Competition by Comparison and Benchmarking Analysis in Transport Regulation

Goals and First Applications by ART

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What is yardstick competition?

- One of the main goals of regulatory intervention is to promote firm efficiency and productivity
- Should the regulator succeed in this, regulated firms would operate at the lowest costs and consumers would benefit from cheaper services
- Competitive environment is the *ad hoc* scenario to incentivize firms' effort to raise efficiency
- *Problem*: in utilities, competition *in* the market is very limited (to specific segment of an industry; e.g. Telecoms and energy). Other forms of competition (*for* the market) may take time to be realized.
- Any potential solution?
- **Competition by comparison** (or **yardstick competition**) stimulates regulated firms to undertake competitive behaviours even in the case of markets where actual competition is hindered (Baumol, 1997).

Goals of yardstick competition/1

- Yardstick competition (or regulatory benchmarking) can be applied when different regulated firms operates in the same industry:
  - Peculiar case in the transport industry (in Italy but not only):
    - Motorway concessionaries;
    - regional train companies;
    - airport operators;
    - local public transport firms.
  - But not only! Similar situation in energy (gas and electricity distribution), water and waste management industries.
- The main idea is to use the information collected from *all* firms to regulate a company by comparing its performance with the whole market.

Essential instrument to reduce the degree of asymmetric information between the regulated firms and the regulator.

Goals of yardstick competition/2

- In more details, yardstick competition has several goals:
  - *the acquisition of relevant information by the public decision-makers*, especially when "cost-of-service" regulation is in place and services are subsidized;
  - *the definition of the optimal dimension of a service area*, i.e. the analysis of the economies of scale achievable in the provision of the service;
  - the definition of *incentive targets for increasing productive efficiency* of the regulated firm;
  - *the analysis of the productivity change*s over time and across regulated firms.
- These goals can be reached through a benchmarking covering:
  - Companies operating in the same industry within a single country (national benchmarking);
  - Companies operating in the same industry but in different countries (international benchmarking).

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The implementation of yardstick competition

- Firms may face substantial differences with respect to:
  - geographic location where they operate,
  - the demographic, economic and social characteristics of their reference markets (e.g. in terms of households density, infrastructures development and so on),
  - the political and regulatory institutions,

  that may directly or indirectly influence the performance (e.g. total costs) of the business activity (especially in case of international benchmarking).

- Fundamental issue: how to deal with firm's heterogeneity?
  - The institutional, geographic or structural features need to be accounted for in the analysis of the regulated firm's performance.
  - It is Essential to analyse such "external" factors and consider them in the estimation procedures.

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First application by ART: motorway concessionaries

- Decision no. 70/2016 aimed at determining the optimal dimension of Italian motorway concessionaries
- Various models were developed to estimate the cost function of motorway concessionaires following the most recent economic literature.
- By applying different methodologies (stochastic frontier and regression analysis) and considering different type of cost functions (Cobb-Douglas and Translog), the purpose is to determine the key factors that best explain the determinants of the production costs for small- and medium-large motorway concessionaires.

Methodology: cost function

- The estimated cost function is the following:

$$C = f(V, LKm, P_i, H)$$

- V is the total number of km travelled (output), LKm is the lenght in KM of a motorway concessionary, P_i are the prices for the acquisition of production factors (labor, capital, maintenance, others) and H are additional firm-level and other structural control variables.

- Different cost components (C):
  a) Operating expenditures (labor, third-party services and other costs)
  b) Maintenance costs
  c) Amortization
  d) Financial expenses

- Hence *total cost* is the sum of all components, while the sum of a) and b) are the *total variable costs*

Methodoloy: variables definition/1

– Input prices (P_i):

*Labor price - **PL*** = Labor costs/Average number of employees

*Maintenance price - **PM***= Maintenance costs/ Number of km travelled

*Other service price - **PS*** = Cost for third partyservices +other costs/Network Lenght

*Capital price - **PK*** = (Amortization + financial expenses) / Network Lenght

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Methodoloy: variables definition/2

– Control variables *(H):*

Structural control

- ***Stoneworks /Km*** = Lenght of viaducts, bridges, tunnels in Km/ Network Lenght
- ***High lanes/Km*** = (3-lanes and 4 lanes km) / Network Lenght
- ***Quality*** = IPAV index – quality pavement indicator

