



Economics of PPPs – Review of Theoretical Literature

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Economics of PPPs – Review of Theoretical Literature

1. Characteristics of PPPs

2. Economics of PPPs

2a, Efficiency

2b, Bundling

2c, Ownership

2d, Renegotiation

3. Political Economy and PPPs



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1. Definition of PPPs

- ❖ No common definition of PPPs
 - ❖ makes it difficult to compare projects across countries/time
- ❖ Here: project agreement based on a long term contract between public and private parties (EC, 2004)
 - ❖ Bundling of construction and operation
 - ❖ Major component of private finance
 - ❖ Private partner in many cases owns asset
 - ❖ Risk sharing
- ❖ Excludes: investments made by regulated utilities, project refinancing, privatisations involving asset sale or outsourcing
- ❖ State retains responsibility to provide (public) service
 - ❖ PPP serves a public policy objective



2. Characteristics of PPPs: Phases and costs

- ❖ Three phases:
 - ❖ Procurement (select firm, design contract, bidding)
 - ❖ Construction
 - ❖ Operation (service provision)

- ❖ Costs involved
 - ❖ Transaction cost
 - ❖ Construction cost
 - ❖ Maintenance cost



2. Characteristics: Transaction costs



- ❖ Transaction costs include e.g. outlays for
 - ❖ establishing and maintaining partnership
 - ❖ organising and participating in the bidding process
 - ❖ negotiating the contract
 - ❖ legal, financial and technical advisory costs in procurement and operational phase
 - ❖ monitoring private partner's compliance with contract
 - ❖ renegotiating the contract during its life-cycle

- ❖ Limited empirical evidence on size of transaction costs



2. Characteristics: Transaction costs



Level of transaction costs in PPPs (% of capital value; sample average)



Sources: NAO, PAC, EIB, authors' estimates



2. Characteristics of PPPs: Risk

- ❖ Three major types of risk
 - ❖ Construction
 - ❖ Demand
 - ❖ Availability

- ❖ Risk allocation can affect cost efficiency through risk assessment and management
 - ❖ E.g. private firm may be better/have more incentives in managing risks

- ❖ To transfer risk, it must be quantified and priceable

- ❖ Risk allocation and National Accounts
 - ❖ Inconsistent definitions across countries and/or time
 - ❖ If private sector does not bear construction risk and either availability or demand risk, PPP is classified as public investment (by Eurostat)
 - ❖ Important implications for public debt and investment figures



2. Characteristics of PPPs: Remuneration



- ❖ User fees/ real tolls

- ❖ Fixed price contract
 - ❖ Incentives for cost reduction
 - ❖ Renegotiation/hold-up problem

- ❖ Cost plus contract
 - ❖ Preferred if performance difficult to measure/ transaction costs high
 - ❖ Risk of cost-overruns with public sector

- ❖ Mixture of remuneration instruments
 - ❖ (e.g. cost plus incentive fee)



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2a. PPPs – a tradeoff

- ❖ Simplified: Trade-off between gains in productive efficiency vs losses in allocative efficiency.
 - ❖ PPPs optimal choice only under certain conditions

- ❖ Productive efficiency
 - ❖ On time/ on budget construction
 - ❖ Lower life-cycle cost
 - ❖ But: higher transaction costs
 - Less competition for PPPs than for traditionally procured projects

- ❖ Allocative efficiency:
 - ❖ Rent seeking by firms likely to result in lower service quality
 - ❖ Public services have characteristics of public or merit good
 - ❖ Market power (natural monopoly), externalities, public good
 - ❖ Social value of public service deviates from private value
 - ❖ Otherwise government has no reason to be involved in provision



2a. Economic arguments pro PPPs



- Efficiency gain through private ownership
 - cost (and quality) incentives
- Efficiency gain through bundling
 - internalise externalities of construction and operation
- Efficiency gain through risk sharing
 - Private and public sector can share risks according to their comparative advantages



2a. (Not so Economic) arguments pro PPPs

- ❖ PPPs may facilitate implementation/justification of user fees compared to traditional procurement.
- ❖ Political Economy arguments
 - ❖ Soft budget constraint
 - ❖ Incentives to pander
- ❖ Hyperbolic discounting may distort government decisions towards PPPs
 - ❖ Relevant if later payments and/or benefits are *discounted* by a factor that increases with the length of the delay
- ❖ Optimism bias may lead to inefficiencies
 - ❖ by government, but also by private partner

2a. PPPs: Challenges



- ❖ Putting incentives right
 - ❖ Moral hazard: cost-cutting and quality-enhancing efforts not verifiable
 - ❖ Information asymmetries: costs, type of builder/operator
 - ❖ Best builder is not automatically best operator

- ❖ Incomplete contracts
 - ❖ Characteristics that determine outcome not specified
 - ❖ E.g. if location of toll booths not specified, firm may place them strategically
 - ❖ Risk of renegotiation, hold-up
 - ❖ Long term contracts adjustable to changing conditions?

