



FINANCING SUSTAINABLE PUBLIC-PRIVATE PARTNERSHIPS (PPP)

Dipl. Volksw. Dr. Sarah Jamil

OUTLINE PART ONE

1. Cooperation between the public and the private Sector - Foundations

- Definition and demarcation
- Variations of PPP
- Application range of PPP
- Theoretical contributions concerning the desirability of PPPs
- Public-Private Partnerships – their history of origins...
- and the driving forces today

2. Elaboration of an appropriate research background for a PPP constitution

- Orthodox approach/ „Mainstream Economics“



OUTLINE PART TWO

- Constitutional Economics
- Economics of self-control
- Public Choice
- Property Rights Theory
- Theory of Agency
- New Political Economy
- 3. Justification of state
 - The social contract
 - The justification of the state and the assumption of Leviathan
 - Rent-seeking activities



OUTLINE PART THREE

- 4. Requirements for an appropriate PPP constitution
- 5. Advantages of PPP
 - The model
 - Empirical relevance
 - Extension of the concept by including financial aspects
 - Rent-seeking
- 6. Complete contract perspective
- 7. Incomplete contract perspective
 - Approach
 - The Model
 - Insights
- 8. Comparison



DEFINITION

- No homogeneous definition of a PPP
- All tasks like construction, operation and design are announced altogether in one single contract.
- When the contract expires after 20-25 years the facility will return to the state.
- The government pays an annual user-fee for the operation of the entity.



DEMARCATIION TO PUBLIC PROCUREMENT

- Separate announcement of the single tasks like building and operation etc.
- The government has to pay for the construction company and the operator immediately (or at least quite soon)
- In case of a PPP the government would pay an annual user-fee.



DEMARCATIION TO PRIVATISATION

- The government announces a public service. Private companies compete for the award of the respective public service.
- The property rights are transferred to the private company.
- Depending on the market, there will be regulatory rules in order to prevent market failure.
- When the government privatises a public entity, the private enterprise that takes over business is responsible for service delivery. The government loses his right to say.



DEMARCATIION TO PRIVATISATION

- In case of a PPP the state pays for a service which is delivered by the private sector. The responsibility for service delivery remains at the state, although the service is privately provided for at least 15 years. In contrast, the state is not responsible for a privatised service.



FURTHER DEMARCATION

- Cross-border leasing
- Outsourcing / Contracting out
- „Concession scheme“



VARIATION OF PPP

- Design, built and operate (DBO)
- Build, own, operate and transfer (BOOT)
- Build, operate and transfer (BOT)
- Build, operate and own (BOO)
- Design, build, finance and operate (DBFO)
- Global PPP



APPLICATION RANGE OF PPP

- Wastewater treatment works, waste management
- Infrastructure (streets, tunnels, toll bridges, toll roads, parking places, road upgrading...)
- Power plants
- Telecommunications infrastructure,
- School buildings
- Airport facilities
- Government offices
- Prisons
- Railway sector (light rail systems, railways subways...)
- Research activities
- Security



THEORETICAL CONTRIBUTIONS CONCERNING THE DESIRABILITY OF PPP

- Desirability of PPP?
- Determination of appropriate criteria:
 - Economic success?
 - Quality of service?
 - Quality of staffing policy (personnel policy)?
- When is the contribution via PPP desirable and when is contribution via public procurement desirable?
 - Which criteria can we identify?
- Is a regulation of governmental action necessary?



PUBLIC-PRIVATE PARTNERSHIPS – THEIR HISTORY OF ORIGINS

- First records from the ancient world (about 20 to 15 Anno Domini)
 - The Roman Empire gave concessions to the Salassi tribe which authorised them to raise money from travellers crossing the Saint Bernhard Pass. In return, the tribe maintained the pass and provided guidance across the mountain.
 - Emperors, particularly Augustus, arranged the construction of memorials, temples, thermal springs, libraries and aqueducts. These buildings were edified by private builders. It is proved, that the Empire raised profits from their building activities.



PUBLIC-PRIVATE PARTNERSHIPS – THEIR HISTORY OF ORIGINS

- The London Bridge was put up in 1286 under King Edward III as a toll bridge. Its construction was financed by the release of tolling rights.
- In 1364 he also released tolling rights on the road that connected London with the Great Northens in return for improving the street which run through three counties.
- In the “West Indian Raid of 1585” Queen Elizabeth contributed 2 of 25 ships. Sir Francis Drake acted as the Queens’ Admiral and had to follow official instructions.
- When the English fleet defeated the Spanish Armada under Sir Francis Drake, just 24 ships out of 34 were supplied by the Queen. The remaining ships were owned privately.



PUBLIC-PRIVATE PARTNERSHIPS – THEIR HISTORY OF ORIGINS

- „Letter of reprisal“ („Freibeuterbriefs“)
- Private Troops / Mercenary armies (Söldnerheer)

In the 1990s around 90 private military troops operated in Africa.

In his work “Il Principe”, Machiavelli, evaluates the existence of mercenary armies and points out the danger which is linked with the aspect that they are not loyal to the prince and follow their own interests. The desire to be a soldier is based on a purely financial aspect.



PUBLIC-PRIVATE PARTNERSHIPS – THEIR HISTORY OF ORIGINS

- Public-private prisons in the United States.
- Entrepreneurs „rented“ prisoners and used them as workers.
- Humanitarians reported a high death and injury rate and blamed the private firms. In 1842 the use of prisoners for labour was restricted by the New York legislation.
- Today, private prisons are popular again, especially in the United States.
- There are PPP prisons in Germany, too.



DRIVING FORCES TODAY

- High need for maintaining and renew infrastructure.
- Borrowing ceilings restrict the opportunity to finance project via debt.
- High need for infrastructure in „Emerging Markets“ / developing countries.
- Private firms successfully interact in the sector for public services.
- Europe wide announcements promote international competition for building- and operation companies.



DRIVING FORCES TODAY

- Low barriers for small enterprises to enter the market.
- Enterprises profit from low interest rates and are free from borrowing ceilings.
- Reform of the public management „New Public Management“



ELABORATION OF AN APPROPRIATE RESEARCH BACKGROUND FOR A PPP CONSTITUTION

- Questions to answer:
 - When is PPP the appropriate form of procurement?
 - Can the citizen rely that the government will always decide in favour of the optimal form of procurement?
 - Do we need a set of Rules in order to regulate and restrict the government?
- Questions that refer to the relationship between state and enterprises:
 - Is there a principal-agent-problem?
 - If yes, are there appropriate information-economic approaches?
 - Assumption of complete and incomplete contracts



ELABORATION OF AN APPROPRIATE RESEARCH BACKGROUND FOR A PPP CONSTITUTION

- Orthodox approach / „Mainstream Economics“
 - Utilitarianism
 - Choice within given set of rules / Maximisation within rules.
 - Self-interested individuals, benevolent and omniscient dictator.
 - No implementation problems at all.
 - Institution have no meaning for an economist in the field of „Mainstream Economics“.
 - Efficiency criteria is the pareto criterion.
 - Maximisation as a consequence of scarce resources and endogenous given restrictions.



