



FINANCING SUSTAINABLE PUBLIC-PRIVATE PARTNERSHIPS (PPP)

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OUTLINE PART II

- 7. Incomplete contract perspective
 - Approach
 - The Model
 - Insights
- 8. Comparison



INCOMPLETE CONTRACT PERSPECTIVE

- Complete constitution:
- All possible contingencies were captured within a contract.
- Design of a complete constitution for PPP, which considers the post constitutional information asymmetry.



INCOMPLETE CONTRACT PERSPECTIVE

- Complete constitution:
- By utilising the mechanism design approach, the welfare of the citizenry was maximised by setting appropriate incentives to the Leviathan. State dependant utilities were derived in order to rank alternative states and policies from the perspective behind the veil of uncertainty. Applying the revelation mechanism made the Leviathan voluntarily reveal the true state of nature.
- Although this analysis gives useful insights, the complete contract design suffers from several drawbacks that motivate a shift of focus to an incomplete contract perspective...



INCOMPLETE CONTRACT PERSPECTIVE

- Implications of incomplete contracts:
 - Bounded rationality.
 - Too expensive to fix all possible contingencies in a contract.
 - Even if such a complex contract existed, a monitoring apparatus would be required in order to determine the actual state of nature.
 - The inability to infer all states of the world ex ante entails that one cannot predict the consequences of the individuals' actions.
 - Due to the uncertain nature of reality, agents have some discretionary leeway when unpredicted contingencies arise.



INCOMPLETE CONTRACT PERSPECTIVE

- The role of incompleteness within the procurement context:
 - PPP are characterised by a specific allocation of ownership, by risk transfer and the underlying incomplete contract
 - The incomplete environment allows for PPPs to generate efficiency gains out of three sources:
 - a specific ownership structure of the asset,
 - bundling of the stages,
 - an appropriate division of risks and the associated rewards from production and procurement.



INCOMPLETE CONTRACT PERSPECTIVE

- The role of incompleteness within the procurement context:
 - The efficiency gains can be divided into productive efficiency (value-for-money) and allocative efficiency.
 - In case of a complete information environment there would be no difference between public provision and provision by a PPP. Then, a complex contract that considers all possible contingencies could attain the same outcomes within PPP and TP projects.
 - The principal can design a complex contract that contains detailed rules for each contingency, and at the same time he would be able to observe his agent enforce the rules.



INCOMPLETE CONTRACT PERSPECTIVE

- For the design of the PPP contract there must be a special focus on the incentives of the political agent to implement particular policies.
- We also assume:
 - Future is not predictable (not even by the author!)
 - Circumstances / situations can occur which are not specifiable yet.
 - No Monitoring
 - All factors must be considered (allocation of ownership...)



INCOMPLETE CONTRACT PERSPECTIVE

○ Allocation of ownership

- When ownership rights are allocated in an efficient way they induce appropriate incentives to the party holding the property rights to maximise the returns from the project. So they induce the incentive to increase the productive efficiency.
- Owner has the residual right to control under all circumstances.
- Ownership means bargaining power.
- Public ownership allows the government to control investments that distort allocative efficiency.
- When the PPP consortia is the owner: Increase of productive efficiency (remember Harts conclusions).



INCOMPLETE CONTRACT PERSPECTIVE

○ Bundling of the stages

- There is a difference between unbundling in case of traditional procurement and bundling in case of PPP.
- Focus is on sunken investments that are made on the building stage that affect the operation and maintenance costs at the operation stage and thus improve productive efficiency.
- In case of unbundling, the building firm has no incentive to make investments that lower the operation costs. At the same time, the builder has no incentive to invest in quality enhancing measures. Then, productive efficiency is lower.
- Investments can have an impact on productive efficiency and allocative efficiency..
- The desirability of PPPs depends on how well a building or service can be specified in a contract.



INCOMPLETE CONTRACT PERSPECTIVE

○ Risk Transfer

- Risk transfer is one of the key features of a PPP that induces incentives to the private party to improve productive efficiency.
- Risk refers to an “uncertain but quantifiable outcome in terms of some of the project’s costs or benefits”.
- This general description encompasses timely and on-budget provision of building and services as well as the revenue risk that is immanent to many projects.
- Kinds of risks, e. g. environmental risks, political and financial risks, construction and operation risks, quality risks, technology risks and exogenous risks which can hardly be predicted in advance.



INCOMPLETE CONTRACT PERSPECTIVE

○ Risk Transfer

- The building and operation firms always have an information edge, and at the same time information issues constrain the design of the procurement contract. Consequently optimal behaviour cannot be elicited by actions based on observable or verifiable variables, because contractual terms are always incomplete.
- Bearing risks can be an incentive to manage and assess risks properly and thereby improve productive efficiency.
- The allocation of risk to the party that is in the best position to handle this specific risk would convey productive efficiency. Problem: environmental risks.



INCOMPLETE CONTRACT PERSPECTIVE

- Evaluation of
 - Demand risk?
 - Regulatory risk?
 - Depends on the political agent: commune vs nation.
 - Division of risks?



INCOMPLETE CONTRACT PERSPECTIVE

- Which is the best kind of an incomplete contract under incomplete information?
 - Self-enforcing contract
 - Individuals are honest as long as honesty is more profitable than being not honest.



