A Contribution to the Contractual Analysis of Public-Private Partnerships
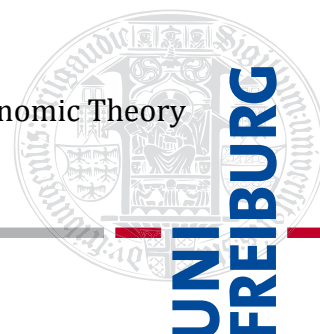
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September 20, 2010

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September 2010

Abstract:

The advantages and the epistemological value of constitutional economics make them a designated research background for a constitutional examination of PPP. The constitutional approach provides an adequate framework that allows clarifying how the process of PPPs may be improved by constitutional restrictions. The relationship among state and the citizens is a principal-agent relationship, whereas builder and operator have an informal advantage in the post constitutional stage. Aim is to design a constitution that makes the state follow a practice for PPP that is in his own interest, as well as in the interest of the citizenry. A normative model of PPP is melted with a formal framework that will be used as a basis for an application of a constitutional stage. It will be shown how a pre-play phase, reciprocal behaviour and a constitutional stage can affect the achievement of first-best outcomes.

1. Introduction

Public-Private Partnership is a variation of privatisation in which parts of a service run solely by the public sector are provided through a partnership between the government and at least one private company. Unlike a full privatisation scheme, in which the new venture is expected to function like any other business, the government continues to participate in some way. Since recent years, this kind of privatisation is discussed controversial. Literature which is linked with this modern aspect of privatisation offers case studies, financing methods and shows a lot of problems which occur in the conversion from theory to practice[1]. Interesting insights are offered by the literature of integration. Hart and Grossman throw attention towards the role of residual control rights which have an important impact on decisions about integration. They mention the existence of incomplete contracts and unforeseeable events and highlight the importance of ownership. Hart and Moore develop a foundation for the incomplete contracts approach[2]. Property rights allow the owner to be in a much better bargaining position, if contingencies arise that are not fixed within a contract. Ownership strengthens the owner and provides incentives to do investments, because he reaps more of the investments in comparison to his partner who gave up his control rights after an integration[3]. The approach of incomplete contracts was picked up in 1997 by Hart et al. while examining the question whether the government should provide a service in-house or contract out provision. They provide a model which shows that private provision is cheaper, but the quality can be higher or lower in comparison to public provision. The allocation of residual control rights has an important impact on their conclusion, because it can set different incentive structures to the providers and their motivations to implement cost and quality innovation[4]. Schmidt developed a model of privatisation, based on incomplete contracts. He shows that different allocations of property rights lead to different allocations of information within a firm and thus alters productive and allocative efficiency. Schmidt describes the costs of privatisation as a distortion of allocative efficiency[5]. Shleifer highlights a crucial property of private ownership: it is a

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[1] Eg. see. Hanss, 2001, pp. 393-411.
[2] See Hart, Moore, 1999, pp. 115-138.
[3] See Grossman, Hart, 1986, pp. 691, 692.
[4] See Hart, Shleifer, 1997, pp. 1127; 1134.
[5] See Schmidt, 1996, pp. 1-5.

source of incentives. He pays attention to the state as a maximiser of social welfare. He illustrates patronage as an argument why state ownership is still widespread although it is not socially desirable in that scale. Further, he refers to the role of politicians who act as rent-seekers[6].

This brief outline of the recent literature of privatisation[7] shows that incomplete contracts, asymmetric information and incentive structures play an important role when advantages of privatisation and private ownership are examined. The objective in the following thesis is the development of optimal rules for Public-Private Partnerships from a constitutional perspective.

The research background and the conception of the state have an impact on the choice of rules. Therefore it is important to clarify which research background should be chosen for the examination of a normative guideline for PPP.

2. The research background

While the neoclassic economists designed the politician as a benevolent agent, appearing as an omniscience of the scientific observer,[8] the public choice theory and constitution economics assume a self interested agent to foster the political understanding and correct the results caused by the misguiding use of the benevolent dictator.[9] While the traditional neoclassic and Keynesian market economics viewed rules and institutions as given data, more and more questions aroused concerning institutional topics.[10] When Buchanan criticised the misleading use of the term "pareto optima" by the new welfare economists, this was the ignition to introduce the individualistic paradigm into the realm of politics. Within the new institutionalism the constitutional economic approach concerns the analysis of rule systems and not the choice within restriction.[11] The rules define the framework in which economic and political agents make their choices, or in Buchanan's words, constitutions are a set of rules that restrict the

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[6] See. Shleifer, 1989, pp. 133-150.
[7] See for example Besley, T., 2001, pp. 1343-1372
[8] Especially Buchanan rejects the assumption of an external observer (!977, pp. 142).
[9] See for example Voigt, 1999, pp.1.
[10] Basic inspiring works came from R. Coase, A. Alchian, H. Demsetz and J. Buchanan.
[11] See Leschke, 1996, pp. 76.

acts and goals of the agents.[12] The constitutional approach claims that rules have to coordinate the actions of the individuals. Otherwise they cannot become one of the conventions of the constitutional regime.[13] The constitutional agent is in position to offer policy advices to those that act within defined rule systems. He is also designated to give advice to those who are involved in a constitutional change.[14] The core of constitutional economics is how a government under a constitution is empowered. Once it is, it may maintain social orders and resolves several problems of coordination and establishes orderly traffic laws.[15] The descriptive power of the constitutional approach was considerably marked by Buchanan and Tullock. In *The Calculus of Consent* they concern a constitution of collective decision rules as a subset of a political constitution. Many works concerning constitutions of public expenditure followed.[16] Common topic was an appropriate restriction for the government.

