Hold-up in regulated contracts: The Argentinean natural gas transmission system case

Martin De Meio Reggiani[a,b], *Miguel Vazquez*[c,d], *Michelle Hallack*[c,d], *Nélida Beatriz Brignole*[a,b,]

[a] *Planta Piloto de Ingeniería Química (PLAPIQUI) Complejo CCT-UAT, CONICET, Camino La Carrindanga Km 7, 8000, Bahía Blanca, Argentina.*

[b] *Laboratorio de Investigación y Desarrollo en Computación Científica (LIDeCC-DCIC), Departamento de Ciencias e Ingeniería de la Computación (DCIC), Universidad Nacional del Sur (UNS), Av. Alem 1253, 8000, Bahía Blanca, Argentina.*

[c] *Economics Department, Fluminense Federal University (UFF), Rua Tiradentes, 17 – Ingá, Niterói, RJ, 24210-510, Brazil.*

[d] *Florence School of Regulation, Robert Schuman Centre for Advanced Studies, European University Institute, Via Boccaccio 151, Florence, Italy.*

Abstract

This article aims to understand the role of policy stability perception in the dynamic of network infrastructures regulation. We contribute to the literature by developing an abstract description in which the regulatory institutions in some countries have virtuous relation with network industries, while other countries enter in a vicious cycle. This abstract description allows us to consider general models that can explain different contexts. We test our description in a real case study.

The asset specificities inherent to network industries mean high transaction costs, which in turn raises the hold-up risk. We depart from the idea that regulation (as rate structures) is a kind of contract between government and private companies. As explained by Williamson (1976) and Goldberg (1976), it is a special kind of arrangements in the presence of incomplete contract that is able to adapt and protect players from holding up themselves. However, regulation can actual play a positive or a negative role in the network infrastructure development.

This article combines two theoretical streams to build a theoretical model. We depart from the conclusions of the contract theory proposed by Salant and Woroch (1992), who model the governments' incentives to behave opportunistically according to investors' investment profiles. We show that their analysis, which is based on the incentive compatibility principles, explains behaviour differences if the investment profile of the industry is heterogeneous. However, it is no able to explain why industries with similar investment profile in diverse countries have completely different dynamics. This model cannot help to explain, for instance, why regulatory tools applied in Europe for network industries (as natural gas) turn out to generate completely different incentives if compared to Latin America. Stein et al. (2008) underlined the importance of policy stability to understanding the Latin America success (or failure) in implementing policies. Regulation is a key element to implement policy, as explained by the authors. We include the variable policy stability perception as a significant element in the understanding of the government's incentives to behave opportunistically.

We check our model with the case study of natural gas network in Argentina. This analysis contributes to understand the role network industries regulation to deal with hold-up problem and how the institutional environment in which regulatory agencies are embedded matters.

1. Introduction

Network industries are characterized by the need for regulation (Kahn, 1988; Gomez-Ibañez, 2003). In this paper, our focus is on the analysis of interaction between public and private parties in regulated contracts.

One of the main outputs of our model is to help explaining the drivers for regulatory governance. In particular, we characterize the behaviour of a government that has to be elected within the framework of a regulated contract. We show that, in some cases, such government has incentives to behave opportunistically. Therefore, regulatory mechanisms must be put into place to avoid those opportunistic behaviours.

A possible basic model is constructed by considering ex ante incentives. One limitation of that approach is that ex ante incentives only cannot explain alone all situations. Particularly, we observe situations where all ex ante incentives are aligned, and, however, there is a lack of investment. Hence, we propose a model that includes the government's opportunistic behaviour. We show that without proper regulatory governance, regulators may have incentives to behave opportunistically. In particular, we characterize the incentives of governments to hold up investors which operate regulated services.