ELABORATION OF AN APPROPRIATE RESEARCH BACKGROUND FOR A PPP CONSTITUTION

○ Constitutional Economics

- Rules are a research object and are not exogenous given elements.
- The rules define the framework in which economic and political agents make their choices.
- These rules restrict the choices of all individuals.
- Economic policy designs its recommendations to those who interact within defined sets of rules.
- Aim: adequate restriction of the government by appropriate rules.



ELABORATION OF AN APPROPRIATE RESEARCH BACKGROUND FOR A PPP CONSTITUTION

○ Constitutional Economics

- Voluntary exchange of restrictions (see later: justification of the state)
- Concept of man: homo oeconomicus
- „Hard core“
 - Methodological individualism
 - Exchange paradigm
 - Democracy



ELABORATION OF AN APPROPRIATE RESEARCH BACKGROUND FOR A PPP CONSTITUTION

- Economics of self-control
 - Individual choose their own constraints. Rules as a research object.
 - Examples: Diets, voluntary reduction of emissions like CO_2 , environmental protection.
- Public choice
 - Homo oeconomicus
 - Methodological individualism
 - Topics: failure of state, Institutions, alternative policy-structures, political interaction...
 - Elaboration of political topics by using elements of economic research.
 - Strong parallels between market and politics.



ELABORATION OF AN APPROPRIATE RESEARCH BACKGROUND FOR A PPP CONSTITUTION

- Property rights theory
 - Already existing arrangements are in the centre of the analysis. Mainly, it focuses on institutions and their effects on households and enterprises.
 - Neglecting the change of institutions in favour of already existing ones classifies this branch as non-constitutional.
- Theory of agency
 - Focuses on the existence of transaction costs.
 - Agency theory generally is applied to analyse hierarchic structures, but it is also applied to all forms of exchange.
 - Principal-agent problems



ELABORATION OF AN APPROPRIATE RESEARCH BACKGROUND FOR A PPP CONSTITUTION

- Theory of agency
 - Agency theory is pivotal for constitutional construction, because it provides valuable information on how relationships among principals and agents work.
 - Principal-Agent structures in the relationship citizen – government / enterprises - government
- New political economy
 - Institutions as „rules of the game“ in order to canalise interactions.
 - Markets and governmental action as research objects.



JUSTIFICATION OF STATE

- The justification of state is an element in several disciplines.
- Justification of the existence of state from a contractual perspective.
- Social contract
 - J.J. Rousseau und J. Locke
 - T. Hobbes
 - Buchanan, Nozick und Rawls
- Pre constitutional stage in the theory of Hobbes
 - „*bellum omnium contra omnes*“



JUSTIFICATION OF STATE

- Pre constitutional stage in the theory of Hobbes
 - „*bellum omnium contra omnes*“
 - As the only way out Hobbes stated a social contract in which every member agrees to surrender its natural law to use violence and therefore alienate their right for self-determination and self-defence to the sovereign.
 - Social contract as the only way out of a world in which life is „*nasty, brutish and short*“.
 - Leviathan personifies a mortal lord to whom the citizens owe the existence of peace and security.
 - Starting from an original position in which the positions have not been distributed yet, the participating individuals are designed as being self-interested.



JUSTIFICATION OF STATE

- After entering the social contract
 - After the roles have been distributed, different objectives emerge, depending on their specific positions.

Anarchy is a starting point which justifies a social order where the rights and institutions result from a constitutional contract.



JUSTIFICATION OF STATE

Before agreement of contract

- No distribution of roles
- *Life is nasty, brutish and short*
- Anarchy
- No protection of property rights and violence
- The only way out is the contractual agreement by constituting the leviathan as the ruler.

After agreement of contract

- Allocation of roles (here: government, citizens; eventually: government, citizens, firms)
- Action out of self-interest will depend on the role of each individual.
- Governmental action is being characterised by self-interest and can lead to the exploitation of the citizens.



JUSTIFICATION OF STATE

- The design of the contract has to consider the behaviour of the leviathan on the post constitutional stage.
 - Benevolent Dictator vs. Leviathan
 - The citizens have the choice between anarchy and the implementation of the leviathan.
 - Option of falling back to anarchy
- Which rules shall be implemented on the constitutional stage?
 - see our general topic of PPP
 - Citizens face a lack of control
 - In case the leviathan exploits the citizens and thereby undergoes a certain level of welfare, everyone will fall back to anarchy.



JUSTIFICATION OF STATE

- Fall-back to anarchy: The welfare-level in the post constitutional stage must at least be as high as in anarchy.
- Challenge of further analysis: how can the leviathan be controlled under asymmetric distribution of information and under the assumption of an information advantage?

Which requirements must a constitution for the procurement of PPP projects fulfil?



JUSTIFICATION OF STATE

- Rent-seeking
 - Government - firms?
 - Which incentives do both parties have in order to form a coalition?



REQUIREMENTS FOR AN APPROPRIATE PPP CONSTITUTION

- Veil of uncertainty
 - Perfect
 - Referring economic and position in society in the post constitutional stage.
 - Incompleteness
 - Referring the economic environment.
- Contract
 - Complete contract
 - Incomplete contract



REQUIREMENTS FOR AN APPROPRIATE PPP CONSTITUTION

Complete contract

- All environmental conditions can be determined in advance.
- Future is predictable.
- For each environmental conditions there can be defined certain rules and utility levels.
- Compatible with post constitutional uncertainty.
- Leviathan has an information advantage.

Incomplete contract

- Future is unpredictable.
- There can occur unpredictable environmental conditions for which no rules can be defined.
- Approach that is close to reality
- Compatible with constitutional uncertainty.
- Leviathan has an information advantage.



REQUIREMENTS FOR AN APPROPRIATE PPP CONSTITUTION

- Which rules for „good PPP politics“ do we have?
 - History?
 - Theory
 - Empiric analysis



ADVANTAGEOUSNESS OF PPP

- Model of incomplete contracts
- Public procurement or procurement via PPP?
- Incompleteness within the model
 - Post constitutional incompleteness (!)
 - Incentives for the agents and property rights do have a significant impact on investments.
 - Distribution of property rights has an impact to increase the incentive to increase productive efficiency.
 - Property rights mean that the owner has the right to control in case that unpredictable circumstances occur. (non contractible situation!).