Within a contractual perspective, each element of a set of rules or institutions can be tested, to which extent they comply with an outcome resulting from a genuine social contract.[17] Applying the agreement on rules in form of a social contract as an efficiency criterion, we can identify a procedural principle of ethics. The god is what emerges from an exemplary procedure.[18] This contrasts the consequentialists' view that denotes a procedure as good which gives good results.[19]

Apart from constitution economics there are other approaches which assume endogenous political structures within economic contexts.[20] The advantageous of a procedural normative criterion for the evaluation of social topics is the implied assumption that the interest and subjective preferences of the individuals determine what is socially desirable. Through voluntary agreement those subjective preferences are articulated. The welfare economist evaluates social

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[12] See Buchanan, 1977, pp. 292.
[13] See Harding, 2006, pp. 299.
[14] See Van den Hauwe,1999, pp. 224.
[15] See Harding, 2006, pp. 301.
[16] See for example, Brennan, Buchanan, (1988 (1980)).
[17] See Brennan, Buchanan, (1988(1980)), pp. 29-30.
[18] This view is represented by the latter genre of the contractarians such as Buchanan, Nozick and Rawls.
[19] See for example Gordon, 1976, pp. 575.
[20] Namely, these are public choice, new institutional economics, new economic history, property rights approach, economic theory of law and political economy of regulation.

outcomes in term of elements of the outcome, instead of basing his judgement on the process which generates the result like the constitutional economist does.[21]

3. Indexing the topic of a constitution for Public Private Partnerships in a theoretical framework

The advantages and the epistemological value of constitutional economics make them a designated research background for a constitutional examination of PPP. The analysis makes use of an anarchic starting point to derive the choice over mutually advantageous rules. The main focus for a PPP constitution from a constitutional background is the exchange of mutual restrictions referring the respective freedom to act. The final verification for the constitution is the constitutional efficiency criterion. This refers to the case when all participating agents agree on rules, restrictions or institutions voluntarily and therefore expect advantages when restricting their freedom mutually. This construction allows to establish an original position, a starting point from which each contractual process may start.[22] This is an adequate starting point for a derivation of constitutional rules of a PPP. Within the context of PPP the constitutional approach will be necessary to induce a situation in which optimal rules for PPPs can be derived. An agreement on structures for public expenditure is possible if and only if there is uncertainty about future positions and the distribution of the tax shares.[23] They will also be designed in a way that they restrict a revenue raising leviathan and will ensure that a procedure for PPPs is being chosen so that it is vital for the aggregated income. The constitutional approach provides an adequate framework that allows clarifying how the process of PPPs may be improved by constitutional restrictions. Improvement refers to the outcomes which are preferred by the citizens. The rules which are to be determined by analyse refer to a given governmental behaviour. As the voting mechanism does not guarantee an appropriate restriction of governmental power, the unanimous agreement is applied as the only way to make state activities result in real improvements.[24]

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[21] See for example Vanberg, 2006, pp. 5.
[22] See Buchanan, 1977, pp. 22.
[23] See Brennan, Buchanan, (1988 (1980)), introduction.
[24] See Brennan, Buchanan, (1988 (1980)), pp. 5-7.

The society consists in the post constitutional stage of the state, citizens and the operator and builder. All agents are assumed to be self interested. The state is the agent of the citizens and the citizens are the principals. The operator and the builder in turn are agents of the state while the state becomes the principal. The theory of agency, a branch of economics of transaction costs, analyses hierarchic structures and relationships. Principals delegate tasks or rights to agents. In this case, the citizens delegate power to the state. The government is allowed to take taxes and has to ensure the provision of public infrastructure. Later on the state delegates the task to build and operate infrastructure to the private firms. Asymmetric distribution of information exists in the post constitutional stage when the state delegates to the operators.[25] The operator and the builder benefit from an information advantage. This often results in opportunistic behaviour and shirking. The same problem exists for the state-citizen-relationship, in which the state appears as the agent. Then he might exploit asymmetric information and let asymmetries accrue[26] to follow its own interests, namely, money and power. Then, the agent is not acting in favour of the preferences of the citizens. In a very extreme occurrence the citizens loose any control on the agent which appears in this characteristic as a leviathan and get exploited by their sovereign. The approach of mechanism design applies in the context of principal agent problems. Knowing that the agents will not reveal their knowledge truthfully, the principal gives them an incentive to do so. This leads to a trade off that may end up with inefficient allocations. This approach assumes that the principal chooses a mechanism that maximises his expected utility. The mechanism design principal agent theory concerns primarily in period informal asymmetries and assumes historical grown structures as given, which contrasts the principal agent theory.[27]

