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***A Brief Introduction to
Modeling for the Regulation
of Transport Infrastructure***



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Overview

▶ 3 Parts to the Presentation

- ✱ The regulation problem
- ✱ The regulatory economic and financial model as a solution
- ✱ The structure of the model



PART 1: The regulation problem

- ▶ **Why regulate?**
- ▶ **What has to be regulated?**
- ▶ **What are the goals of regulation?**
- ▶ **What are the regulatory trade-offs?**
- ▶ **What are the regulatory instruments?**
- ▶ **How to pick among instruments?**



Why regulate?

▶ Operator enjoys a monopoly

- * ⇒ Risk of excessive tariff
- * ⇒ Risk of inadequate service levels and quality
- * ⇒ Risks of non-compliance of contractual commitments to users or to government
- * ⇒ Risk of low efficiency in the provision of goods and services



What has to be regulated?

- ▶ **Unbundle activities and differentiate among them**
 - * Natural monopoly: need to regulate
 - * Competition feasible/desirable: introduce it

e.g. Airports: differentiate between operational, handling & commercial activities



What goals for regulation?

▶ **Financial sustainability**

- ✱ the right for operators and investors to make a return that is: (i) fair and (ii) consistent with the costs of financing its contractual commitments

▶ **Allocative efficiency**

- ✱ Prices reflecting costs, including high fixed costs

▶ **Productive efficiency**

- ✱ Optimal use of resources so : minimize Costs



Specific dimensions to transport (1)

- ▶ **Redistributional concerns**
 - ✱ Interregional equity (financing low Demand local infrastructure)
- ▶ **Cross-subsidiation**
- ▶ **Access**



Specific dimensions to transport (2)

- ▶ **Alternatives (e.g. free alternative road)**
- ▶ **Safety/National Security issues**
- ▶ **Congestion**

