Opportunism in Public-Private Project Financing

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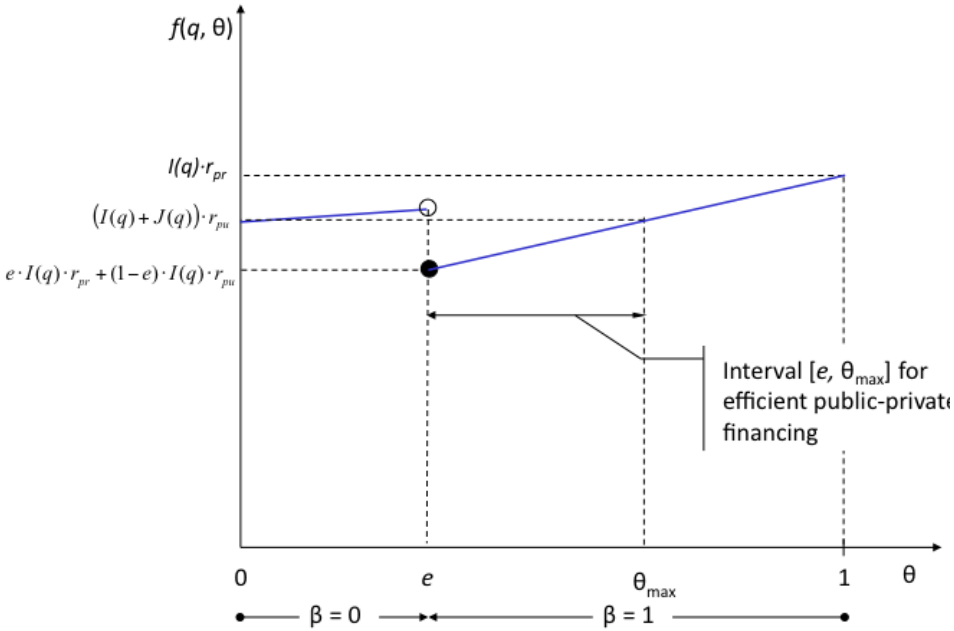
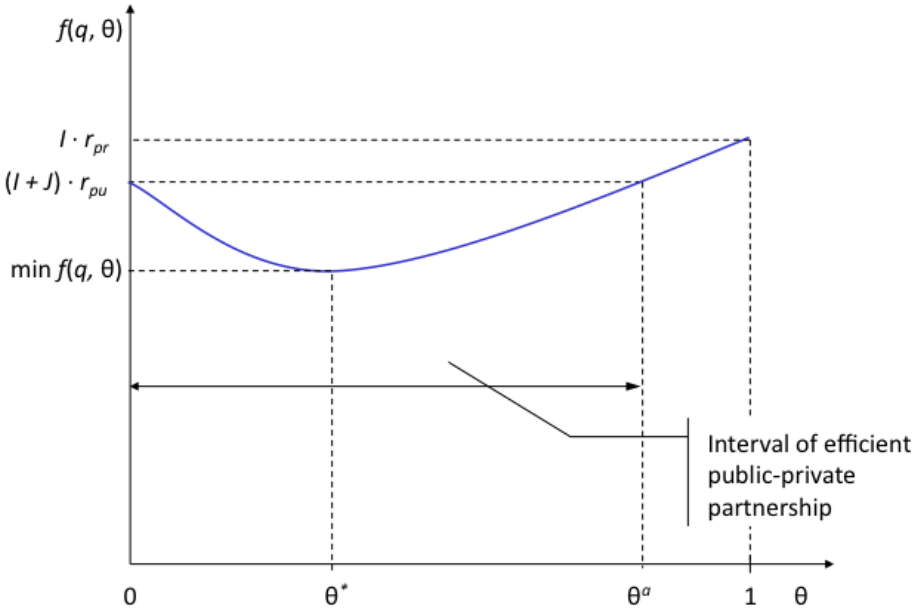
Background: Previous Research

Private ownership	0	(0,20)	[20,40)	[40,60)	[60,80)	[80,100)	100	Total
Concession	**43**	**3**	**23**	**112**	**75**	**48**	**748**	**1052**
Build, rehabilitate, operate, and transfer	20	1	7	37	21	23	395	504
Rehabilitate, lease or rent, and transfer	5	0	0	2	5	1	50	63
Rehabilitate, operate, and transfer	18	2	16	73	49	24	303	485
Divestiture	**91**	**19**	**86**	**206**	**92**	**77**	**195**	**766**
Full	1	0	0	0	3	1	161	166
Partial	90	19	86	206	89	76	34	600
Greenfield project	**74**	**9**	**50**	**222**	**204**	**175**	**1611**	**2345**
Build, lease, and transfer	0	0	0	1	0	1	9	11
Build, operate, and transfer	28	6	30	147	128	111	634	1084
Build, own, and operate	20	3	17	45	32	39	472	628
Merchant	26	0	3	29	44	24	472	598
Rental	0	0	0	0	0	0	24	24
Management and lease contract	**24**	**0**	**3**	**13**	**5**	**7**	**162**	**214**
Lease contract	8	0	2	8	5	7	61	91
Management contract	16	0	1	5	0	0	101	123
Grand Total	**232**	**31**	**162**	**553**	**376**	**307**	**2716**	**4377**
	5%	1%	4%	13%	9%	7%	62%	100%

Source: World Bank PPI Project Database

Background: Previous Research





Under conditions of financial advantage of the public sector and know-how advantage of the private sector, hybrid public-private capital structure may be more efficient than solely public or solely private capital structure

Motivation for the Paper

1. Infrastructure & PPP: out of 4377 projects (9901 obs.), 94% have >20% private financing (World Bank's PPI Data Base)
2. Utility companies have significant sunk investments & long-term payback
3. Risk of opportunism−public or private−can be an effective deterrent to many potentially successful PPPs

Opportunism

Opportunism is not tantamount to simply pursuing one's interests: "By opportunism I mean **self-interest with guile**. This includes but is scarcely limited to more blatant forms, such as lying, stealing, and cheating. Opportunism often involves **subtle forms of deceit**. Both active and passive forms and both *ex ante* and *ex post* types are included" (Williamson, 1985)

Setup

1. Players with partially aligned interests:
    a) Private: profit
    b) Public: social output (consumer's utility) + profit
2. Inelastic demand for infrastructure (≈fixed part in two-part tariff regime)
3. Opportunism
    a) Public agent can expropriate or over-regulate
    b) Investor can lower investments or quality
4. Opportunism for one period and information about deviation revealed in subsequent periods
5. Exit (put) & bail-out (call) over-the-counter options on private shares