The analytical task is to link the relationship of the constitutional approach and the neoclassic contract theory which is based on the principal agent theory, the property rights theory and the transaction cost theory.[28] The constitution is designed in a way that the state follows a practice for PPP that is in his own interest, as well as in the interest of the citizenry. Hence, the constitution has to be

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[25] As the agents knows more about the task that he has to fulfil and about his actions, abilities and preferences.
[26] See Neumärker, 1995, pp. 23.
[27] See Fuldenberg, Tirole, 1991, pp. 246-250.
[28] See Neumärker, 1995, who indexes the topic of a constitution of public expenditure in the theoretical context and highlights the relationship of the constitutional approach and the neoclassical contract theory.

incentive compatible and excludes a fallback into the anarchic chaos. The distribution of information is important. While it is equally distributed behind the veil of ignorance, it varies ex post. The state, who is principal and agent at the same time has an information advantage in comparison to the citizens and a information disadvantage to the private operators. Those advantages make it difficult for the citizens to control how the state complies with the PPP constitution and how he exercises the PPP practice. On the other hand, the private providers can vary their provided quality without making it obvious to the state. The degree of control varies with the asymmetry of information ex post. The contractual design has to incorporate the danger of a leviathan endowed with an information advantage. It will be shown later, that the theoretical models which concern the PPP practice consider the informal asymmetries among builder, operator and the state.

Harts model applies in the post constitutional stage when the roles are already distributed. The following sections try to transform the model in a way in which a constitutional stage is being added. This allows us to derive rules that are in the mutual interest of the members of the society. In *The Constitution of the Non-For-Profit Organisation: The reciprocal Conformity to Morality* Grimalda and Sacconi develop a formal framework that will be used as a basis for an application of a constitutional stage. They investigate the question how the existence of Non-Profit Organisations (NPO) can be explained. Therefore they implement a non cooperative game and show how an outcome can result that complies with principles of fairness and reciprocity. The NPO is supposed to be based on a hypothetical social contract among all players which affirm a principle of fairness. Before the non cooperative game starts, all players engage in a hypothetical cooperative bargaining game. In doing so they justify their participation in the organisation. This decision must be rational from every point of view.[29] All participants are driven by the principle to maximise their utility, but are unable to identify their roles and names in the post constitutional stage. Here, the social contract works as a constitutional ideology that legitimates the organisation from an ex ante perspective. The authors adopt a Nash bargaining solution as a normative criterion for defining a moral preference regarding the outcomes of the

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[29] See Grimalda, Sacconi, 2002, pp. 263.

original game, which orders outcomes according to fairness. This ideology can be compared to a *pre-play communication*. The players in the non cooperative game comply with the fairness principle although they do not have monetary incentives to do so. The players expect reciprocity which conforms to the constitutional ideology to be a utility source per se.[30]

The next section will introduce Harts model. Hart, an economist that made a name in particular within the framework of the contract theory calls in his paper *Incomplete contracts and public ownership: remarks and an application to public-private partnership* the attention away from financing aspects, there to the costs of the contract.

In a latter section the PPP context will be applied in the framework of Grimalda and Sacconi and it will be examined if a constitutional stage will derive appropriate normative guidelines for PPPs.

4. Basics

Hart refers to the theory of the firm that implicates incomplete contracts. That means suboptimal outcomes result out of the fact that uncertain events can occur in future and can hardly be fixed in a contract. Within the privatisation literature there are generally complete contracts assumed. Consequently, suboptimal outcomes result from moral hazard and asymmetric information. When for every decision a complete and an incomplete contract are taken as a basis, two things will become obvious. The incentives for the agents on one hand and the role of the property rights on the other hand which have an impact on the investments. In the case of two vertical integrated firms, the property rights should be distributed in a way, that there will be an optimal trade-off between two effects: If firm A acquires firm B, A has more residual control rights, hence a greater bargaining power when uncontracted contingencies arise. Because A earns higher returns on his investment, A has the incentive to invest more. B is going to invest less, because his bargaining power is lower. Such a trade-off does not occur in the privatisation context. Hart uses prisons as an example, to show the difficult nature which arises within public and private ownership.[31] A manager will probably

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[30] See Grimalda, Sacconi, 2002, pp. 264.

[31] See Hart, 2003, pp. 69-71.

make more investments. However, he does investments which will reduce the quality of the object, for example, if he installs electrified fences to reduce the amount of required guards. But there is the incentive to do investments which will increase the quality of the object, as well. To decide whether public or private ownership is preferable one has to focus on the impacts of the two mentioned effects. This is crucial for the second part of Harts paper, in which he introduces a preliminary Model of costs and benefits of PPPs. The advantage of each model lies in the contractual obligation of services. To give a better insight, Hart examines two cases with two different contractual arrangements.[32] In the case of a PPP the government contracts with a private party, which is supposed to build and run the prison. The builder has the opportunity to subcontract with a third party to operate the prison. In case of a conventional provision, the state signs two different contracts. One contract with the builder and one contract with another party to run the prison. Hart introduces two kinds of investments. Productivity increasing investments, i, that lead to a more attractive prison and better operation opportunities and productivity lowering investments e that cut costs and quality.

In the first-best, i and e are chosen to maximise the net benefit.