- ❖ Transaction costs



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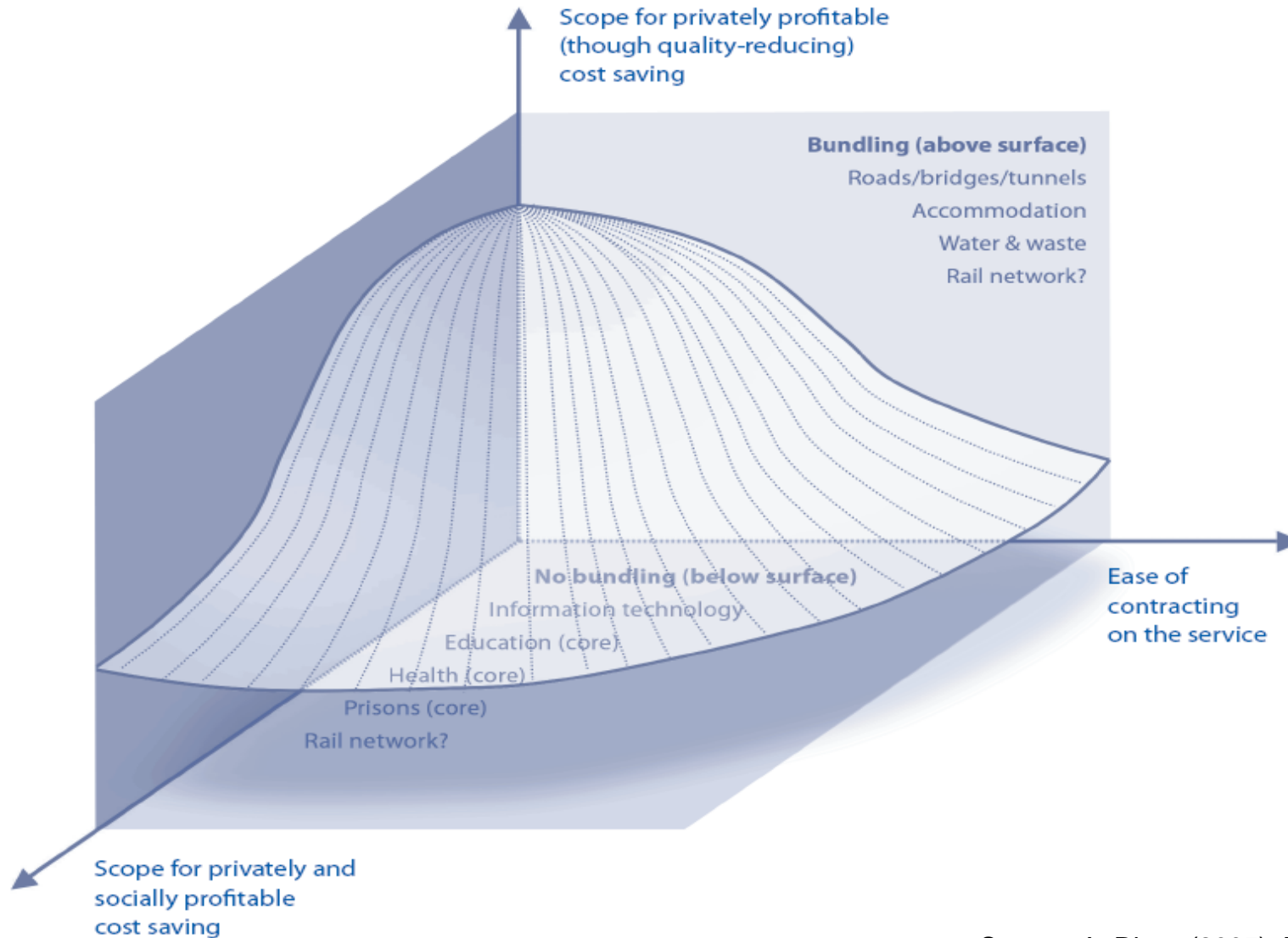
2b. Bundling vs unbundling?