ADVANTAGEOUSNESS OF PPP

○ The model:

- PPP = 1 contract with consortia consisting of a builder and an operator. It is possible that the operator contracts with a third firm (Subunternehmer).
- TP (traditional procurement) = 1 contract with a builder that encompasses the properties of the building and 1 contract with an operator that comprises the properties of operation.
- government = contractual partner without own (selfish) agenda
- Time line:
 - t=0: government signs a contract with the builder to build a basic building for a price =P
 - t=1: the prison starts to operate till t=2. In case of TP the contract specifies the service quality in t=1.



ADVANTAGEOUSNESS OF PPP

- The model:
 - The price which to government will pay to the operator equals the operation costs.
 - The desirability of each alternative becomes obvious by having a closer look on the investments....



ADVANTAGEOUSNESS OF PPP

- The model:
 - 2 kinds of investments:
 - i = productive investment, that makes the building more attractive and easier to run – corresponds to higher quality.
Example: Prison with programmes and special staff for the rehabilitation of inmates.
 - e = unproductive investment, reduces total costs and quality – corresponds to a quality-shading investment
Example: Prison with electric fences instead of staff.
 - The builder realises these investments during the building stage.



ADVANTAGEOUSNESS OF PPP

- The model:
 - Incomplete contract:
 - The builder can provide an infrastructure of low quality since he has an information advantage and since there is a lack of control by the principals (the government).
 - The builder will build the cheapest prison possible while staying within the contract.
 - Examples: Using poor cement, obsolete technics, etc.



ADVANTAGEOUSNESS OF PPP

- The model:

- The investments i and e have an impact on costs C in $t=1$ and social benefit B of the infrastructure.

$$B = B_0 + \beta(i) - b(e),$$

$$C = C_0 - \gamma(i) - c(e).$$

- The (unverifiable) social benefit B is measurable, but not verifiable.
- Costs C are borne by the operator and are not verifiable.



ADVANTAGEOUSNESS OF PPP

- The model:
 - i+e are the entire investments of the builder



ADVANTAGEOUSNESS OF PPP

- Impacts of the incentive-structure?
 - In case of PPP: A builder will internalise the costs of service provision since either he provides the service himself or he subcontracts the service. That means high operation costs will matter for him.
 - In case of TP: the builder is just engaged for the building stage. He has no incentive to care for the operation costs since he will leave the project before the operation stage starts.
 - The advantageousness of PPP or TP depends on the effects by the investments i and e .



ADVANTAGEOUSNESS OF PPP

The conclusion of the investigation are that any builder who is engaged within a PPP project will have the incentive to do investments that lower the operation costs of the facility, because he will be faced with those costs when the operation stage starts.

A builder who is only engaged to the building stage within a TP will not consider the operation costs.

The desirability of any alternative will be based on the values of the respective investments i and e .



ADVANTAGEOUSNESS OF PPP

- FIFB (full information first best) for i and e by a benevolent dictator (complete contract perspective!):
- He has no preference for unproductive investments of type e and will only execute type i investments. That means B-C-i

$$B_0 + \beta(i) - b(e) - C_0 + \gamma(i) + c(e) - i$$

- First-order conditions:

$$\beta'(i^*) + \gamma'(i^*) = 1$$

$$c'(e^*) - b'(e^*) = 0$$



ADVANTAGENESS OF PPP

- In an incomplete contract setting this not realistic (no complete contracts, ASIV, no benevolent omniscient dictator).
- **Structure of traditional procurement:**
- The builder gets the price P to build the building. The operator gets a Price that equals the costs of operation: $C = C_0 - \gamma(\bar{i}) - c(\bar{e})$
- The builder chooses i and e in order to solve his maximise his profits $Max(P_0 - i - e)$
- He chooses $\bar{i} = \bar{e} = 0$
- There will result a price $P_0 = \bar{i} + \bar{e} = 0$



ADVANTAGEOUSNESS OF PPP

- Resulting benefit for the state: $B - C - P_0 = B - C - i - e$
- The builder will neither internalise the benefit B nor the costs C.
- That means he invests the optimal amount of e (e=0) but less of i (0 instead of 1).
- TP is preferable when the quality of the building can easily be specified within a contract, whereas the properties of service cannot. In that case, the builder cannot easily deviate from the contractual agreements.



ADVANTAGEOUSNESS OF PPP

- **Structure of PPP:**
- The builder has the incentive to internalise the costs of service provision since he provides the service by himself or via a subcontractor. He will offer the subcontractor a price that equals his operation costs C .
- He chooses i and e in order to solve:

$$\text{Max } P - C - i - e = P - C_0 + \gamma(i) + c(e) - i - e$$

foc:

$$\gamma'(\bar{i}) = 1$$

$$c'(\bar{e}) = 1$$



ADVANTAGEOUSNESS OF PPP

- The resulting benefit for the government is:
 $B-P = B-C-i-e$
- The builder does not internalise the social benefit B , but he internalises the costs C . He invests more in i , but still not enough. He also invests too much in e .
- PPP is preferable when the quality of service can easily be specified in a contract and when performance is measurable.
- An underinvestment in i within TP would have much more negative consequences than an overinvestment in e .



ADVANTAGEOUSNESS OF PPP

- Trade-off between both alternatives:
- TP: neither the social benefit B nor the operation costs C are internalised.
- PPP: builder will not internalise the social benefit B but not the operation costs C .

- Is the model reliable?
- Which elements do we need in order to design a constitution for PPP?



ADVANTAGEOUSNESS OF PPP

○ Empiric Relevance

- Harts Modell was examined by Riess et al. (2005), NAO (2003) using data from GB), Schneider (2000) (using data from USA).
- Hart „speculates“ that prisons and schools might be candidates for unbundling (TP), but prisons are rather a case for bundling (PPP).
- Highway projects, bridges, tunnels, waste water treatment and water supply are candidates for bundling / PPP.
 - reason: high potential for „life-cycle cost savings“.
 - „public interest“ remains maintained, since quality of service can easily be defined in a contract.
- Health service, education, public management, prisons and IT services are not appropriate for PPP.



ADVANTAGEOUSNESS OF PPP

○ Empiric relevance

• IT services

- The life-cycle is very short. Also asset must be renewed frequently. Therefore the period for reaping synergies from building and operation is very short.
- Due to rapid technical changes within IT the scope of incomplete contracts is very large.
- Frequent renegotiations of the contract are costly, and performance failure are immanent.
- Data from UK support Harts model.
- NAO (national audit office) recommend not to provide IT services via PPP.