Within unbundling Hart concludes that the builder will neither internalise the benefit B, nor the costs C. $\bar{i} = \bar{e} = 0$ means, that he invests the optimal amount of e, but less of i. Conventional procurement is preferable, when the quality of building can easily be specified within a contract, but not the properties of service. An underinvestment in i is not a serious issue. Under these conditions, an overinvestment in e under PPP may be more severe.

In case of bundling the builder does not internalise the benefit, but he internalises the costs. He invests more in i, but still not enough. He invests too much in e. PPP is preferable, when the quality of service can easily be specified in a contract and if the performance is measurable. An underinvestment in i at conventional provision would have much more negative consequences than an overinvestment in e.[33] We will now switch to an approach that is based on the idea of social preferences. Afterwards it will be elaborated if linking both concepts can lead to implications for rules for PPP.

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[32] See Hart, 2003, pp. 71.
[33] See Hart, 2003, pp. 74.

5. Grimalda and Sacconis framework

In their paper *The Constitution of the Non-Profit Organization: Reciprocal Conformity to Morality* Grimalda and Sacconi investigate the question how the existence of Non-Profit Organisations can be explained. They focus a set of agents I and their profiles of actions, denoted with σ. Their preferences can be selfish, or deontologic. That means their profiles of actions are conforming to an external criteria, here, fairness. The agents may agree on fairness in a constitutional stage. A deontological profile corresponds with optimality. The agents have reciprocal preferences as well. That means the motivation to comply with the abstract principle increases, if the other agents comply with the principle.[34] Conformity of agent i with the principle can be defined as follows:

$$f_i(\sigma) = \frac{T(\sigma_i) - T^{MAX}(\sigma_i)}{T^{MAX}(\sigma_i) - T^{MIN}(\sigma_i)} \quad (1)$$

$T^{MAX}(\sigma_i) / T^{MIN}(\sigma_i)$ are numerical values which denote the esteem of the agent with the normative principle. $T^{MAX}(\sigma_i)$ is associated with agent i performing an ideal action. $T(\sigma_i)$ indicates the value of the normative principle corresponding to i´s choice σ. $f_i(\sigma_i)$ is an index that varies between 0 and -1. If agent i´s action fully complies with the normative principle, the index is 0. If his action is not consistent with the principle, the index is -1. This term is used to define reciprocity as well.[35] It is the estimation accorded of agent i to other players' compliance with the ideology:

$$\tilde{f}_{-i}(\sigma_{-1}) = \frac{T(\sigma_{-i}) - T^{MAX}(\sigma_{-i})}{T^{MAX}(\sigma_{-i)}) - T^{MIN}(\sigma_{-i})} \quad (2)$$

[34] See Grimalda, Sacconi, 2002, pp. 256.
[35] See Grimalda, Sacconi, 2002, pp. 258.

$T^{MAX}(\sigma_{-i})/\ T^{MIN}(\sigma_{-i})$ are numerical values which define that the normative criterion assumes when other players maximises, or minimises is. The closer $f_{-i}(\sigma_{-i})$ is near 0, the more comply the other agents with the normative criteria.[36] Now, Grimalda and Sacconi introduce a utility function consisting of three components: material utility $U_i(\sigma)$ and ideal utility which is the product of $f_i(\sigma_i)$ and $f_{-i}(\sigma_{-i})$.

$$V_i(\sigma) = U_i(\sigma) + \lambda_i(1 + \tilde{f}_{-i}(\sigma_{-i}))\left[1 + f_i(\sigma_i)\right]$$

This formal setting will be applied in a production game.[37] In games, roles, rules, outcomes, strategies and pay-offs offer a framework to model situations. The main purpose of games is to solve complicated quantitative problems.[38] The participating agents are an entrepreneur E, a worker W and a consumer C. The agents E,W produce a good, which is consumed by C. C´s pay-off is affected by the others actions, whereas E´s and W´s pay-offs are not affected by the workers action. So the consumer C is a dummy variable.[39] The commitments of E and W have an impact on the quality of the good they produce. The players have two different opportunities: either they are on a par with a profit-orientated market standard, or they permit improvement in the quality of the good, which triggers extra costs, which have to be borne by the agents themselves. If the worker decides to a high degree of commitment to produce a product of high quality, he will earn a relatively low wage. Alternatively, he has the opportunity to realise a relatively high wage $\overline{w}$, if he decides to give a low contribution. The result in this non cooperative game is a good of low quality. $h_w; l_W$ denote a high / low degree of commitment. The entrepreneur earns returns when he sells the good. Those earnings are the only source of material utility. He can invest in quality improving technologies which cause additional costs c. The consumer receives utility according to the commitment of the worker and entrepreneur.[40] $h_E; l_E$ denote quality improving or quality shading actions of the entrepreneur. If W and E

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[36] See Grimalda, Sacconi, 2002, pp. 259.
[37] See Grimalda, Sacconi, 2002, pp. 260.
[38] See Scharle, 2002, pp. 228; 229
[39] See Grimalda, Sacconi, 2002, pp. 260.
[40] See Grimalda, Sacconi, 2002, pp. 261.