- ❖ Unbundling: here traditional procurement
 - ❖ Government contracts separately with builder and operator of the asset

- ❖ Bundling: here facility construction and service provision are bundled
 - ❖ Private party builds and runs the asset

- ❖ Benchmark needed to assess performance of PPPs
 - ❖ Also public provision entails inefficiencies
 - ❖ But difficult to assess

2b. Trade-offs: unbundling vs bundling



Source: A. Riess (2005), EIB Papers 2005/1



2b. Bundling vs unbundling?

- ❖ Unbundling good if quality of building can be well specified and quality of service not
 - ❖ With unbundling construction firm not liable for quality of service
 - ❖ Underinvestment in quality under conventional provision not serious
 - ❖ Overinvestment in pure cost reduction under PPP may be serious

- ❖ PPS (bundling) good if
 - ❖ quality of service can be well specified and quality of building not
 - ❖ Underinvestment in service quality with unbundling maybe serious' overinvestment in pure cost reduction under PPP not
 - ❖ Investment in quality under PPP may still be too low: firm only considers cost effects of quality
 - ❖ positive externality between cost and quality



2b. Analytical Framework based on Iossa and Martimort (2008)

- Productive (a) and unproductive (e) effort. Externalities:
 - Builder: a raises social benefits and may either raise or reduce cost
 - Service provider: e does not affect social benefits, reduces cost

- Costs of service provision:

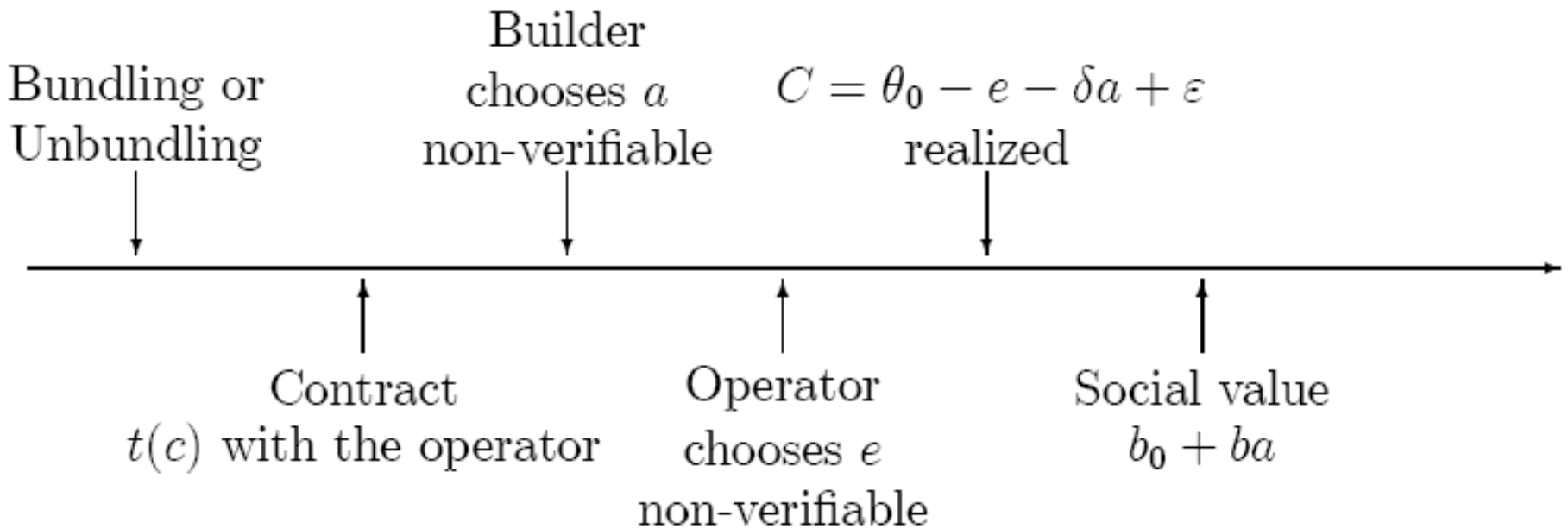
$$C = \theta_0 - e - \delta a + \varepsilon$$

- δ positive: positive externality between social benefits and cost
 - δ negative: negative externality between social benefits and cost
 - ε random variable (captures e.g. operational risk)
- Remuneration:
 - Builder receives fixed payment.
 - Cost remuneration scheme for provider net of cost:

$$t(c) = \alpha - \beta C \quad \text{with} \quad 0 \leq \beta \leq 1$$

- $\beta=0$: cost plus contract, $\beta=1$ fixed price contract

2b. Sequence



- ❖ Social benefits: $B = b_0 + ba$
- ❖ e does not affect social benefits



2b. Benchmark: efforts observable

- First best: Government's objective function

$$\max_{(a,e)} b_0 - \theta_0 + (b + \delta)a + e - \underbrace{\frac{a^2}{2} - \frac{e^2}{2}}_{\text{costs of effort}} = (b + \delta, 1)$$

