Investment in Transport Infrastructure, Regulation, and Gas-gas Competition

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Problem

- Role of imports in the context of the liberalization of natural gas markets

- Investment in transport capacity should have an impact on regional market power and efficiency of alternative control instruments

Institutional context – EU

- Industry features
  - High concentration
  - Dependency on foreign supplies

- Structural reforms
  - Promotion of "gas-to-gas" competition
  - Network expansion

- Role of transport capacity
  - Anticipate growth of demand

  - Affect market structure

Literature

- Electricity
  - Regulatory perspective (Nasser, 1998)
    - Importance of institutions to obtain "optimal" network expansion
    - Identification of the substitution and strategic effect of transmission capacity
  - Competitive strategies in deregulated markets (Borenstein et al., 2000)
    - Highlights the relationship between transmission and market equilibrium

- Natural Gas
  - Empirical work on access pricing in the US (Doane and Spulber, 1994)
    - Impact of network interconnection on the degree of market integration
  - Simulation work on successive oligopolies in the EU (Boots et al, 2004)
    - Price distortion due to market power, mainly in the trading segment

Capacity expansion as a policy instrument for promoting competition

However, short-term analysis does not really leave room for capacity expansion decisions..

Closer to this work

- Natural Gas (Cremer and Laffont, 2002, Cremer, Gasmi, and Laffont, 2003)
  - - Impact of local market power on network size when transport capacity is the only control instrument
  - - "Excess" capacity to mitigate monopoly power

- Electricity (Smeers and Wei, 1999)
  - - Oligopoly with generators competing à la Cournot and regulated transmission prices"Excess" capacity to mitigate monopoly power

Objective

- Analyze some policies, including imports, to be implemented by a social planner concerned by the exercise of regional market power

- When the social planner cannot directly control transport capacity, analyze the role of transport regulation under imperfect competition in the gas commodity market

Determinant factors

- Available control instruments
- Cost structure (technology)
- Cost of public funds
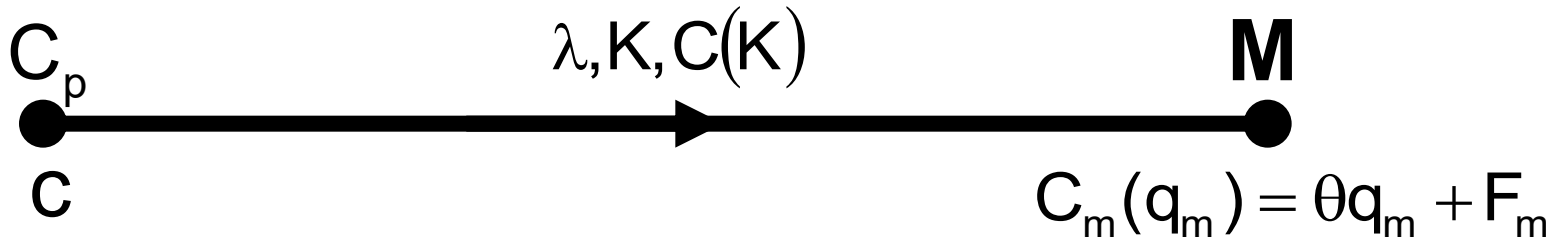- Market structure
- Information structure

Step 1

Controlling regional monopolies in the natural gas industry – The complete information case

- Objectives:

  - Study a sample of fiscal-, pricing-, and investment-type policies when regional market power is of concern.
  - Analyze the degree of substitutability among control instruments

Model

$$C_p \quad\quad\quad \lambda,K,C(K) \quad\quad\quad M$$

$$C \quad\quad\quad C_m(q_m) = \theta q_m + F_m$$

- Assumptions:
  - Cost gap (zero or positive)
  - Decreasing returns in capacity building
  - Fixed cost to the regional firm
  - Positive social cost of public funds
  - Complete information

- Agents:
  - Benevolent social planner
    - Program:
      Maximize W in market M under appropriate constraints (IR and incumbent active)

    - Control Instruments:
      - Transport capacity : K
      - Price (output) : p_M
      - Transfers : T
  - Consumption in monopoly market M