commit to produce a good of high quality, there will result a surplus *s* for the consumer. If just one of the agents provides such an activity, the surplus is only a fraction δ of *s*. If none of the agents contributes such an action the utility of the consumer will be 0. For the production game, the following restrictions are binding:

$$\overline{w} \succ \underline{w}$$
$$R - \underline{w} - c \geq 0$$
$$0 \prec \delta \prec 1$$

The production game will be played twice. The consumer's surplus will be neglected in round I. The pay-offs refer to the worker and the entrepreneur. Hence, the agents will behave selfish.

	h_E	l_E
h_W	$\underline{w}; R - \underline{w} - c$	$\underline{w}; R - \underline{w}$
l_W	$\overline{w}; R - \overline{w} - c$	$\overline{w}; R - \overline{w}$

$l_E; l_W$ is a dominant Nash equilibrium. None of the agents has the incentive to do a quality improving action. In the following, the game will be played with the consumers:[41]

	h_E	l_E
h_W	$\underline{w}; R - \underline{w} - c$;s	$\underline{w}; R - \underline{w}$; δs
l_W	$\overline{w}; R - \overline{w} - c$; δs	$\overline{w}; R - \overline{w}$;0

A equilibrium with a pay-off $\underline{w}; R - \underline{w} - c$;s can be interpreted that the agents have an ex-ante arrangement. They have chosen a principle, which is a rational of from

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[41] See Grimalda, Sacconi, 2002, pp. 262.

all points of view. Fair distribution might be a principle, which all three involved parties would accept. In this pre play phase all agents are rational. They neither know their names, nor their roles in the game. The core of the contractarian approach is that a fair distribution can be achieved through a rational agreement. Here another idea explains the outcome. For the worker and the entrepreneur are fair distributions of utility a source of utility per se. In the following section this formal Model of Grimalda and Sacconi will be used, to examine, if Harts conclusions change, if the participating agents are multiple-preferences based or if they are engaged in a hypothetical pre play bargaining game. Further, it will be investigated, how optimality can be reached.

6. Melting together both concepts

The term, which defines conformity with the normative principle, will be applied in the following context. In the constitutional stage the agents will agree on principles that are in the common interest of all individuals who are not informed about their roles and names yet. Their participation in the game ensures that it is rational, i.e. advantageous for each individual to join the game. The first-best, $e^* = 0$ and $i^* \succ 0$ stand for the optimum. The starting point differs from Grimalda and Sacconis. In their paper they focus high and low wages of worker and entrepreneur. A high wage corresponds to a high level of utility of the consumer; a low wage corresponds to a low level of utility. In the following analyse we will see, that not the absolute amount of the pay-offs play a crucial role, but the choice of $i;e$.

Bundling

We focus two kinds of provided goods: good operated prisons and bad operated prisons. Builder and operator produce the good "good operated prison". It consists of the characteristic of the building and the quality of service. The agents have the same utility function, Grimalda and Sacconi introduced in their paper, which consists of material and ideal utility.

$$V_i(\sigma) = U_i(\sigma) + \lambda_i \left[1 + f_i(\sigma_i)\right]$$

The prisoner receives utility, which results of the contributions of the builder and the operator. His level of utility does not influence the utilities of the operator and the builder. Hence, the prisoner is a dummy player. The builder can realise three different wage levels:

Builder

He is confronted with the following maximising problem: $Max(P_0 - i - e)$. He has the choice, either to provide a good operated prison if he sets $e^* = 0$ and $i^* \succ 0$. Consequently, he will realise a relatively low wage. If he chooses his contribution with the aim of solving his maximisation problem, he will realise a relatively high wage. Hence, he will provide a bad operated prison. $l_E; h_E$ define, if the builder does quality improving investments, which increase the quality of the prison, or if he invests in quality shrinking measures.

$$\overline{w}_E = p - c - \underline{i} - e^*$$ high wage level

$$\underline{w}_E = p - c - \bar{i} - \bar{e}$$ low level of wage

$$w_E^{\,*} = p - c - \bar{i} - e^*$$ optimal level of wage

In the following analyse, we will neglect the low wage level $\underline{w}$, because the builder has no incentive to choose *i;e* in such a level, if he wants to maximise his utility. The following restriction applies for his wage levels:

$$w^* < \overline{w}$$

Operator

The wage corresponds to the price which the state will pay to the operator. This corresponds to the operation costs $C = C_0 - \gamma(\hat{i}) - \hat{}(e)$, whereas the builder has chosen the amount of $\hat{i}; \hat{e}$. The wage is a fixed variable for the operator. He has two opportunities: He can realise a relatively low wage $\underline{w}_B$, if he contributes h_B and bears higher costs to provide a good prison operation. He has the opportunity to adjust his contribution and his expenditures at the fixed wage and hence realise a relatively high wage $\overline{w}_B$. l_B defines a low effort. There are three different wage levels which result from the choice of the builder:

$$w^* < \bar{w}$$

$$0 < \sigma < 1$$

$$P - C - i - e \geq 0$$

The production game will be played twice. First, the utility of the consumer will be neglected. In the second game, his utility will enter the game.

	h_E	l_E
h_B	$\underline{w}_B$; $p - c - \bar{i} - e^*$	$\underline{w}_B$; $p - c - \underline{i} - e^*$
l_B	$\overline{w}_B$; $p - c - \bar{i} - e^*$	$\overline{w}_B$; $p - c - \underline{i} - e^*$

In $l_B; l_E$ there is a dominant Nash equilibrium. None of the agents has the incentive to give a high contribution and therefore accept a lower wage. In the equilibrium the builder will invest $e^* = 0$. This is a positive aspect of the builder's decision.

	h_E	l_E
h_B	$\underline{w}_B$; $p - c - \bar{i} - e^*$; s	$\underline{w}_B$; $p - c - \underline{i} - e^*$; σs
l_B	$\overline{w}_B$; $p - c - \bar{i} - e^*$; σs	$\overline{w}_B$; $p - c - \underline{i} - e^*$; 0

In the following section we will analyse the case of bundled provision.