- Solution $a^{FB} = b + \delta, \quad e^{FB} = 1$

- Risk premium in case of risk transfer to firm

$$\frac{r\sigma^2\beta^2}{2}$$

- With r degree of risk aversion and σ variance of ε
- Depends on remuneration scheme: β

2b. Unbundling



- Builder: $\tilde{a} = 0$
 - Rewarded by fixed payment.
 - No incentive to engage in quality enhancing effort

- Service provider:
 - Objective function

$$\max_{\tilde{e}} \alpha - \beta(\theta_0 - \tilde{e}) - \frac{\tilde{e}^2}{2} - \frac{r\sigma^2\beta^2}{2}$$

- Thus, two incentive constraints for government

$$\tilde{a} = 0 \quad \tilde{e} = \beta$$



- Government maximizes

$$\max_{(a,e)} b_0 - \theta_0 + (b + \delta)a + e - \frac{a^2}{2} - \frac{1+r\sigma^2}{2}e^2$$
$$s.t. \quad e = \beta, a = 0$$

- Solution: $a_u^{SB} = 0 < a^F$

$$e_u^{SB} = \frac{1}{1+r\sigma^2} < 1 = e^{FB}$$



2b. Bundling (PPPs): negative externality $\delta < 0$

- Two incentive constraints of firm

- For e :

$$\max_{\tilde{e}, \tilde{a}} \alpha - \beta(\theta_0 - \tilde{e} - \delta\tilde{a}) - \frac{\tilde{a}^2}{2} - \frac{\tilde{e}^2}{2} \text{ thus } e = \beta$$

- For a : no benefits for firm from a . Therefore $a = 0$

- Thus, with negative externality ($\delta < 0$), bundling and unbundling yield the same result.

$$a_b^{SB} = a_u^{SB} = 0 \quad e_b^{SB} = e_u^{SB} < e^{FB}$$



2b. Bundling (PPPs): positive externality $\delta > 0$

- Builder internalizes quality to the extent that it reduces cost

$$\max_{\tilde{e}, \tilde{a}} \alpha - \beta(\theta_0 - \tilde{e} - \delta\tilde{a}) - \frac{\tilde{a}^2}{2} - \frac{\tilde{e}^2}{2}$$

- Incentive constraints to be considered by government:

$$a = \beta\delta \quad e = \beta$$



2b. Bundling (PPPs), positive externality $\delta > 0$

- Government's problem

$$\arg \max_{(a,e)} b_0 - \theta_0 + (b + \delta)a + e - \frac{1 + r\sigma^2}{2}$$

$$s.t. \quad e = \beta, \quad a = \beta\delta$$

- Result with bundling:

- Positive externality: Bundling strictly dominates unbundling
- Positive quality enhancing effort, increase in cost-reducing effort:

$$\delta e_b^{SB} = a_b^{SB} > a_u^{SB} = 0 \quad e_b^{SB} \frac{(1 + (b + \delta)\delta)^2}{(1 + \delta^2 + r\sigma^2)} > e_u^{SB}$$

2b. Open issue: Risk management



- How to model risk allocation and risk management in this framework?
- One could argue that this is captured by cost reducing effort (e).
- However, e and ε are independent (ε exogenous).
- One possible way to specify risk allocation more clearly:

