Presentation Outline

Introduction
› Why to estimate the economic impact?

Modelling framework
› Taxonomy and Analysis objectives and s
› Assumptions and key definitions
› Key outputs – results

Case studies
› Greek transport industry and projects

Key conclusions
6 professionals (2+4 professors)
6 PhD candidates
10 MSc – MBA graduates

Research interest on
Transport Economics and project financing
Transport Business, Management and Decision making, (Management, Strategy, B.R.)
Methodological tools (O.R., M.I.S.-D.S.S., Economic Spatial and Big-

DUTH/Economics Department
Decision making and Transport economics laboratory

- Research
  - European Research Frameworks
  - Transport Industry
  - Authorities
  - Institutions, Associations

- Consulting
  - Transport Authorities (Europe, MENA)
  - Transport Industry

- Publications (2013-2016)
  - 20 papers
  - 3 reports
World Transport Infrastructure Investment needs 2009-2030
Investment in transport infrastructures is one of the main preconditions enabling countries to accelerate or sustain the pace of their development and achieve the Millennium Development Goals (MDGs) (*United Nations in 2000*).

Port infrastructures attract a lot of interest because of substantial impacts on communities, economy, and business development. Port infrastructures are crucial infrastructures that boost economic development (*Esfahani & Ramirez, 2003; Phang, 2003; Sanchez-Robles & Shah, 1992; Short & Kopp, 2005; Wang, 2002; WDR, 1994*).

In decision making involved politics, planners, economists, regulators, investors, and, almost, every side of society, (*Guangshe et al., 2003*).

Decision makers consider economic development in project evaluation as a key decision criterion in their long range plans. (*Rod and Gupta 2003*).

The decision may lead from some days to some years depends on definitions on Transport Infrastructure Economic Assessment.
The funding process of the transport infrastructure projects is as a Foreign Direct Investment (FDI) for the national economy, providing new business opportunities, motivation and better performance (Estache 2006, Sahoo and Dash 2009). National, supranational government, private capital and development banks have supported a sharp increase in the magnitude and frequency of infrastructure projects (Soussi H.2005).

Decision makers have associated improvements in the business with greater inflows of FDIs in major infrastructure projects, (World Bank, 2013).

Several investment projects in transit systems have been undertaken with an explicit goal of economic development (Schauer 2000).
The reality of today in increasingly more uncertain times reaffirmed by recent developments associated with the increasingly energy-dependent multidimensional global economic crises.

- The longstanding crisis of world poverty (Hollander, 2003),
- The growing food production crisis (The Observer, 2008a; 2008b),
- The declining availability of global energy resources (Pfeiffer, 2007),
- The climate change induced global warming (Stern, 2007), and
- The global finance liquidity crisis (Porter, 2005).

Major public infrastructure procurement through concession contracts was booming before financial and credit crisis (World Bank, 2013).

The recession increased the demand for concession contracts from governments as it is seen as a way to continue building transport infrastructure.
Key questions in strategic planning and decision making

What will be the ripple effects across the Regional Economic System?

What is the Region Economic Base?

How many jobs will be gained?

How much total Output will be gained?
Economic Impact Assessment Methods

**QUANTITATIVE METHODS**
- Benefit
- Output analysis
- Programming
- Analysis
- Flow
- Process
- Benefit
- Output analysis

**2. QUALITATIVE METHODS**
- SWOT analysis
- Ratios
- Indicators
- Multicriteria analysis

Decision making → Policy making
ECONOMIC IMPACT AND ECONOMIC VALUE ANALYSIS

ECONOMIC IMPACT ANALYSIS

INPUT OUTPUT ANALYSIS

COMPUTABLE GENERAL EQUILIBRIUM

COST BENEFIT ANALYSIS

COST BENEFIT

IO

CGE

CBA
COST BENEFIT ANALYSIS

- Sports clarification of the aim of the Ct; estimate what will happen if the Ct is undertaken, and what will happen if it is not;
- Evaluate whether the proposed project is the best option available;
- Identify whether components of the Ct are the most efficient;
- Evaluate whether the project is financially sustainable; (payback, NPV, Risks);
- Provide an informed view to decision-makers as to whether the project is worthwhile for society.
hodology framework

4 Step analysis

Economic system analysis
- Industry expenditure cycle - financials
- Project lifecycle scenario development

Economy Input and Output
- Direct impact
- Indirect impact
- Induced Impact

Step 1
- Economic framework

Step 2
- Sectors share affected
- Transaction tables per activity

Step 3
- Construction period
- Operation period

Step 4
- Direct impact
- Indirect impact
- Induced Impact
Types of Impact

**DIRECT**
Generated by firms which will construct and operate the transportation infrastructure

**INDIRECT**
Generated by wider supply-chain firms purchasing goods and services from nation-based suppliers, in turn generating output, profits and employment among suppliers

