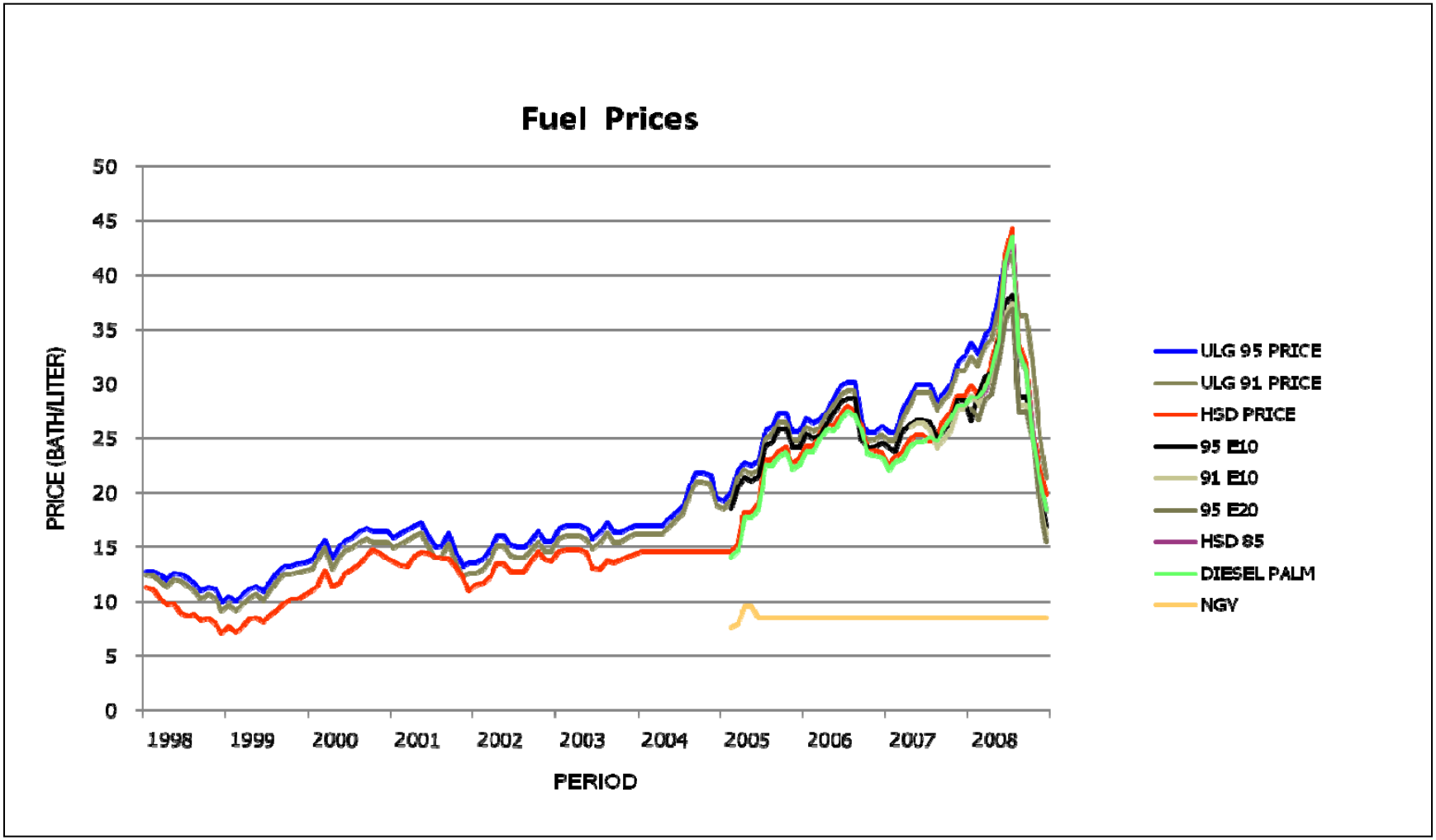
# Transport Demand Elasticity of Bangkok and Nakhon Ratchasima

27 August 2009

# Fuel prices (1998 – 2008)



# Why elasticity is important?

- To understand the sensitivity of gasoline demand to changes in prices and income
  - Impacts of gasoline price change on various transport modes
  - Optimal taxation
  - Price-based policies to climate changes