INCOMPLETE CONTRACT PERSPECTIVE

- Post constitutional knowledge
 - Leviathan must be constrained with appropriate rules.
 - Individuals know the difference between PPP and TP. They know that contracts are incomplete and there is asymmetric information.
 - Effect of ownership is common knowledge.
 - Effect of bundling and unbundling is common knowledge.
 - Effect of risk transfer is common knowledge.
 - Financial effect of PPP is common knowledge.



INCOMPLETE CONTRACT PERSPECTIVE

- The voting constraint and the concept of Leviathan
 - Is the electoral process adequate to “move the officeholder toward a position where the advancement of self-interest approximates the advancement of the interests of his constituents”?
 - The threat to dissolve a contractual relationship is a crucial tool within the theory of self-enforcing contracts.
 - Citizens have the chance to get rid of the leviathan in a peaceful way, as soon as the welfare level undergoes the anarchic level.
 - majority voting mechanism.



INCOMPLETE CONTRACT PERSPECTIVE

- The voting constraint and the concept of Leviathan
 - The Leviathan earns a political income as long as he is in office. In case of non-re-election he will lose his salary. This income has to be high enough so that the non-re-election is dreadful to the politician.
 - Leviathan must ensure that the utility level is higher than the anarchic level.
 - In case the leviathan is democratically unbounded there is no possibility to get rid of the government in a peaceful way.
 - The frequency of elections will have an impact on the incentives and the behaviour of the Leviathan.



INCOMPLETE CONTRACT PERSPECTIVE

- The model
 - It is impossible to display all contingencies.
 - The development of technologies is uncertain (it is unforeseeable!)



INCOMPLETE CONTRACT PERSPECTIVE

○ The model

- Considering that the future is unforeseeable (even by the author), there will be three scenarios after the veil has fallen:
 - 1. Projects where the properties of the building can easily be described within a contract and consequently traditional procurement is the optimal alternative.
 - 2. Projects where the properties of service can easily be described within a contract (and are measurable) and consequently PPP is the optimal alternative.



INCOMPLETE CONTRACT PERSPECTIVE

- The model

- Considering that the future is unforeseeable (even by the author), there will be three scenarios after the veil has fallen:

- 3. Projects where the properties are unforeseeable. Reasons are manifold: technical development is unforeseeable, properties of service or building are too complex to fix them within a contract (since it would be too expensive). For this 3rd possibility we cannot derive a recommendation for the optimal procurement alternative.

These unforeseeable contingencies will be denoted by θ



INCOMPLETE CONTRACT PERSPECTIVE

- Properties of the building are displayed by the following vector:

$$\theta = \{\theta^{good}, \theta^{bad}, \theta^{unknown}\}$$



INCOMPLETE CONTRACT PERSPECTIVE

Principals

- Their utility depends from the fact whether the right procurement alternative was chosen.
- For the contingency *unknown* we don't have clear guidelines yet, so the individuals consult their knowledge on the incentives of the private firm to invest too much in quality reducing measures and at the same time to increase the productive efficiency. They know that unbundling tends to reduce productive efficiency but sustains a certain amount of allocative efficiency.



INCOMPLETE CONTRACT PERSPECTIVE

Principals

- In case they cannot infer whether the implementation of innovations plays a role in the operation stage, it might be rational for them to prefer unbundling and implement a renegotiation clause in the contract so that they can bargain ex post over the implementation over further technologies in case it turns out that innovations are crucial.



INCOMPLETE CONTRACT PERSPECTIVE

Principals

- For the sake of more transparency, we will display the utility U_i for now by an index varying between s and 0 expressing the extent to which the government's decision satisfies the principles that were derived by Hart.
- In case the government's decision fully complies with Hart's recommendations, the citizens get the non-monetary surplus s of good public services that is generated by the induced incentives of the firms to implement the appropriate incentives.
- In case they suffer from poor public service quality their level of utility is 0 .



INCOMPLETE CONTRACT PERSPECTIVE

Principals

- Generally it is assumed that the individuals vote for unbundling in case of unforeseen contingencies, because thereby they can rely on allocative efficiency. The utility S_{TP}^U will result.
- In case the government decides a bundled solution, the individuals will probably risk allocative efficiency. Then they will receive S_{PPP}^U .



INCOMPLETE CONTRACT PERSPECTIVE

Principals

- We will assume that $s_{TP}^U > s_{PPP}^U$ with a higher probability, since a higher allocative efficiency goes hand in hand with unbundling. The probability of investing too much and to increase productive efficiency is higher in case of bundling.
- Since the future is sufficiently unknown we must assume that $s_{TP}^U < s_{PPP}^U$ also can happen. It would be rational for the individuals to implement a renegotiation clause in case of unforeseen contingencies.



INCOMPLETE CONTRACT PERSPECTIVE

- It is assumed that: $0 < (s_{IP}^U, s_{PPP}^U) < s$



INCOMPLETE CONTRACT PERSPECTIVE

Firms

- Firms receive a cost-covering fee from the government.
 - In case of unbundling they receive P-i-e and
 - in case of bundling they get P-C-i-e.
 - (still they cannot be controlled by the government and so they gain extra utility by undergoing the contract.)
 - Remember: the optimal alternative is the one where the firm can hardly undergo the contract since either properties of building or service can be fixed in the contract well.