**INDUCED**
Recycling of Euros as a result of spending from direct and indirect

**CATALYTIC IMPACT**

Economic impact
ECONOMIC IMPACT: 2 ANALYSIS FRAMEWORKS

- Based on the measuring the flow of expenditures around the economy
- Analysis by the sectors of economy
- Provide information regarding the distribution of impacts per economic activity

INPUT OUTPUT

- High level of confidence in results
- Models interconnectedness of sectors and market transactions
- No correlation with the price elasticity and changes
- Demand driven

COMPATIBLE GENERAL EQUILIBRIUM

- The complicated to data collection
- Models interconnectedness of sectors, institutions, factors, and market transactions
- Explicitly accounts for price changes
- Maintains explicit supply constraints
ECONOMIC IMPACT ANALYSIS – MULTIPLIERS

Multipliers Concept

Economic Impact measures how a change in income or employment in one sector flows around to all other sectors.

Compare ratio of income from a counterfactual (policy or shock) to current data.

- **Direct**: affect on immediate sector or industry.
- **Indirect**: affect on upstream or downstream sectors from direct sector.
- **Induced**: affect on secondary sectors.

Economic impact can be expressed as a multiplier:

\[ \text{Direct} + \text{Indirect} + \text{Induced} = x \]

Each 1 Euro (or 1%) change in direct sector, the total economic impact increases by x.
Case studies

Airports
- AIA
- Kastelli – Crete inland

Sea ports
- Piraeus
- Thessaloniki

Motorways
- 5 PPPs motorway project in Greece
CASE STUDIES I – IO AIA

Total Economic Impact on Greece

Added Value 5.1 bn euro

63% of Greek GDP

2,987 Jobs

5% Employment of Greece
CASE STUDIES – IO AIA

3% National GDP

Impact on employment

99,987 Jobs

71,791

15,036

13,160

1.95bn

500m

2.65bn

Added Value

Indirect & Induced

Direct

Catalytic

5.1 bn Euro

2.5% employment

3% National GDP

Direct

Indirect & Induced

Catalytic

1.95bn

500m

2.65bn

5.1 bn Euro

2.5%
### Cost Benefit Analysis - New Airport in Crete

Reallocation of a regional tourist airport that has reached its capacity.

<table>
<thead>
<tr>
<th>Airport Infrastructure</th>
<th>Existing Airport</th>
<th>New Airport</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal area (sq. meters)</td>
<td>41,800</td>
<td>70,000</td>
</tr>
<tr>
<td>Number of runways</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Length of runway (meters)</td>
<td>2,680</td>
<td>3,800</td>
</tr>
<tr>
<td>Aircraft capacity</td>
<td>10</td>
<td>44</td>
</tr>
</tbody>
</table>
COST BENEFIT ANALYSIS - NEW AIRPORT IN CRETE

- Identify reallocation of the airport objectives
  - Reduce delays associated with airport Congestion, Improve Airport Efficiency

- Specify assumptions about future demand conditions
  - Projected growth in demand for airport services, changes in facility and capacity

- Identify the Base case
  - With the reallocation and without the reallocation scenario

- Determine the evaluation Period
IO ANALYSIS-NEW AIRPORT IN CRETE

Years of construction

1st year 2nd year 3rd year 4th year

Income (Mio Euro)

Induced Indirect Direct

960 1,690 1,450 1,210
250 450 380 320
800 1,400 1,200 1,000

19.2 33.8 29 24.2
5 9 7.6 6.4
16 28 24 20
IO ANALYSIS-AIR TRANSPORT IN CRETE

- Impact on employment:
  - 58,500 Jobs
  - 3,500
  - 350
  - 220

- Impact on GDP:
  - 4,070 mio Euro GDP Contribution

- Overall employment:
  - 10 %
  - 50,000
  - 5,000
  - Indirect & Induced
  - Catalytic