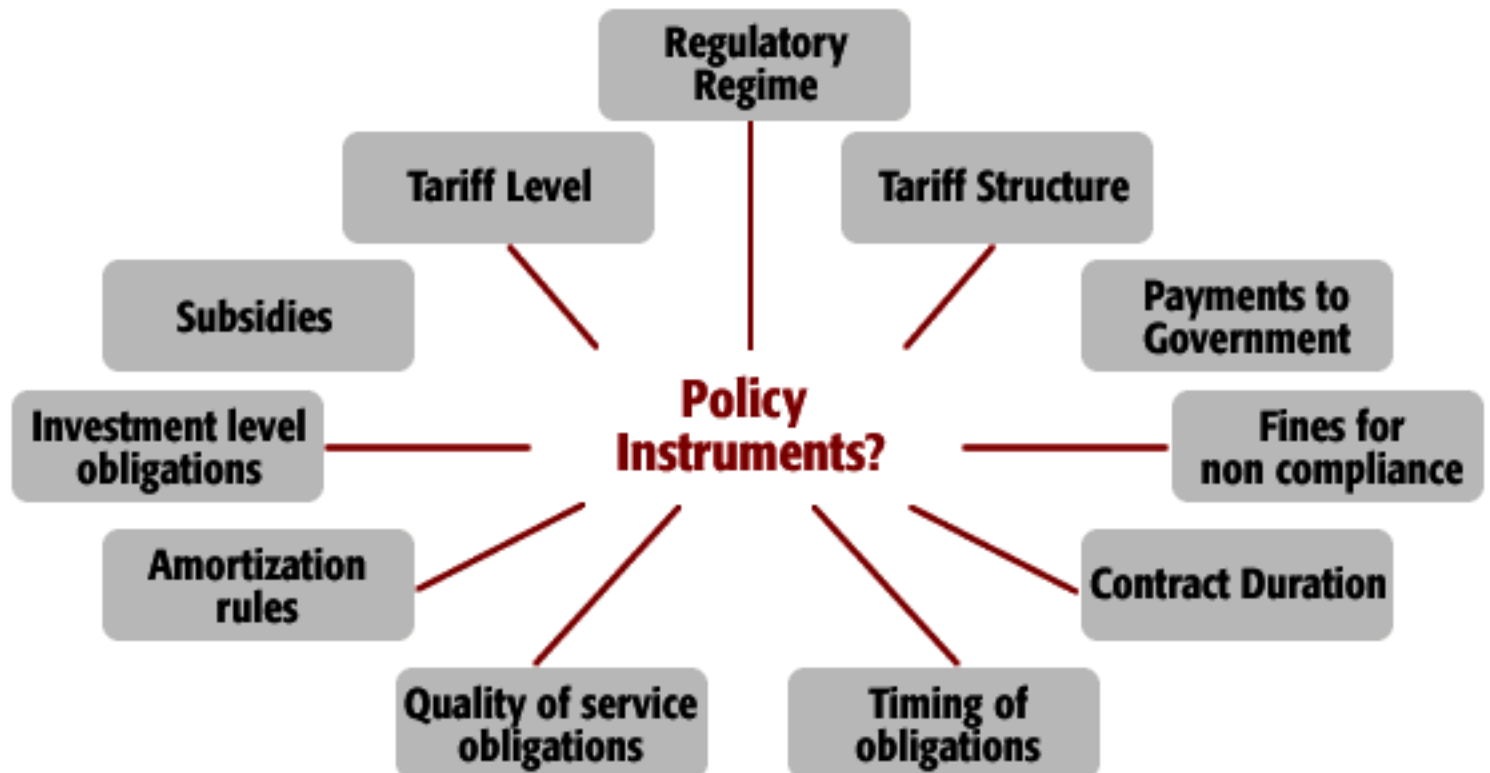


What regulatory trade-offs?

- ▶ **Allocative vs. Productive Efficiency**
 - * Is a guaranteed cost recovery consistent with the incentive to minimize costs?
- ▶ **Short run vs. long run Allocative Efficiency**
 - * Short or long run marginal cost pricing
- ▶ **Efficiency vs. Sustainability**
 - * How realistic is marginal cost pricing when asking the private sector to finance investments?
- ▶ **Sustainability vs. Social concerns**
 - * Are these concerns always consistent with the financial viability of the firm?



Overview





How to pick among instruments?

- ▶ **Need an analytical framework to:**
 - ✱ Ensure the internal consistency of:
 - ▶ *All contractual obligations on operator and on government and any changes to these,*
 - ▶ *The combination of regulatory instruments,*
 - ▶ *Assumptions on projected behavior of various actors*
 - ✱ Quantify impact of options on various players in a transparent rule-based regulatory process
- ▶ **The best such analytical framework is...
the regulatory economic and financial model**



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Part 2

*The regulatory economic
and financial model as a solution
to the regulatory problem*

PART 2: The regulatory economic and financial model as a solution to the regulatory problem

- ▶ **Modeling for regulatory consistency**
- ▶ **Defining the information requirements**
- ▶ **A big picture view of the model**



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Part 2

*The regulatory economic
and financial model as a solution
to the regulatory problem*

Modeling for regulatory consistency

▶ Two main dimensions

- 1** Economic
- 2** Financial



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Part 2

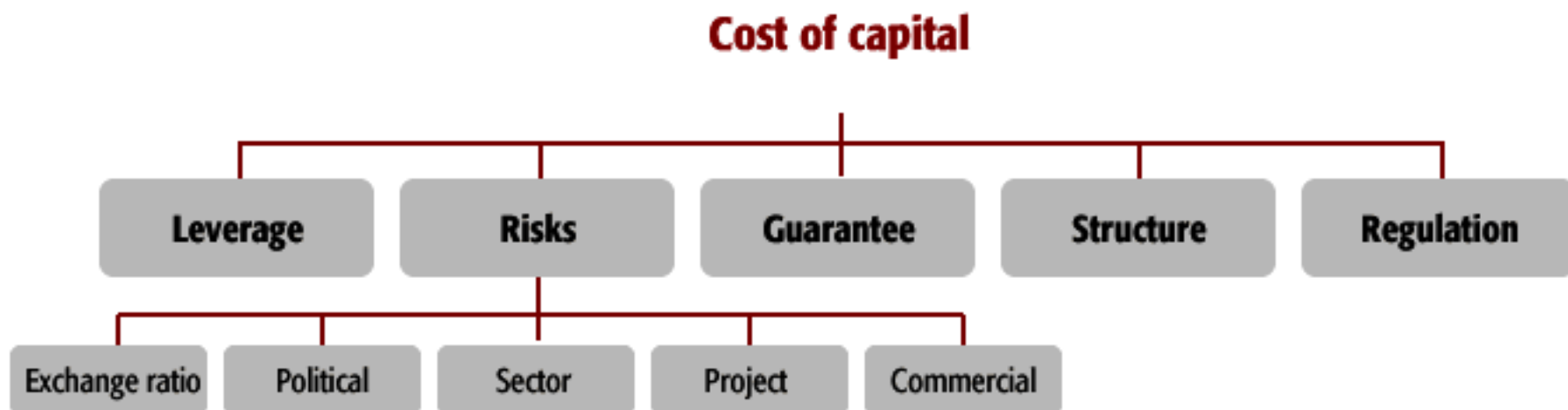
*The regulatory economic
and financial model as a solution
to the regulatory problem*