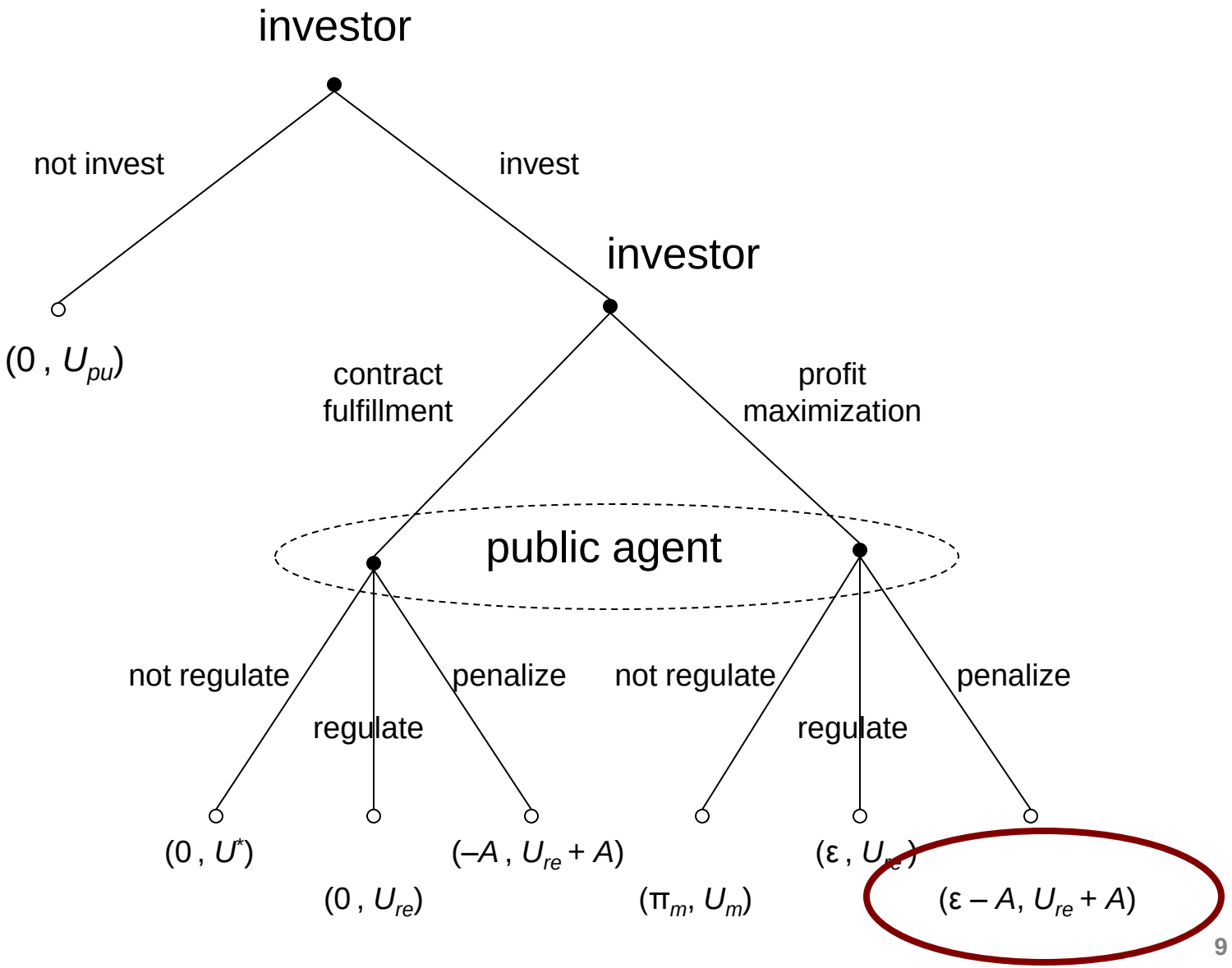
Main Results

1. Repeated games increase payoffs achievable for the PPP agents comparing to the Nash stage game
2. Exit/bail-out options reduce the gains from opportunism and foster close cooperation
3. Exit/bail-out option mechanism for PPP combines the advantages of incomplete “once-and-for-all” contracts and long-term with short-term contracts
4. Option mechanism solves problem-free transfer of assets (Posner) and dynamic costs (Williamson)

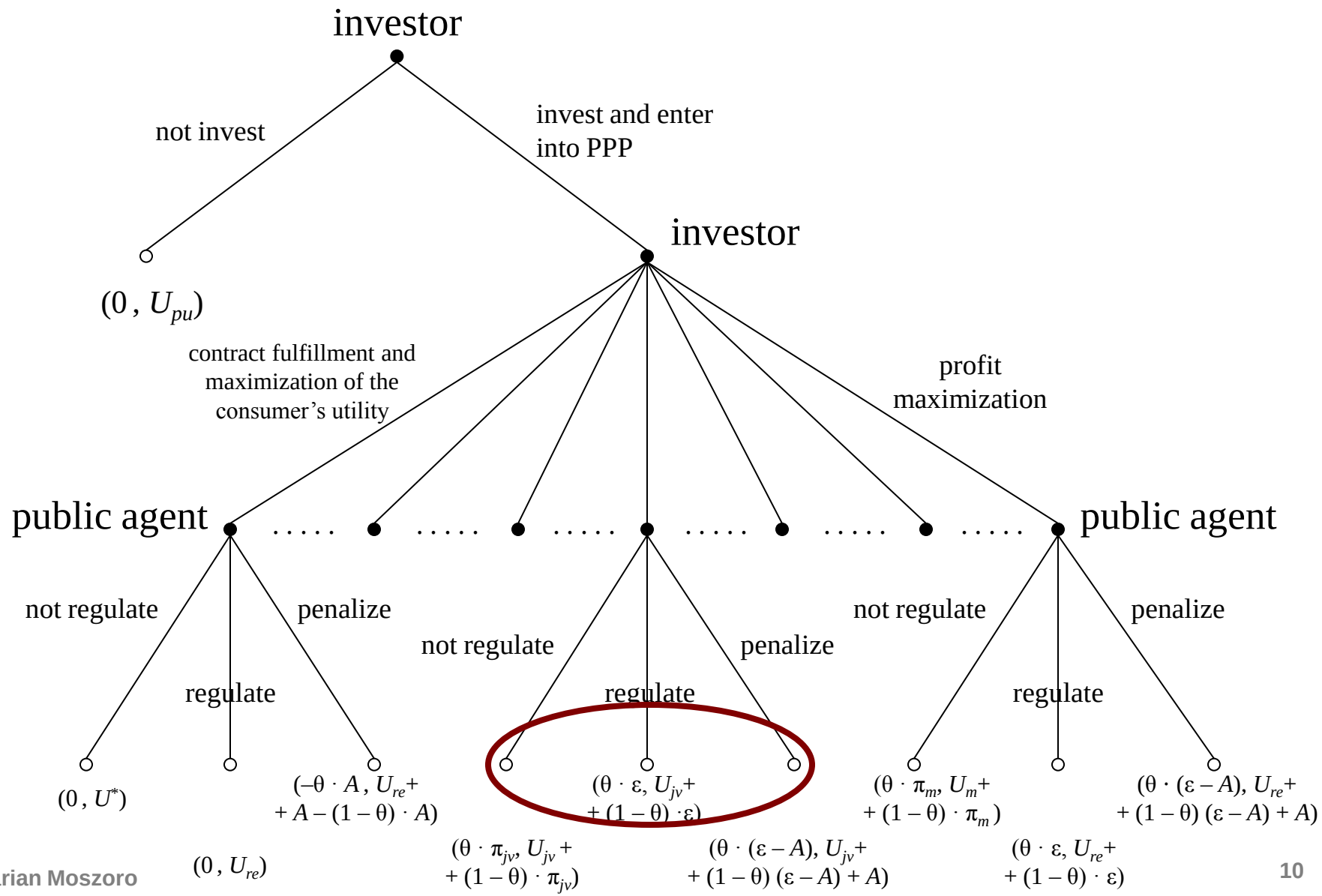
Agenda

1. Opportunism in regulatory & PPP games
    a) One-shot regulatory game
    b) One-shot PPP game
    c) Repeated PPP game: conditions for public & private opportunism
    d) Example
2. Minimizing risk of opportunism
    a) Public opportunism → exit (put) options
    b) Private opportunism → Bail-out (call) options
3. Long-term, short-term, complete, incomplete contracts vs. exit/bail-out option mechanism
4. Generalization & other applications

One-Shot Regulatory Game



One-shot PPP Game (jv)



Public Opportunism in PPP Repeated Games

1. Unprofitability of opportunism in one period if future losses considered in a sequential game

2. High r_{pu} or low NOPAT/I ratio → public agent's opportunism
3. Public opportunism decreasing in NOPAT contradicts rent appropriation in private opportunism

Public Opportunism in PPP Repeated Games (2)

4. Example: Poznan Water Company in 2002
   a) Possible partial privatization, i.e., good case study
   b) NOPAT/I = 3.5% (2001), 1.3% (2002); r_{pu} = 6.65%; assuming θ = 0.5, NOPAT/I should have been >9.975% to avoid public opportunism
   c) Low profitability and hence high likelihood of public opportunism could have been a deterrent for the private investor in the privatization process
5. Paradox: PPP may improve profitability, but because utility companies' profitability is low before PPP, public agents are prone to behave opportunistically
6. As r_{pu} in emerging economies decreases, conditions for public opportunism will become more difficult to satisfy → investors should be more inclined to invest