Our starting point is the consideration of ex ante incentives. In that sense, Salant and Woroch (1992) proposed a game where a government and a company sign a long term contract for the provision of a public service. In this agreement, the former decides the rate level while the latter operates the infrastructure and invests in a certain way so as to satisfy the demand requirements in each period. After presenting a repeated game, the authors conclude that if the infrastructure is non-durable –that is, some investment must be made each period in order to adapt its capacity to the demand– and the interest rate is relatively low, an equilibrium exists where the price is set above the total unit cost and investment in expansion is positive. The main idea behind this equilibrium is that the absence of investment could be used as a credible threat against the intention of a government to decrease rates in the search of political advantage. Following this argument, the authors recognise the only possible equilibrium if the infrastructure durability and low interest rate conditions are not met: the political benefit derived from the profit distribution amongst consumers will be higher than the cost of ignoring the agreement; consequently, there is a hold-up risk. As explained by Glachant and Hallack (2009), the nature of the asset specificity of the investments in network infrastructures leads to a considerable risk of "hold-up". The quasi-rent generated by the use of specific assets can lead to disputes over its appropriation. Clearly, specific assets create a risk of opportunism from governments.

The aim of this article is to analyse the effect of opportunism on privatised public services. In particular, the government's opportunistic behaviour in a democracy has been introduced in an infinitely repeated game. By introducing this variation, it was evaluated the conditions under which hold-up may occur when the non-durable condition is absent in a single governmental term. Furthermore, a description of the Argentinean natural gas transmission sector in the last decade has been used to support our model conclusion.

The paper is structured as follows: first, the modelling approach is presented. The governments' opportunistic behaviour is included since it is a key element in the model characterization. Secondly, a simplified model is introduced in Section 3 so as to depict a general overview. Also, a model extension of the initial representation is proposed in Section 3.3. Finally, after the case study has been analysed in Section 4, the concluding remarks and possible improvements are discussed.

2. Modelling approach

The proposed model is an application of the Folk Theorem in an infinitely repeated game (Friedman, 1971; Fudenberg and Tirole, 1991). By employing the same theorem, Salant and Woroch (1992) modelled a contract between a government and investors to provide a public service. While the former determines the rate that maximises the consumers' surplus, the latter decide the investment that must be made each period in order to maintain or increase the supply, and to maximize their profit. By following a trigger strategy, both players decide whether to cooperate or not. If someone decides to breach the contract, the counterpart will decide to punish as well. This punishment will consist in no investment and prices low enough to prevent earning any profits.

Salant and Woroch (1992) evaluated the possible equilibria that were sustainable in time. The main result of their analysis lies in two sustainable equilibria. The first one is based in an open-loop game. The government's best strategy in this scenario is to establish the price as low as possible due to the lack of information from the other player. Similarly, investors will not invest owing to the uncertainty related to the price decision from their counterpart. Therefore, the only equilibrium possible will be no cooperation, and this will also be the minimax solution of the game. In fact, since the open-loop equilibrium subsists in a close-loop game, it could be used as a persuasive threat. In a close-loop game, Salant and Woroch (1992) proved that if the interest rate is relatively low, a solution close to the planning one[1] may be feasible. In order to achieve this, the infrastructure needs to be updated constantly, and this requirement gives the investor the power to force the other part to set the price above the minimum unit cost. In that model, those two equilibria are sustainable in a continuum where the government seems to behave consistently over time. The choice of the government, however, depends on the political stability.

As explained by Stein et. al (2008), some countries are able to commit and enforce a policy, while other countries' policies are reversed easily (even within the same administration period). In countries with more stable policies, incremental changes (or renegotiation) are eventually expected in long-term agreements. However, this coordination should be done through consensus and compromise. On the other hand, volatile policy environment is characterized by a lack of consultation with different groups in the society (it focus on interest of groups supporting the government), the consequence of the separation between government interest and State interest, means often short term priorities (as the election cycle is the horizon) over long term interests.

In any democracy, political parties engage in periodical elections to gain or maintain the control of the State. Therefore, this election process may stimulate an opportunistic

[1] A planning solution is that one that maximises the consumer's surplus subject to the participation condition of the investor.

behaviour in the ruling party. That is, they could try to maximise their political advantage in the short term rather than concentrating in society's long run welfare (a time inconsistency may arise). The introduction of this kind of opportunism will contribute to improve Salant and Woroch (1992) findings and we will introduce the role of political institutions as a key element in the regulatory behaviour.