Economic Consistency [1]

- ▶ **The model will have to generate monitorable information on:**
 - ✱ The Cost of Capital (COC): it represents the sector's fair and reasonable rate of return a regulator will have to allow
 - ✱ The Internal Rate of Return (IRR): it represents what the business generates given all the contractual obligations

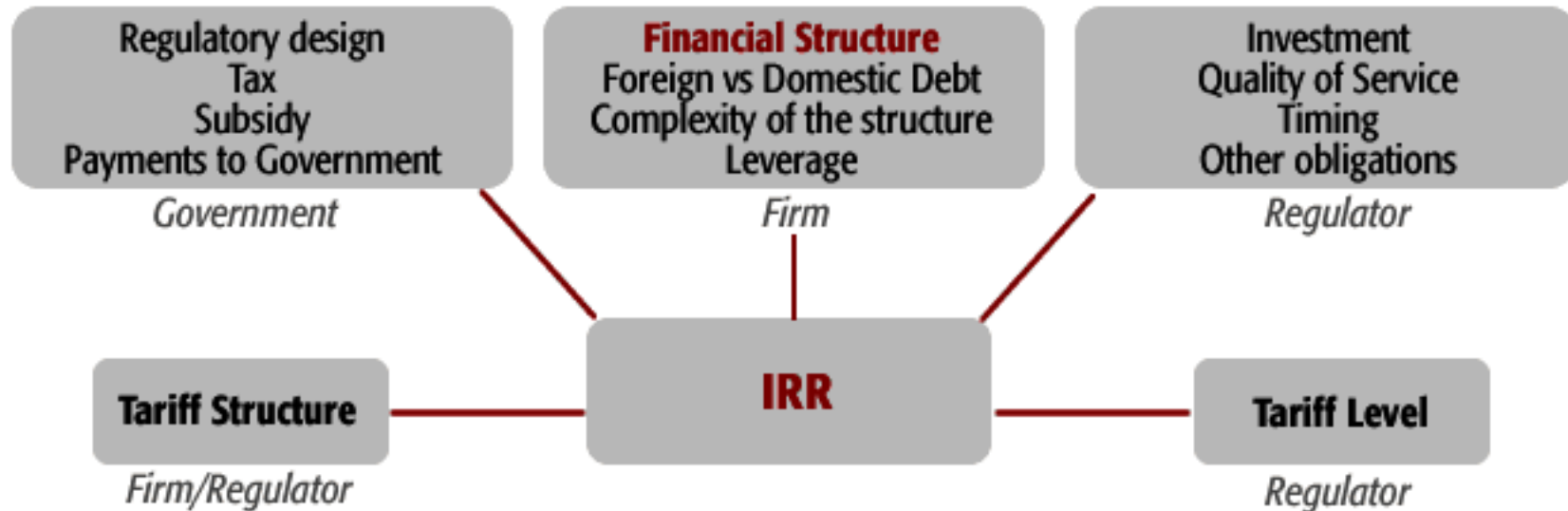


What drives the cost of capital?