Minimizing the Risk of Public Opportunism

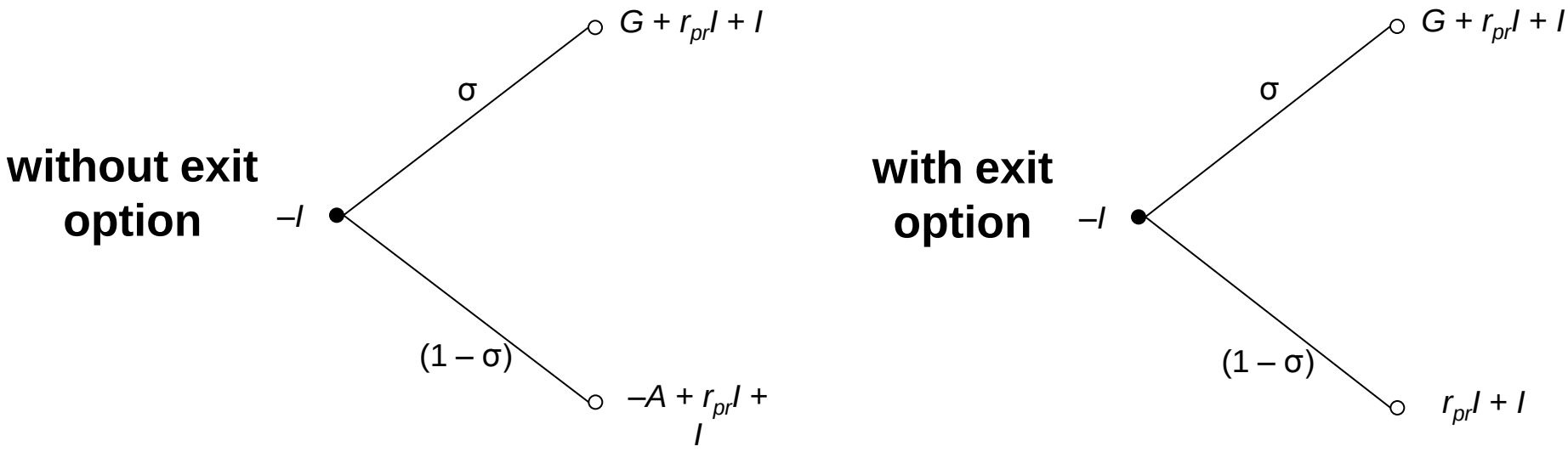
1. **Contractual provisions** for compensation from the public agent when profit falls below the expected level: public agent in an ambiguous position (judge in own cause)
2. **Insurance** needs a factual trigger (not behavioral)

Proposition 1: A perpetual **exit (put) option** at a striking price equal to the annualized investment, where the public agent is short and the private investor long, offsets the gains from public opportunism in a PPP and thus reduces *ex ante* the probability of public opportunism

Financial vs. Real Options

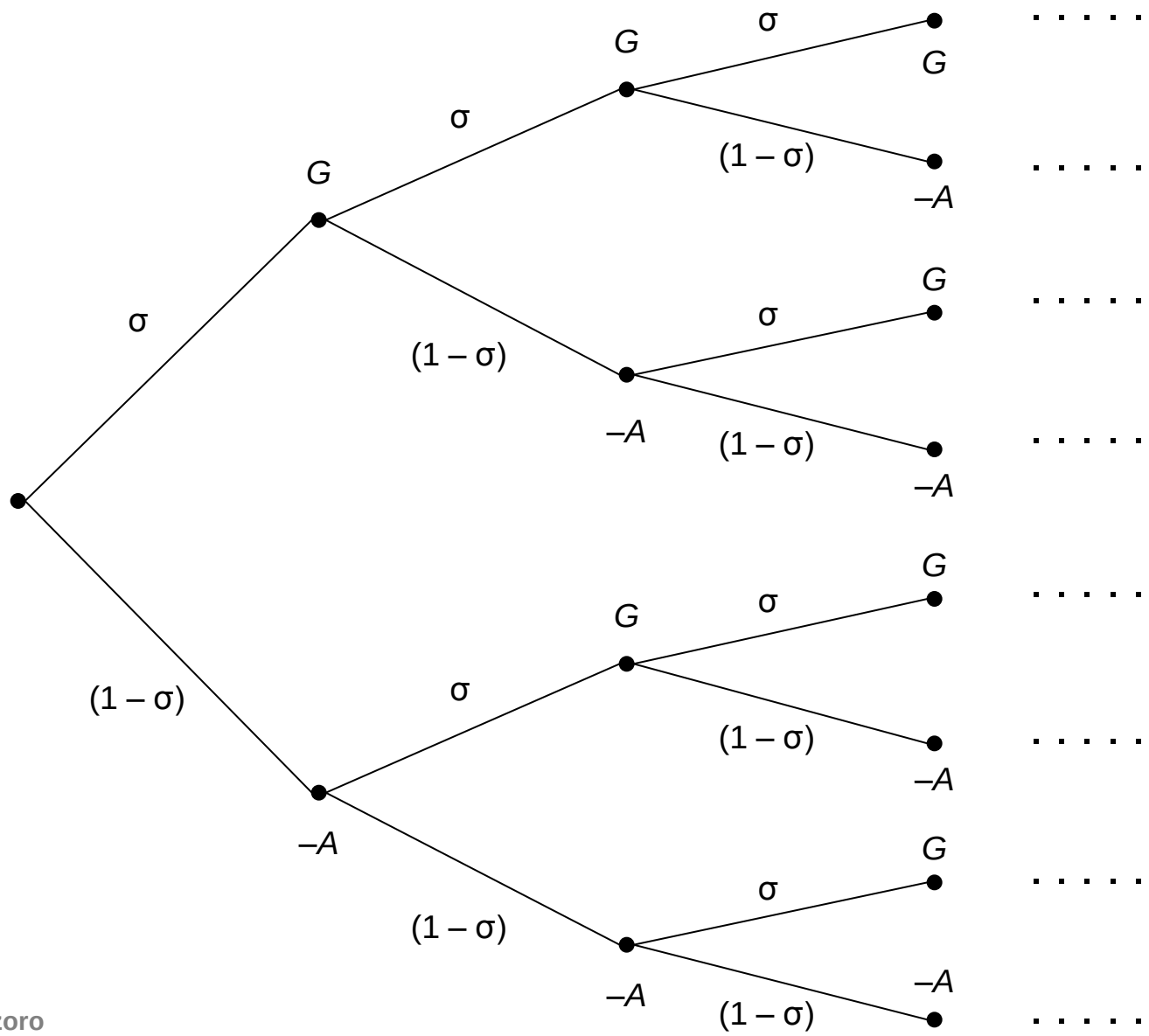
	Financial Options	Real Options
Underlying asset	**Investor's shares in utility company**	Physical ("real") asset
Form of the contract	Standardized	**Over the counter**
Pricing of the underlying asset	Market	**DCF-type + flexibility in decision making**
Risk	**Market and firm specific risk**	**Market and firm specific risk**
Decision method	Comparison of market and strike price	**Multiple criteria (incl. political and externalities)**
Incidence	Singularly	**Sequence of options**
Managing options and influencing their value	Passive management	**Active management**
Type	American/European	**Commonly American**
Accessibility	Financial markets	**Over the counter**
Valuation model	Black-Scholes (continuous data)	**Binominal option pricing model**
Complexity level	Standard	**High complexity**
Execution right	**Option holder**	Multiple agents involved