INCOMPLETE CONTRACT PERSPECTIVE

Firms

- For the sake of better transparency, the extra benefits will be displayed by a factor ν which can take the values $\{\bar{\nu}, \underline{\nu}\}$.



INCOMPLETE CONTRACT PERSPECTIVE

We will look at the different kinds of scenarios that may arise and their impacts on the firms' extra benefits:

- θ^{good} arises and the government implements unbundling: the firms can hardly undergo the well specified requirements, and the extra utility is \underline{v} .
- θ^{good} arises and the government implements bundling: the firms have a relatively broad scope to undergo the requirements, and they can receive the extra utility of \bar{v} .



INCOMPLETE CONTRACT PERSPECTIVE

We will look at the different kinds of scenarios that may arise and their impacts on the firms' extra benefits:

- θ^{bad} arises and the government implements unbundling: the firms have a relatively broad scope to undergo the requirements, and they can receive the extra utility of \underline{v} .
- θ^{bad} arises and the government implements bundling: the firms can hardly undergo the well specified requirements, and the extra utility is \bar{v} .



INCOMPLETE CONTRACT PERSPECTIVE

We will look at the different kinds of scenarios that may arise and their impacts on the firms' extra benefits:

- θ^u : in this case it is almost impossible to infer the opportunities to shade quality and to undergo contractual requirements. The firms can realise extra benefits that range from 0 to \bar{v} .



INCOMPLETE CONTRACT PERSPECTIVE

- Conclusion:

In the following analysis any state in which the optimal choice is the realisation of a public procured project is denoted by θ^{TP} . States that require the realisation of a PPP are denoted by θ^{PPP} . The condition θ^u captures all characteristics of the uncertain future.



INCOMPLETE CONTRACT PERSPECTIVE

- Common knowledge behind the veil of uncertainty:
 - The individuals behind the veil must account that the firms either have no chance to gain extra benefits or have broad opportunities to shade quality in many ways.
 - They must assume that the government will renegotiate the contract when neither θ^{IP} nor θ^{PPP} arises.
 - The way ownership rights are allocated determines the incentives of either the firms to implement investments that promote productive efficiency or the government's incentive to sustain allocative efficiency by reducing the firm's incentive to increase productive efficiency..



INCOMPLETE CONTRACT PERSPECTIVE

- Common knowledge behind the veil of uncertainty:
 - The citizens are aware that the government always has the chance to renegotiate the contract.
 - The allocation of several risks and the allocation of ownership are instruments that can promote the performance of the project.
 - In case a project is running bad right from the start, renegotiations are an instrument to upgrade the performance of the projects.
 - The citizens must carefully consider implementing the right incentives for the Leviathan so that he is willing to promote the quality of operation.



INCOMPLETE CONTRACT PERSPECTIVE

- Incentives of the government
 - Does the government has an incentive to engage in favour of a high quality?
 - How can we implement an incentive system for a selfish agent under incomplete information?
 - [we will see that there will be differences depending on the research background: mainstream economics versus constitutional economics]



INCOMPLETE CONTRACT PERSPECTIVE

Incentives of the government

- Differences in financial structure of PPP and TP make the leviathan prefer PPP.
- For the Leviathan it is undesirable when firms exploit their scope to undergo the contractual terms, since he pays for something that is not delivered. Since this amount of money is quite low we must ask, if the amount is sufficiently high enough so that the incentive works?



INCOMPLETE CONTRACT PERSPECTIVE

Incentives of the government

- The Leviathan's focus is on his budget or more specifically on the maximisation of the excess of the budget.
- The government is the master of the budget which is denoted by T . It is obliged to keep the budget in balance which requires that $T \geq 0$



INCOMPLETE CONTRACT PERSPECTIVE

Incentives of the government

- Leviathan is anxious that the citizens' utility does not undergo the anarchic level: $U^i < U_A^i$
- It is the Leviathan's duty to provide a public infrastructure.
 - It is his right to exist and so generates utility
 - But: it reduces his budget



INCOMPLETE CONTRACT PERSPECTIVE

Incentives of the government

- 2 different analyses: democratically bounded leviathan vs. unrestricted leviathan.
- If he is democratically restricted he must keep the welfare level above the anarchic level, because of the majority voting system.



INCOMPLETE CONTRACT PERSPECTIVE

Renegotiation of the contract

- What actually happens during these renegotiations and what are the variables that are to be allocated?
- The leviathan can enforce any outcome he wants – this is not an intellectual problem for him. The problem is his incentive-structure.



INCOMPLETE CONTRACT PERSPECTIVE

- Renegotiation of the contract
- Here are the variables that are to be allocated:
 - Property rights
 - In case the government remains the owner over the entire period of the contract there are no incentives for the private party to invest in quality enhancing investments.
 - When the asset is owned by the private party and is transferred at the end of the contract, there are incentives for the private owner to increase the quality in case his effort is reimbursed by an adequate price at the end of the contract.