$$\varepsilon = \eta + \nu(a) + \omega(e) + \psi(\text{gov. action})$$



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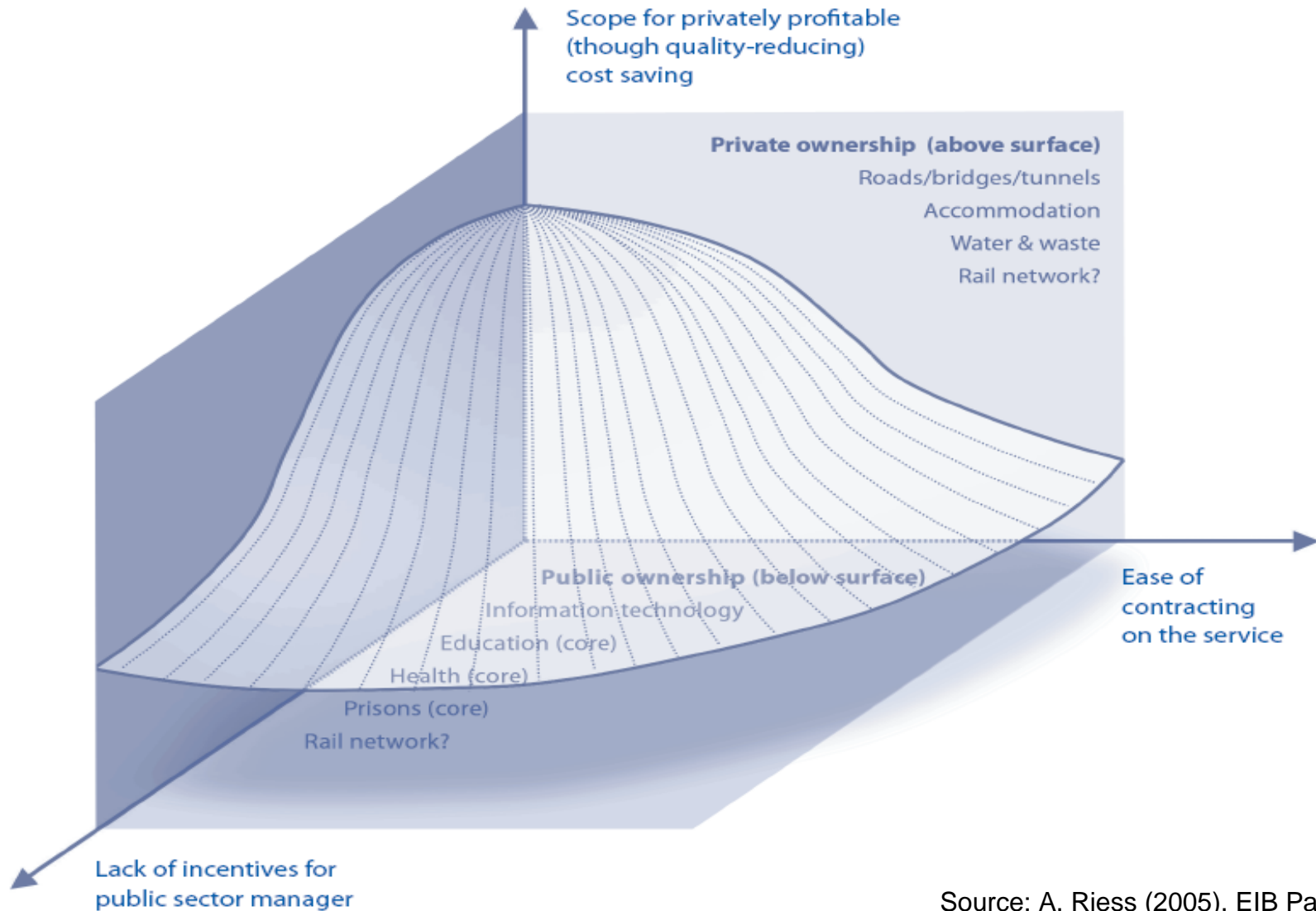


2c. Ownership (EIB Papers 2005)

- ❖ Matters if contracts are incomplete
- ❖ Analytically: two types of ownership
 - ❖ 1. Residual control rights during building and operation
 - ❖ 2. Owner can claim value of asset at the end of operating phase
- ❖ 1. Example: Technological progress
 - ❖ With public ownership (1) government needs to approve unforeseen changes
 - ❖ Renegotiation costly; share additional profit with government?
 - ❖ Lower incentive for private partner to realize efficiency gains
 - ❖ But: private firm may neglect service quality if not verifiable
- ❖ 2. Example: Claim asset at end of operating phase
 - ❖ Incentive to increase residual value of asset
 - ❖ May be socially beneficial or not



2c. Trade-offs: private vs. public ownership (1)



Source: A. Riess (2005), EIB Papers 2005/1



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3. Analytical Approach towards PPPs