PPP (bundling)

The state fixes the quality of service within a contract. The builder has the choice, weather he provides the service himself, or if he subcontracts the service. He receives a payment which corresponds to his costs:

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

Because the builder is responsible for providing the service, he has the incentive to internalise the costs of service provision. Consequently, the level of the utility maximising wage changes, because he does more of productivity increasing investments i', but also more of quality shading investments e'.

So:

$$\underline{i} < i' < i^*$$
$$e^* < e'$$

Builder

He can provide a building of high quality, which ensures a good prison operation, but he can also choose $i;e$ to solve his maximisation problem and therefore provide a prison of poor quality.

$$\overline{w}_E = p - c - i' - e'$$
$$\underline{w}_E = p - c - \overline{i} - \overline{e}$$
$$w_E^* = p - c - \overline{i} - \underline{e}^*$$

Operator

Either, he has the role of a subcontractor, or the builder has the role of an operator. The wage levels change, because the result from the builders choice of $i;e$ of the builder.

$$\underline{w}_B = C_0 - \gamma(i') - c(e')$$
$$\overline{w}_B = C_o - \gamma(\overline{i}) - (\overline{e})$$
$$w_B^* = C_0 - \gamma(\overline{i}) - (e^*)$$

The pay-offs of the state and the prison occupant remains unaltered. The production game will be applied in a PPP context:

	h_E	l_E
h_B	$\underline{w}_B; p - c - \overline{i} - e^*$	$\underline{w}_B; p - c - i' - e'$
l_B	$\overline{w}_B; p - c - \overline{i} - e^*$	$\overline{w}_B; p - c - i' - e'$

In $l_B; l_E$ there is a dominant Nash equilibrium. None of the agents has the incentive to give a high contribution and therefore accept a lower wage. In the equilibrium the builder will choose $e' > 0$ and $i' > \underline{i}$. It is good, that he invests in

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quality improving measures, but the investments in quality lowering measures are not good. In the following game, the utility of the prisoner will enter the game.

	h_E	l_E
h_B	$\underline{w}_B; p-c-\bar{i}-e^*; s$	$\underline{w}_B; p-c-i'-e'; \sigma s$
l_B	$\overline{w}_B; p-c-\bar{i}-e^*; \sigma s$	$\overline{w}_B; p-c-i'-e'; 0$

7. Result

The difference between bundling and unbundling occurs, because the builder internalises the costs, but not the benefits, in case of bundled provision. In case of conventional provision, neither costs nor benefits are internalised. In the post constitutional stage neither builder nor operator have an inventive to provide good infrastructure for the society. The utility of potential users is excluded from their utility function.

The first-best solution is based on a social contract, which all participants agree and which implies fairness as a normative principle. There is a pre play stage in which all participants agree in a hypothetic bargaining game with their participation in the production game, without knowing their roles.[42] A rational player will only agree with participation, if the distribution is fair. Without communication during the pre play stage a fair arrangement according to the distribution of utility is implausible. In a constitutional stage the individuals would agree on rules that yield a "good prison operation". Results that promote the utility of the operator and the builder, but not the utility of the users would not be accepted. If Harsanyi´s theory of the maximisation of the expected utility would be applied one has to implement the restriction that the utilities of builder and operator would be sufficiently small in comparison to the users' utilities.

Another way to explain the occurrence of the first-best solution is reciprocal behaviour. The expectation that other players will comply with the normative principle as well, is a source of utility per se. In Harts context, that means, the builders utility increases if he beliefs that the operator engages in a good prison

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[42] See Grimalda, Sacconi; 2002; pp. 263.

operation. In the following section, the model will be applied, to show how the choice that leads to an optimal outcome can be rational. First, it will be applied in the context of conventional provision.

After introducing the Nash Welfare function, it is obvious, that the dominant strategy makes sense. The Welfare function is defined as follows:

$$N(U_1,...U_N) = \prod_{i=1}^{N}(U_i - d_i)$$

d_i defines the reservation utility of the agents they can obtain when the bargaining process breaks down. In the present context, the reservation utility is zero.[43] If the builders and operators pay-offs are inserted in this function, the following values result.