INCOMPLETE CONTRACT PERSPECTIVE

- Renegotiation of the contract
- Here are the variables that are to be allocated:
 - Bundling
 - Bundling also gives strong incentives to the firm to invest. Since the decision whether to bundle or not is determined at the beginning of the relationship, it is not topic for renegotiations. What matters is that more risk is transferred to the private party when bundling is optimal.
 - Risiktransfer
 - Transferring design, cost and operating risk to the contractor provides incentives to the private party to keep the costs low. In case a high quality increases the social benefit of a facility, but at the same time has a negative impact on life-cycle costs, this can be a counter-argument to PPPs.



INCOMPLETE CONTRACT PERSPECTIVE

- Renegotiation of the contract
- Here are the variables that are to be allocated:
 - Transfer of risk
 - The optimal payment mechanism is rather based on user charges when the demand risk is small and the contractor is risk-averse. A payment mechanism based on availability is rather preferable when risk aversion and demand risk are high.
 - The optimal mechanisms trade-off the insurance given to the contractor and the incentives to increase the surplus by consumers.
 - In sectors where demand is affected by the contractor's effort, the demand risk should be borne by the contractor.
 - For sectors that are mainly used by the public sector and which display the public sector policy, the demand risk should completely be borne by the government.



INCOMPLETE CONTRACT PERSPECTIVE

- Renegotiation of the contract
- Here are the variables that are to be allocated:
 - Re-communalisation
 - Here the government transfers the facility back to the public ownership before the duration of the contract expired. The contract is terminated ahead of schedule.
 - Another costly alternative is the re-tendering of a PPP contract, for example in case of prolonged service disruption. Sometimes it is a problem if a contract is terminated when there is no sufficient market for secondary contracts.

Prominent examples are the private tube contractor for London Underground (Metronet), or the Channel Tunnel Raillink.



INCOMPLETE CONTRACT PERSPECTIVE

- Since the future is unforeseeable, it might happen that other variables become crucial in renegotiations.
 - For example, the dynamic environment of technology might even change some of the predictions..



INCOMPLETE CONTRACT PERSPECTIVE

- Displaying the problem in a game theoretic setting
 - Requirements:
 - The relationship between government and firms within the procurement process.
 - After the incentive constellations became apparent, an additional step is the design of appropriate incentives for the agent in order to behave in a way that is in the interest of the individuals



INCOMPLETE CONTRACT PERSPECTIVE

○ Game theoretic setting

- The game has to have a three-stage design in order to display the chronologically differentiated structure. Multistage games allow for actual decisions to affect future pay-offs indirectly by affecting the actions of other players.
- **Stufe 1:** Leviathan decides to provide a new infrastructure. The citizens are able to observe that the government satisfies an obligation that was delegated to it behind the veil. They honour this, but this time they are unable to observe the quality of the infrastructure.



INCOMPLETE CONTRACT PERSPECTIVE

- Game theoretic setting
 - **Stage 1:**
 - **Assumption:** a certain fraction of the projects can fail right from the start. This probability is low and correlates with projects that are inappropriate to the current state of nature. Knowing that it cannot monitor the firms completely, the government can infer the right procurement alternative. In case it made a wrong decision, it can still mend this mistake by renegotiating the contract.



INCOMPLETE CONTRACT PERSPECTIVE

- Game theoretic setting
- **Stage 1:** Renegotiations are costly for the government. The last resort is to bring the infrastructure back to the ownership of the commune and to terminate the contract with the operator company.
- After the first stage is over, the citizens evaluate the Leviathan's performance in an election. In case he remains in office and in case he was democratically constrained, the second stage of the game starts.



INCOMPLETE CONTRACT PERSPECTIVE

- Game theoretic setting
- **Stage 2:** The government again decides on procurement decisions. In case there are some suboptimal projects, the government has the chance to renegotiate the contract and adapt some of the critical variables in order to improve the performance of the projects. At the end of this stage, the citizens are able to observe the quality of the projects. In case a sufficient amount of the projects fails, or suffers from poor quality, the citizens will drop the government. An unconstrained/ persistent leviathan can only be deposed by a revolution.



INCOMPLETE CONTRACT PERSPECTIVE

- Game theoretic setting
- **Stage 3:** The government either has to buy back the infrastructure (in case ownership was allocated to the firm), or where the infrastructure is transferred back automatically. In both cases the duration of the project is over and it becomes obvious to the government how much money it actually spent on it.



INCOMPLETE CONTRACT PERSPECTIVE

- Game theoretic setting
- Within the game it will be assumed that the government has two choices of strategy. It can either perform a quality enhancing action h_G or a quality decreasing action l_G .
- In stage 1 all 3 contingencies can occur:

$$\theta = \{\theta^{good}, \theta^{bad}, \theta^{unknown}\}$$



INCOMPLETE CONTRACT PERSPECTIVE

θ^T	h_F	l_F
h_C	(x^T, \underline{v})	
l_C		(x', \bar{v})



INCOMPLETE CONTRACT PERSPECTIVE

θ^{DDP}	h_F	l_F
h_C	(x^{DD}, \underline{v})	
l_C		(x', \bar{v})



INCOMPLETE CONTRACT PERSPECTIVE

θ^U	h_F	l_F
h_C	(x^U, \underline{v})	
l_C		(x^U, \bar{v})



INCOMPLETE CONTRACT PERSPECTIVE

- Sequential game:
 - The government always makes the first move by announcing the procurement alternative (TP or PPP).
 - Then the firms move by participation in a bidding procedure. Depending on their ability, they undergo the requirements of the contract.
 - So far we distinguished projects that were realised as a PPP and TP, denoted by x_{PPP} and x^{TP} .