ADVANTAGEOUSNESS OF PPP

○ Empiric relevance

• Health sector

- Are supposed to be a good candidate for PPP, since the building and facility management are one party.
- But: there are sector-specific reasons against bundling: clinical services underlay rapid technological change and it is difficult to contract on such services in the long-run.
- Assets which are necessary to provide clinical services hat a much shorter life-cycle than hospitals. If a PPP provides both services, to contracts must be written: one for the long-term facility management and one to mange the medium-term facility of clinical services.
- Poor performance of PPP hospitals in GB; number of „PFI“ (PPP) hospitals was reduced in GB.



ADVANTAGEOUSNESS OF PPP

○ Empiric relevance

• Schools

- Schools are no candidate for bundling/ PPP: quality in PPP schools is far lower than in TP schools.
- Best examples for innovations came from TP schools.
- Costs for maintenance and the janitor were higher at PPP schools
- New PPP schools were not build up faster than PPP schools.
- The quality of PPP schools improved during the past years.
- Some PPP schools have better design innovations than TP schools.



ADVANTAGEOUSNESS OF PPP

○ Empiric relevance

• Highway projects

- Bundling results innovative design like modulus roadbased and stone mastic asphalt (Flüsterbeton). Advantages: noise-reduction reduced traffic disruption from maintenance and lower costs for building, raw-material and time costs.
- Road projects from 1990-2005 that were financed in the EU-15 are characterised by higher construction costs than TP-highway projects.
- The authors conclusion is correct insofar that as it promotes the usage of innovative solutions, but ex ante costs are higher.



ADVANTAGEOUSNESS OF PPP

- Empiric relevance
 - Security sector
 - Is seen as a typical governmental task.
 - PPP-prisons, private security staff, private armies, mercenary armies and security companies.



ADVANTAGEOUSNESS OF PPP

○ Empiric relevance

- Security sector
- PPP-prisons in GB
 - Cost savings: 30% due to new design solutions and less staff. 80% of the running costs of a prison are costs for the staff.
 - Lower quality of service for the prisoners (food from catering companies)
 - Young and low qualified staff (less prejudiced with regard to prisoners, at the same time their greenness can lead to security problems).
 - Lower salaries in PPP prisons with 14.500€ compared to 18.000€ in TP prisons leads to recruiting problems.
 - In areas with low unemployment: understaffed prisons.



ADVANTAGEOUSNESS OF PPP

○ Empiric relevance

- Security sector
- PPP-prisons in GB
 - Comparison of TP- and PPP-prisons: very difficult, since TP-prisons often are much older so that some technical elements cannot be implemented.
 - PPP-Prisons have a better design that leads to lower maintenance costs and easier operation.
 - History of private prisons shows that this sector was prone to exploitation of prisoners. Many people have a critical position towards private engagement in security issues.



ADVANTAGEOUSNESS OF PPP

- Empiric outcomes and the model:
 - In general, Harts outcomes comply with empiric data. There is one exception: IT services are no candidate for PPP, because of dynamic environment.
 - In case the characteristics of the building can easily be described within a contract: traditional procurement
 - In case the characteristics of operation can easily be described within a contract: PPP



ADVANTAGEOUSNESS OF PPP

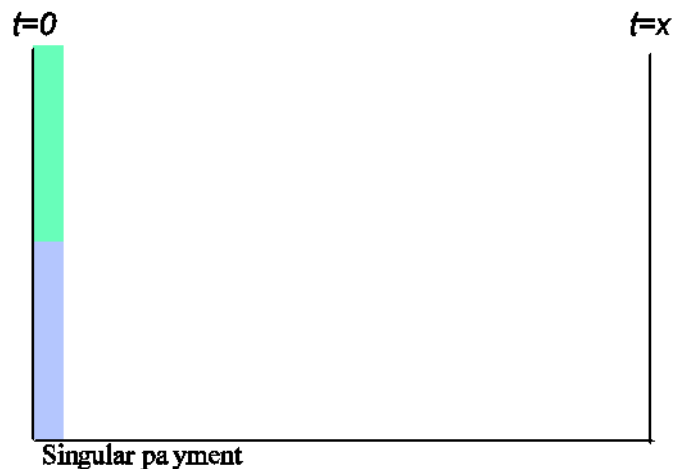
- In which way must we extend the model in order to display reality in an appropriate way?
 - Effect on public household
 - maybe: rent-seeking
 - Till now: no reason to decide in favour of one or the other alternative.
 - But: the way both alternatives are financed is different!



ADVANTAGEOUSNESS OF PPP

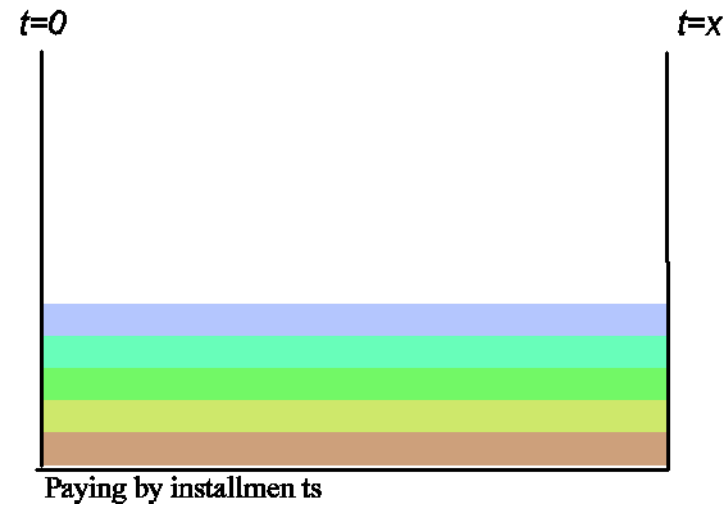
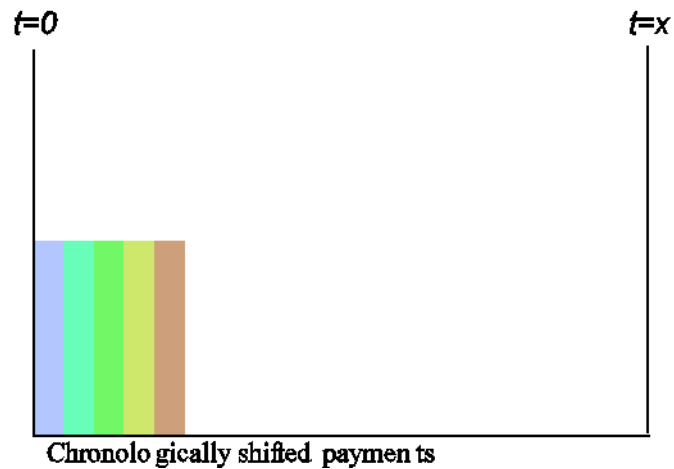
○ Financial structure

