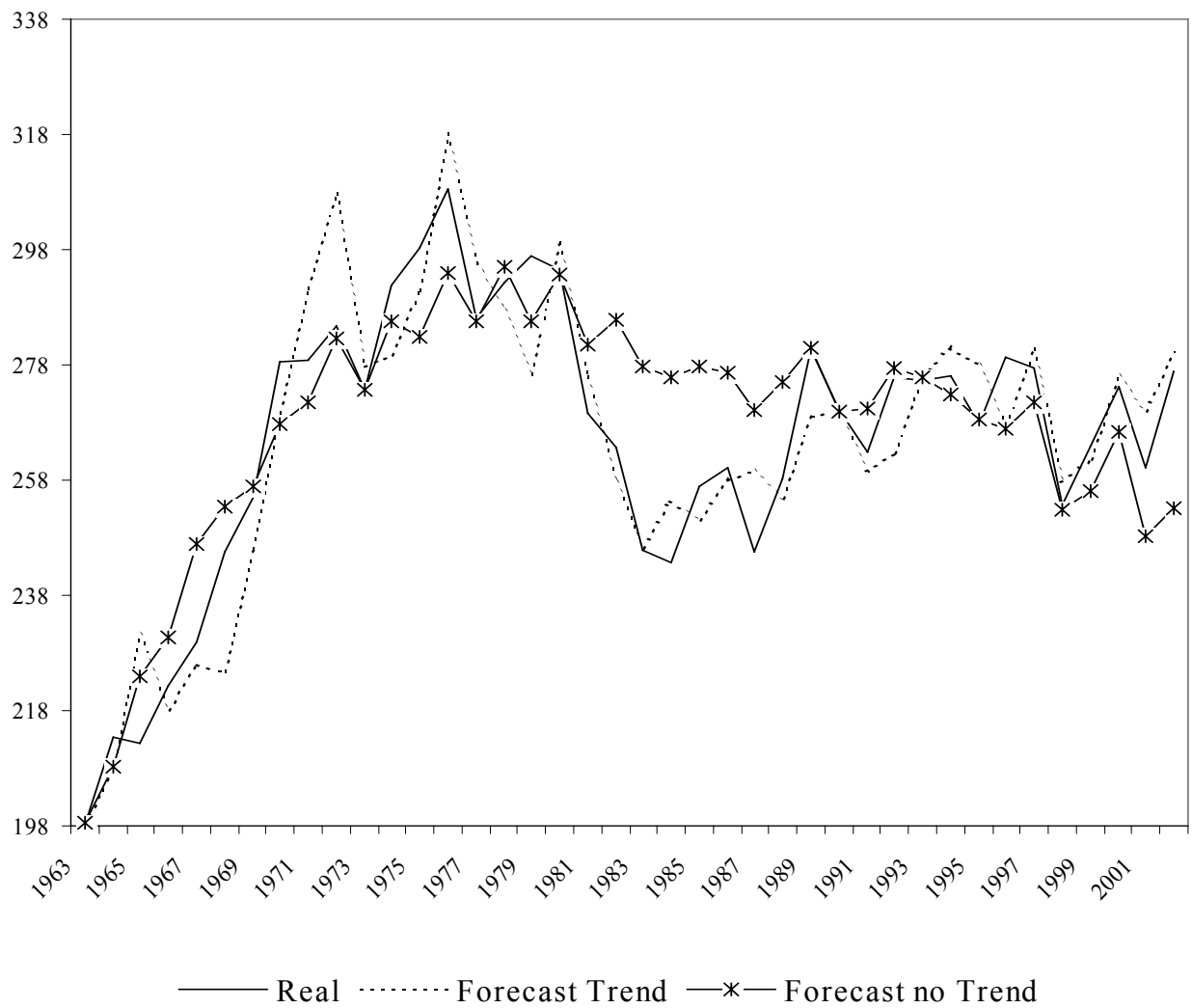
TABLE 3
Demand elasticities:

