Economic Valuation Methods for Public Investment in Hydrail

Jason W. Hoyle

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Valuation Methods

- Traditional
  - Discounted cash flow, life-cycle, cost-benefit
  - Effectiveness limited by uncertainty
- Incorporating uncertainty
  - Scenarios, sensitivities, simulations
  - Data-intensive, subjectively probabilistic

Valuation Scope

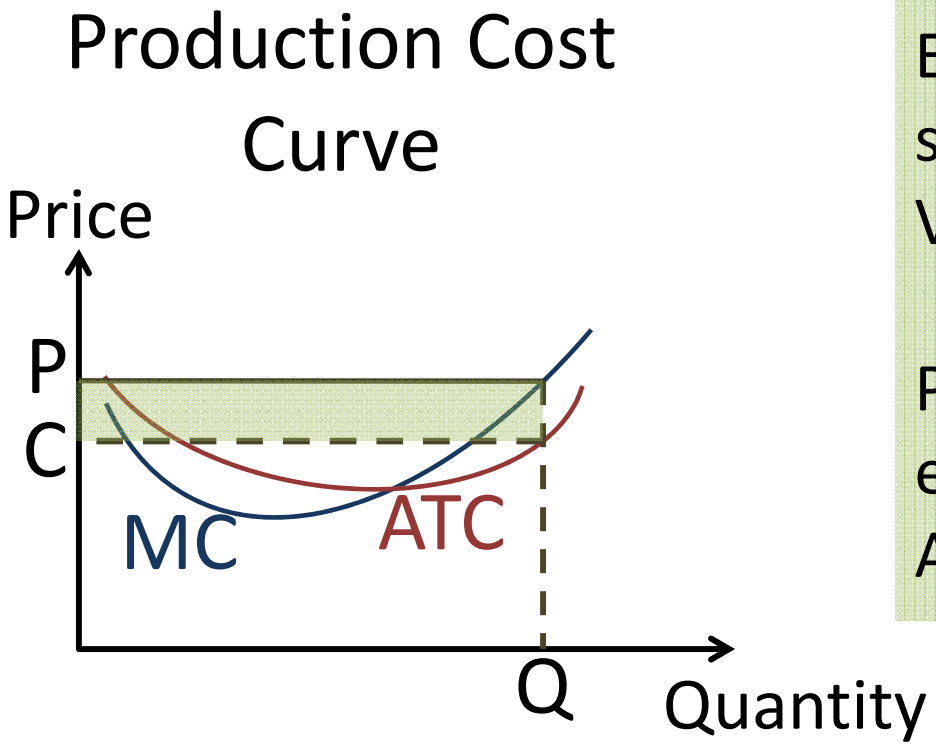
- Device/equipment
  - Hydrail/diesel/electric/hybrid; locomotive:EMUs
  - Metrics: performance, fuel, maint., service life
- Intrasystem (within rail transport system)
  - Expanded to include infrastructure
- Intersystem (whole transportation system)
  - Expanded to include rail, road, water, and air
- Socio-economic (whole of locality)

Hydrail's Intersystem Value

- Transportation system in general
  - Physical and supporting infrastructure
  - Utility = mobility of labor, commodities, products
  - Intertemporal classification as *f*(technology)
- Transportation system as a good or service
  - "Produced" by a public entity
  - Monopolistic supply with inelastic demand
  - Effect is structural/technological coercion
- Public entity is, in this sense, a monopoly firm