- PPP: annual user-fee
- TP: Government pays at once for the building and the operation and not in form of a user-fee (comparable to a leasing-rate)



ADVANTAGEOUSNESS OF PPP

- Financial structure



ADVANTAGEOUSNESS OF PPP

○ Financial structure

- What does the annual user-fee cost?
- In case the whole amount can be invested in the first period at a given credit interest?
- If the user-fee must be paid from running income?
- If the user-fee must be financed by public loan (or at least a part of the amount of money)



ADVANTAGEOUSNESS OF PPP

○ Financial structure

- Numerical example:

User-fee of 7 200€ per year over 5 years.

Payment of 36 000€ at once in case of TP.

In $t=1$ invest 32 0531€ in order to pay the annual user-fee of the interest rate at 4%.

➡ It seems obvious that the payment by instalments is more appealing.



ADVANTAGEOUSNESS OF PPP

- Financial structure
 - Numerical example:

Generally, the consortia will receive a user fee that incorporates a compensation for inflation and an alternative interest rate that the builder realised if he received the money at once and invested it at the capital market.



ADVANTAGEOUSNESS OF PPP

○ Financial structure

- Numerical example 2:

User-fee of 7 200€ per year over 5 years.

Payment of 36 000€ at once in case of TP.

In $t=1$ the government pays the costs of the credit. In case the debit rate is 5% the extra payments to the bank are: 1989,23€

➔ TP would be cheaper



ADVANTAGEOUSNESS OF PPP

- Financial structure

In case the budget is constrained, many projects can be realised at the same time, if it ends up with higher costs.

This special characteristic can make that PPP becomes the preferred alternative.



ADVANTAGEOUSNESS OF PPP

○ Concepts of rent-seeking

- Backwards-induction in case of TP: The builder „asks“ if he additionally gets the award for the operation stage.
- PPP-consortia implements a far more complex infrastructure in order to take a higher user-fee for operating the infrastructure. Example: Facility managements costs correlate with the area (in m²).
 - Additional revenue can be used in order bribe the government.



COMPLETE CONTRACT PERSPECTIVE

- Design of a complete constitution for PPP, which considers the post constitutional asymmetric information.
- The incentive scheme must be designed in a way so that the governments decision is not influenced by financial aspects. The government should always realise the appropriate procurement alternative. Additionally, the citizens cannot control the government – they suffer from an informational deficit, ie. they cannot infer which procurement alternative the optimal one is. The advantageousness of each alternative becomes obvious far later.



COMPLETE CONTRACT PERSPECTIVE

- Application of mechanism design theory
 - Considers post-constitutional asymmetric information. (Principal-Agent-Structure)
 - Allows the deviation of second-best allocations, by inducing the right amount of inefficiency.
 - The government must tell the citizens the state of nature and then – based on the state of nature – decide for an procurement alternative. Here, we cannot expect that we will end up with FIFB (full information first best) –values since the government will exploit his information advantage. Only by deviating second-best values, we can design an incentive-compatible contract.



COMPLETE CONTRACT PERSPECTIVE

- Design
- 2 environmental conditions: $\theta = [\theta^{PPP}; \theta^{IP}]$
 - Only the government (agent) can observe these states
 - For each environmental condition there will be a contract that consists of a cost-component and an allocation-component.
 - The agent (government) reports the environmental condition that maximises his private utility.
 - Incentive-efficiency means, that the less attractive state yields in a utility level for the state which is at least as high as the utility level of the preferred state.



COMPLETE CONTRACT PERSPECTIVE

- The amount of all procured projects is x , whereas a fraction is procured as PPP projects x_{PPP} and another fraction is public procured x_{TP} .

So, $x = [x_{PPP}; x_{TP}]$

- Government will pay an amount t for providing the infrastructure. We will assume that $t^{TP} > t^{PPP}$.



COMPLETE CONTRACT PERSPECTIVE

- Utility level of Leviathan/ the government may never lie below the anarchic utility level
 - participation constraint

$$U^1(t, x, \theta) \geq U_A^1$$

- It is important that he participates in each environmental condition:

$$U^1(t, x, \theta^{IP}) \geq U_A^1$$

$$U^1(t, x, \theta^{PPP}) \geq U_A^1$$



COMPLETE CONTRACT PERSPECTIVE

- The principals/ citizens

The principals pay a fix transfer T in the form of taxes to enable the government to finance its protective functions and the supply of public goods. T is not directly linked to x , but the government can exert money from the public budget to finance several activities.

The utility of the principals is their receipts in terms of the appropriate alternative minus the costs they have to pay anyway:

$$U_i(x, T)$$



COMPLETE CONTRACT PERSPECTIVE

- The principals/ citizens

The environmental condition is relevant for the leviathan, citizens are

Citizens would be able to enforce a FIFB-contract, in case they had complete information:

$$(x^{IP^*}; t^{IP^*}); (x^{PPP^*}; t^{PPP^*})$$

For the Leviathan, the respective utility levels result: $U^1 = T + \theta^{IP} x^{IP} (T - t^{IP})$

$$U^1 = T + \theta^{PPP} x^{PPP} (T - t^{PPP})$$



COMPLETE CONTRACT PERSPECTIVE

- The agent is not able to exert any surplus, since the efficient amounts x_{TP}^* and t^{TP*} / x_{PPP}^* and t^{PPP*} are realised.
- The environmental condition is displayed as a positive parameter θ which reflects the agents utility for any of the procurement alternatives.