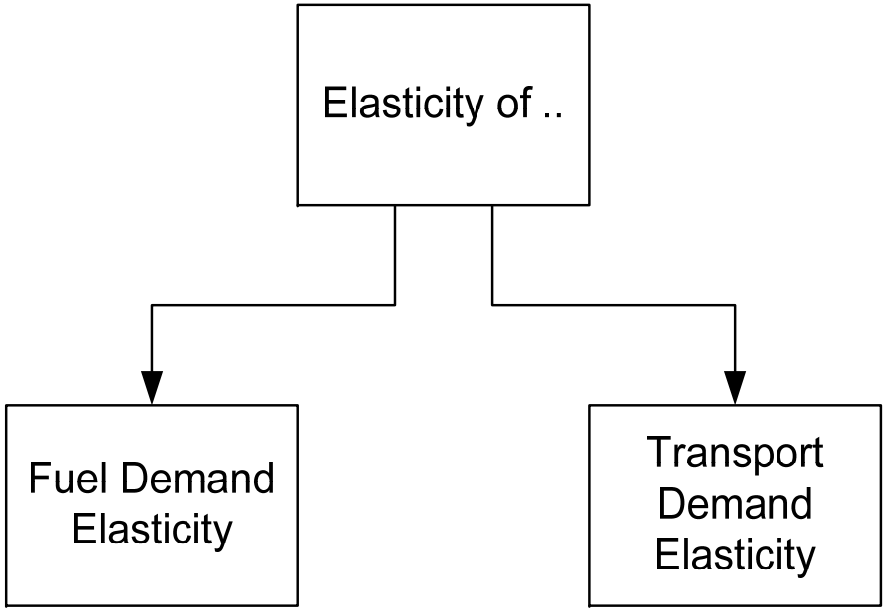
# Demand elasticity

- summarizes the responsiveness of demand to changes in the factors determining the level of demand.

- Describe the change in demand per one unit change in price
  - E.g., price Elasticity of Gasoline Consumption

    = -0.10
  - That is 100 percent increase in gasoline price, the gasoline consumption would reduce by 10 percent

# The Demand Elasticity




**Consumption of**
- ULG+ Gasohol
- LPG + NGV
- Diesel

- Traffic volumes on expressway
- MRTA Ridership
- BTS Ridership
- BMTA Ridership

# The Demand Elasticity

## General Function Form of demand model

$$\ln Y_t = \alpha + \beta lnPG_t + \gamma lnZ_t + \delta lnY_{t-1}$$

Where

$Y_t$= fuel demand or transport demand in period t.

$PG_t$ =average gasoline price in period t.

Zt= Vector of other relevant explanatory variable

$Y_{t-1}$=demand in time period t-1

with this formulation

Short run elasticity = $\beta$

Long run elasticity = $\beta/(1-\delta)$

# Development of Demand Functions

- Multiple regression analysis
- Quarterly data for 10 years from 2541 – 2551 B.E.

  (~ 40 data points)
- Avoidance of multi-collinearity
- Justification of the estimated coefficients

# Independent variables

- Price of ULG95, NGV, LPG, Diesel
- No. of stations supplying NGV, LPG
- GDP, GPP, Population
- No. of registered vehicles, trucks, buses
- Bus fare, BTS Fare, MRTA fare, Expressway toll
- Seasonal factor