Conventional provision

$$N_{hh} \equiv N(h_B, h_E) = \underline{w}_B(p - c - \overline{i} - e^*)s$$
$$N_{hl} \equiv N(h_B, l_E) = \underline{w}_B(p - c - \underline{i} - e^*)\sigma s$$
$$N_{lh} \equiv N(l_B, h_E) = (\overline{w}_B(p - c - \overline{i} - e^*)\sigma s$$
$$N_{ll} \equiv N(l_B, l_E) = 0$$

PPP (Bundling)

$$N_{hh} \equiv N(h_B, h_E) = \underline{w}_B(p - c - \overline{i} - e^*)s$$
$$N_{hl} \equiv N(h_B; l_E) = \underline{w}_B(p - c - i' - e')\sigma s$$
$$N_{lh} \equiv N(l_B, h_E) = \overline{w}_B(p - c - \overline{i} - e^*)\sigma s$$
$$N_{ll} \equiv N(l_B, l_E) = 0$$

Starting from the pay-offs from the production game, the Welfare function will be maximised when driving the dominant strategy. For this to be the case it is required that:

$$N_{hh} > N_{hl}$$
$$N_{hh} > N_{lh}$$

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[43] See Grimalda, Sacconi, 2002, pp. 265.

This implies that the additional costs required for the quality improving measures, weighted by the consumer's surplus gain, are not too large in comparison with the profits of the firm when the worker accepts a relatively low wage. The second term implies, that the utility of the builder and the operator increase, if the operator accepts a relatively low wage. The operator's loss of utility is being compensated through the gain of utility of the other participating agents.

This example clarifies the crucial role of the absolute values of the parameters. Their values determine which strategy is a rational one. The higher the gain in prisoner's surplus, if both contribute for a good prison operation, the more probable they will choose $l_B; l_E$. Which are the implications of this outcome? In the context of a NPO one can estimate in which branches they occur. They are in sectors, where a joint effort results in a higher effort for the consumer. That means, the gain in surplus in high enough, so that a high contribution is being compensated.[44]

How can a pay-off matrix be modified, so that the participants choose a strategy which implies optimal outcomes?

Equations (1) and (2) are a starting point to show that in $l_B; l_E$ is a psychological equilibrium. Based on the utility function (3) whereas the Nash Welfare function is a normative principle, an outcome can be optimal, when the ideal utility is sufficiently higher than the material utility. The operator's utility consists of the relatively low wage and the compliance to the normative principle:

$$V_B(h_B, b_B^1 = h_E, b_B^2 = h_W) = \underline{w} + \lambda \quad (4)$$

In the following section will be examined, if the operator has the incentive to deviate from his strategy h_B. When the agent deviates from a certain outcome he has to take into account that others expectations are coherent with his performing the action leading to that outcome. He can estimate the possible changes in his comprehensive utility deriving from not conforming to these expectations. $\sigma_w < 1$

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[44]See Grimalda, Sacconi, 2002, pp. 266.

indicates the probability with which the worker plays h_w. The estimation of the operators compliance with the ideology is unaffected by this deviation, since he beliefs, that he is going to perform h_B. Hence, $\tilde{f}_{-B}(h_E) = 0$

The workers conformity with the normative principle must change. If the builder is going to perform h_E with the probability of one, the following values for the Nash Function result:

$$N(\sigma_B, h_E) = \sigma_B N_{hh} + (1 + \sigma)N_{lh}$$

If the operator beliefs hat his action maximises the Nash function, he is going to play h_B.

Formally:

$$N^{MAX}(\sigma_B) = N_{hh}$$

bzw.

$$N^{MIN}(\sigma_B) = N_{lh}$$

To clarify the psychological costs of deviation, these values are substituted into the function measuring the operator's conformity with the ideology:

$$f_B(\sigma_{WE}) = \frac{(1 - \sigma_B)(N_{lh} - N_{hh})}{N_{hh} - N_{lh}} = 1(1 - \sigma_B)$$

The comprehensive utility of the deviation is:

$$V_B(\sigma_B, h_E) = \sigma_B \underline{w} + (1 - \sigma_B)\overline{w} + \lambda \sigma_B$$

The ideal utility of the operator is now smaller than in (4), because he has to bear the psychological costs for the facts, that he is not reciprocating the action of the builder. The builder might feel guilty, knowing the builder did everything to comply with the normative principle. But this outcome can be interpreted in another way, too. The operator might feel guilty, because he did not fulfil the expectations of the builder. To ensure, that the operator acts in a quality improving way, the following restriction must be fulfilled:

$$V_B(h_B h_E) > V_B(\sigma_B, h_E) \Leftrightarrow \lambda_B > \overline{w} - w^*$$

This condition states that the weight attributed to the ideal utility must be sufficiently high to compensate the loss of material utility caused by not performing the best action. This implicates an outcome in which both agents drive a strategy which implicates the highest utility for the third (dummy) player. This strategy is contradictory to the forecast for selfish agents. One would expect, that they would act in a way to maximise their own utility. The sufficient condition for such equilibrium is a sufficiently high appreciation for the normative principle and the belief that the other agent acts reciprocal.