Behavior of the Capitalist Firm

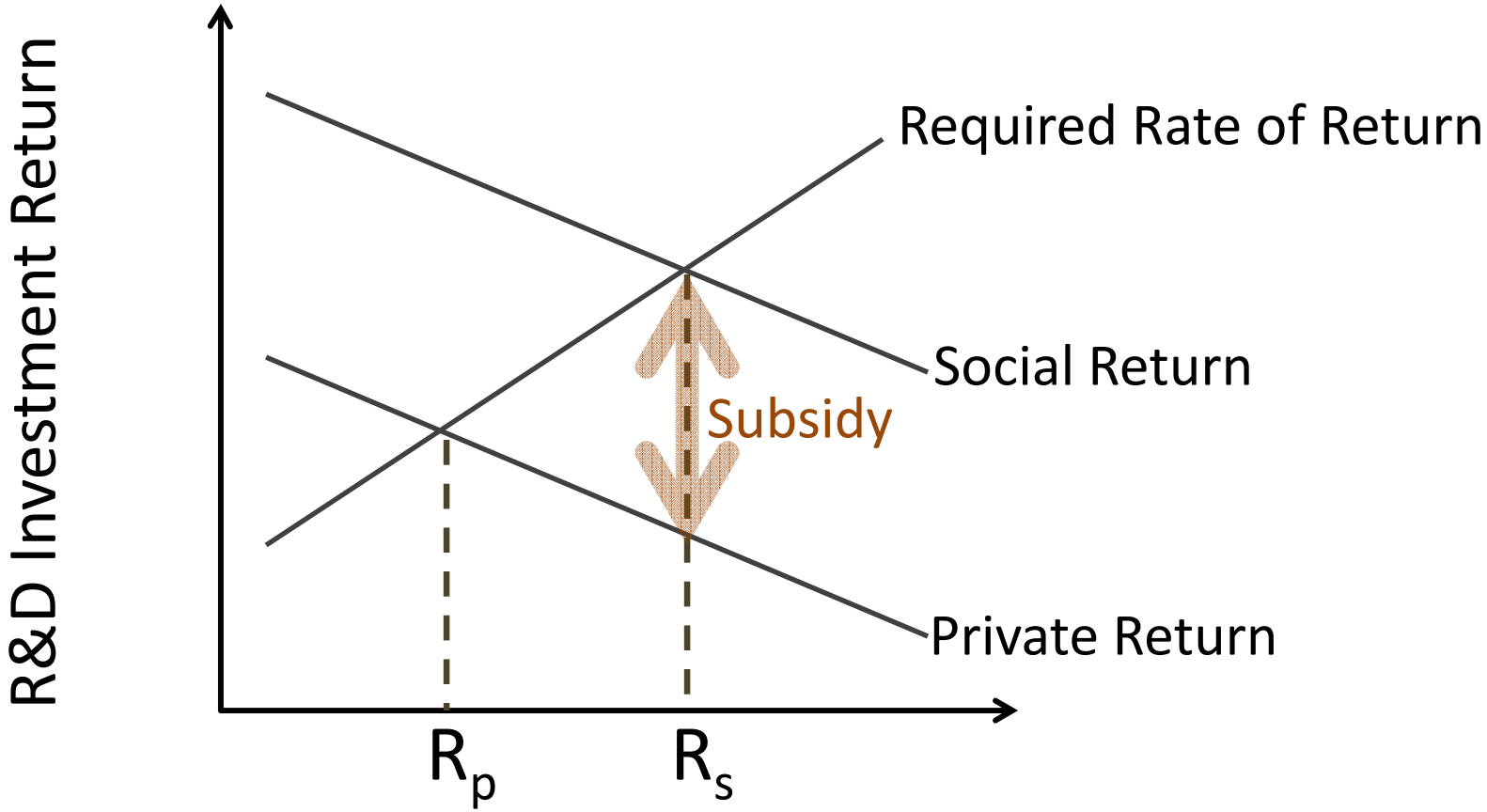
- Purpose: perpetual shareholder return (profit)