# RESULT REGRESSION ANALYSIS OF ULG+GASOHOL CONSUMPTION IN THAILAND

| VARIABLE | Model 1 | | Model 2 | | Model 3 | | Model 4 | | Model 5 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | β | t-stat | β | t-stat | β | t-stat | β | t-stat | β | t-stat |
| Constant | 25.207 | .083 | 27.230** | 4.908 | 12.599** | 12.264 | 12.096** | 22.642 | 10.310** | 7.915 |
| PG95 | -.162 | -1.614 | -.094 | -2.123 | -.058* | -2.127 | -.014 | -.777 | -.134* | -2.272 |
| GDP | -.495* | -2.393 | | | | | | | .206* | 2.129 |
| POP | .464 | .028 | | | | | | | | |
| Gt-1 | -.156 | -.420 | -.149 | -.577 | .389** | 7.478 | .433** | 8.762 | .396** | 7.837 |
| CAR | -.149* | -2.678 | -.182** | -3.485 | .044* | 2.079 | | | | |
| SNGV | .009 | .163 | | | | | | | | |
| SGAS | .022 | .279 | -.008 | -.468 | | | | | | |
| SLPG | .097 | .354 | | | | | | | | |
| Adjusted $R^2$ | .678 | | .512 | | .645 | | .645 | | .674 | |
| F-test | 4.945 | | 4.941 | | 39.182 | | 39.182 | | 29.938 | |
| Conclusion | Method :Enter<br>Correlated among:<br>PG95 and GDP<br>PG95 and POP<br>PG95 and CAR<br>PG95 and SNGV<br>PG95 and SGAS<br>PG95 and SLPG | | Method :Enter<br>Correlated among:<br>PG95 and GDP<br>PG95 and CAR<br>PG95 and SGAS | | Method :Enter<br>Correlated among:<br>PG95 and CAR | | Method :Enter<br>Predictor variable<br>Are Uncorrelated | | Method :Enter<br>Correlated among:<br>PG95 and GDP<br>Best Model | |

* denotes significance at the 0.05 level
* * denotes significance at the 0.01 level

# ULG+GASOHOL CONSUMPTION - THAILAND

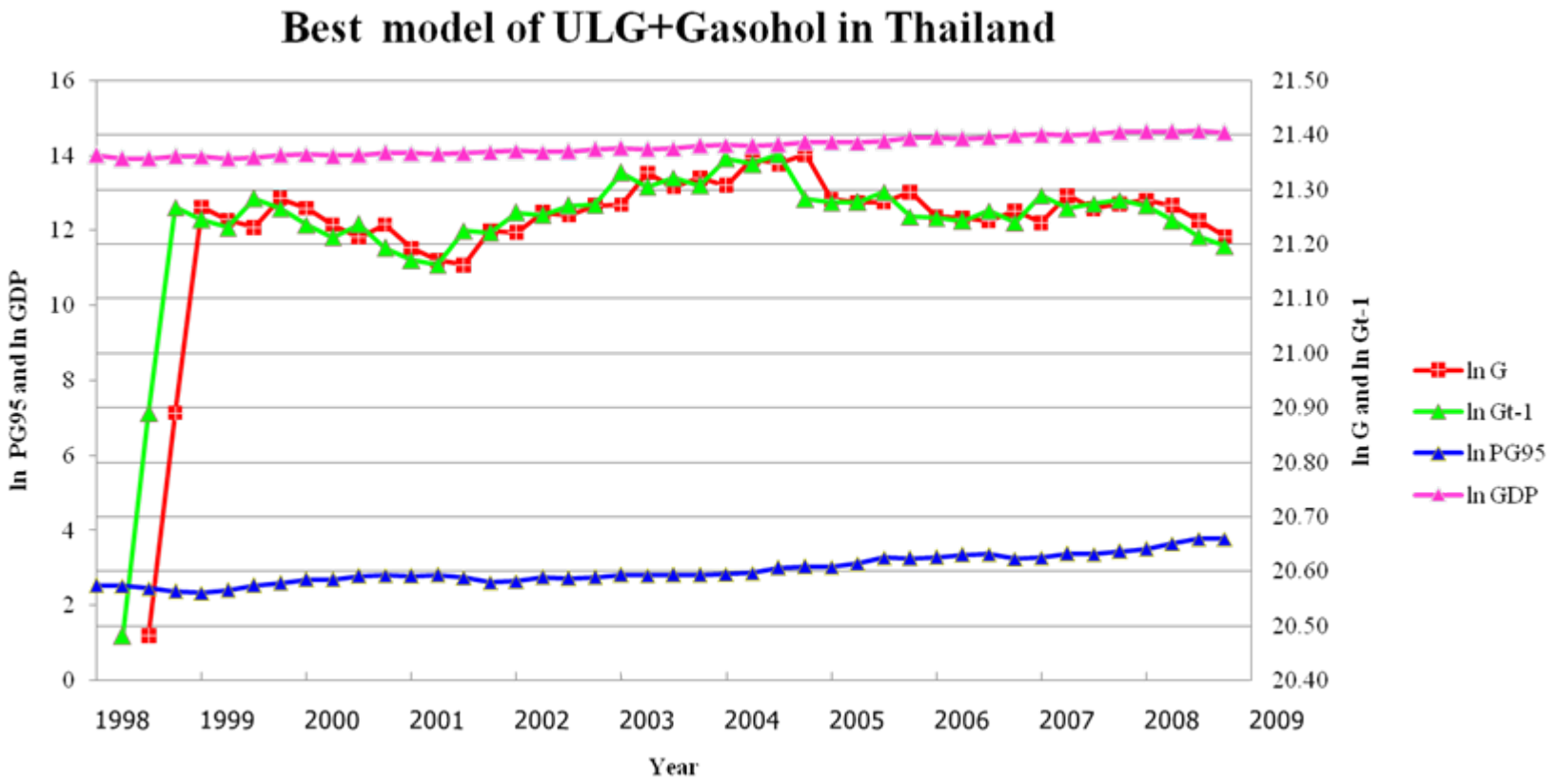
$$Ln(D_t) = 10.310 - 0.134(P_{ULG95,t}) + 0.206Ln(GDP_t) + 0.396Ln(D_{t-1})$$