INCOMPLETE CONTRACT PERSPECTIVE

- Now, the indices A and I are introduced that denote appropriate and inappropriate projects. Still, they are either a PPP or TP, but the new indices are appropriate for a far more general elaboration.
- We make the simplification because of the unforeseeable future!
- Similar approach: Production game (Grimalda, Sacconi, 2002).



INCOMPLETE CONTRACT PERSPECTIVE

- All stable results are presented in the following diagram:

	θ^{IP}	θ^{PPP}	θ^I
h_G	$(x^{IP}, \underline{v}, U^i)$	$(x^{PPP}, \underline{v}, U^i)$	$(x^A, \underline{v}, U^i)$
l_G	$(x^{IP}, \underline{v}, U^i)$	(x^{IP}, \bar{v}, U^i)	(x^I, \bar{v}, U^i)



INCOMPLETE CONTRACT PERSPECTIVE

- Way to the solution:
 - Utility level of the government, depending on his action and the contingencies.
 - Then, we can see, if the government has an incentive to behave in a „good way“ and if he enforces a good procurement policy.
- What can we expect?
 - There will be a difference between a democratically constrained and unconstrained leviathan/ government.
 - The government will have no incentive to enforce a completely good procurement policy.



INCOMPLETE CONTRACT PERSPECTIVE

The citizens utility:

- Stage 1: In the first stage they can observe that the government attends its duty and provides a sufficient amount of infrastructure. I. e., their aggregated utility level is $\sum_i U^i \geq \sum_i U_A^i$
- In case a sufficient amount of projects fails, the utility of the individuals can undergo the anarchic benchmark level.



INCOMPLETE CONTRACT PERSPECTIVE

The citizens utility

- At the end of stage one the citizens cannot observe either the quality of the service yet or the amount of projects that failed in the beginning.
- Their utility consists of „appropriate projects“ minus the utility of „failed projects“.



INCOMPLETE CONTRACT PERSPECTIVE

The citizens utility

- Level 2: The quality is now obvious.
- In case the average utility undergoes the anarchic benchmark $\sum_i U^i < \sum_i U_A^i$ the individuals will drop a democratically constrained leviathan out of office.
- An unconstrained Leviathan will be overthrown if $\sum_i U^i \ll \sum_i U_A^i$



INCOMPLETE CONTRACT PERSPECTIVE

The governments' utility

- Both kinds of governments can infer that there is a probability p that certain projects fail which are not adequate to the actual state of nature.
- Both share the same objective function

$$U^1 = T + x(T - t) \quad t = \sum t_j \quad T \geq \sum t_j \quad x = \sum x_j$$

- Therefore the utility function can be rewritten:

$$U^1 = T + x_j(T - t_j)$$



INCOMPLETE CONTRACT PERSPECTIVE

The governments' utility

Side conditions: $\sum_i U^i < \sum_i U_A^i$ resp. $\sum_i U^i \ll \sum_i U_A^i$
 $T \geq 0$

The government has to keep the budget in balance. He faces a trade-off referring x : On the one hand it is desirable for him to provide projects x , because they display his right to exist as a Leviathan and he also utilises these assets.

On the other hand he does not want to spend too much money from the budget, since it also gives him utility when he skims its revenue for himself.



INCOMPLETE CONTRACT PERSPECTIVE

Maximisation problem of the government:

$$\max_x U^1 - \lambda \left[\sum_{i=1}^n (U^i - U_A^i) \right] - \mu [T] - \nu [T - \sum t_j]$$

$$L(x, \lambda, \mu, \nu) = U^1 - \lambda \left[\sum_{i=1}^n (U^i - U_A^i) \right] - \mu [T] - \nu [T - \sum t_j]$$



INCOMPLETE CONTRACT PERSPECTIVE

Consequences from the maximisation problem:

- From the maximisation follows that he has the incentive to invest in x , but since he faces a trade-off with the budget, only to a certain degree.
- x is positive because the Leviathan uses the public goods, too, and at the same time his position is linked to the obligation to provide the infrastructure.
- He is not interested in an endless extension of the provision of x , since he is constrained by the budget rule $T \geq 0$.
- The utility function of the persistent Leviathan differs from the constrained government as the persistent one can rely on the fact that he will reach the third stage with a far higher utility where the procurement contracts expire.



INCOMPLETE CONTRACT PERSPECTIVE

- Persistent leviathan vs. unconstrained leviathan:
 - The possibility of being dropped out of office makes the government a bit less farsighted. The two different participation constraints of the citizens have an impact on the way the two regimes discount the future. The consequence of this difference is, that both regimes have a different discount factor .
 - In case the discount factor is near to 0, the future hardly matters and future pay-offs have a low impact on the chosen actions in the foregoing period.