Firm-level control

- ***Residual period/lenght of concession*** = Years at the end of the concession/Lenght of the concession in year
- ***Debt/Equity***= Debt to Equity ratio
- ***Group dummies*** = Dummy for controlling for large groups (SIAS, Atlantia, others)
- ***Tariff dummies*** = Dummy for controlling for the specific regulatory scheme (i = 1, …, 6)

Time and firm dummies

Methodology: the econometric models/2

- Functional forms:

***Cobb-Douglas**:*

$$lnC = cost + \alpha_1 \, ln \, V + \alpha_2 \, ln \, LKm + \ldots + \varepsilon$$

***Translog** (example):*

$$lnC = cost + \alpha_1 \, ln \, V + \alpha_2 \, ln \, LKm + \beta_1 \, (ln \, V)^2 + \beta_2 \, (ln \, LKm)^2 + \gamma_{12} \, ln \, V \, ln \, LKm + \ldots. + \varepsilon$$

- **Cost**: Total cost (opex + capex)
- **Methods**: *Stochastic frontier analysis* (with time invariant and time varying decay; wth constraints) and *fixed effects regression* (with constraints)
- **Data**: 23 concessionaries from 2005 to 2014 collected through a dedicated questionnaire developed by ART and filled in by the companies

Methodology: economies of scale

- We adopt the approach by Caves, Christensen e Tretheway (1984, *RAND*);

- The degree of economy of scale is determined by the following ratio (for a Cobb-Douglas functional form):

$$ES = 1/(\alpha_1 + \alpha_2)$$

Traffic volume coefficient (α_1)

Lenght of network coefficient (α_2)

- There exists economy of scale if ES > 1 and diseconomy of scale if ES < 1

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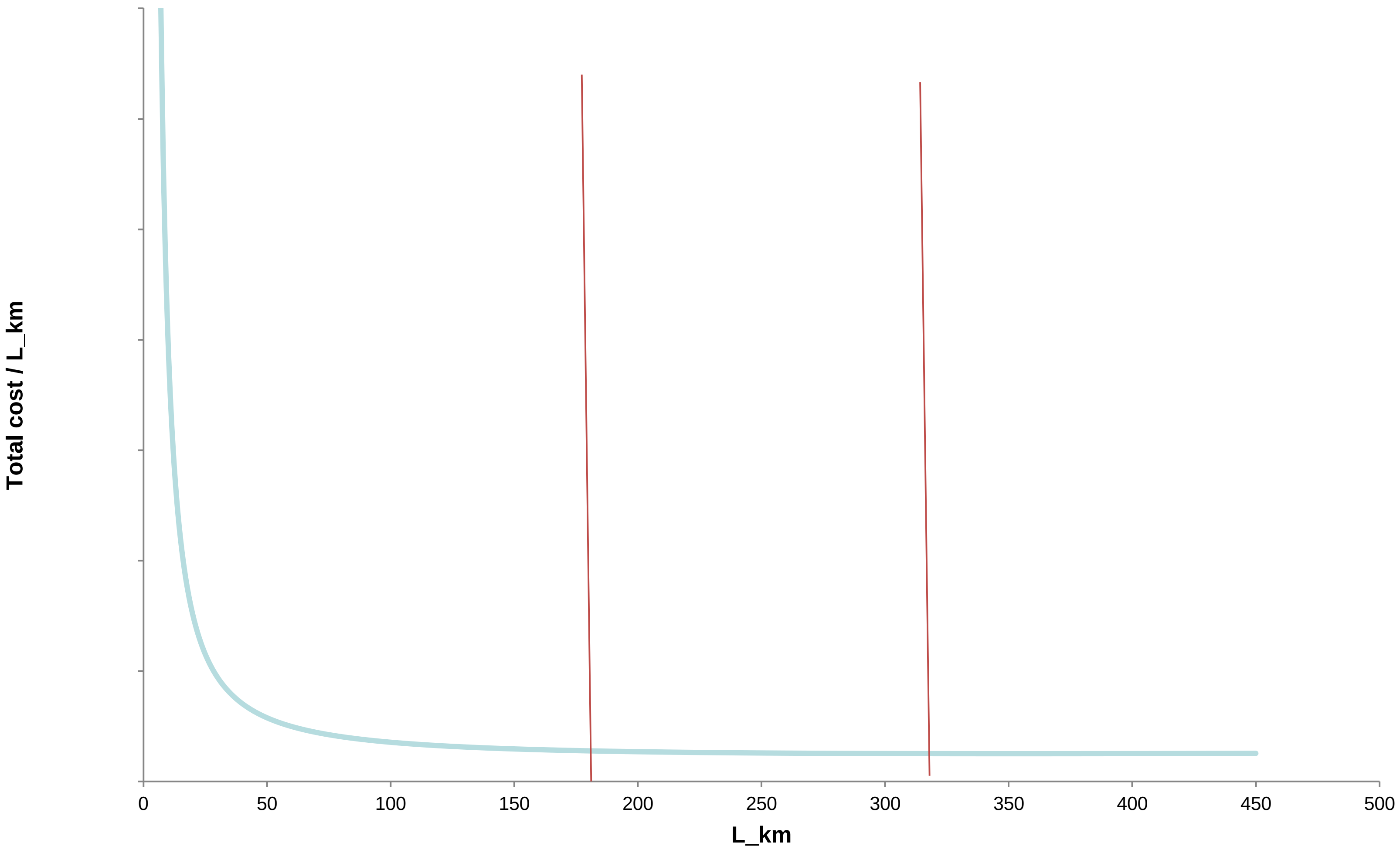
Average *efficient* cost in Italian Highways