What drives the Internal Rate of Return?



also type of restructuring:

- ✱ Degree/Duration of Exclusivity
- ✱ Composition of client base



Economic Consistency [2]

▶ Basic decision criteria

- ✱ If $IRR = COC \Rightarrow$ the ideal benchmark for regulators, because:
 - ▶ *The Net Present Value (NPV) of the business is 0*
 - ▶ *No “excess” profit for the operator*
 - ▶ *Comparable to profit in a competitive market*



Economic Consistency [3]

► Basic decision criteria

- ✱ if $IRR > COC \Rightarrow$ Regulatory decision consistent with viable and sustainable private provision of the service, BUT “excessive profit”

\Rightarrow Regulatory action may be needed to eliminate excessive profit (e.g. reduce tariffs, subsidies)

- ✱ if $COC > IRR \Rightarrow$ Private operator driven to bankruptcy

\Rightarrow Regulatory action may be needed to ensure service continuity (e.g. direct or indirect subsidies, changes in service obligations/timing, contract duration, ...)



Economic Consistency [4]

▶ Warnings

- ✱ Remember that any instrument restoring the equilibrium between IRR and COC implies trade-offs among goals
- ✱ Hence, the regulator needs to understand what drives the two indicators
 - ▶ *how the contract obligations of the operators and the regulatory design influences these indicators*



Defining Financial Consistency

- ▶ **In addition to economic consistency,
need to check for financial consistency:**
 - ✱ Standard financial ratio monitoring:
 - ▶ *What Credit Rating Agencies check
when assessing financial solvency*
 - ▶ *Equity, capital and free cash flow*
 - ▶ *Ratio on rate of return, liquidity, debt*
 - ✱ ...but also, need monitoring:
 - ▶ *to recognize macro driven difficulties of access
to credit markets can be complex*



The use of these models

- ▶ **These decision criteria and hence the models are crucial in:**
 - ✱ Assessing restructuring options and policy options before privatization
 - ✱ Ordinary tariff revisions
 - ✱ Extraordinary revisions
 - ✱ Renegotiations

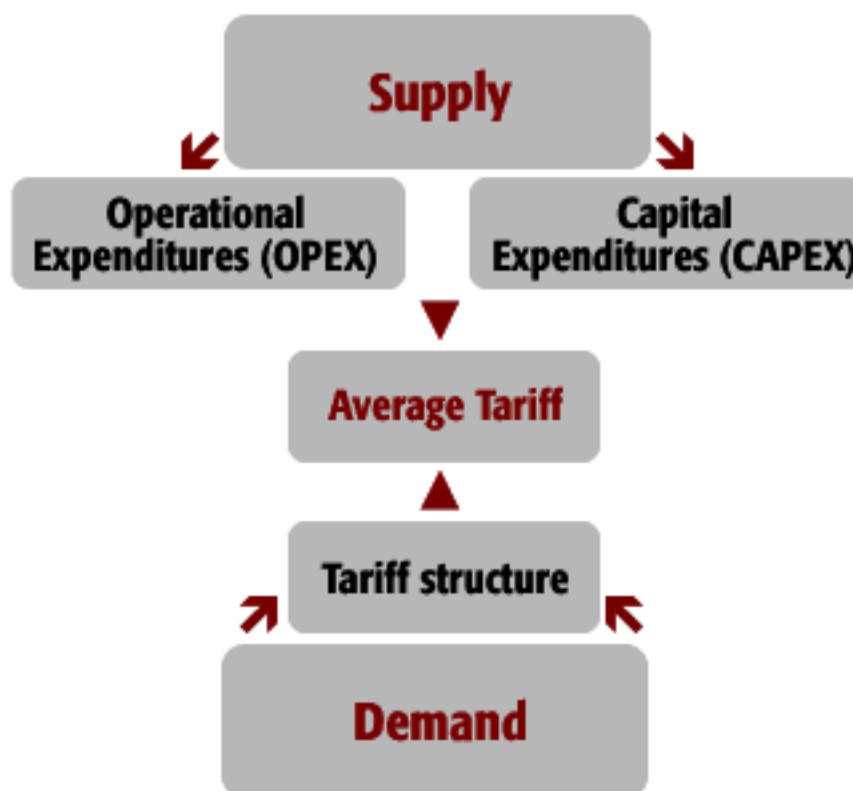


PART 3: The Model Structure

- ▶ **What the model needs to reflect**
- ▶ **Modeling OPEX**
- ▶ **Modeling CAPEX**
- ▶ **Modeling the tariff structure**
- ▶ **Solving the model for the average tariff**
- ▶ **Regulatory information requirements**



What does the model need to reflect?