Role of transport capacity

- Building K has two effects on efficiency
  - Productive inefficiency (cost gap)
  - Allocative inefficiency   (regional market power)

- Liberalization should lessen intervention → reduce the set of available instruments to the social planner
  - One would expect the planner to intensively rely on the remaining instruments to fight market power

Removing T and p_M should require a strictly higher level of transport capacity ("excess" capacity)

Analysis design

- Three control schemes:
  - Scheme A: $\{K, p_M, T\}$
  - Scheme B: $\{K, p_M\}$
  - Scheme C: $\{K\}$

- Study the consequences, in terms of transport capacity, of removing control instruments

- Explore the issue of the need of "excess" capacity when public funds are costly

- Characterize the conditions that necessitate "over" ("under")-sizing of the transport network

Social planner's incentives to invest in infrastructure in an increasingly deregulated environment

Conclusion

- Transfers and capacity substitutes to fight market power

- Social value of capacity depends on efficiency gap and shadow cost of regional monopoly profit maximization constraint

Step 2

Incentive regulation of regional monopolies in natural gas markets

- Objectives:

    – Introduce information incompleteness in our framework
    – Assess the impact on capacity planning of asymmetric information about the regional monopoly's technology

Model

$$C_p \xrightarrow{\ \lambda, K, C(K)\ } M$$

$$C$$

$$C_m(\tilde{\theta}, q_m) = \tilde{\theta} q_m + F_m$$
$$\theta \in \{c, \theta\}, \quad \theta > c$$
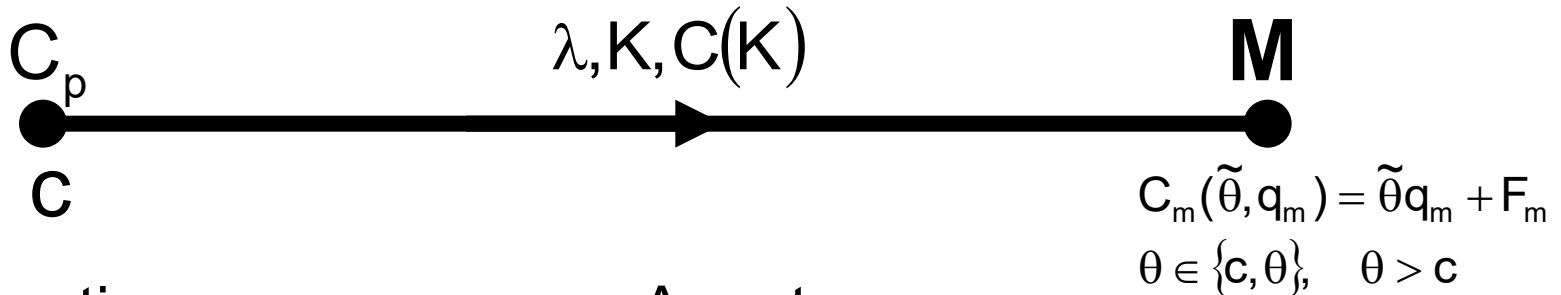
- Assumptions:
  - Cost gap (positive in expectation)
  - Decreasing returns in capacity building
  - Fixed cost to the regional firm
  - Positive social cost of public funds
  - Asymmetric information: regulator's priors on $\tilde{\theta}$

- Agents:
  - Benevolent social planner
    - Program:
      Maximize expected W in market M
      under appropriate constraints (IC & IR)
    - Control Instruments:
      - Transport capacity : K
      - Price (output) : p_M
      - Transfers : T
  - Consumption in monopoly market M

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Role of capacity

- Asymmetric information should make the regulator rely more intensively on transport capacity to fight monopoly power

    - Asymmetric information should require a strictly higher level of transport capacity than under complete information or a situation when there is uncertainty (benchmark)

- The ability of the regulator to commit to investments in transport infrastructure should result in higher levels of transport capacity

Analysis design

- Three control schemes:
  - Scheme A: $\{K, p_M, T\}$
  - Scheme B: $\{K, p_M\}$
  - Scheme C: $\{K\}$

- Characterize the conditions under which asymmetric information calls for higher (lower) capacity under A and B

- Study the consequences of commitment to investments by the regulator (under scheme C)