With the aim of dealing with the political institutions that can impact the incentive of regulatory opportunism in the sense previously detailed, a categorisation suggested by Jones (2005) is adopted. The author classified democracies according to the manner that political parties compete. If political competition is based on policy and voters judge politicians by the degree that they achieve those policies, the system is called programmatic. In this context, there is a higher policy stability, as it takes into account how policy is actual implemented and its resulted impact in the different groups of interest in the society. On the other hand, if those voters judge their parties by the way they fulfil their interests, the political system is called "clientelist". In this context, the policy stability is lower as the policy makers will decide based on which is their support group and what is the short term interest of these groups. Regulatory framework is impacted directly or indirectly by the kind of political environment in place. For instance, even the degree of regulatory independence to achieve the policies objectives is different.

3. General Model

To begin with, the context where the model is set and some behavioural assumptions will be described:

1) The political system is a representative democracy. In this respect, each elected government has a finite period and may be re-elected.

2) The State must provide public services that require a certain periodic investment in infrastructure which is specialized to that purpose[2]. Frequently, infrastructure requires

[2] The concept of asset specificity (Williamson, 1979) in this model implies that the infrastructure has a unique task and could not be used for other purposes.

substantial financing that, in some cases, the State cannot afford by itself. Therefore, it may choose to provide these services through investors under the control of a regulatory agency. This long-term contract describes the rate scheme and a series of expansion investments. Like most of these controlled services, the regulatory agency has the legal authority to periodically adjust rates according to certain criteria (i.e. price cap, cost plus, and variations).

3) Players follow a grim trigger strategy, which means that only if prices cover the total costs, investments will be made. Conversely, only if the investment contracted is made, the government will set a price above the minimum. Otherwise, the minimax solution, consisting of zero investment and a price equal to operating costs, will last until the end of the contract.

4) Before the contract is signed, players have their own private knowledge about the *know-how* and the infrastructure stock. The intersection between the set of investors' information (K_I) and set of the government's one (K_G) will be the common information (K_C), which is going to be taken into account to establish the amount of investments in the contract.

5) As seen in Hart (2007), if rates are high enough to cover all operating costs, the company would prefer to continue its operations because a hostile relationship is preferable to losing completely the sunk costs. Also, as long as operations are economically and financially feasible, investors could withstand the lost profits in the expectation of renegotiating the contract with a future government. Similarly, if the benefits from the contract breaching are equal than the costs, the government would decide not to neglect the agreement.

6) Investors are risk-averse.

Afterwards, and for the sake of simplicity, some assumptions will be made[3]:

1) There exists only one regulated utility.

[3] The first assumption is discussed in the Final Comments and Discussion section.

2) The contract initially signed assumes efficient investments. That is, the incomes are equal to the sum of all costs, including capital one. This assumption will be lifted in order to achieve a more generalized model.

With the intention of identifying when an agreement is sustainable in the long run, an incentive compatibility condition that describe the government's behaviour is proposed. Unlike Salant & Woroch (1992), a government's behavioural parameter is introduced to reveal which equilibria are sustainable in the long term. In other words, the contract will subsist provided that the incentive compatibility condition holds (Equation 1).

$$(1) \quad Breach\ Cost\ (BC) \geq Breach\ Benefit\ (BB)$$

The government has the right to set the rate. In order to do so, it will observe the incentive compatibility condition with the data available and then it will decide if it is suitable to decrease the price, or not. We assume that if the government neglect its commitment, he will try to obtain the maximum benefit, that is, it will transfer as much rent as possible.

The government's opportunistic behaviour will be stimulated by the impact of costs and benefits in terms of electoral advantage. In order to model this idea, a subjective discount factor is included to weigh the net effect differently throughout the entire period. This subjective discount is a factor that increases the interest rate, and it is composed of an exogenous variable, α, which is introduced to characterize the government's behaviour profile. More precisely, α measures the government's tendency to disrespect institutionalism and a recurring propensity to neglect commitments in order to increase its electoral advantage. Additionally, this opportunistic behaviour value is mitigated by $\rho_t \in [0,1]$, which represents the assessment that the government gives to the negative consequences for itself, in the *t*-th period, originated in the contract violation.

This composite factor ($\alpha^{1-\rho_t}$) would vary over the remainder of the contract, and it would affect cost and benefit valuation differently depending on whether the ruling party is in power in the *t*-th period or not.