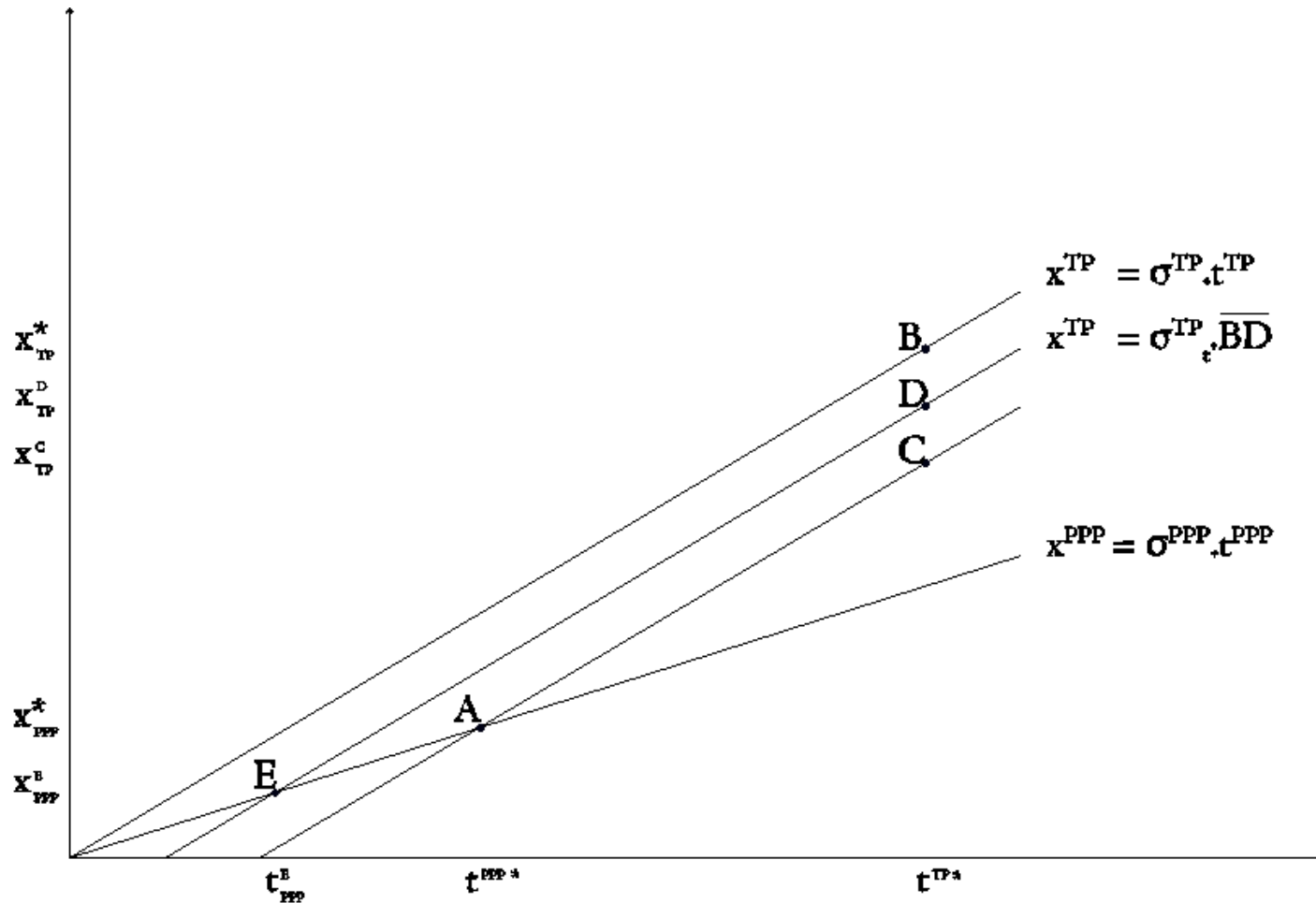
COMPLETE CONTRACT PERSPECTIVE

○ Imperfect information

- If the principals offered FIFB-contracts $(x_{PPP}^*; t^{*PPP})$ and $(x_{IP}^*; t^{IP*})$, the agent would choose $(x_{PPP}^*; t^{*PPP})$ and announce θ^{PPP} .
- The contracts must be designed in a way so that the leviathan is indifferent with regard to both alternatives. Then, he will report truthful.
- Geometrically we can identify the contractual constellation where the indifference curves of the leviathan cross each other. The parameter θ generates heterogeneity among the environmental conditions. The indifferent curves of the leviathan have a different location which is determined by θ .



COMPLETE CONTRACT PERSPECTIVE



COMPLETE CONTRACT PERSPECTIVE

- The parameter θ determines the marginal augments of utility for the agent. The monotony condition is denoted by:

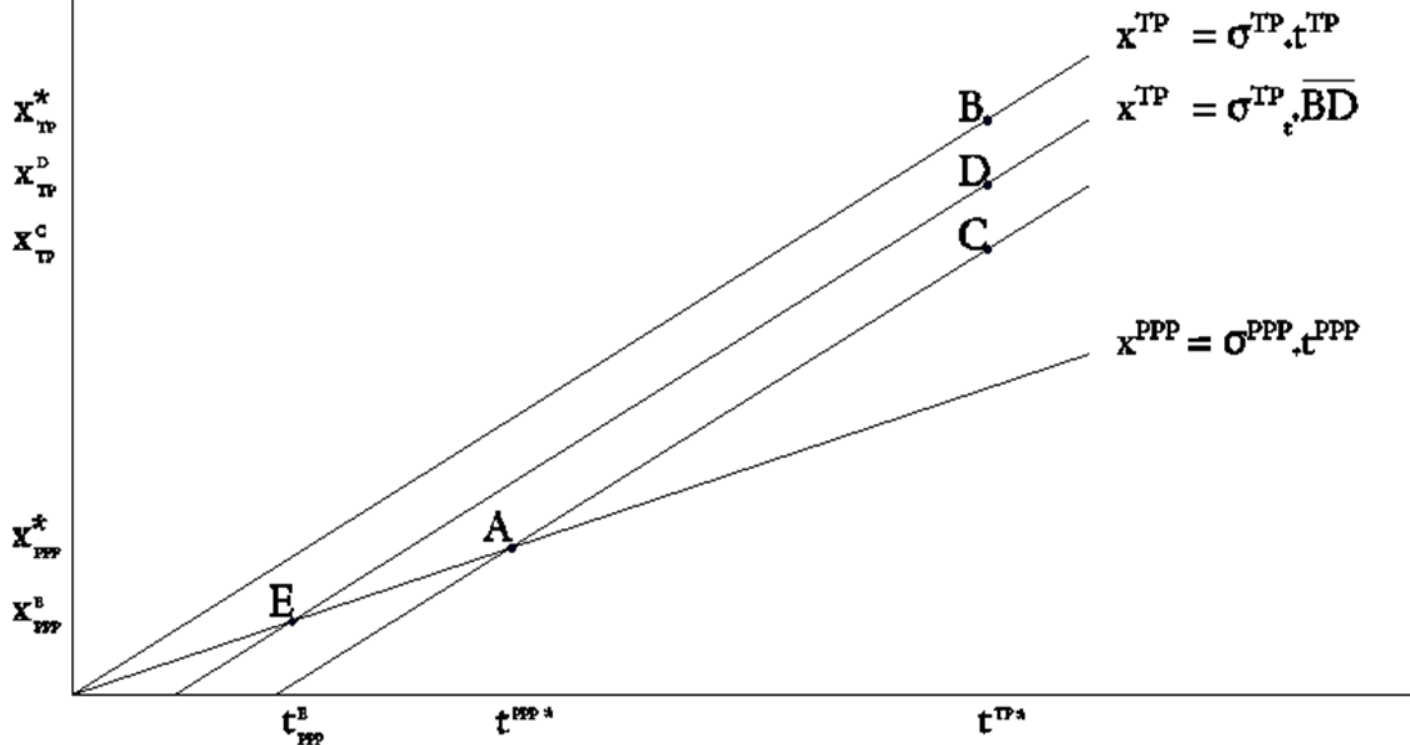
$$\frac{d[U^1(x, \theta^{IP})]}{x} > \frac{d[U^1(x, \theta^{PPP})]}{x} \quad \forall x$$