Social planner's incentives
to invest in infrastructure when
regulation of the incumbent is under
asymmetric information

Conclusion

- Role of asymmetric Information
    - Its impact is not unambiguous
    - Scheme A: High capacity is needed to reduce information rents
    - Scheme B: High capacity needed only if the information rent of the more efficient firm is an issue

- Commitment
    - Its impact is not unambiguous
    - Scheme C: High capacity needed when incumbent profit-maximizing behavior is socially costly

Step 3

Transport capacity and competition in gas markets

- Objectives:
  - Study the interaction between transport regulation (upstream) and market structure under imperfect competition in the gas commodity market (downstream)

  - Perform a comparative welfare analysis of policies based on alternative (downstream) market configurations through numerical simulations

Model

$$T : C_T(K), F_T, p_K$$

A   B

C

$$I : \quad C_I(q_I), p(\cdot)$$
$$M : \quad c, p_K, p(\cdot)$$
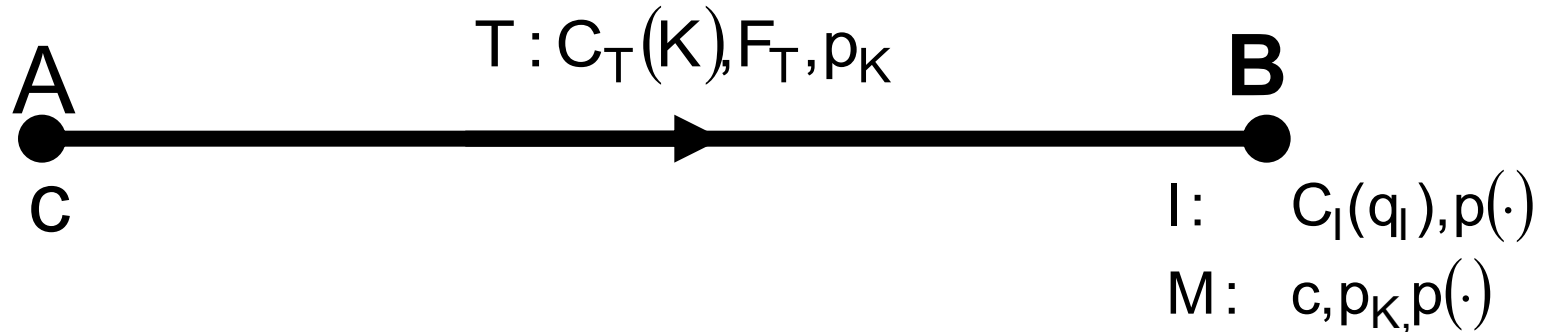
- Assumptions:
  - Natural monopoly of transport calls for regulation (p_K)
  - The marketer M imports gas from an alternative market A at cost $c + p_K$
  - No or imperfect competition in quantities in market B
  - Linear demand

- Agents:
  - Benevolent social planner
    - Program:
      Maximize W in market B under appropriate constraints (T's participation constraint and market B equilibrium)

    Control Instruments:
      - Transport charge   : p_K
      - Transporter (T)
      - Incumbent (I), consumers and marketer (M) in market B

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Role of capacity

- The lower the transport charge p_K, the higher the level of transport capacity and

- The higher the level of competition in market B (the higher the social welfare)

Analysis design

- Obtain the general solution to the problem of the regulator for a given downstream competitive framework

- Synthesize the outcome of the downstream firms' interaction by generic equilibrium output responses to changes in the transport charge

- Apply the general setting to the following scenarios
  - No competition
  - Stackelberg competition
  - Cournot competition
  - Competition with a fringe of gas traders

- Perform welfare comparisons through simulations

Conclusion

- The regulator should balance the impact of the transport charge between:
  - The profitability of the marginal and infra-marginal units of capacity built by the transporter
  - The marginal profitability of the downstream agents I and M

- Simulations:
  - Confirm that more competition is socially desirable
  - The ordering of p_K and K across market configurations reveal some redistribution conflicts
  - Importance of the capacity building technology in the characterization of these conflicts

Extensions – Fostering competition

- Performance of gas-release programs

- Should gas release be just a transitory instrument?