In addition, this opportunism representation could be considered as a principal-agent problem between the State and a particular government. In any representative democracy, the State is a legal entity which is headed by a potentially different political party each period. This may introduce a time inconsistency among priorities given that, while the State's objectives should be consistent with its long-term existence, an opportunistic government may focus on those objectives which increase their electoral advantage in the short-term.

This principal-agent problem is a serious concern of which any investor should be alert. While the contract conditions are often negotiated and signed with a single government, the real counterpart in a utility provision contract is the State, which is periodically leaded by various parties with distinct political profiles. This means that opportunistic profiles may change over time and the chances of hold-up are uncertain in the long-run.

3.1. Incentive compatibility condition

Another important step in our analysis consists in specifying the incentive compatibility condition (Equation 1), evaluated at any time i after the contract signing and before the contract's end T.

Equation 2 depicts the Breach Benefit (BB), which is rent that governments could transfer from the company to consumers.

$$(2) \quad BB = \sum_{t=i}^{T-i} LP_t \times {\delta_t}^t$$

BB is the sum of the investors' lost profits due to the hold-up, discounted up to the end of the contract (T period). In this expression, LP_t is the lost profit in the t-th period. This loss may be originated by several strategies pursued by the government. For instance, prices could be deliberately cut or frozen, new taxes applied to utilities might be created or risen, or more demanding conditions in the service provision could be requested.

The Equation 3 specifies the Breach Costs (BC), whose structure is similar to the Breach Benefit one.

$$(3) \quad BC = \sum_{t=i}^{T-i} PE_t \times {\delta_t}^t$$

BC is the discounted sum of the public expenditure (PE) originated in the contract breach. This expenditure consists in the idea that the public service provision is essential and the State should afford not only the legal penalties for breaching the contract, but also it should invest what is necessary to meet the demand requirements in case that the investors have underinvested.

It is crucial to recognise that there exist social benefits and costs, such as the economic activity improvement based on lower energy prices or the social loss caused by service interruptions if investments are not enough to cope with the demand level. Nevertheless, our aim is limited to the analysis of those costs and benefits that derive directly from a contract, leaving aside any social effect not specified in it.

The discount factor $\delta_t \in [0,1]$, which is descripted in Equation 4, is applied until the end of the contract (T).

$$(4) \quad \delta_t = \frac{1}{1 + r \times \alpha^{1-\rho_t}}$$

This subjective discount factor is formed by the interest rate r multiplied by the opportunism factor $\alpha^{1-\rho_t}$. As it was previously described, $\alpha \in [1, \infty)$ is a bound variable that reveals the opportunism profile of the government. The more deceitful the government is, the larger α should be. This compound discount factor (δ_t) also varies over time owing to the fact that $\rho_t \in [0,1]$ depends on how the government strongly value the negative consequences of holding up an investor in the t period. If the government sensed that its actions would imply any serious setback for its future in t, ρ_t would tend to 1. Conversely, ρ_t is closer to zero as the difficulty becomes less significant.

For instance, it is important to consider the influence of periodical elections over this model and, in particular, how the re-election of the governing party may account for contradictory results. If the chances of being re-elected were uncertain, the preference of securing the success may reinforce the hold-up scenario in case that the government's profile is opportunistic ($\alpha > 1$) and most of the costs fall after the election (t'-th period). However, there is an opposite rationale against hold-up since, in case of winning, the future breach costs would be dealt by the same party, which may seriously compromise the future administration. Hence, $\rho_t \to 1$ will soften the effect of an opportunistic behaviour.

3.2. Comparative statics

In order to describe benefits and costs strictly related to contracts, some expenditures are suggested. These aspects are usually present in almost any kind of regulated contract. Therefore, Equation 5 depicts the form that PE may possible adopt.

$$(5) \quad BC = \sum_{t=i}^{T-i}[FPC_t + I_t(K_C)] \times {\delta_t}^t$$

FPC_t represents the financial penalty clause or any other monetary penalty foreseen at the time t. In order to be effectively dissuasive, it must exceed the residual value of the investments made up to i. In other words, the investor should be compensated, at least, for the non-recouped investments. $I_t(K_C)$ is the value of pending investments that the investor would not make (based on the trigger strategy). These investments will follow the value specified in the contract, that is, the value will be a function of the common knowledge K_C at the moment of the agreement signing.