- When this condition holds, the precondition is fulfilled that the higher environmental condition θ^{IP} is the basically better condition from the agents viewpoint. i.e. : $\theta^{IP} > \theta^{PPP}$
- Under θ^{IP} the leviathan must pay more for a given increase in x than under θ^{PPP} for the same increase in x .



COMPLETE CONTRACT PERSPECTIVE

- Single crossing property:
- The indifference curves of the agent only cross once.



COMPLETE CONTRACT PERSPECTIVE

- The single crossing property is an assumption expressed in geometrical terms: The distance between utility levels for any parameter values either has to be increasing in a strictly monotonic way or decreasing in a strictly monotonic way.
- For each given increase in x the leviathan has a lower ability to pay if the environmental condition yields a PPP.
- In case the environmental condition yields traditional procurement, the leviathan has a higher ability to pay.



COMPLETE CONTRACT PERSPECTIVE

- His different abilities to pay under both conditions allow the principals to segment the environment. The fact that TP yields in a higher utility for the agent allows a segmentation of the environmental condition.



COMPLETE CONTRACT PERSPECTIVE

- Reasons for different abilities to pay:
 - The opportunity costs of traditional procurement are higher, since the financial scope decreases much more compared to the realisation of a PPP. The government is able to realise more PPP projects than TP projects if the budget is constrained.
 - At the same time the realisation of a PPP tightens the constrained budget. Even if the whole amount is available at the beginning of the project, it may happen that the financial situation changes so that it has to finance the user fee via a public loan or it at least cannot use the monetary amount for investment purposes. (Example: Financial crisis)



COMPLETE CONTRACT PERSPECTIVE

- Reasons for different abilities to pay:
 - In case the government hopes not to finance the user fee via a public loan, it calculates similar costs within both alternatives. Additionally, the PPP transfer structure incorporates lower opportunity costs in a short-term perspective. In an integral consideration a PPP is the alternative that is more likely to be more expensive and that incorporates more risks, as elaborated above.
 - In case the Leviathan is democratically constrained he might not consider financing the whole amount in terms of user fee payments. Then a PPP is the cheaper alternative for him (but not for the citizenry!)



COMPLETE CONTRACT PERSPECTIVE

- Reasons for different abilities to pay:
 - See last point: Traditional procurement can be cheaper than a PPP, but if the user fee is financed via a public loan or if the interest rate for evaded interest earnings is high, the PPP will turn out to be the more expensive alternative. Since the perception of the agent counts here, it will be assumed that the lower opportunity costs of a PPP let the PPP seem to be an appealing alternative for the government.



COMPLETE CONTRACT PERSPECTIVE

- Traditional procurement still is the higher environmental condition, because it incorporates a lower default risk of the consortia that are responsible for the operation and the whole costs are more transparent and stable.
- The predicted costs of a PPP can change over the duration.
- Next challenge...the maximisation problem and the derivation of second-best contracts.



COMPLETE CONTRACT PERSPECTIVE

○ Approach:

- *Remember: The principals' task is to design an appropriate contract that incentivises the agent to report truthfully about the actual condition.*
- The principal's objective function has to be maximised. It contains each utility level under the respective environmental conditions.
- There are 2 side constraints:
 - 1. The incentive compatibility constraints ensure that the agent prefers the contract which is designed for the actual environmental condition.
 - 2. The participation constraints must ensure that the agent accepts the contract, no matter which environmental state applies.



COMPLETE CONTRACT PERSPECTIVE

- The principal's objective function is:

$$\max[\xi(T + \theta^{PPP} x^{PPP} (T - t^{PPP}))] + [(1 - \xi)(T + \theta^{IP} x^{IP} (T - t^{IP}))]$$

- Incentive compatibility constraints:

$$\theta^{IP} t^{IP} - x_{IP} \geq \theta^{IP} t^{PPP} - x_{PPP} \quad (\text{IC1})$$

$$\theta^{PPP} t^{PPP} - x_{PPP} \geq \theta^{PPP} t^{IP} - x_{IP} \quad (\text{IC2})$$

- Individual rationality (/participation) constraints:

$$\theta^{IP} t^{IP} - x_{IP} \geq U^A \quad (\text{IR1})$$

$$\theta^{PPP} t^{PPP} - x_{PPP} \geq U^A \quad (\text{IR2})$$



COMPLETE CONTRACT PERSPECTIVE

- The contracts maximise the expected utility of the principals and fulfil the side constraints at the same time.
- Next challenge...derivation of the second-best contracts...



COMPLETE CONTRACT PERSPECTIVE

- The single crossing property will be used to simplify the maximisation problem. This implies that x and t are increasing in θ : $x_{PPP} \leq x_{TP}$ and $t^{PPP} \leq t^{TP}$
- The individual rationality constraint (IR 1) can be neglected because it is satisfied automatically because of the following inequality:

$$\theta^{IP} t^{IP} - x_{TP} \geq \theta^{IP} t^{PPP} - x_{PPP} \geq \theta^{PPP} t^{PPP} - x_{PPP}$$

- This inequality holds due to $\theta^{IP} > \theta^{PPP}$



COMPLETE CONTRACT PERSPECTIVE

- The incentive constraint for the low state is to be deleted, since the agent has no incentive to realise TP if the environmental condition is PPP

- Information rent in order to make the agent report truthfull:

$$(\theta^{TP} - \theta^{PPP})t^{PPP}$$

- This rent generates a positive surplus for the leviathan, in case he reports truthfull under θ^{TP} .



COMPLETE CONTRACT PERSPECTIVE

- The rent must be high enough so that the agent is indifferent between both alternatives, but it must not be too high, so that it doesn't reduce the utility of the citizens too much.