4. Political Economy and PPPs

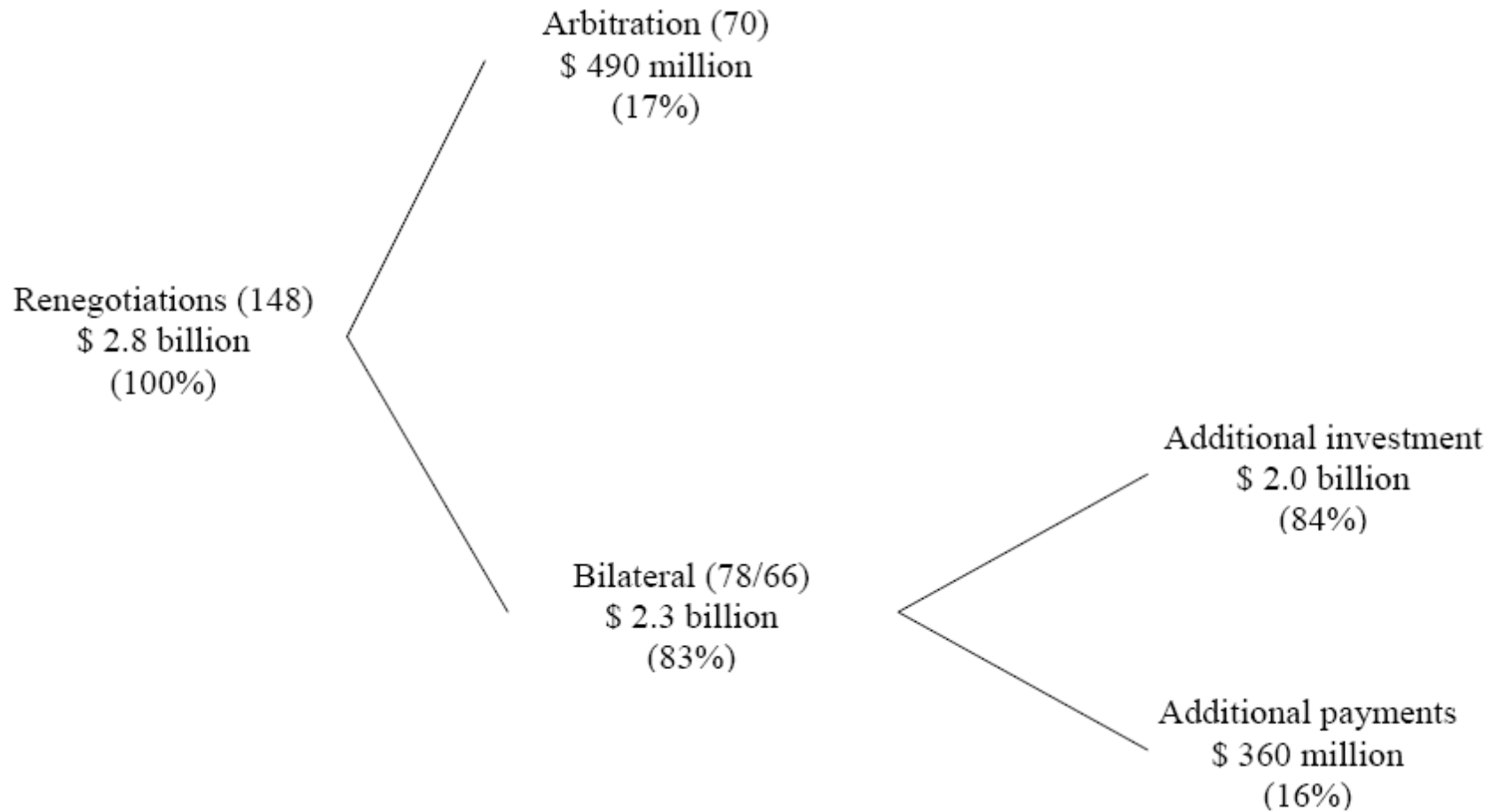


2d. Renegotiation (Engel, 2009)

- ❖ Examples
 - ❖ additional works unrelated to original project
 - ❖ adjustment of remuneration scheme in case of unforeseen costs
- ❖ Renegotiations often
 - ❖ opportunistic
 - ❖ in early stages of contract (e.g. construction)
- ❖ Firms use renegotiation to
 - ❖ lowball their offers, expecting to break even through renegotiation
 - ❖ renegotiations pay for additional expenditure
- ❖ Governments use renegotiation to
 - ❖ circumvent budgetary constraints
 - ❖ shift burden of payments to future administrations



