Econ 366 – Energy Economics

Fall 2012

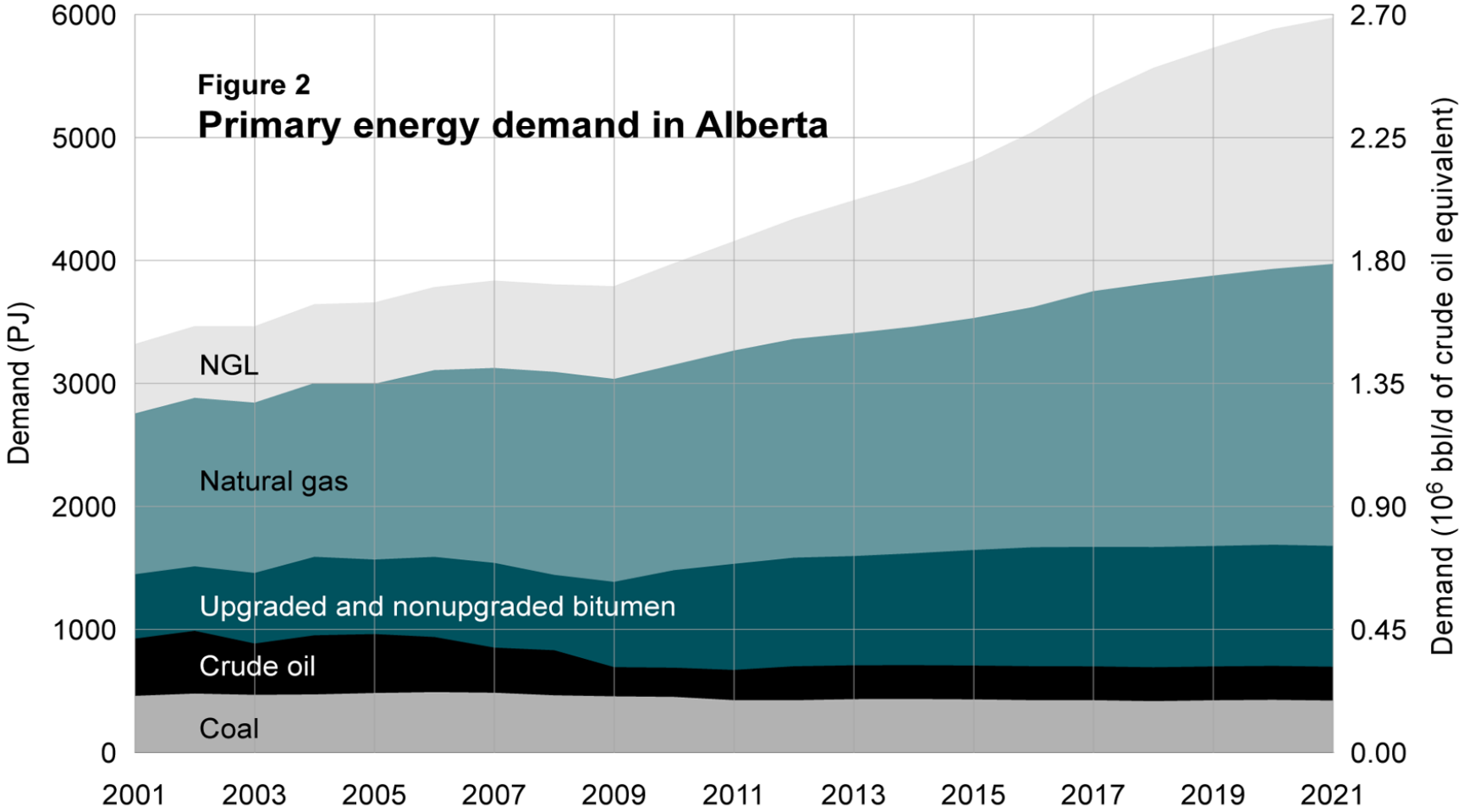
Other Approaches to Demand Analysis

Growth in Consumption

- Descriptive Approaches:

    1. Graphical: plot what has been happening to the quantities consumed over time (possibly projecting into the future)

Detailed Alberta Primary Energy Demand
All sectors by primary fuel type
Source: ERCB st98-2012-overview