One-Shot PPP Game with Exit Option

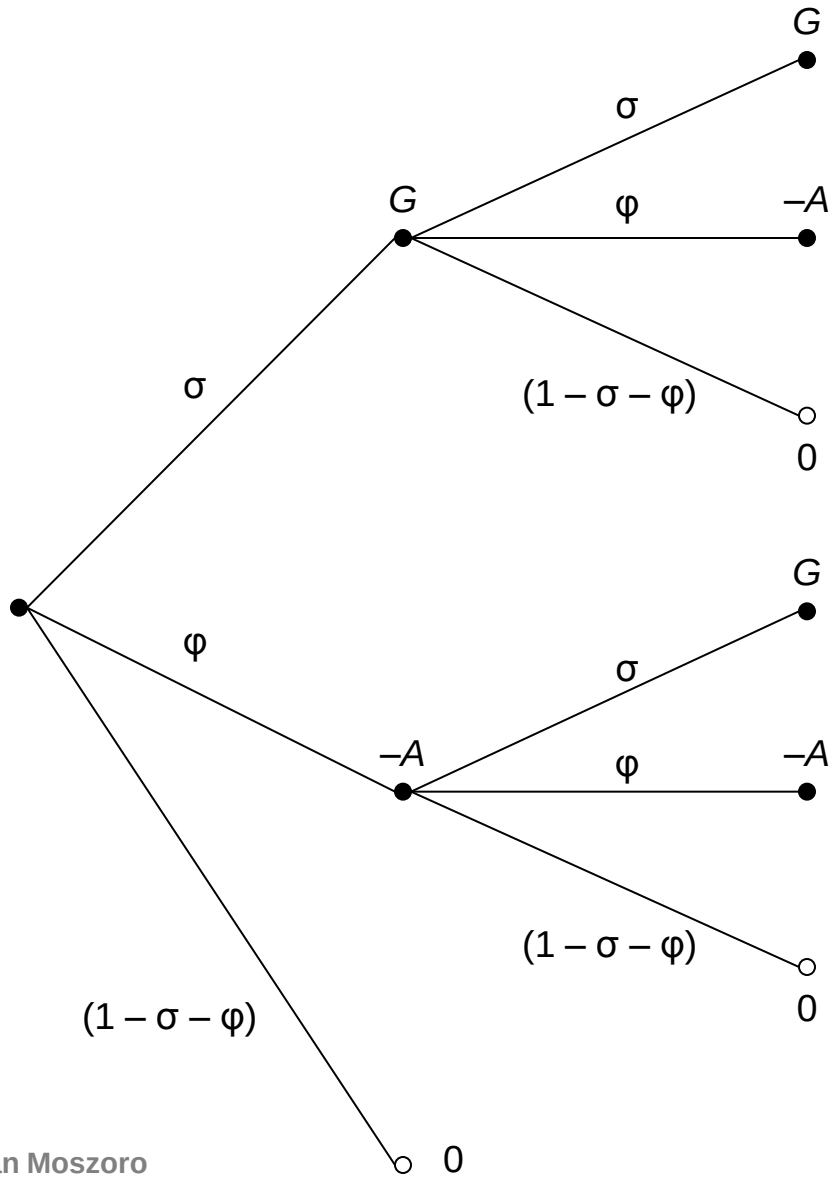


***Lemma 1**: A contract with an exit option held by the private investor in a public-private company is always of non-negative value and satisfies minimax conditions*

Repeated PPP Game



Repeated PPP Game with Exit Option



Corollary 3: *The <u>pessimistic</u> private investor's payoff of a contract with an exit option with a strike price equal to the annualized investment is non-negative and satisfies minimax conditions*

Minimizing the Risk of Private Opportunism

Opportunism strategy is profitable for the private investor if

$$r_{pr} > 1 - (\pi_m - \text{NOPAT})/\text{I}$$

Corollary 4*: The higher* π_m *and* r_{pr}*, the more likely the private investor will behave opportunistically; the higher* I *and* NOPAT*, the less likely the private investor will behave opportunistically*

Corollary 5*: Low* NOPAT/I *ratio increases the likelihood of both public and private opportunism*

Trigger to Bail-Out

1. Lack of fulfillment of contract terms regarding investments
2. Appearance of a new technology ("dynamic-costs problem") which the incumbent investor lacks and which can notably improve the effectiveness of the utility company
3. Monopoly profit by curbing production, lowering quality, or raising prices

→ Public agent might find it beneficial to regulate the monopoly or repurchase shares from the private investor and enter into a new partnership, or create a public monopoly

Bail-Out Option

1. Social tranquilizer and lower third-party opportunism (Spiller and Moszoro, 2011)
2. Tool for enhancing the efficiency of utility companies and lowering the costs of opportunistic renegotiations
3. Solves the “dynamic-costs problem” (Williamson, 1976) of periodically repeated auctions, i.e., “short-termism” in the investment behavior of the incumbent firm (Laffont and Tirole, 1993)

Option Mechanism: Conclusions

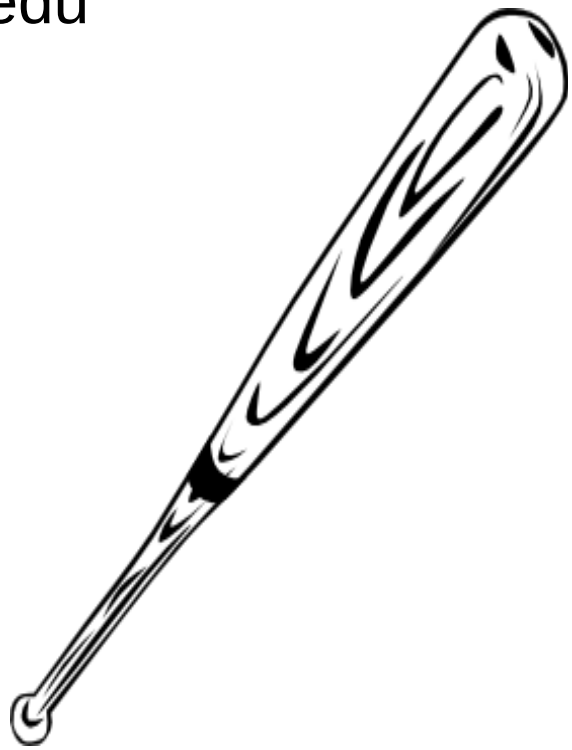
1. Stability of “once-and-for-all” and long-term contracts, with flexibility short-term contracts
2. Problem-free transfer of assets (Posner) boils down to the strike price of the options
3. Natural monopoly ≈ contestable market: reduce (behavioral) entry barriers
4. Mechanism does not eliminate the problem of human capital, transfer of experienced staff, and the advantage of the incumbent investor