Main results

- Irrespective of the method used (frontier or fixed effect estimates), the value of 180 km (corresponding to the 75th percentile of distribution in the sample examined) results to be the minimum threshold value for the optimal length (km) of the motorway infrastructure subject to a concession.

- The maximum threshold, despite varying according to model and sample used, was estimated at approximately 315 km

- For lengths exceeding 315 km no additional efficiency gains related to industrial and structural aspects of motorway concessionaires seem to be generated.

Second (on going) application: Regional Railway transport service

- Decision no. 69 of 18 May 2017
- A proceeding was started to identify methods and criteria for defining efficiency objectives for the operation of regional rail passenger services subject to public service obligations
- End of the proceeding: March 2018 (expected)

Benchmarking in Railway transport

Author	*Data*	*Dependent variable*	*Output*	*Input*	*Environmental or context variables*	*Functional form*
Leveque (2004)	*22 Regions 1997-1998*	*Operating costs*	*Total train-km*	• *- Length (km) of regional network* • *- Price of inputs (assumed as constant and therefore not included)*	• *- Delinquency rate* • *- Average load factor* • *- Train average speed* • *- # rolling stock*	*Cobb-Douglas*
Farsi, Filippini, Greene (2005)	*50 operators 1985-1997*	*Total costs*	*passenger-km* *ton-km*	- *Price of labour: labour cost / # of total employees* - *energy price: energy cost/power consumption (kWh)* - *Cost of capital (total costs - labour costs - energy costs) / total number of seats offered* •	• *- Network length (Km)* • *- Time dummies*	*Cobb-Douglas*
Wheat & Smith (2015)	*28 operators 2000-2010*	*Total costs – charge costs*	• *- length (km) of lines* • *- total train hours* • *- # stations served*	- *Price of labour: labour cost / # of total employees* - *Non-payroll price: (Rental costs of rolling stock, maintenance costs, energy costs and other costs)/ # rolling stock*	• *- Train average length: vehicles-km/train-km* • *- Average speed (train-km/train hours)* • *- Load factor: passenger-km/train-km* • *- # operated rolling stock* • *- # operated stations* • *- Dummy for Intercity TOC* • *- Dummy for trains operating in London & South Eastern*	*Translog (with hedonic variables)*
Boitani (2016)	*29 service agreements 2014*	*Total costs*	• *- Seat-km* • *- Train-km*	• *- Price of inputs (assumed as constant and therefore not included)* • *- Commercial speed*	• *- Train service productivity = train-km/number of trains used* • *- Hours of operation* • *- Seats per travel*	*Cobb-Douglas*
Thiebaud (2016)	*20 regions 2009-2012*	*Net costs = total costs – revenue from charges = fees payable under the Agreement*	*Vehicles-total km*	• *- Load factor* • *- Price of inputs (assumed as constant and therefore not included)*	• *- average # of stopping points per line;* • *- Network complexity/existence of important nodes* • *- # stations per area served* • *- # stations per network length* • *- # remaining years to end of concession*	*Cobb-Douglas*

Conclusions

- Powerful instrument to reduce regulator’s asymmetric information on firms’ cost by comparing the performance of firms operating in the same industry
- Potential application to *all* transport sectors
- Fundamental to account for differences across companies and/or across areas where companies operate
- To this aim, it is important to get inspired by the specialized economic literature, that can provide useful insights and ideas to implement regulatory benchmarking in practice