COMPLETE CONTRACT PERSPECTIVE

- Da $\theta^{TP} > \theta^{PPP}$ gilt, und die marginalen Grenzkosten mit jedem x steigen, gilt auch $x_{TP} > x_{PPP}$. Dieser Zusammenhang muss in einem Anreizkompatiblen Vertrag berücksichtigt sein.
- Nachdem 2 der Nebenbedingungen gestrichen wurden (IC1, IR1), verbleibt folgendes Maximierungsproblem:



COMPLETE CONTRACT PERSPECTIVE

$$\max[\xi(T + \theta^{PPP} x_{PPP}(T - t^{PPP}))] + [(1 - \xi)(T + \theta^{IP} x_{IP}(T - t^{IP}))]$$

$$\theta^{IP} t^{IP} - x_{IP} \geq \theta^{IP} t^{PPP} - x_{PPP} \quad (\text{IC } 2)$$

$$\theta^{PPP} t^{PPP} - x^{PPP} \geq U^A \quad (\text{IR } 2)$$



COMPLETE CONTRACT PERSPECTIVE

- If the information rent is incorporated into the problem, we will get the following equation:

$$\max[\xi(T + \theta^{IP} x_{IP}(T - t^{IP})) - (\theta^{IP} - \theta^{PPP})t_{PPP}] + [(1 - \xi)(T + \theta^{PPP} x_{PPP}(T - t^{PPP}))]$$

- In case of θ^{IP} the agent gets an information rent, in case of θ^{PPP} the agent does not get an information rent.



COMPLETE CONTRACT PERSPECTIVE

- Properties of the new contracts after the optimisation
 - The second-best transfer in the high state (θ^{IF}) is the same like the one in the first-best contract. For the low state (θ^{PPP}) the optimal transfer is lower. I. e., only the transfer for the low state is distorted in the second-best solution.
 - In the low state θ^{PPP} the agent will not receive a rent. The whole transfer he may take from the budget must be paid to a private firm. In case the high state applies, the agent may keep the informational rent.



COMPLETE CONTRACT PERSPECTIVE

- The information rent must be high enough so that the agent has no incentive to report the wrong environmental condition, but it must be considered that not too much public utility is wasted.

x_{TP}^*



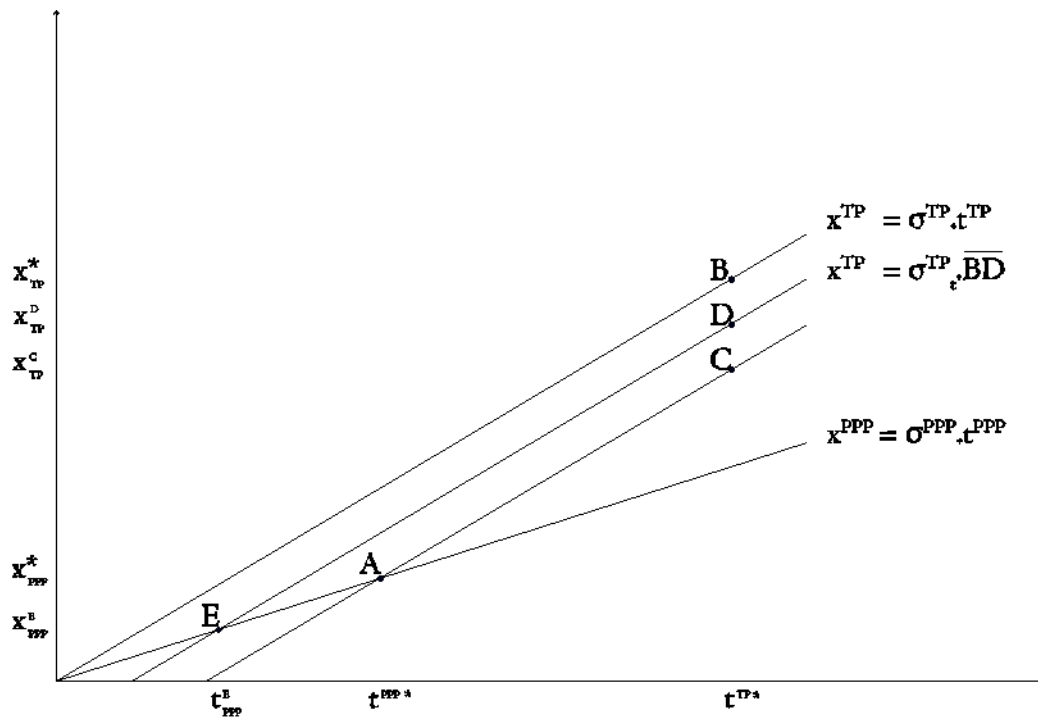
COMPLETE CONTRACT PERSPECTIVE

After the optimisation the second-best contracts have five properties:

- 1. In the high state the efficient amount x_{TP}^* is realised.
- 2. Only within the high state the agent is indifferent between his own contract and the contract for the lower state.
- 3. In each state, except for the lowest state, the agent gets an information rent. The rent increases depending on the type of agent or with the states the agent is faced with.
- 4. In all states, except for the highest state, the agent gets a sub-efficient allocation.
- 5. In the lowest state the agent gets no surplus.



COMPLETE CONTRACT PERSPECTIVE



COMPLETE CONTRACT PERSPECTIVE

- Linear indifference curves under the assumption that $x_{TP} = \theta^{TP} t^{TP}$ and $x_{PP} = \theta^{PPP} t^{PPP}$ are constant.
- FIFB allocationen in A and B (not incentive compatible since the agent will always choose the contract in which he ends up in B).
- By offering a rent to the agent, his indifference curve will be shifted parallelly and a new opportunity could be contract C. Then, the agent would be indifferent between A and C since both allocations are on the same indifference curve.
- For the citizens contract C yields a loss of utility since they have to pay a rent to the agent.



COMPLETE CONTRACT PERSPECTIVE

- The agent extracts the same transfer like in B which is t^{TP^*} but instead of providing x_{TP}^* he provides x_{TP}^C .



COMPLETE CONTRACT PERSPECTIVE

Conclusion:

- Using the mechanism-design approach we derived second-best contracts.
- Behind the veil of uncertainty the individuals expect that there will be 2 different environmental conditions.
- For both environmental conditions we derived contracts so that the leviathan will be indifferent between a truthful and a wrong report.



COMPLETE CONTRACT PERSPECTIVE

- How would the analysis change, if we assume that there is collusion?



COMPLETE CONTRACT PERSPECTIVE

- Which aspects are not considered in the analysis?
- Where are the boundaries of the complete contract perspective?