Economic profit, or surplus value – Marx's Valorisation

Perfect competition, Price equals the minimum Average Total Cost

Technology (R&D) Incentive Gap

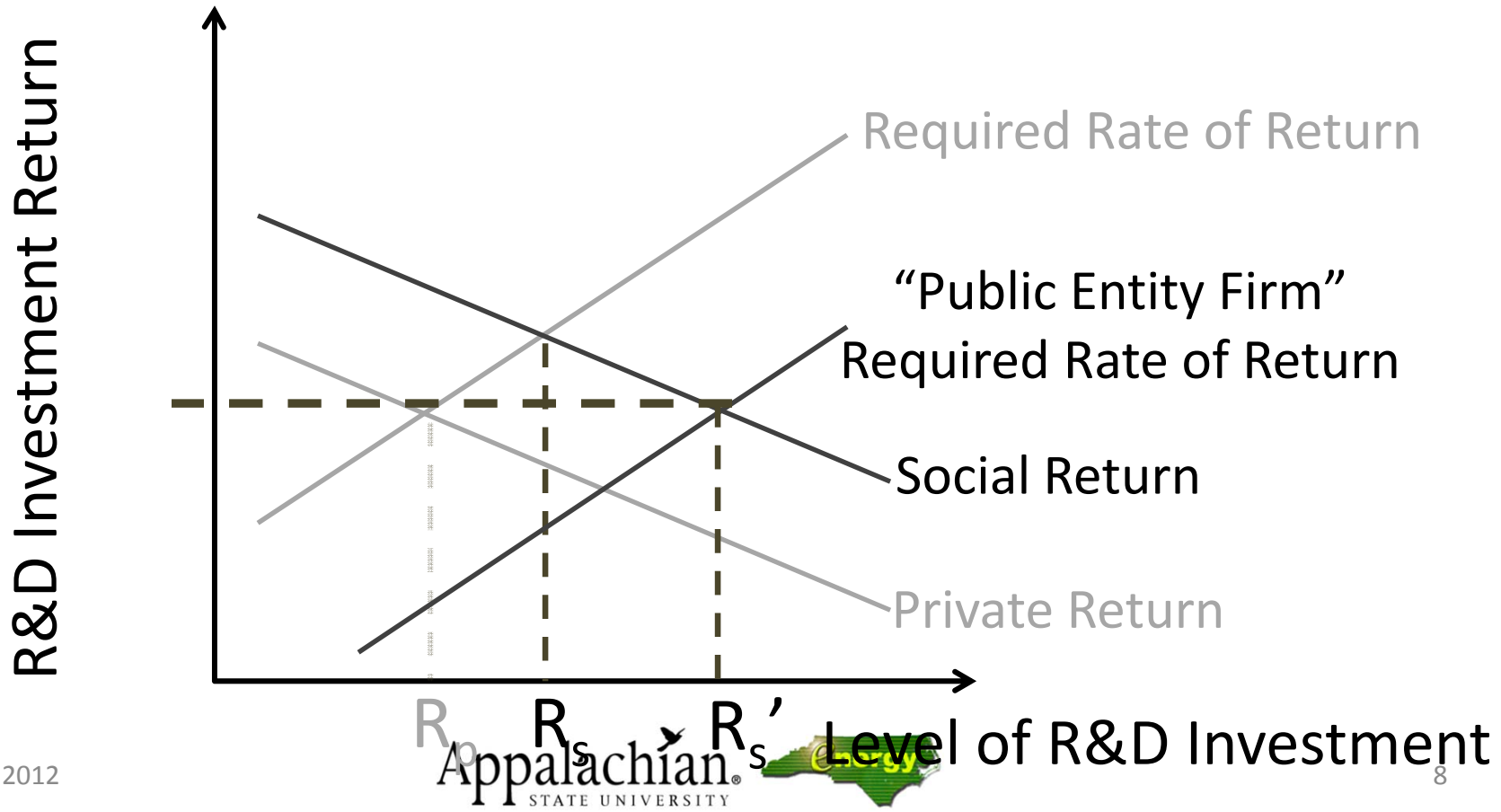


H_2's Positive Externalities

- Increased efficiency relative to internal combustion
- Emission-free at point of use
- Virtually unlimited supply of raw material from which H_2 fuel may be derived
- Eliminates dedicated fuel-to-use pathways

Public Entity as Firm

Shareholders = public; return = attainment of positive externalities or the “social return”; eliminate subsidy



R&D Investments by Public Entity "Firm"

- Surplus value for the public entity firm is attaining positive externalities/social benefit at minimum average total cost (minATC)
- Given the shift from carbon-intensive to hydrogen-intensive energy at some unknown future point in time
- Min. ATC achieved by minimizing marginal cost, in this case minimizing cost of H_2-fueled transportation system
- Investment in H_2 transportation system -> risk of technological obsolescence

Hydrail: Value Innovation Strategy

- Goal: make R&D investments in H_2 transport system in pursuit of minimal average total cost
- Hydrail concept supports minimizing marginal cost with limited risk of technological obsolescence
  - High volume demand of H_2, fixed location and limited quantity of refueling infrastructure, regular refueling frequency of fixed fuel quantities
- Result of Hydrail is low marginal cost of H_2 fuel, and substantial shift towards fundamentally changed transportation system

Contact Information

Jason W. Hoyle, Research Analyst

Appalachian Energy Center,

Research Institute for the Environment, Energy & Economics,

Appalachian State University, Boone, NC

Phone: +1.828.262.7934

Email: hoylejw@appstate.edu

www.hydrail.org