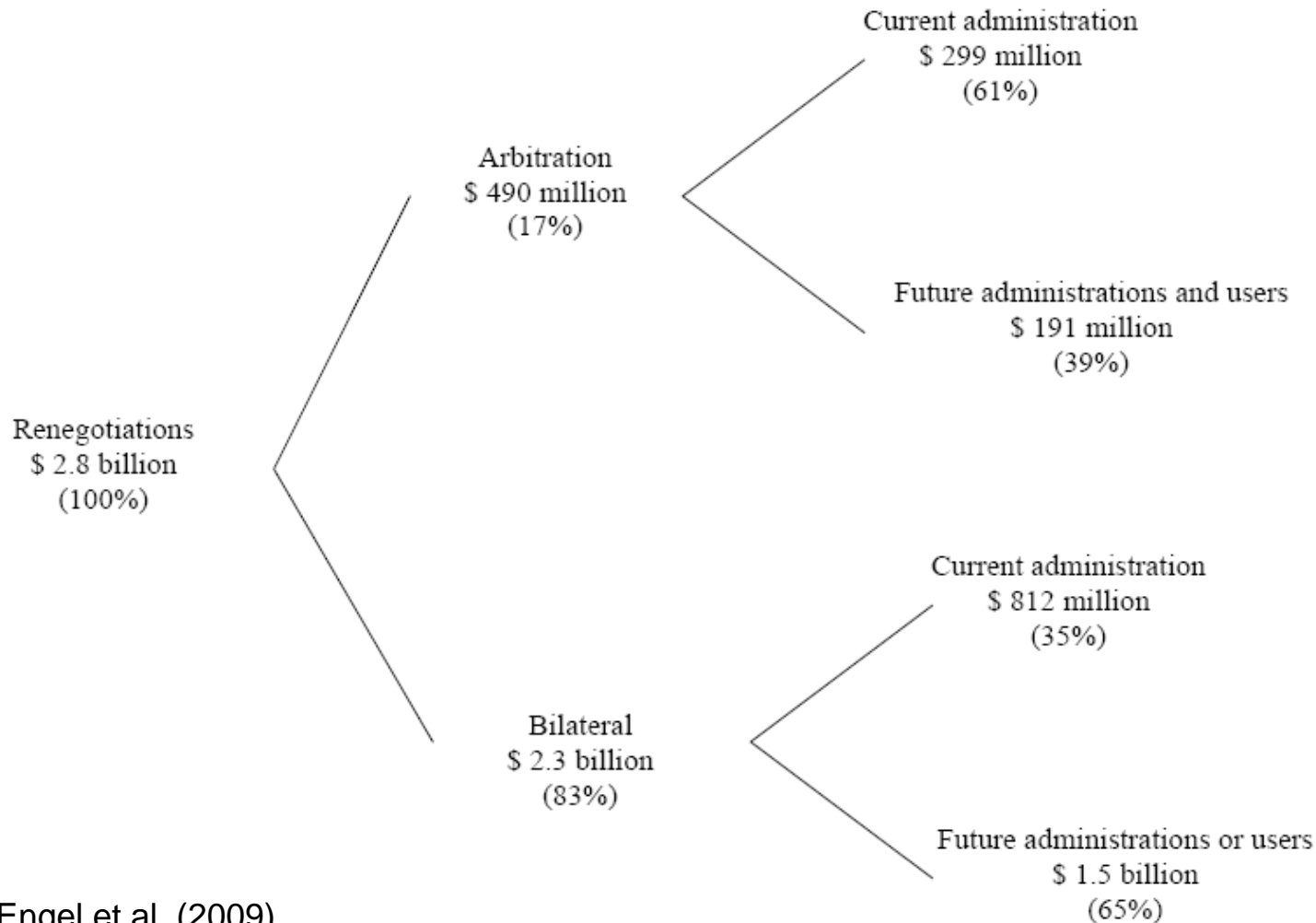
2d. Renegotiations in Chile: How and what is renegotiated?



Source: Engel et al. (2009)



2d. Renegotiation in Chile: Who pays when PPPs are renegotiated?



Source: Engel et al. (2009)