Grimalda and Sacconi examine, if a psychological equilibrium can exists, even if both agents act selfish.[45] Hence, the operator derives material utility:

$$V_B(l_B, l_E) = \overline{w}$$

The operator cannot gain an increase of utility from deviating from this outcome. He beliefs, the builder will act as follows:

$$\tilde{f}(b_B^1 = l_E, b_B^2 = l_B) = -1$$

Hence, there is no incentive to act contrary to his self interest. Other strategies would lead to an outcome that would be worse. The same consideration holds for the builder. According to Grimalda and Sacconi, there exists an equilibrium, where the agents are indifferent to self interest and morality, even if they would tend to act according to the normative principle, that means even if their λ are sufficiently high. This equilibrium is known as an *organisational failure.*[46] Applied in Harts context, that would mean, even if conditions for a good prison operation exist, a suboptimal outcome can occur, in which both agents act selfish and so provide a bad prison operation. Such equilibrium occurs, if none of the agents can signalise his attitude towards the normative principle.[47] A very popular

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[45] See Grimalda, Sacconi, 2002, pp. 269.
[46] See Grimalda, Sacconi, 2002, pp. 269.
[47] See Grimalda, Sacconi, 2002, pp. 270.

proposal for solution recommends the implementation of a communication phase before the game starts. The agents have the chance to disclose their attitudes towards efficient outcomes. According Grimalda and Sacconi, this proposal is incomplete, because of asymmetric information.[48] A selfish builder could pretend a high esteem for the normative principle, and during the game he exploits the operator while playing l_E.

Another way to implement reciprocity would offer the constitutional stage. Here the individuals might agree on such behaviour. Rules that require reciprocal acting would be the result in a post constitutional world, instead of the assumption of individuals who feel guilty when not acting reciprocal.[49]

8. Outlook

The production game provided a good starting point. The rules and pay-offs play a crucial role regarding to the outcome. The characteristic of the utility functions clarifies that the gain in surplus is devisive for the outcomes. Those results allow identifying which measures are necessary to modify the rules in a way that optimal outcomes are guaranteed. According to Binmore,

"...laboratory experiments for policy purposes (...) is not only firmly established as a tool for widening debate, but that is an activity that can only sensibly be undertaken by economists who understand the institutions that are to be reformed."

As the purpose of this work is to examine a framework for the *Constitutional Regulation of Public-Private Partnerships*, an adequate laboratory experiment might offer a broad insight of the attitudes of players when they act in a PPP environment, such as risk sensitivity, preferences regarding the utility of several outcomes etc. As roles, rules, strategies and pay-offs govern the PPP procedures it is important modelling them in games to identify the failures and problems of PPP[50]. The identification of suitable games is a challenge in the following part of this work.[51]

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[48] See Grimalda, Sacconi, 2002, pp. 271.
[49] This assumption is problematic as it deviates from the homo oeconomicus assumption.
[50] See Scharle, 2002, pp. 229.
[51] For a detailed elaboration of a constitution for PPP, see Jamil, forthcoming.

Those results can provide a basis on which recommendations for constitutional rules can be made on. In this context, it is a crucial question, which rules the citizens accept and how rules have to be designed so that they are self enforcing for the political decision maker.[52]

It has to be examined whether political decision makers have incentives to prefer PPP to traditional procurement and therefore have to be restricted.

Harts approach can be expanded and so offer insights in the frame of incentive structures. For example, Bentz et al. focus in their paper *"Public-Private Partnership: What should the state buy?"* the role of control rights within bundled and unbundled provision. They focus the state agencies ability on implementing investments in efficiency-enhancements. They assume that each contract provides incentives and causes inefficiencies. Two kinds of contracts are differentiated: "refined" and "generic" contracts. The first one provides a detailed specification of the project and thus discloses the state agency's information. A generic contract reveals just specifies general duties, but the details will reveal after signing the contract. An important role plays unit costs of service provision, which are linked with the efficiency of the asset. An inefficient assed implicates high costs of service provision and vice versa.[53] Their ability on implementing investments in efficiency-enhancements by the builder is determined by whether the government chooses the conventional provision or a PPP Project. If set up costs of service delivery are low, the conventional provision is preferable. If efficiency-enhancing investments and service delivery are relatively cheap, a PPP model is preferable.[54] Those insights are important guidelines for designing rules for Public-Private Partnerships.

9. Further applications

Harts paper *Incomplete contracts and public ownership: remarks and an application to public-private partnership* is a foundation that allows distinguishing among bundling and unbundling. Several authors used this approach to develop further going theories such as Bennet and Iossa. Others have proved the approach according to its applicability. For example, Riess investigates

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[52] See Jamil, forthcoming.
[53] See Bentz et al., 2003, pp. 7; 8.
[54] See Bentz et al., 2003, pp. 27.

whether the incentive orientated and performance based mechanism of PPPs works for all sectors, or if it is comprising only for some. He carries on the point that all PPPs can be applied to all sectors if the service can be specified, measured and guaranteed. As this is an unrealistic assumption the extent to which they can be applied across sectors differs much.[55] He refers on Harts results to determine roads, bridges, tunnels, water resources and water supply, waste management and accommodation services[56] as candidates for bundling. There common characteristic are a high potential of life-cycle cost savings. As it is easy to contract on the service public-interest objectives can be ensured. This characteristic does not apply for services in health, education, administration of criminal justice and IT.[57] In comparison to Hart, he focuses the single sectors and services very thoroughly and supports his theory with empirical data from the United Kingdom.

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[55] see Riess, 2005, pp. 12.
[56] For example, schools, hospitals, public buildings and prisons.
[57] see Riess, 2005, pp. 17.

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