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL	
	Short ^a run	Long ^b run	Short ^a run	Long ^b run	Short ^a run	Long ^b run
no trend						
Price	<i>-0.02</i> (-0.06 : 0.01)	<i>-0.14</i> (-1.89 : 0.04)	<i>-0.33</i> (-0.49 : - 0.18)	<i>-0.55</i> (-0.70 : - 0.37)	<i>-0.06</i> (-0.14 : 0.01)	<i>-0.26</i> (-1.01 : 0.05)
Income	<i>0.05</i> (-0.20 : 0.30)	<i>0.28</i> (-9.75 : 1.12)	<i>0.58</i> (0.34 : 0.83)	<i>0.95</i> (0.76 : 1.10)	<i>0.25</i> (0.09 : 0.42)	<i>1.05</i> (0.61 : 1.69)
random trend						
Price	<i>-0.29</i> (-0.65 : 0.06)	<i>-0.40</i> (-1.09 : 0.08)	<i>-0.40</i> (-0.63 : - 0.17)	<i>-0.46</i> (-0.72 : - 0.21)	<i>-0.21</i> (-0.32 : -0.11)	<i>-0.36</i> (-0.89 : -0.14)
Income	<i>0.91</i> (0.46 : 1.37)	<i>1.25</i> (0.87 : 1.59)	<i>1.14</i> (1.11 : 1.16)	<i>1.30</i> (1.05 : 1.69)	<i>0.75</i> (0.39 : 1.12)	<i>1.26</i> (0.95 : 1.74)

a: 95 % confidence interval based on standard error used to compute p-value.

b: 95 % confidence set based on the Fieller method.

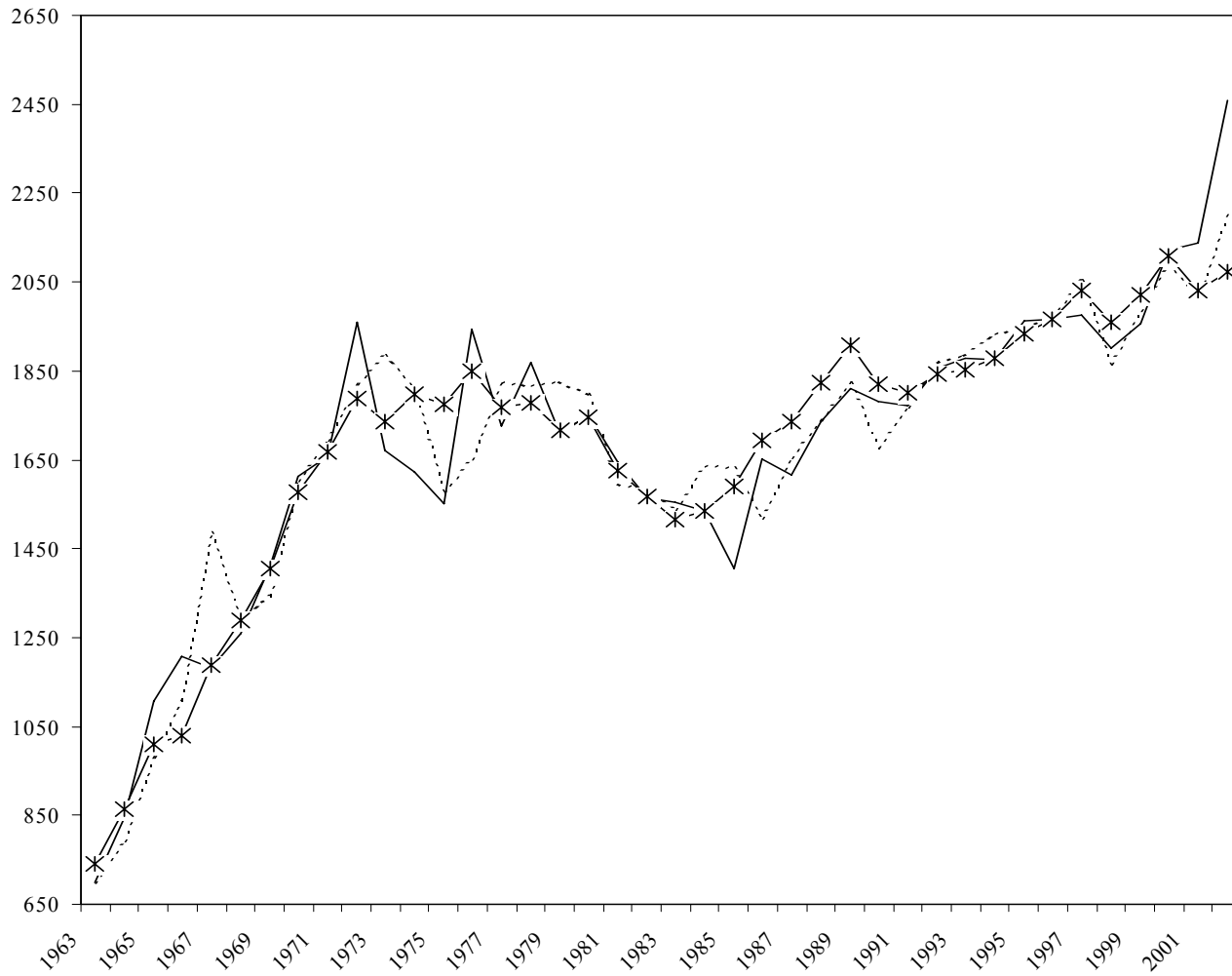
FIGURE 4
TOTAL ENERGY DEMAND
RESIDENTIAL