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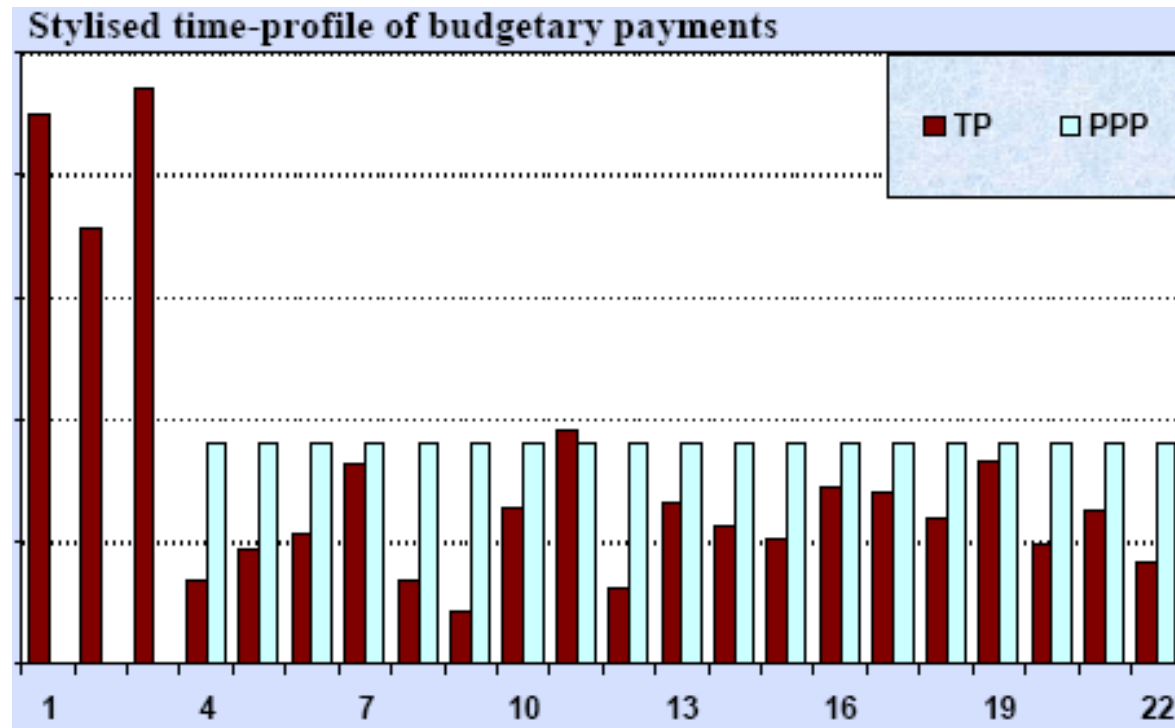


3. Government's budget constraint

- ❖ This section is based on Maskin and Tirole (2007)
- ❖ “Cynics suspect that the government remains keen on PFI not because of the efficiencies it allegedly offers but because it allows ministers to perform a useful accounting trick.” The Economist, July 2nd 2009.
- ❖ Soft budget constraint: take liabilities off balance sheet
 - ❖ Soft budget constraint: may be good or bad
 - + May relieve budget constraint, e.g. in developing countries
 - Tie-up future spending, government tempted to over-invest



3. Government budgetary impact - Compared



Source: EFS, EIB

- ❖ Traditional procurement (TP): construction costs, later (lower) maintenance costs
- ❖ PPPs: no construction cost, later (higher) payments
 - ❖ payments may vary over time; depends on remuneration/risk allocation
 - ❖ e.g. shadow tolls may be conditional on demand

3. Political economy and PPPs: Intuition



- ❖ Maskin and Tirole (2007):
- ❖ Government officials may have preferences that differ from those of a social welfare maximiser
 - ❖ Ideological, social or political ties
 - ❖ Incentive to pander
- ❖ Politicians' project choices influenced by
 - ❖ Desire to please constituencies
 - ❖ Favour high cost projects that benefit a favoured group
 - ❖ Budget constraints
- ❖ Spending caps to set correct incentives?

3. Political economy and PPPs: Model



- Three project types: High, low and uncertain cost
- If cost uncertain:

$$\bar{C} = \rho C_L + (1 - \rho) C_H \quad \text{with} \quad C_H > B > \bar{C}$$

- Public official can pass off a favoured high-cost project as one with unknown cost
 - Awarding cost plus contract (which is designed for uncertain cost projects)
- Cost plus contracts vulnerable to adverse selection
 - Government can not only use it for its original purpose (projects with unknown cost) but also for inefficient pet projects.

3. Political economy and PPPs: Model



- ❖ Public officials' behaviour more in line with social welfare if subject to spending limit

- ❖ Optimal accounting system - two options
 - ❖ Tight: only favoured projects of uncertain costs and projects to be known as low-cost are undertaken
 - ❖ Loose: all projects are undertaken except those that are high cost and do not benefit a favoured group
 - ❖ Loose budget constraint optimal if
 - ❖ portion of favoured groups is small and
 - ❖ probability of ex ante knowledge about costs is small



3. Political economy and PPPs: Unbundling

- ❖ Separate contracts for building and service provision
- ❖ Unbundling prevents early public assessment of projects' costs
 - ❖ More room to pass on favoured high cost projects
 - ❖ (Weakly) reduces social welfare
- ❖ Cost of unbundling here due to misalignment of official's and public's interests



3. Political economy and PPPs: Private financing

- ❖ Through pre-evaluation, private financiers certify the cost of a project
 - ❖ Learn period 2 costs ex ante with probability x
 - ❖ Thereby constrain public official to run less high cost projects
 - ❖ potentially raise welfare by preventing high cost projects from being undertaken.

- ❖ With private financier, contractor can accept fixed price contract even for projects with unknown costs.
 - ❖ Learn costs ex ante with probability x
 - ❖ Private finance associated with higher frequency of fixed-price contracts



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