



Causality between energy consumption and economic growth

**Case of Greece
Case of Estonia**

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Importance

**Kyoto Protocol
Copenhagen Climate Summit
Various EU policies (f.e. CO2 reduction)**

**Economic growth vs Environmental policy
Energy policy, energy sources (renewables)**

**Reducing economy's dependency on imported energy
(foreign trade balance, political security)**



Previous studies

Empirical research dates back to 1970s, times of the first energy crisis.

Growing interest again since 2007-2008.

Different theoretical approaches and empirical methodology used give various and often contradictory results.

- n Correlation**
- n Existence of causal relationship**
- n Direction of causal relationship**
- n Degree of causal relationship**
- n Price elasticity of energy demand**



Limitations and problematic issues

No consensus about theoretical framework and suitable methodology!

Different variables:

All energy vs only electricity / oil / gas / renewable sources

Energy measured in energy or monetary units

Comparing GDP, real GDP, GDP per capita, GDP growth, GDP in current or constant prices, industrial output ...

Diverse set of samples (time series, sometimes quite short)

Aggregated energy consumption vs by business sectors

Industrial or household

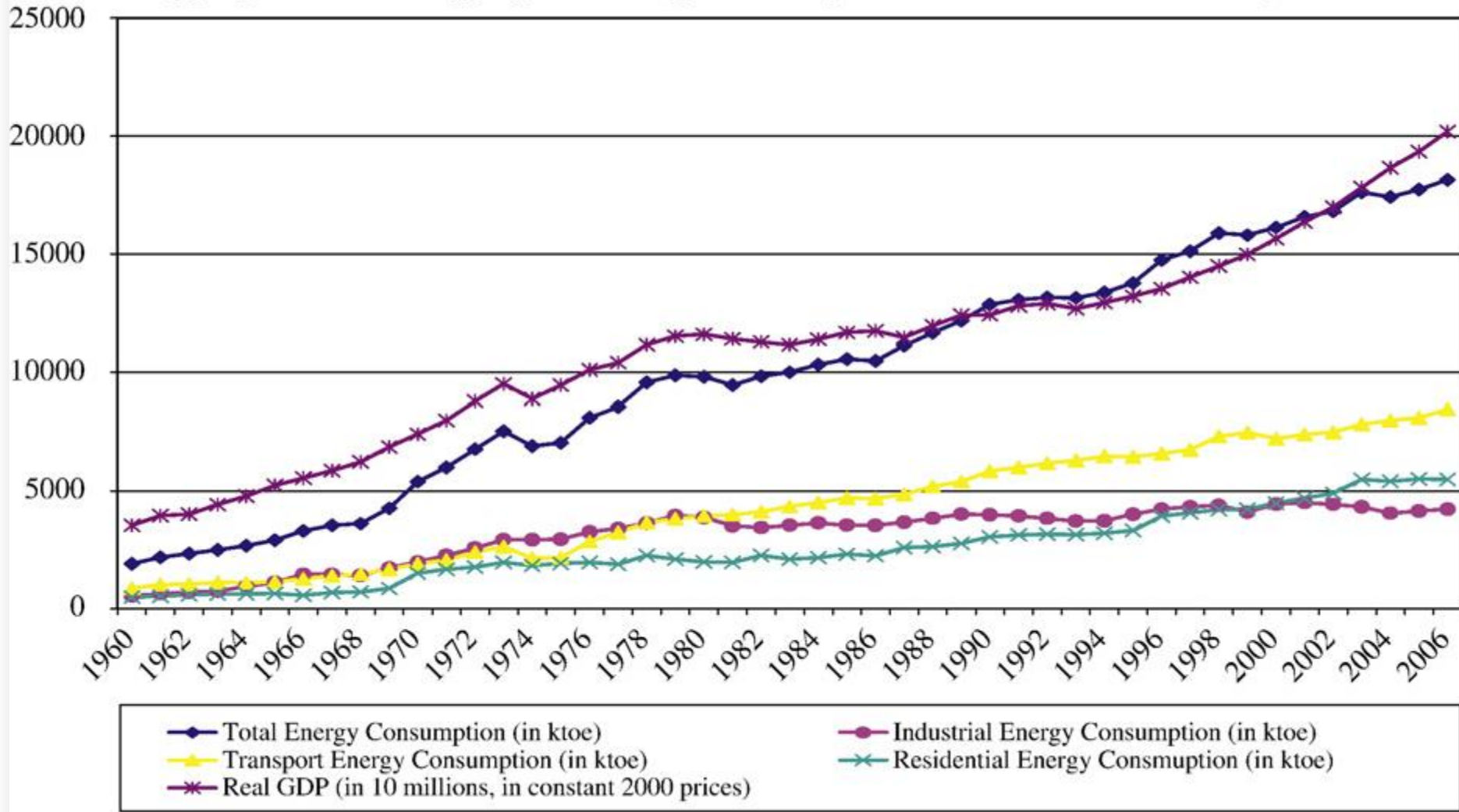
Different econometric approaches

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Case of Greece (1)

Aggregated and disaggregated energy consumption and real GDP in Greece, 1960-2006



According to research made by Stella Z. Tsani (2010)

Methodology: Toda and Yamamoto (1995)



Case of Greece (2)

TOTAL ENERGY CONSUMPTION → REAL GDP

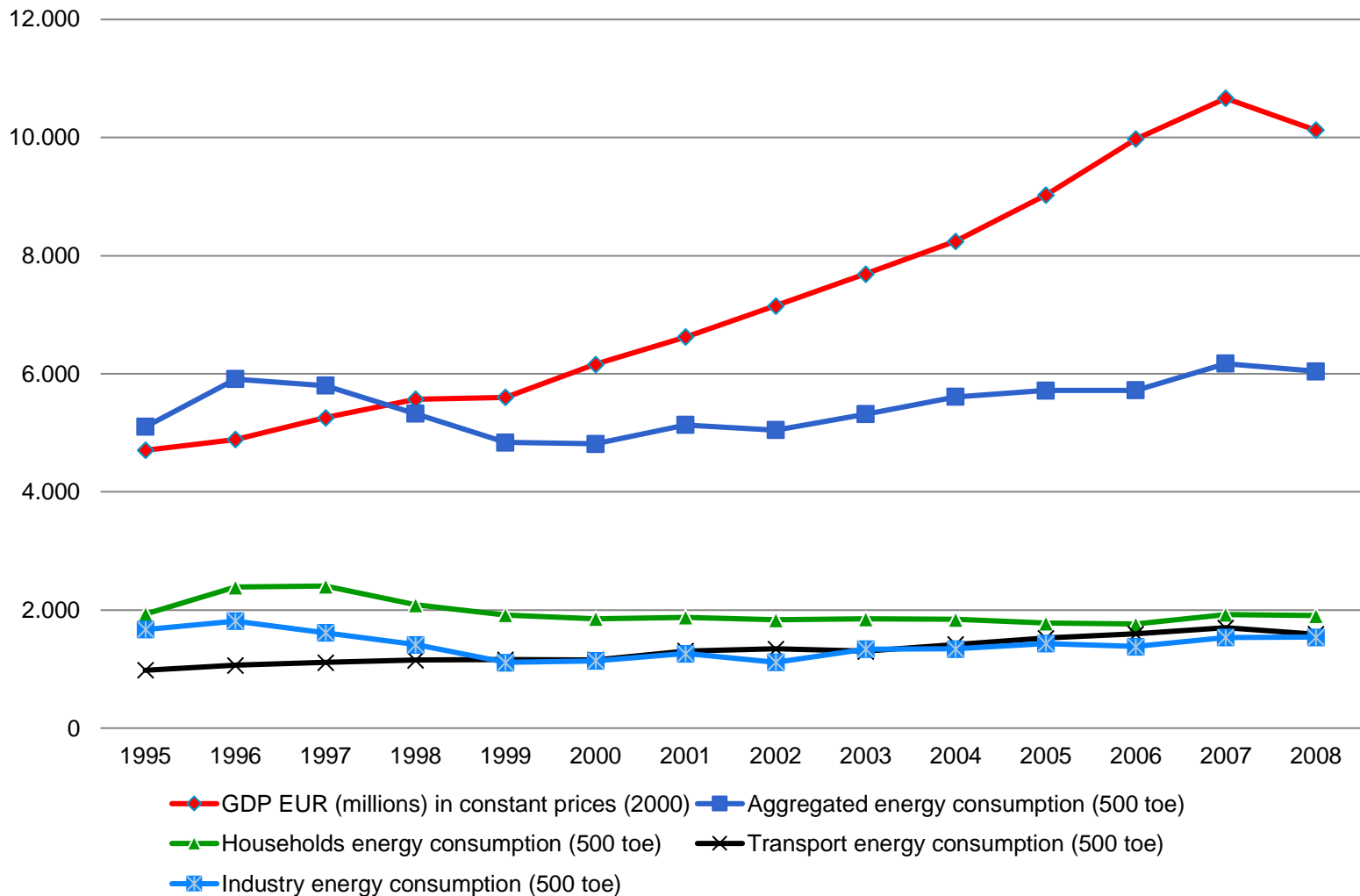
INDUSTRIAL ENERGY CONSUMPTION ↔ REAL GDP