INCOMPLETE CONTRACT PERSPECTIVE

- Persistent leviathan vs. unconstrained leviathan:
 - In case future matters and the factor is near to 1 the actual decision considers future threats or benefits.
 - The discounting factor will not exactly be specified for both regimes, but it is obvious that the persistent Leviathan has a higher discounting factor, since his decisions in the first stage surely affect his pay-offs in the next two stages. The constrained regime cannot be sure that he will be affected by his choices in the foregoing periods, since there is the possibility that he will not be in office when period two or three starts. The chance to penalise deviant behaviour in the future allows cooperation without binding agreements.



INCOMPLETE CONTRACT PERSPECTIVE

- Persistent leviathan vs unconstrained leviathan:
 - index cl refers to a constrained Leviathan and pl refers to a persistent Leviathan.

$$\delta_{cl} < \delta_{pl}$$



INCOMPLETE CONTRACT PERSPECTIVE

Impact of the voting constraint between stages one and two (neglecting differences in financial structure):

No reason why both governments should decide in favour of an inappropriate procurement alternative. Doing so would not be a big difficulty for them since they profit from an informational advantage to their principals.

In case the governments decide in favour of the appropriate alternative, they can decrease the scope of the firms to undergo the contract. This is appealing insofar as the governments get what they paid for instead of giving a monetary extra benefit to the firms. Another reason to choose the right alternative is that the risk of project failure can be eliminated.



INCOMPLETE CONTRACT PERSPECTIVE

- This is more important for the constrained government that has to take the principal's utilities into account.
- To conclude, there is no risk that the governments might decide in favour of the wrong alternative since there is no incentive for doing so. This assumption holds as long as the financial and budgetary impacts of both alternatives are neglected.



INCOMPLETE CONTRACT PERSPECTIVE

The calculus of the Leviathan regime

- Both regimes assume to play the above mentioned three-stage game. The democratic Leviathan is supposed to play the game as long as he is deselected. Therefore this game can be classified as an infinite one.
- In case it is finite one could assume that the government would defect in the first period because of backwards induction.
 - In case the utility loss for the government is sufficiently high when the citizens abolish the Leviathan, it is questionable whether defection in the sense of undergoing the social contract by opportunistic reporting is a rational strategy of the government.



INCOMPLETE CONTRACT PERSPECTIVE

The calculus of the Leviathan regime

- „inappropriate alternative“ x_1 leads to x_1^f or x_1^A
- In case the government decides to provide the appropriate procurement alternative it can gain the following utility level when the three-stage game is played infinitely often.

$$U^1 = u^1(x^A)[1 + \delta + \delta^2 + \dots] = u^1(x^A) \sum_{t=0}^{\infty} \delta^t = \frac{u^1(x^A)}{(1 - \delta)}$$



INCOMPLETE CONTRACT PERSPECTIVE

The calculus of the Leviathan regime

- Can there be an equilibrium for the government always to perform a quality enhancing action in any state of nature?
- In case the government decides to deviate from his optimal response to the actual state of nature, a
- utility level $u^1(\tilde{x}^J)$ will result that is above the utility that would result from his $u^1(x^A)$ optimal response to the state, which is denoted by

$$u^1(r^1(x^J)) > u^1(x^A)$$



INCOMPLETE CONTRACT PERSPECTIVE

The calculus of the Leviathan regime

- If the government's suboptimal response results in a deselection, the government's utility level for the following periods will be the anarchic utility.
- The discounted utility from defecting is:

$$u^1(r^1(x^J)) + u^1(x^J, x_r^J) \frac{\delta}{(1-\delta)}$$



INCOMPLETE CONTRACT PERSPECTIVE

The calculus of the Leviathan regime

- Deviating from the optimal structure is not rational in case

$$u^1(\tilde{x}^I) + u^1(x^I, x_r^I) \frac{\delta}{(1-\delta)} < \frac{u^1(x^A)}{(1-\delta)}$$

- Under the assumption that the three-stage game is not infinitely repeated, we can rewrite the conditions as follows::

$$u^1(\tilde{x}^I) + u^1(x^I, x_r^I) [\delta + \delta^2] < u^1(x^A) [1 + \delta + \delta^2]$$



INCOMPLETE CONTRACT PERSPECTIVE

The calculus of the Leviathan regime

- An „inappropriate alternative“ x^I must not necessarily end up in a „failed project“. Citizens will realise the quality of the alternative in stage 2.
- So the citizens will not deselect such behaviour after stage 1. But in stage 2 the real quality of projects become obvious in case an sufficient amount of projects suffer from poor quality. The citizens will deselect the government.