**Adjusted $R^2$ = 0.674**

**Short-term elasticity = -0.13**

**Long-term elasticity = -0.22**

# RESULT REGRESSION ANALYSIS OF ULG+GASOHOL CONSUMPTION IN THAILAND



# Selected Demand Functions

**ULG+GASOHOL CONSUMPTION - Bangkok**

$$Ln(D_t) = 14.133 - 0.292(P_{ULG95,t}) + 0.332Ln(GDP_t) + 0.050Ln(Vehreg_t) + 0.109Ln(D_{t-1})$$

**Adjusted $R^2$ = 0.870**

**ShtTrm El. = -0.29**

**LngTrm El. = -0.58**

**ULG+GASOHOL CONSUMPTION – Korat**

$$Ln(D_t) = 14.133 - 0.064(P_{ULG95,t}) + 0.420Ln(GDP_t) + 0.538Ln(D_{t-1})$$

**Adjusted $R^2$ = 0.854**

**ShtTrm El. = -0.06**

**LngTrm El. = -0.14**

**LPG + NGV CONSUMPTION - THAILAND**

$$Ln(D_t) = -0.011 + 0.359(P_{ULG95,t}) + 0.956Ln(D_{t-1})$$

**Adjusted $R^2$ = 0.991**

**ShtTrm El. = 0.36**

**LngTrm El. = 8.16**

# Selected Demand Functions

**DIESEL CONSUMPTION - THAILAND** **Adjusted $R^2$ = 0.991**

$$Ln(D_t) = 3.244 - 0.141(P_{DSL,t}) + 0.081Ln(Trkreg_t) + 0.838Ln(D_{t-1})$$

**ShtTrm El. = -0.14**

**LngTrm El. = -0.87**

**DIESEL CONSUMPTION - Bangkok** **Adjusted $R^2$ = 0.871**

$$Ln(D_t) = 0.762 - 0.096(P_{DSL,t}) + 0.095Ln(Trkreg_t) + 0.914Ln(D_{t-1})$$

**ShtTrm El. = -0.10**

**LngTrm El. = -1.12**

**DIESEL CONSUMPTION - Korat** **Adjusted $R^2$ = 0.441**

$$Ln(D_t) = -0.692 - 0.226(P_{DSL,t}) + 0.539(GPP_t) + 0.461Ln(D_{t-1})$$

**ShtTrm El. = -0.23**

**LngTrm El. = -0.42**

# Selected Demand Functions

**TRAFFIC on EXPRESSWAY – Bangkok** **Adjusted $R^2 = 0.941$**

$$Ln(D_t) = 6.369 - 0.043Ln(P_{ULG95,t}) + 0.350Ln(GPP_{GBA,t}) + 0.271Ln(Vehreg_{GBA,t}) + 0.199Ln(D_{t-1})$$