Generalization & Other Applications

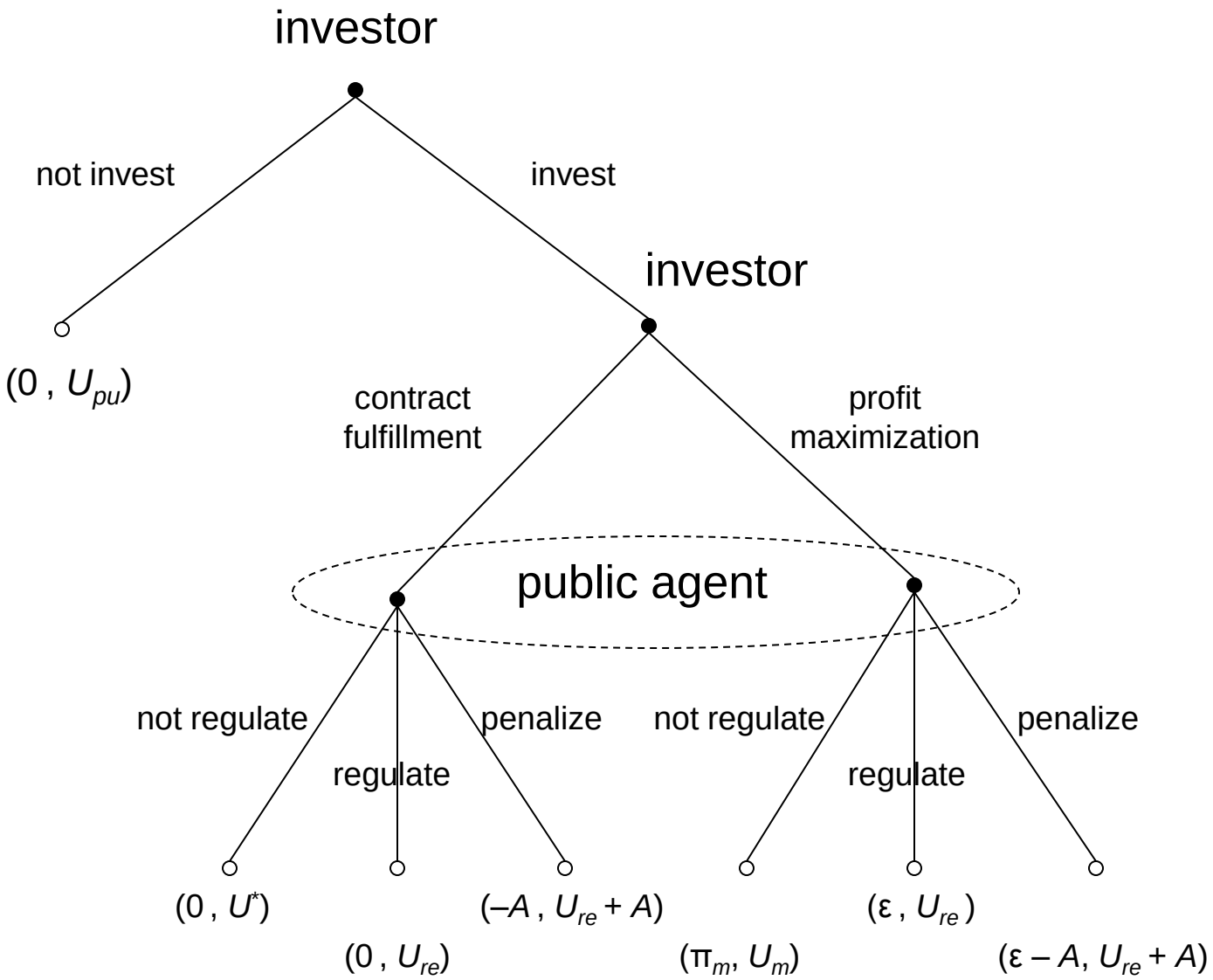
1. Games where players have partially aligned interests and can deviate from cooperation or free-ride for one period, and information about deviation is revealed in subsequent periods:
    a) Mergers & Acquisitions
    b) Principal-agent relations (board options and financial crisis...)
    c) Cooperatives and export consortia
2. Call/put options foster long-term cooperation
3. Call/put options increase the payoffs of the players for each discount factor

Help

1. Please, no mercy in comments and critics
2. Possible databases: factual or counter-factual
3. Email: mmoszoro@iese.edu



One-Shot Regulatory Game

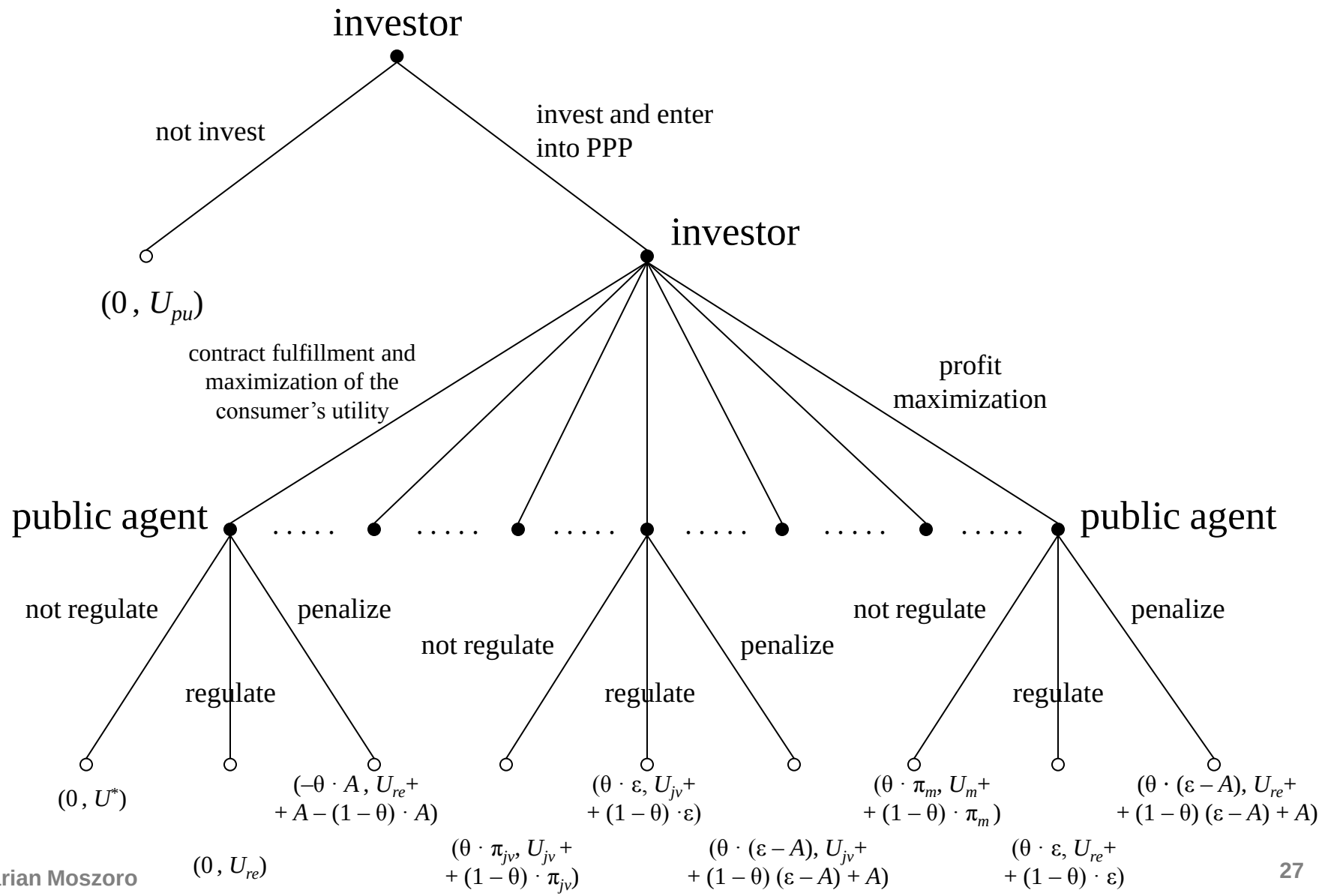


Payoff Matrix of the “Invest” Subgame

		Public agent		
		Not regulate	**Regulate**	**Penalize**
Private investor	**Contract fulfillment**	$(0, U^*)$	$(0, U_{re})$	$(-A, U_{re} + A)$
	Profit maximization	(π_m, U_m)	(ε, U_{re})	$(\varepsilon - A, U_{re} + A)$

1. “Profit maximization” is the dominating strategy for the private investor
2. Public agent’s best response is “Penalization”
3. Subgame Nash equilibrium: “Profit maximization−Penalization”
4. Stage Nash equilibrium: “Not invest”

One-Shot PPP Game (jv)