RMSE, no trend: 12 975.75

RMSE , trend: 9 674.98

FIGURE 5
TOTAL ENERGY DEMAND
COMMERCIAL



—— Real Forecast Trend —*— Forecast no Trend

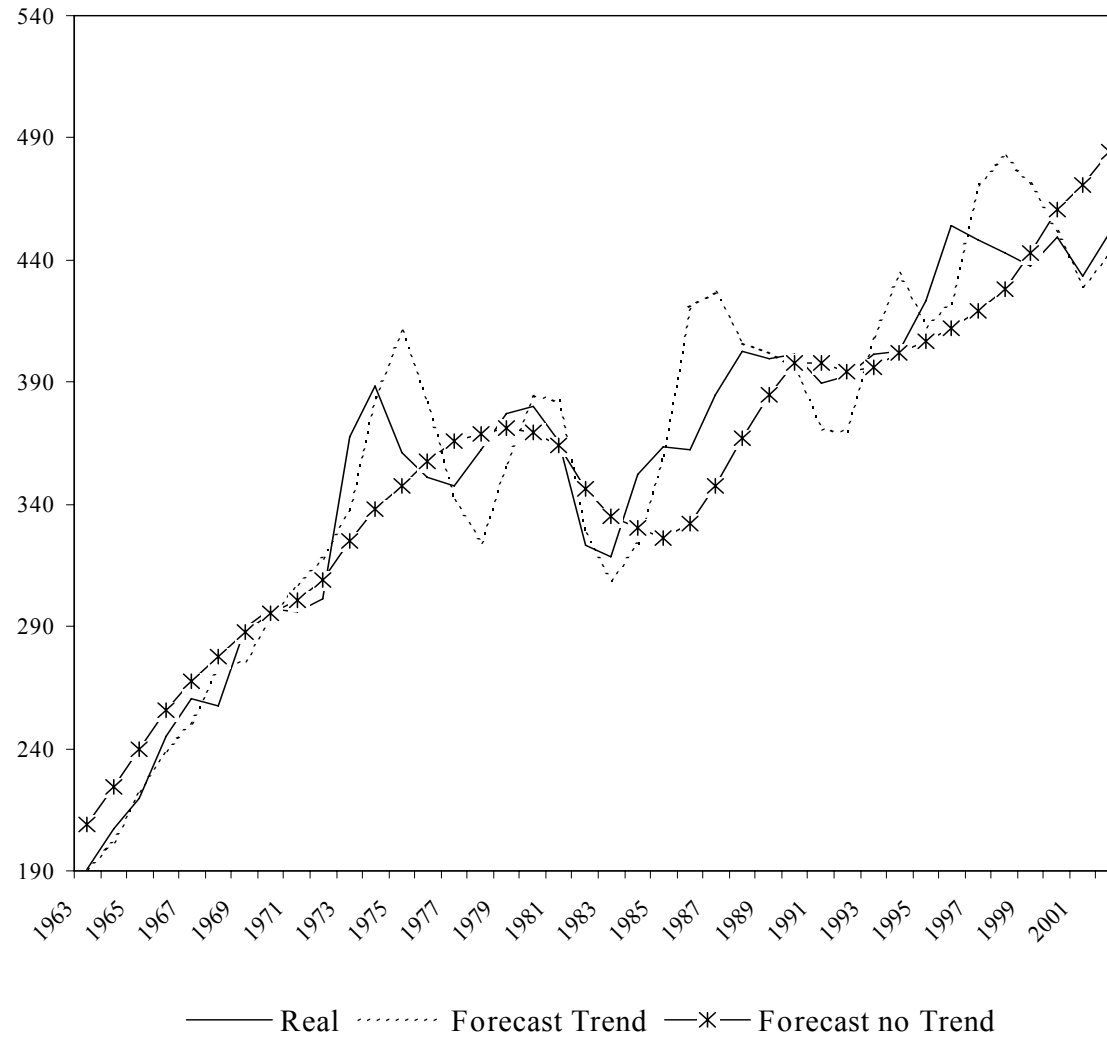
RMSE, no trend: 14 778.07

RMSE, trend: 11 523.87