**ShtTrm El. = -0.04**

**LngTrm El. = -0.06**

**BMTA BUS RIDERSHIP – Bangkok** **Adjusted $R^2 = 0.953$**

$$Ln(D_t) = 26.451 + 0.080Ln(P_{ULG95,t}) - 0.928Ln(GPP_{GBA,t}) - 0.019Ln(Vehreg_{GBA,t}) + 0.115(Season) + 0.267Ln(D_{t-1})$$

**ShtTrm El. = 0.08**

**LngTrm El. = 0.11**

# Selected Demand Functions

**MRTA SUBWAY RIDERSHIP – Bangkok** **Adjusted $R^2$ = 0.176**

$$Ln(D_t) = -4.554 + 0.024Ln(P_{ULG95,t}) + 0.912Ln(POP_{GBA,t}) + 0.220Ln(D_{t-1})$$

**ShtTrm El. = 0.02**

**LngTrm El. = 0.03**

**BTS SKYTRAIN RIDERSHIP – Bangkok** **Adjusted $R^2$ = 0.920**

$$Ln(D_t) = 1.364 + 0.048Ln(P_{ULG95,t}) + 1.219Ln(GPP_{GBA,t}) - 0.134Ln(Fare_{BTS,t}) + 0.258Ln(Season)$$

**ShtTrm. El. = 0.05**

**LngTrm El. = N/A**

# Conclusion elasticity

**TABLE SHORT RUN AND LONG RUN ELASICITY OF FUEL CONSUMPTION AND TRANSPORT DEMAND ELASTICITY IN THAILAND.**

| | SHOT RUN | LONG RUN |
|---|---|---|
| 1.ULG &Gasohol Consumption elasticity | -0.13* | -0.22* |
| 2.NGV&LPG Consumption elasticity | 0.36 | 8.16 |
| 3.Diesel Consumption elasticity | -0.14** | -0.87** |
| 4.Traffic on expressway elasticity | -0.04 | -0.06 |
| 5.Bus ridership elasticity | 0.08 | 0.11 |
| 6.MRTA ridership elasticity | 0.02 | 0.03 |
| 7.BTS ridership elasticity | 0.05 | - |

* denotes significance at the 0.05 level
* * denotes significance at the 0.01 level

# Conclusion elasticity

**TABLE SHORT RUN AND LONG RUN ELASICITY OF FUEL CONSUMPTION IN BANGKOK AND NAKHON RATCHASIMA.**

| | SHOT RUN | LONG RUN |
|---|---|---|
| **BANGKOK** | | |
| **1.ULG &Gasohol Consumption elasticity** | **-0.29**** | **-0.58** |
| **2.Diesel Consumption elasticity** | **-0.09** | **-1.12** |
| **NAKHON RATCHASIMA** | | |
| **1.ULG &Gasohol Consumption elasticity** | **-0.06** | **-0.14** |
| **2.Diesel Consumption elasticity** | **-0.23** | **-0.42** |

*** denotes significance at the 0.05 level**
*** * denotes significance at the 0.01 level**

# Compare with other country

**Demand Elasticity of Fuel consumption with respect to fuel price per liter.**

| Country | Short Run | Long Run |
|---|---|---|
| Thailand(2009) | -0.13 | -0.22 |
| Goodwin *et al.*(2004) | -0.25 | -0.64 |
| M. Nagy Eltony ,Gulf Cooperation Council(1996) | -0.11 | -0.17 |
| Goodwin(1992) | -0.27 | -0.73 |

**Demand Elasticity of traffic on expressway with respect to fuel price per liter.**

| Country | Short Run | Long Run |
|---|---|---|
| Thailand(2009) | -0.04 | -0.06 |
| James Odeck,Norway(2008) | -0.56 | -0.82 |
| Anna Metas *et al*.,Spain(2002) | -0.30 | -0.53 |
| Ira Hirschman *et al*.,New York(1995) | -0.09 | -0.5 |

# Compare with other country

**Demand Elasticity of bus ridership with respect to fuel price per liter.**

| Country | Short Run | Long Run |
|---|---|---|
| Thailand(2009) | 0.08 | 0.11 |
| Luk Hepburn ,Australia(1993) | 0.07 | - |
| Storchmann,Germany(2001) | 0.07 | - |
| Jeremy Mattson , U.S. (2008) | 0.12 | - |

# Thank you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