“Invest and Enter into a PPP” Subgame Payoff Matrix

		Public agent								
		Contract fulfillment and welfare maximization			Mixed strategy			Profit maximization		
		Not regulate	Regulate	Penalize	Not regulate	Regulate	Penalize	Not regulate	Regulate	Penalize
Private investor	Contract fulfillment and welfare maximization	$(0, U^*)$	$(0, U_{re})$	$(-\theta \cdot A, U_{re} + A - (1 - \theta) \cdot A)$	$(0, U^*)$	$(0, U_{re})$	$(-\theta \cdot A, U_{re} + A - (1 - \theta) \cdot A)$	$(0, U^*)$	$(0, U_{re})$	$(-\theta \cdot A, U_{re} + A - (1 - \theta) \cdot A)$
	Mixed strategy	$(\theta \cdot \pi_{jv}, U_{jv} + (1 - \theta) \cdot \pi_{jv})$	$(\theta \cdot \varepsilon, U_{re} + (1 - \theta) \cdot \varepsilon)$	$(\theta \cdot (\varepsilon - A), U_{re} + (1 - \theta) (\varepsilon - A) + A)$	$(\theta \cdot \pi_{jv}, U_{jv} + (1 - \theta) \cdot \pi_{jv})$	$(\theta \cdot \varepsilon, U_{re} + (1 - \theta) \cdot \varepsilon)$	$(\theta \cdot (\varepsilon - A), U_{re} + (1 - \theta) (\varepsilon - A) + A)$	$(\theta \cdot \pi_{jv}, U_{jv} + (1 - \theta) \cdot \pi_{jv})$	$(\theta \cdot \varepsilon, U_{re} + (1 - \theta) \cdot \varepsilon)$	$(\theta \cdot (\varepsilon - A), U_{re} + (1 - \theta) (\varepsilon - A) + A)$
	Profit maximization	$(\theta \cdot \pi_m, U_m + (1 - \theta) \cdot \pi_m)$	$(\theta \cdot \varepsilon, U_{re} + (1 - \theta) \cdot \varepsilon)$	$(\theta \cdot (\varepsilon - A), U_{re} + (1 - \theta) (\varepsilon - A) + A)$	$(\theta \cdot \pi_m, U_m + (1 - \theta) \cdot \pi_m)$	$(\theta \cdot \varepsilon, U_{re} + (1 - \theta) \cdot \varepsilon)$	$(\theta \cdot (\varepsilon - A), U_{re} + (1 - \theta) (\varepsilon - A) + A)$	$(\theta \cdot \pi_m, U_m + (1 - \theta) \cdot \pi_m)$	$(\theta \cdot \varepsilon, U_{re} + (1 - \theta) \cdot \varepsilon)$	$(\theta \cdot (\varepsilon - A), U_{re} + (1 - \theta) (\varepsilon - A) + A)$

Note: π_m – monopoly profit; π_{re} – regulated monopoly profit; π_{jv} – public-private joint venture profit.

Normalized "Invest and Enter into a PPP" Subgame Payoff Matrix

		Public agent								
		Contract fulfillment and welfare maximization			Mixed strategy			Profit maximization		
		Not regulate	Regulate	Penalize	Not regulate	Regulate	Penalize	Not regulate	Regulate	Penalize
Private investor	Contract fulfillment and welfare maximization	$(0, G)$	$(0, 0)$	$(-A/2, A/2)$	$(0, G)$	$(0, 0)$	$(-A/2, A/2)$	$(0, G)$	$(0, 0)$	$(-A/2, A/2)$
	Mixed strategy	$(G/2, G/2)$	$(\varepsilon/2, \varepsilon/2)$	$((\varepsilon - A)/2, (\varepsilon + A)/2)$	$(G/2, G/2)$	$(\varepsilon/2, \varepsilon/2)$	$((\varepsilon - A)/2, (\varepsilon + A)/2)$	$(G/2, G/2)$	$(\varepsilon/2, \varepsilon/2)$	$((\varepsilon - A)/2, (\varepsilon + A)/2)$
	Profit maximization	$(\pi_m/2, U_m - U_{re} + \pi_m/2)$	$(\varepsilon/2, \varepsilon/2)$	$((\varepsilon - A)/2, (\varepsilon + A)/2)$	$(\pi_m/2, U_m - U_{re} + \pi_m/2)$	$(\varepsilon/2, \varepsilon/2)$	$((\varepsilon - A)/2, (\varepsilon + A)/2)$	$(\pi_m/2, U_m - U_{re} + \pi_m/2)$	$(\varepsilon/2, \varepsilon/2)$	$((\varepsilon - A)/2, (\varepsilon + A)/2)$

Normalizations: $U^* - U_{re} = G$, $U_{iv} = U_{re}$, $\pi_{iv} = G$, $\theta = 1 - \theta = 0.5$; then subtracting $(0, U_{re})$ from payoff matrix

Normalized “Invest and Enter into a PPP” Subgame Payoff Matrix

By backward induction, game simplified to choice of strategies made by the investor that correspond to **most effective protective strategies** chosen by the public agent

		If		
		$G > \varepsilon + A$	$A/2 < G < \varepsilon + A$	$G < A/2$
Private investor	Contract fulfillment and welfare maximization	$(0, G)$	$(0, G)$	$(-A/2, A/2)$
	Mixed strategy	$(G/2, G/2)$	$((\varepsilon - A)/2, (\varepsilon + A)/2)$	$((\varepsilon - A)/2, (\varepsilon + A)/2)$
	Profit maximization	$((\varepsilon - A)/2, (\varepsilon + A)/2)$	$((\varepsilon - A)/2, (\varepsilon + A)/2)$	$((\varepsilon - A)/2, (\varepsilon + A)/2)$

Note: cases of weak inequalities disregarded

Corollary 1*: In a one-shot PPP game the best strategy for the private investor consists either of investing and implementing a mixed strategy of moderate profit if $G > \varepsilon + A$, or completely refraining from investing in all other cases.* ***If $G < \varepsilon + A \leq I$, the private investor will not invest and will not enter into a public-private partnership****.*

Pricing PPP Exit Option

$$V_{put} = \mathrm{NPV}_{pr\_put} - \mathrm{NPV}_{pr}$$

$$V_{put} = \theta \frac{\sigma \cdot G}{(1 + r_{pr})} - \theta \cdot \left[\frac{\sigma \cdot G - (1 - \sigma) \cdot A}{(1 + r_{pr})} \right]$$

$$V_{put} = \theta \frac{(1 - \sigma) \cdot A}{(1 + r_{pr})}$$

***Lemma 1**: A contract with an exit option held by the private investor in a public-private company is always of non-negative value and satisfies minimax conditions*

Pricing PPP Exit Option in Repeated Game

$$V_{put} = \mathrm{NPV}_{pr\_put} - \mathrm{NPV}_{pr}$$

$$V_{put} = \theta \frac{\sigma \cdot G - \varphi \cdot A}{r_{pr} + 1 - \sigma - \varphi} - \theta \frac{\sigma \cdot G - (1-\sigma) \cdot A}{r_{pr}}$$

***Corollary 3**: The pessimistic private investor's payoff of a contract with an exit option with a strike price equal to the annualized investment is non-negative and satisfies minimax conditions*

Pricing PPP Exit Option in Repeated Game (2)

In financial notation:

$$\mathrm{NPV}_{pr} = -I + \sum_{t=1}^{T-1} \frac{\theta \cdot \pi_{jv}}{(1+r_{pr})^t} + \theta \frac{I \cdot (1+r_{pr})}{(1+r_{pr})^T}$$

$$\mathrm{NPV}_{pr} = -I + \theta \cdot \left[\pi_{jv} \frac{1-(1+r_{pr})^{-(T-1)}}{r_{pr}} + \frac{I}{(1+r_{pr})^{T-1}} \right]$$

Profit π_{jv} in all periods from 1 to T – 1 indicates that the cost of capital has been covered, while $I/(1 + r_{pr})^{T-1}$ ensures that, upon execution of the option during the period T when the private investor incurs loss, the cost of capital will be recovered