FIGURE 6

TOTAL ENERGY DEMAND

INDUSTRIAL



RMSE, no trend: 21 919.09

RMSE, trend: 20 452.50

FIGURE 1
TREND LEVEL
RESIDENTIAL



FIGURE 2
TREND LEVEL
COMMERCIAL

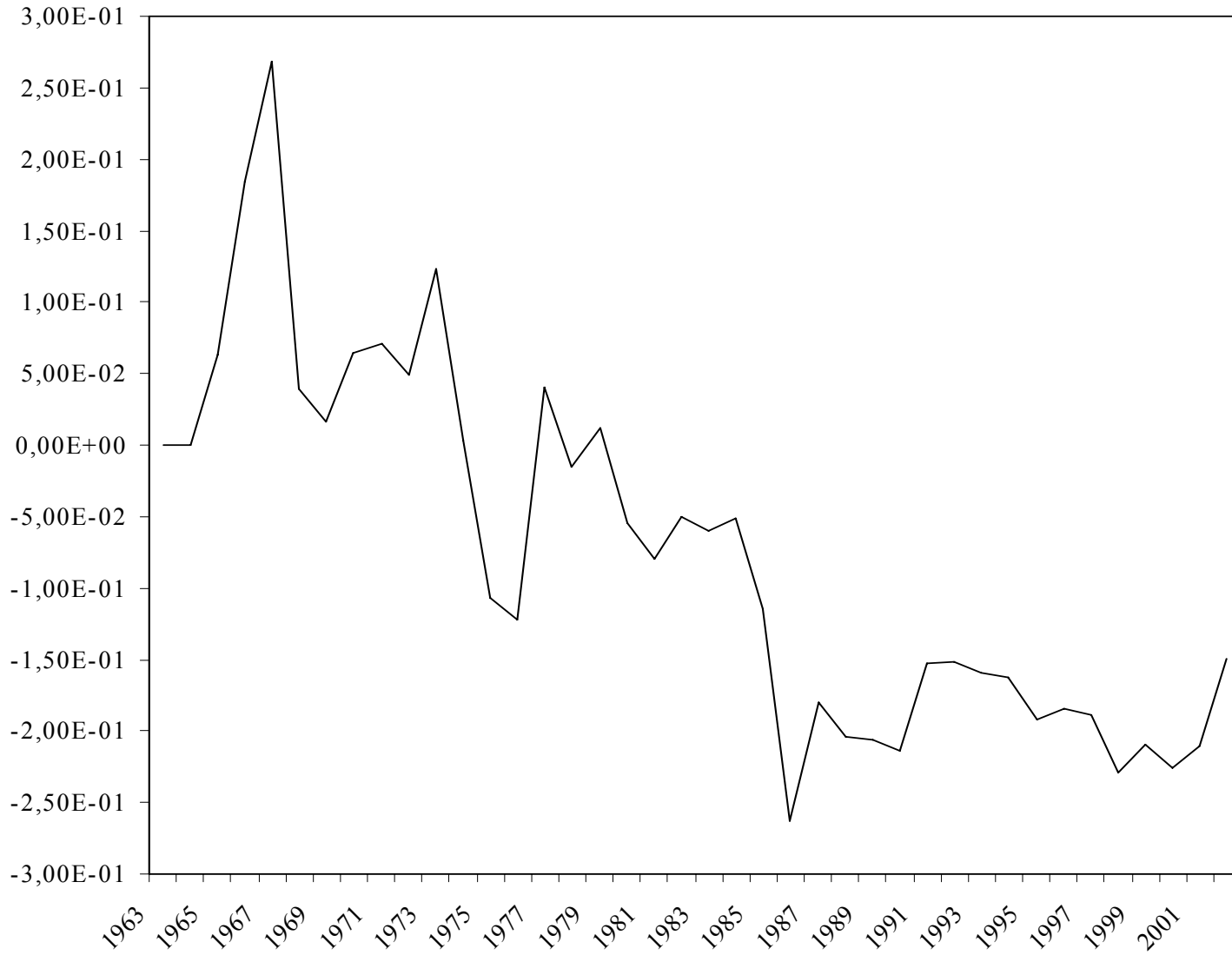


FIGURE 3
TREND LEVEL
INDUSTRIAL