- Contribution:
  - 4,070 mio Euro GDP
  - 10 %

- 5,000

- Direct

- 3,500

- Indirect & Induced

- Catalytic

- 220

- 3,500
IO ANALYSIS – AIR TRANSPORT IN CYPRUS

Impact on employment

- Direct: 11,500
- Indirect & Induced: 370
- Catalytic: 500
- Overall: 7,000

Impact on GDP

- Catalytic: 2,950

Overall GDP: 3,820 mio Euro

% Overall employment in GDP: 20%

78,800 Jobs
<table>
<thead>
<tr>
<th>Economic sectors with the higher multipliers</th>
<th>Multipliers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Products of agriculture, hunting and related services</td>
<td>1.65</td>
</tr>
<tr>
<td>Petroleum and natural gas; services oil and gas extraction</td>
<td>1.66</td>
</tr>
<tr>
<td>Food products and beverages</td>
<td>1.55</td>
</tr>
<tr>
<td>Coke, refined petroleum products</td>
<td>2.05</td>
</tr>
<tr>
<td>Chemicals, chemical products and man-made fibres</td>
<td>1.75</td>
</tr>
<tr>
<td>Metals</td>
<td>1.55</td>
</tr>
<tr>
<td>Electrical energy, gas, steam and hot water</td>
<td>2.10</td>
</tr>
<tr>
<td>Construction work</td>
<td>1.50</td>
</tr>
<tr>
<td>Wholesale trade, commission trade services, vehicles, motorcycles</td>
<td>2.05</td>
</tr>
<tr>
<td>Hotel and restaurant services</td>
<td>1.85</td>
</tr>
<tr>
<td>Internal – regional transport services (public transports, taxi, etc)</td>
<td>1.55</td>
</tr>
<tr>
<td>and Telecommunication services</td>
<td>1.55</td>
</tr>
<tr>
<td>Real Estate</td>
<td>2.10</td>
</tr>
<tr>
<td>Business services (agents, etc)</td>
<td>2.20</td>
</tr>
</tbody>
</table>
### FINANCIALS

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Revenue</strong></td>
<td>106.8 Mio Euro</td>
<td>56.4 Mio Euro</td>
<td>19.0 Mio Euro</td>
<td>386.5 Mio Euro</td>
</tr>
<tr>
<td><strong>Operating Costs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Costs (except staff costs)</strong> in the “Third party” and Utilities**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Assets</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SALAMIS TRAFFIC**

- Empty Containers
- Transshipments

**TRANSIT**

- Empty Containers
- Transshipments

**CRUISE**

- Empty Containers
- Transshipments

**SARONIC GULF**

- Empty Containers
- Transshipments

**CABOTAGE**

- Empty Containers
- Transshipments
**FINANCIALS (2013)**

- **Revenue**: 51.56 Mio Euro
- **Operating Costs**: 18.4 Mio Euro
- **Costs (except staff costs) in the “Third party” and Utilities**: 8.4 Mio Euro
- **Assets**: 164 Mio Euro

**Graph:**
- **Number of Passengers**
- **Year**

**Data:**
- Empty
### Total Impact Port Thessaloniki

<table>
<thead>
<tr>
<th></th>
<th>Direct</th>
<th>Indirect</th>
<th>Induced</th>
<th>Catalytic</th>
<th>Total Impact</th>
<th>%Regional</th>
<th>%Greece</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employees</td>
<td>627</td>
<td>547</td>
<td>547</td>
<td>1174</td>
<td>2348</td>
<td>0.92%</td>
<td>0.07%</td>
</tr>
<tr>
<td>-</td>
<td>26.7 Mio €</td>
<td>12.7 Mio €</td>
<td>12.7 Mio €</td>
<td>39 Mio €</td>
<td>78 Mio €</td>
<td>GDP 0.45%</td>
<td>GDP 0.05%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Values</strong></td>
<td>0.92%</td>
<td>0.07%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 1: Multiplier Values

<table>
<thead>
<tr>
<th></th>
<th>(TYPE I MULTIPLIER)</th>
<th></th>
<th>(TYPE II MULTIPLIER)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOTAL-INDUCED</strong></td>
<td>1.174</td>
<td><strong>TOTAL-INDUCED/DIRECT EFFECTS</strong></td>
<td>2.15</td>
</tr>
<tr>
<td><strong>TOTAL/DIRECT</strong></td>
<td>4.29</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NO INDUCED EFFECTS</strong></td>
<td>2.15</td>
<td><strong>ALL INDUCED EFFECTS</strong></td>
<td>4.29</td>
</tr>
<tr>
<td><strong>EMPLOYEES</strong></td>
<td>925</td>
<td><strong>EMPLOYEES</strong></td>
<td>1.850</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>(TYPE I MULTIPLIER)</th>
<th></th>
<th>(TYPE II MULTIPLIER)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOTAL-INDUCED</strong></td>
<td>38928825.7</td>
<td><strong>TOTAL-INDUCED/DIRECT EFFECTS</strong></td>
<td>1.45</td>
</tr>
<tr>
<td><strong>TOTAL/DIRECT</strong></td>
<td>2.91</td>
<td><strong>ALL INDUCED EFFECTS</strong></td>
<td></td>
</tr>
<tr>
<td><strong>NO INDUCED EFFECTS</strong></td>
<td>1.45</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Final Impact Port Piraeus