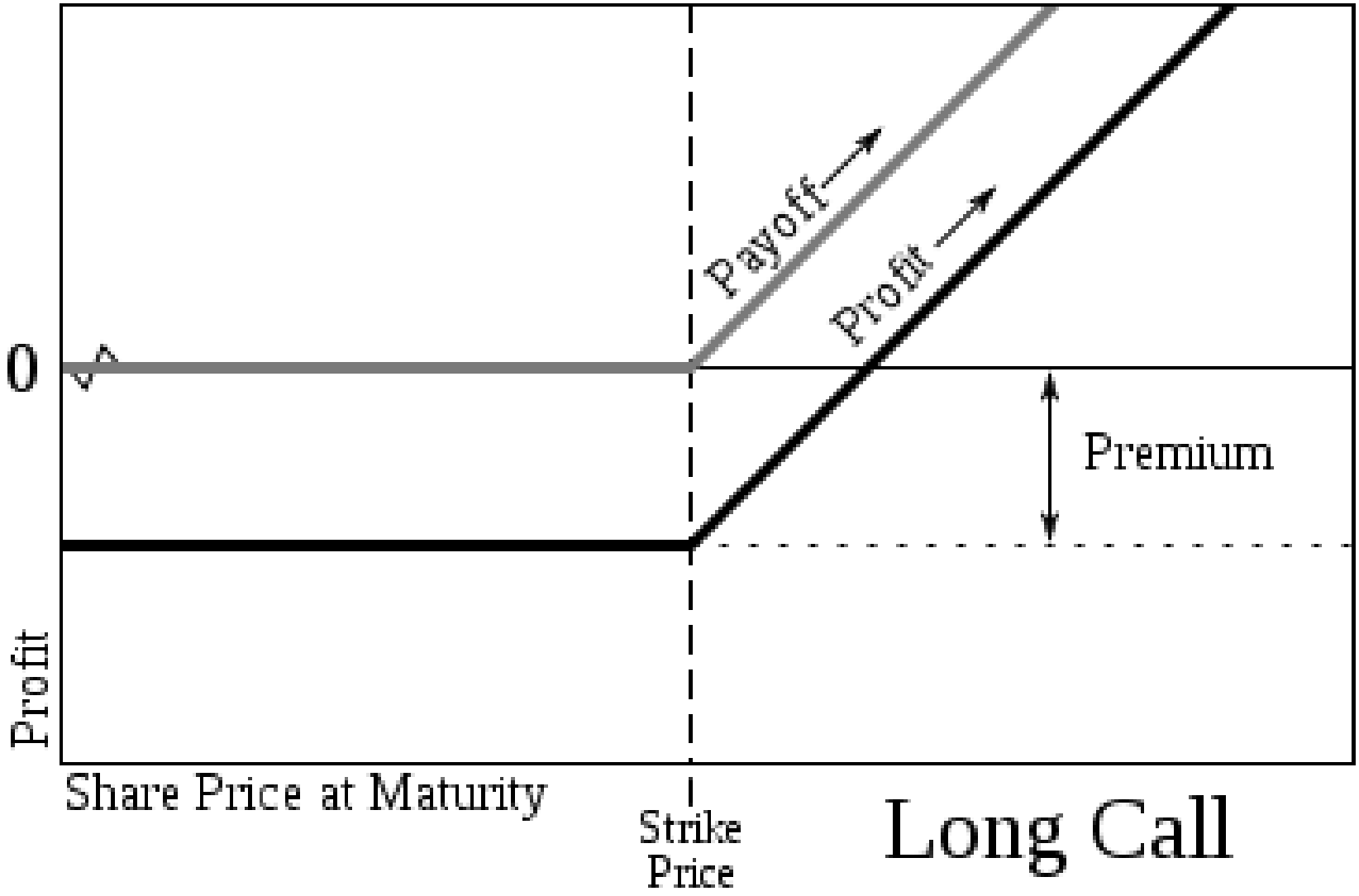
Contractual Characteristics of PPPs

1. “Serious contractual difficulties”: bounded rationality and opportunism
2. Complete “once-and-for-all” contracts (Stigler 1968): save on transaction costs; but claims from unforeseen circumstances, unrealistic
3. Incomplete long-term contracts (Demsetz 1968): enable renegotiation, soothe claims dispute from unforeseen events; but successful bidders can renegotiate terms, regulatory agent required
4. Renewable short-term contracts (Posner 1972): solve adapting long-term agreements; but questionable low transaction cost, equal conditions for incumbent bidders, and new bidders during contract renewals

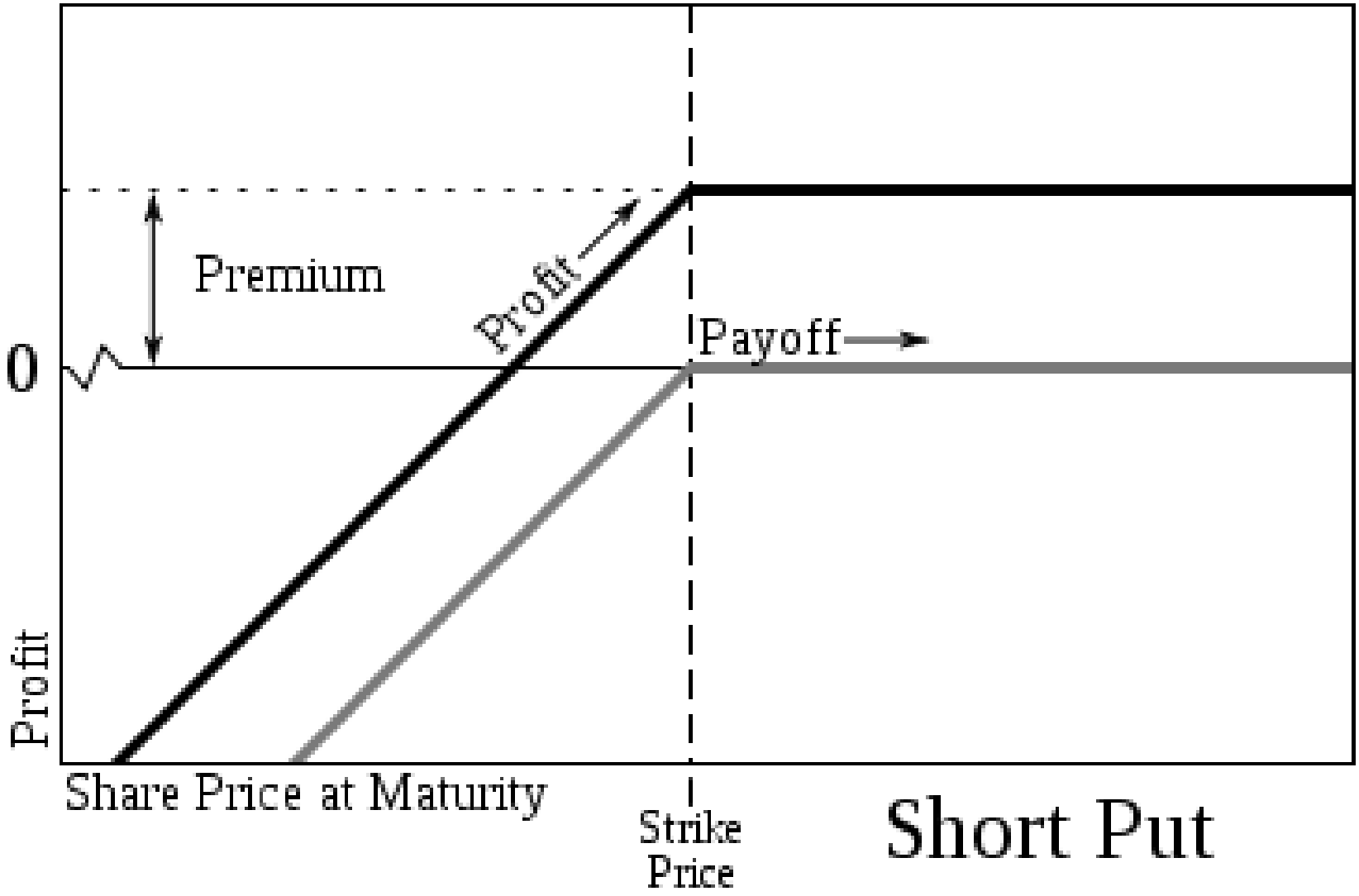
Exit/Bail-Out Option Mechanism in Finance Language

	Bail-out (Call) option	**Exit (Put) option**
Public	long	short
Private	short	long