*Defines
Required
Revenue
(RR)*

*Sends
economic signal
and deals
with social concerns*

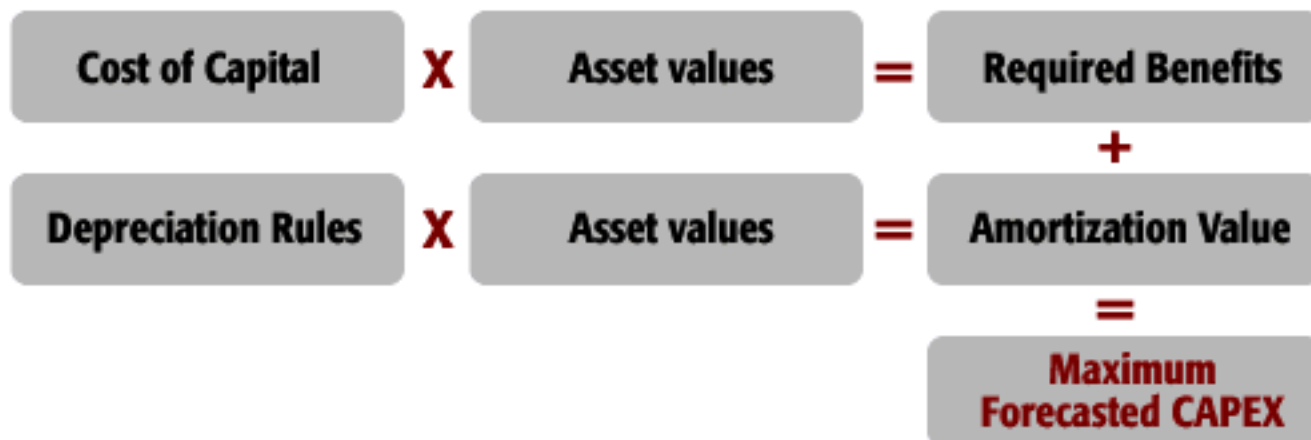


Modeling OPEX & CAPEX?

- ▶ **OPEX = operational and maintenance costs**
- ▶ **CAPEX = investment in fixed assets**
- ▶ **Need to model what drives them:**
 - ✱ Expected demand
 - ✱ Required service quality
 - ✱ Expected efficiency gains



Modeling CAPEX?



⇒ CAPEX = Required Benefits + Amortization



Modeling the tariff structure

- ▶ **The two extreme structures are:**
 - * A uniform tariff for all user types
 - * An individual tariff for every user
- ▶ **In practice, regulators use an intermediary structure differentiating tariffs according to:**
 - * Peak & Off peak pricing to manage the complex issue of congestion
 - * Size/weight of transport means
 - * Environmental issues (noise, pollution, safety of transport means)



Solving the model for an “ideal” Tariff?

It means setting “P” so that:

$$0 = -K_i + \sum_{j=1}^N \frac{P \times Q - O\&M - I - T \pm Tr}{(1+r)^j} + \frac{K_f}{(1+r)^N}$$

- * *P x Q: Required Revenue = Average Tariff (P) x Consumption Volume (Q)*
- * *O&M: Operation and Maintenance Expenditures (OPEX)*
- * *T: Tax*
- * *I: Investment*
- * *r : Cost of Capital*
- * *K_i: Initial Asset Base*
- * *K_f: Asset Base in period N*
- * *Tr: Transfers*



All this requires good information

▶ On the firm

- * Regulatory accounting with separation of regulated and non regulated activities
 - ▶ *requires clearly defined OPEX and CAPEX allocation rules*
 - ▶ *requires specific valuation rules*

▶ On the market

- * Demand structure and level forecasts

▶ On other firms

- * For benchmarking



...Learning more about these models

- ▶ **Manual included in CD1**
- ▶ **Tests in CD2 (generic Model an Q&A)**
- ▶ **Training seminars (WBI and others)**
- ▶ **Web site of regulators**
 - ✳ Many regulators have quite good sites on cost of capital and asset valuations