INCOMPLETE CONTRACT PERSPECTIVE

The calculus of the Leviathan regime

- In case the government decides to take the risk and to realise x^I , it has to take the respective costs of the renegotiations into account if it wants to avert its voting out. This reduces its personal utility by

$$u^1(x^I) - \alpha$$



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The calculus of the Leviathan regime

- There can be an equilibrium for playing x^A in case that costly renegotiations are not profitable. The necessary condition would be:

$$u^1(\tilde{x}^I) + (u^1(x^I) - \alpha) \frac{\delta}{(1-\delta)} < \frac{u^1(x^A)}{(1-\delta)}$$

- In case the game is not infinitely repeated:

$$u^1(\tilde{x}^I) + (u^1(r^1(x^I) - \alpha)[\delta + \delta^2] < u^1(x^A)[1 + \delta + \delta^2]$$



INCOMPLETE CONTRACT PERSPECTIVE

The calculus of the Leviathan regime

- In stage 3 both kinds of government will have to take the entire costs into consideration, since the contract expires.
- Additional costs that result out of instalments that were either financed by running income or by loans will be considered, as well as costs that result out of an inappropriate risk transfer when the government buys back a facility that is in need of a renovation. They will be captured within a factor β .
- For $\beta = 0$ there are no additional costs at the end of the project.



INCOMPLETE CONTRACT PERSPECTIVE

The calculus of the Leviathan regime

- The costs that are captured in factor β can be relevant in both scenarios, no matter if the government decided to provide the “appropriate alternative” or the “inappropriate alternative” since these additional costs are contingent on the way the projects are financed.



INCOMPLETE CONTRACT PERSPECTIVE

The calculus of the Leviathan regime

- The temporal utility functions will be summarised as follows:

1. In case the government decides in an optimal way and there are no contingencies that require a renegotiation of the contract and that the instalments were not financed by loans or from running costs.

$$u^1(x^A)(1 + \delta + \delta^2)$$



INCOMPLETE CONTRACT PERSPECTIVE

The calculus of the Leviathan regime

- Just like in the first case, but with additional financing costs so that $\beta > 0$:

$$u^1(x^A)(1 + \delta) + (u^1(x^A) - \beta)(\delta^2)$$



INCOMPLETE CONTRACT PERSPECTIVE

The calculus of the Leviathan regime

3. In case the government decides to provide an inappropriate procurement alternative and then has to renegotiate the contract in order to realise a facility with high quality and performance. Such a project will almost satisfy the citizens utility after some rectification. It is assumed that no additional costs arise in the last stage, so that $b = 0$.

$$u^1(x^J, x_r^A) + [u^1(x^J, x_r^A) - \alpha](\delta) + [u^1(x^J, x_r^A)(\delta^2)]$$



INCOMPLETE CONTRACT PERSPECTIVE

The calculus of the Leviathan regime

4. In case there are additional costs of financing the project ($\beta > 0$)

$$u^1(x^J, x_r^A) + [u^1(x^J, x_r^A) - \alpha](\delta) + [u^1(x^J, x_r^A) - \beta](\delta^2)$$



INCOMPLETE CONTRACT PERSPECTIVE

The calculus of the Leviathan regime

- The last scenario displays the case in which the government is dropped out of office after the first stage:

$$u^1(x^f, x_r^f) + u_{\Delta}^1(x^f, x_r^f)(\delta) + u_{\Delta}^1(x^f, x_r^f)(\delta^2)$$



INCOMPLETE CONTRACT PERSPECTIVE

Consequences for the incomplete social contract

- An obvious problem of the procurement processes is that the decision process is distorted due to the difference in financing both alternatives. Since it is not legitimate to recommend abolishing one of the key characteristics of a PPP, namely the payment by instalments, other solutions must be elaborated.



INCOMPLETE CONTRACT PERSPECTIVE

Consequences for the incomplete social contract

- The fact that the contract duration usually lasts longer than the legislative period has the effect that the political leader does not take the future financing costs sufficiently into account. Then, the short frequency of elections is not desirable.
- Alternatively, the contract period could be shortened or the frequency of elections could be extended to

$$\tau + 1 > t$$



INCOMPLETE CONTRACT PERSPECTIVE

Consequences for the incomplete social contract

- Then, the contract would be self-enforcing in a way, so that it would be in the government's interest not to finance PPP projects when the budget is too constrained.
- This would also be in the interest of the citizens and particularly future generations. This is no severe problem in case the government is not tied by elections. At the same time surrendering elections might exhibit other threats.



INCOMPLETE CONTRACT PERSPECTIVE

Consequences for the incomplete social contract

- The allocation of ownership typically remains with the government. This again is a characteristic of a PPP that distinguishes it from pure privatisation. The allocation to the firms would complicate the problem in a way that we would have to design an incentive contract for them to behave in the citizens' interest. Since many of the projects do not face a demand risk, the citizens would not be able to show their dissatisfaction by rejecting the usage of the facility.
- Competition would be no mechanism that constrained the behaviour of the private operators to behave according to the citizens' interests.



INCOMPLETE CONTRACT PERSPECTIVE

Consequences for the incomplete social contract

- Allocating ownership to the government makes the analysis easier, since the government is the only agent that has to be analysed since he has any bargaining power in any possible situation. It is his decision to trade-off the allocative and the productive efficiency in an appropriate way.
- By assuming that there will be a time (stage two) in which the citizens will be able to observe the true performance of the facility, one can be sure that that the government will renegotiate the contract in a way that the performance of the infrastructure is guaranteed.