RESIDENTIAL ENERGY CONSUMPTION ↔ REAL GDP

TRANSPORT ENERGY CONSUMPTION - REAL GDP

Case of Estonia (1)

Energy consumption in Estonia and real GDP, 1995-2008



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Case of Estonia (2)

Correlation is overall weaker than in Greece.

Correlation is relatively stronger for industrial and transport sector and for period since 2000.

Causality:

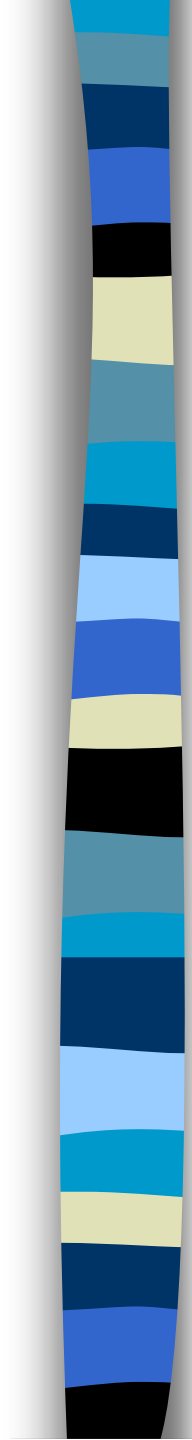
TOTAL ENERGY CONSUMPTION ↔ REAL GDP (2000-2008)

INDUSTRIAL ENERGY CONSUMPTION ↔ REAL GDP

RESIDENTIAL ENERGY CONSUMPTION - REAL GDP

TRANSPORT ENERGY CONSUMPTION - REAL GDP

Possible explanations

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- n **Period of fast economic development and shift from a subcontracting (low cost) towards knowledge-based economy**
 - n **Rising prices of energy (market, excise tax)**
 - n **Increasing availability of energy-efficient technologies**
 - n **Decreasing population (total or per capita studies)**
 - n **Rise of public awareness about energy efficiency (programs, campaigns etc.) and shift in mindset “green consumers” ???**

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Policy implications

In order to address environmental concerns without hindering economic growth, emphasis should be put on the demand side and energy efficiency improvements.

Increasing share of renewable energy sources may give solution to the current dilemma between environmental sustainability and economic growth.

Economy and energetics is going through extensive changes these years and the relationships of the history may not work the same way in changed conditions. Possibility of paradigm shift.



Thank You for your attention!

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