Growth in Consumption

- Descriptive Approaches:...
  2. Percentage change calculations from one year to the next:

$$100 \times [Q_t - Q_{t-1}] / Q_{t-1}$$

Example: Growth in the use of energy for residential space heating in Canada from 2007 to 2008

Growth in demand $= 100 \times [920.8_{PJ} - 904.2_{PJ}] / 904.2_{PJ}$

$= 1.84\ \%$

(http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/tablestrends2/res_ca_2_e_4.cfm?attr=0)

Growth in Consumption

- Descriptive Approaches:
  3. Average Annual Growth over a several year period $100 \text{ x} \left[\left(\frac{Q_{T1}}{Q_{T0}} \right)^{1/(T1-T0)} - 1 \right]$

  Example: Growth in the use of energy for residential space heating in Canada from 1998 (752.2PJ) to 2008 (920.8PJ)

  Average Annual Growth in demand = 2.04 %

  (http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/tablestrends2/res_ca_2_e_4.cfm?attr=0)

Elasticity of Energy Demand

- Basic Definition:
  - Percentage change in the amount of energy demanded when a 'determining' variable changes by 1%
  - Calculated as the ratio of the percentage change in quantity demanded to the percentage change in:
- Price of Energy → own-price elasticity
- Price of another good (another energy source, another factor input) → cross-price elasticity
- Income (or economic activity) → income elasticity

Elasticity of Energy Demand

- Demand can be ‘elastic’, ‘unit elastic’ or ‘inelastic’
  - Elastic: a 1% change in “X” leads to a greater than 1% change in demand
  - Inelastic: a 1% change in “X” leads to a less than 1% change in demand
- Own-price elasticities are negative for downward sloping demand curves, but often reported as positive numbers

Calculating Elasticities: Method 1

- If we have data on both variables for 2 years, we can make an elasticity calculation
- Example: Income elasticity of the residential demand for energy to provide space heating
  - Average (real) after-tax family income in 2007 was $58,900. In 2008 it was $59700.
    - source: CANSIM series v1545571
  - Energy quantities were provided in a previous example

Income Elasticity of the Demand for Energy to provide Space Heating

- Percentage change in real income: 1.36%
- Percentage change in energy used for space heating: 1.84%
- Elasticity = (1.84)/(1.36) = 1.35
- Demand is income elastic
- Caveat: Other things besides income have changed!

Re-calculate elasticity taking into account change in # of households

- Number of households in 2007:12,985,000
- Number of households in 2008:13,164,000
- Source: NRCan OEE Residential Sector CanadaTable 20 (Total Households by Building Type and Principal Heating Energy Source)
  http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/tablestrends2/res_ca_20_e_4.cfm?attr=0

→Per household use of energy for heating was _____ in 2007, _____ in 2008

→Elasticity of per household energy for heating with respect to real household after tax income is _____

Calculating Elasticities: Method 2

- If we know the exact form of a demand function (i.e., we have a demand equation), we can use this to calculate elasticities
  - If you are familiar with calculus, you can use simple formulas (provided in class).
  - Otherwise you can use calculated quantity demanded at two different prices (or incomes) and plug these into the usual formula.

Short-run vs long-run elasticities

- In the long run, firms and households make changes to their energy-using capital stocks (appliances, machines, vehicles) in order to alter their energy consumption.
- Empirically, long-run elasticities can be difficult to calculate (since so many other things change across several years ....)

Example from textbook: Table 3.10

- $\ln Q_t = -3.793 - 0.124 \ln(Pt) + 0.652 \ln N(Y_t) + 0.748 \ln(Q_{t-1})$

- Short-run price and income elasticities: -0.124 and 0.652
- Speed of adjustment determined by lagged Q coefficient
- Long-run elasticities: -0.494 and 2.589

Energy Intensity

- Amount of energy used per unit of _____ (depends on the application).
- Sometimes presented in terms of 'energy efficiency' (less energy intense ↔more energy efficient)
- Comparisons are made either across time or across countries / regions.
- Differences may or may not be due to technological improvements or 'better use' of energy. For example, compositional effects; size of underground economy.