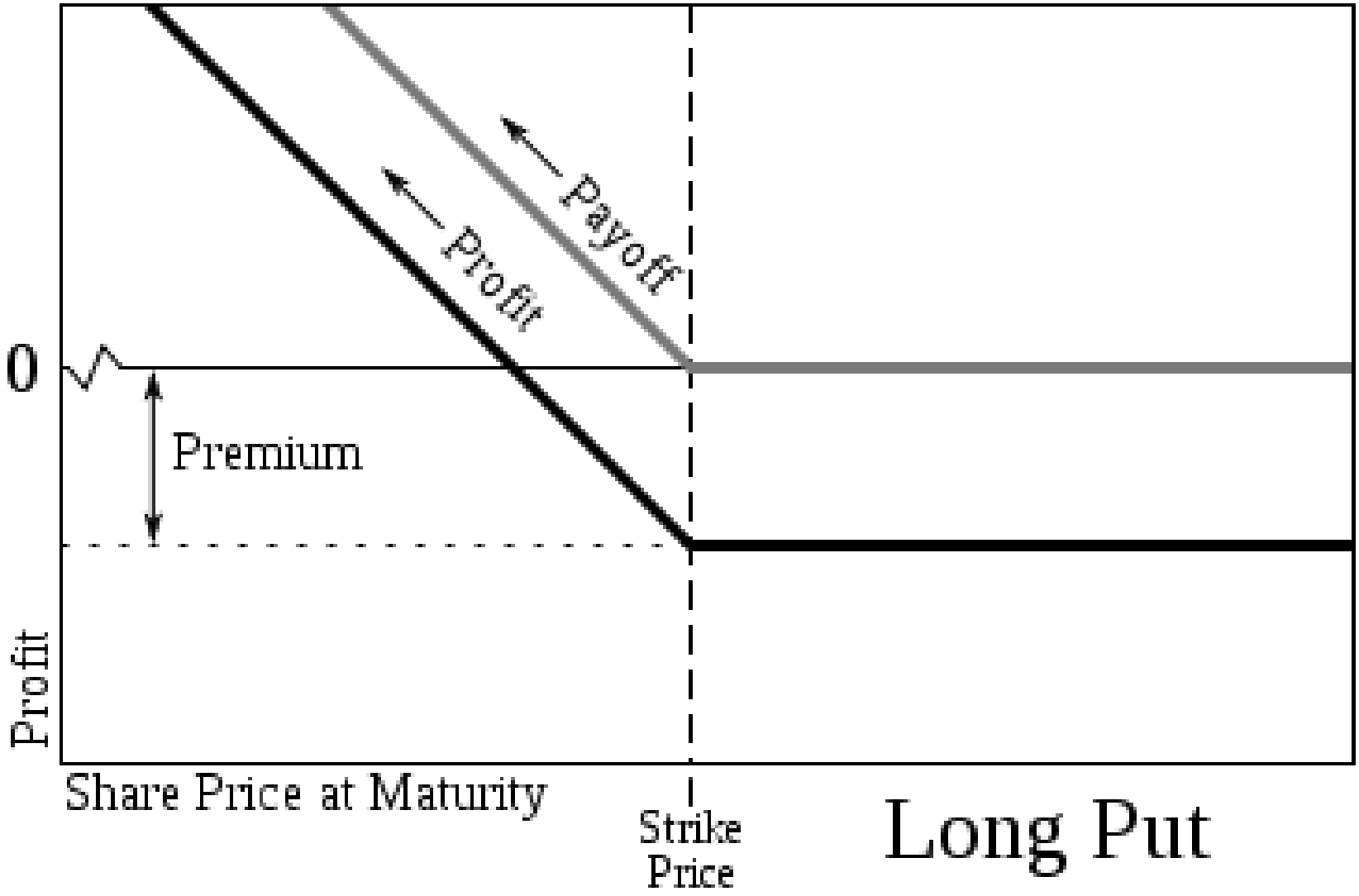
Public Long Call Option



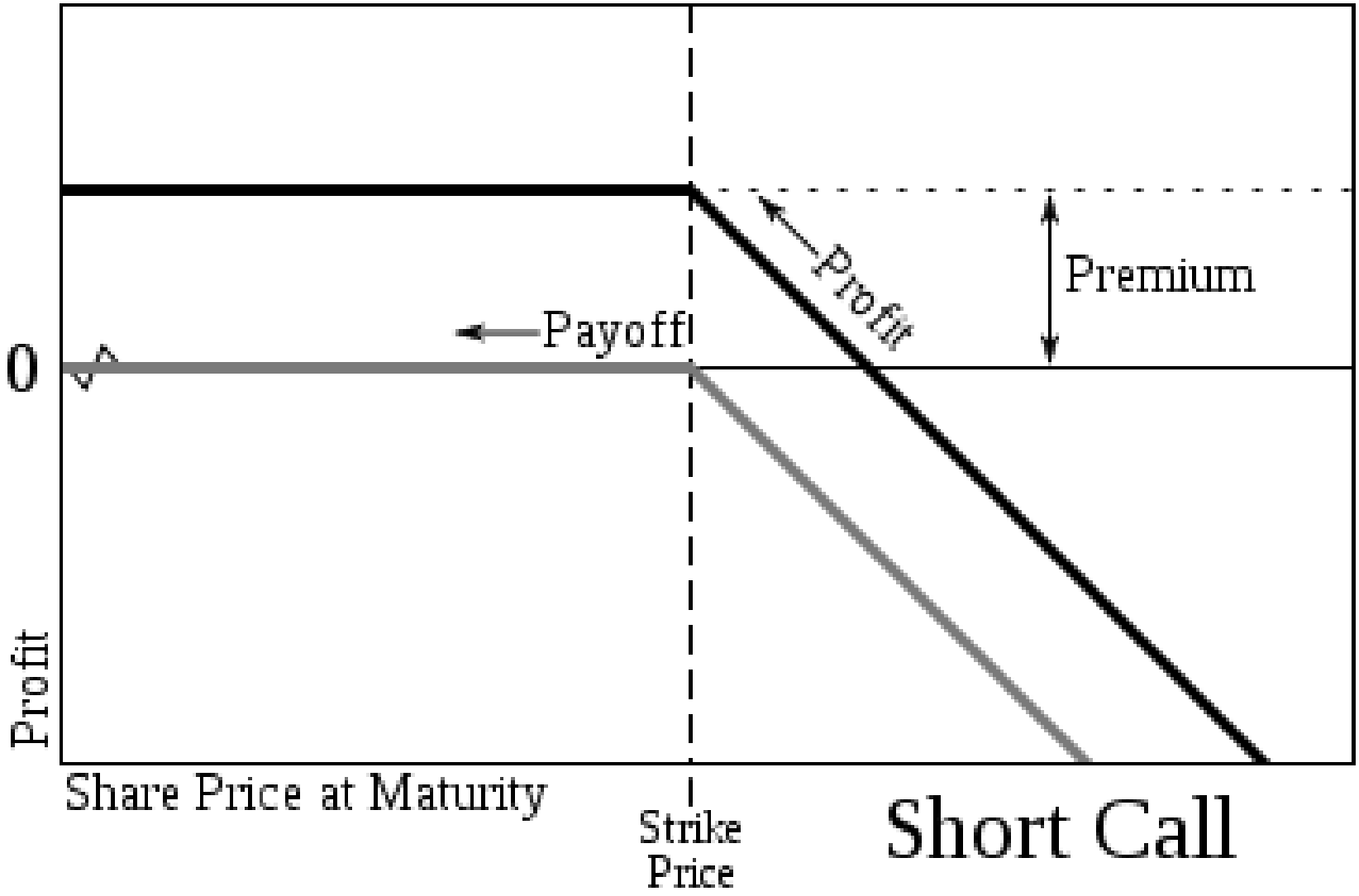
Public Short Put Option



Private Long Put Option



Private Short Call Option



Call/Put Options “Net”