<table>
<thead>
<tr>
<th></th>
<th>Direct</th>
<th>Indirect</th>
<th>Induced</th>
<th>Catalytic</th>
<th>Total Impact</th>
<th>%Regional</th>
<th>% Greece</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.096</td>
<td>5.913</td>
<td>8.009</td>
<td>497.167</td>
<td>513.185</td>
<td>17.5%</td>
<td>12.3%</td>
</tr>
<tr>
<td>Added Value</td>
<td>101 Mio€</td>
<td>132 Mio €</td>
<td>232 Mio €</td>
<td>3.590 Mio €</td>
<td>4.055 Mio €</td>
<td>GDP 4.3%</td>
<td>GDP 2.2%</td>
</tr>
<tr>
<td>Regional GDP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>GVA 4.6%</td>
<td>GVA 2.6%</td>
</tr>
<tr>
<td>Greek GDP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Multiplier Types

<table>
<thead>
<tr>
<th></th>
<th>(TYPE I MULTIPLIER)</th>
<th>(TYPE II MULTIPLIER)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL-INDUCED</td>
<td>TOTAL-INDUCED/DIRECT EFFECTS</td>
<td>TOTAL/DIRECT</td>
</tr>
<tr>
<td></td>
<td>232 Mio €</td>
<td>1.76</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.53</td>
</tr>
<tr>
<td>NO INDUCED EFFECTS</td>
<td>INCOME</td>
<td>ALL INDUCED EFFECTS</td>
</tr>
<tr>
<td></td>
<td>122 Mio €</td>
<td>244 Mio €</td>
</tr>
</tbody>
</table>
Motorways are part of the priority of the TEN-T network, which connects Greece to the rest of the EU.

### Motorways Project

<table>
<thead>
<tr>
<th></th>
<th>Cost (billion €)</th>
<th>Length to be constructed</th>
<th>Length to be upgraded</th>
<th>Length to be operated</th>
</tr>
</thead>
<tbody>
<tr>
<td>ODOS</td>
<td>1.00</td>
<td>196</td>
<td>172</td>
<td>360</td>
</tr>
<tr>
<td>AN MOTORWAY</td>
<td>0.95</td>
<td>25</td>
<td>205</td>
<td>230</td>
</tr>
<tr>
<td>PIA ODOS</td>
<td>1.40</td>
<td>284</td>
<td>82</td>
<td>366</td>
</tr>
<tr>
<td>AL GREECE MOTORWAY (E65)</td>
<td>1.37</td>
<td>175</td>
<td>-</td>
<td>232</td>
</tr>
</tbody>
</table>
### Employment (in full-time equivalent jobs)

<table>
<thead>
<tr>
<th>Year</th>
<th>Construction period-T1</th>
<th>Operation period -T2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase I</td>
<td>3,400</td>
<td>1,000</td>
</tr>
<tr>
<td>Phase II</td>
<td>13,600</td>
<td>1,000</td>
</tr>
<tr>
<td>Phase III</td>
<td>17,000</td>
<td>1,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Direct impacts</th>
<th>Total Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase I</td>
<td>68.0</td>
<td>226.0</td>
</tr>
<tr>
<td>Phase II</td>
<td>279.9</td>
<td>930.2</td>
</tr>
<tr>
<td>Phase III</td>
<td>362.8</td>
<td>1205.7</td>
</tr>
</tbody>
</table>

### Income (in million €)

<table>
<thead>
<tr>
<th>Year</th>
<th>Direct impacts</th>
<th>Total Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase I</td>
<td>68.0</td>
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<td>362.8</td>
<td>1205.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Direct impacts</th>
<th>Total Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>t=1</td>
<td>1,000</td>
<td>13,200</td>
</tr>
<tr>
<td>t=2</td>
<td>1,000</td>
<td>18,200</td>
</tr>
<tr>
<td>t=3</td>
<td>1,000</td>
<td>23,200</td>
</tr>
</tbody>
</table>
NARIOS AND MODELLING

scenarios and Modelling Assumptions

TOTAL IMPACT ASSESSMENT (T1 & T2)
CONCLUDING REMARKS

The analysis framework depends on the research objective:

- BA – Project financing
- GE – Business productivity into regional/national economy model
- IO – Socioeconomic impact assessment

Support decisions on tourist regions as “demand accommodators” deals

- New investments – Infrastructure expansion projects (CBA)
- Productivity and competition for a sector of economy - Tourism and transport (CGE)
- Estimate socioeconomic impact – Jobs and Income (IO)

Most of the cases need a combination of methods to determine effects and define relationship.
OKI NHG AHEAD

KING NHG AHEAD

- Research
  - Welfare and Social return
  - Adjusting modelling assumptions
- Research community
  - Compare with other cases
  - Compare to other investments
- Professional bodies
  - Feeding strategic plans
  - Inform market and investors
Estimating the economic impact of transports

Please, feel free for any question...

For more details
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