INCOMPLETE CONTRACT PERSPECTIVE

Consequences for the incomplete social contract

- Therefore it is quite desirable that the legislative period incorporates the second stage since the government incorporates the threat of renegotiations before it decides on the procurement alternative. The government can thereby be incentivised to act in a more farsighted way.
- An election before a renegotiation of the contract can incentivise the Leviathan to disregard the costs a . In case the frequency of elections is too short, the social contract is not desirable. In case the frequency has the optimal duration $\tau + 1 > t$, the contract is self-enforcing in a way that the government considers the costs of renegotiations before it considers the implementation of the procurement alternative.



INCOMPLETE CONTRACT PERSPECTIVE

Consequences for the incomplete social contract

- This linkage still holds if we incorporate the assumption that the firms try to bribe the government.
- The optimal duration would also set the appropriate incentive to the government to consider financing costs that accrue at the end of the contract when the user fees were financed from running costs or public loans. The contract would then make sure that the government acts in the interest of the citizens.



INCOMPLETE CONTRACT PERSPECTIVE

Consequences for the incomplete social contract

- Projects that incorporate a demand risk and a payment scheme in which the firms gain their returns from the users and not from availability incorporate an incentive problem. In order to make the project look more viable and in order to win the bidding, the firms tend to overestimate future demand. This optimism bias leads to a short-term benefit to the contractor, but it is unlikely that the project is viable in the long run. Even a renegotiation of the contract is a second-best solution of this problem. This bias can even lead to re-communalisation if the firm gets bankrupt or receives additional financial support from the government that will yield in additional costs b in the last period



INCOMPLETE CONTRACT PERSPECTIVE

Consequences for the incomplete social contract

- A solution would be a modified bidding process. First of all, the government must be incentivised to be interested in an appropriate estimation of the demand risk. This can be realised by an adaption of the legislative period over the entire project duration.
- Incentivising the government in an appropriate allocation of demand risk can make the government decide in a way it trades-off insurance versus incentivising the firm to enforce demand-boosting investments.



INCOMPLETE CONTRACT PERSPECTIVE

Consequences for the incomplete social contract

- It turned out that PPP contracts often had to be renegotiated when the sector is dynamic, such as the IT sector. In order to keep renegotiation costs a low, it would be in the interest of the citizens as well as that of the government to exclude PPP projects in such dynamic fields. Excluding PPPs from dynamic sector is self-enforcing, since it is in the interest of the agents to comply with the rule. The frequencies of renegotiations easily outweigh the attractive financing structure of a PPP since they display additional costs and incorporate the threat of a delayed service delivery. Frequent renegotiations are also expensive for the private partner, at least they are time-consuming.



INCOMPLETE CONTRACT PERSPECTIVE

Consequences for the incomplete social contract

- Environmental risks, such as earthquakes or floodwaters become more and more relevant since climate change proceeds. These damages are usually covered by insurances, but there are some projects where additional investments are beneficial to make the facilities, such as bridges durable in case of a flood. Therefore it is rational to allocate this risk to the private operator to incentivise him to do appropriate investments and to estimate the occurrence probability of risk appropriately. The firms decide whether they want to insure certain risks by an appropriate insurance.



INCOMPLETE CONTRACT PERSPECTIVE

Consequences for the incomplete social contract

- Regulatory and political risks refer to changes of either of the systems. This is rather on behalf of the private partners and, of course the citizenry in case the service delivery is shortened or interrupted.
- The contracts therefore have to be designed in a way that the delivery of high quality service is guaranteed, even if the project falls out of favour after a changeover of power. An example could be projects like all-day child care facilities or private prisons that not necessarily have to comply with political ideologies.



INCOMPLETE CONTRACT PERSPECTIVE

Consequences for the incomplete social contract

- Construction- and operation risks: should remain with the private partner, otherwise there will be wrong incentives during the building stage. Consequences will be low quality of the building and the operation.



INCOMPLETE CONTRACT PERSPECTIVE

Consequences for the incomplete social contract

- Projektspezifische Eigenschaften die nach Periode 3 eine Rolle spielen können, sollten besonders berücksichtigt werden, da die Bürger im Modell nach Periode 3 keine Sanktionierungsmöglichkeiten mehr haben.
- Rückkaufisiko und residual Wert: Bei Rückkaufmodellen trägt der Staat das Rückkaufisiko; „Endspieleeffekt“ beim Investor (dh. Kein Anreiz gegen Ende des Vertrages Investitionen zu tätigen).
- Der Informationsvorteil des Investors kann dazu führen, dass dieser am Ende eine Einrichtung an den Staat verkauft, die einen geringeren Wert als den Kaufpreis hat.



INCOMPLETE CONTRACT PERSPECTIVE

Conclusion

- Bei automatischem Rücktransfer: Es gibt zwar immer noch Endspieeffekte, aber der Staat trägt nicht mehr das Rückkaufisiko.
- Falls die Infrastruktur am Ende an den Investor verkauft wird, muss dieser für Ersatz sorgen. Zentral ist, dass keine öffentlichen Gelder verschwendet werden. Einerseits würde dies den Endspieeffekt beseitigen, andererseits könnte der Staat einen Anreiz haben die Infrastruktur zu verkaufen um den Haushalt aufzufüllen. Der Verbot von solchen Kaufoptionen am Ende des Vertrages kann einen Lösungsansatz darstellen.



INCOMPLETE CONTRACT PERSPECTIVE

Summary

