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
• **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**

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

\[ C_m(\tilde{\theta},q_m) = \tilde{\theta}q_m + F_m \]

\[ \theta \in \{c, \theta\}, \quad \theta > c \]

- **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): \( pM \)
      - Transfers: \( T \)
  - Consumption in monopoly market \( M \)
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
• 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 $B$
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?