On the other side, the strategy adopted by the government in case of contract violation could consist in reducing the price to a minimum, letting the investors cover only the operating costs $c_t(K_C)$ agreed (Equation 6). In doing so, the government could transfer rent from the company to the consumers in the amount of the quantity transported q_t[4] multiplied by the difference between the original price p_t and the reduced price. According to the trigger strategy, the new price would be as low as the operating cost $c_t(K_C)$.

$$(6) \quad BB = \sum_{t=i}^{T-i}[p_t - c_t(K_C)] \times q_t \times {\delta_t}^t$$

Once BC and BB are defined, their amounts depend on the effect of the opportunism on δ_t. Since $\frac{\partial \delta_t}{\partial \alpha} < 0$ and $\frac{\partial \delta_t}{\partial \rho_t} > 0$, an increasing opportunism would mean that the future

[4] Since utilities should always satisfy the quantity demanded, q_t is considered as an exogenous variable. This quantity is usually specified in the contract as a restriction that the investor must achieve at all times regardless the actual capacity of the infrastructure.

is relatively unimportant ($\lim_{\alpha\to\infty} \delta_t = 0$) while the effect of ρ_t would tend to moderate this perception. This means that an opportunistic government would favour policies that have a positive impact in their own term. In other words, both breach benefits and cost after the end of their term have scarce subjective value to them. On the other hand, if the opportunism degree reached a minimum ($\alpha = 1$) or the consequences of breaching the contract are seriously negative to the acting government, then $\delta_t = \frac{1}{1+r}$ and the principal-agent problem effect would be minimum as well.

This first evaluation implies that δ_t oscillates between zero and one and, most importantly, the best and worst scenarios for the private investor are determined. The investor's best-case scenario is obtained when $\alpha = 1$. Since an efficient contract (Assumption 2) means that $\sum_{t=0}^{T}\{[p_t - c_t(K_C)] \times q_t - I_t(K_C)\} \times \delta^t = 0, BC$ is going to be higher than BB in the amount of $\sum_{t=i}^{T} FPC_t \times \delta^t$ (Equation 7), provided that the penalty clause is effectively dissuasive. Consequently, the government would not have incentives to hold up their counterpart, regardless of the investments and penalties distribution over time.

$$(7) \quad \sum_{t=i}^{T-i}[FPC_t + I_t(K_C)] \times \delta^t > \sum_{t=i}^{T-i}[p_t - c_t(K_C)] \times q_t \times \delta^t$$

Regardless of the opportunistic behaviour, the same conclusion is obtained when $\rho_t = 1$. Given that the outcomes of breaching a contract could be extremely costly for the government (i.e. in terms of reputation or a certainly won re-election), violating an agreement could not be viable, notwithstanding the short-term benefit it could provide.

On the contrary, the worst-case scenario for the company is when the government is highly opportunistic, the infrastructure does not need to be increased to cope with the demand, and the penalty clause is foreseen to be enforceable after the governing period. First, it can be seen in Equation 8 that the *BB* tends to a positive number as α raises and $\rho_t < 1$.

$$(8) \lim_{\alpha\to\infty} BB = \sum_{t=i}^{t'}[p_t - c_t(K_C)] \times q_t \times {\delta_1}^t > 0$$

Then, *BC* tends to zero since the penalty and investment problem must be dealt by the coming governments (Equation 9).

(9) $\lim_{\alpha \to \infty} BC = \sum_{t=i}^{t'} [FPC_t + I_t(K_C)] \times {\delta_1}^t + \sum_{t=t'+1}^{T} [FPC_t + I_t(K_C)] \times {\delta_2}^t = 0$

Like in Salant and Woroch (1992), if the infrastructure is updated in the short-term and the lawsuit is predicted to be concluded over after t', there are strong incentives to hold up the investors because, in the limit, the breach costs are lower than the breach benefits.

These two setups describe extreme scenarios. As both sides of the incentive compatibility condition are continuous on $\alpha^{1-\rho_t}$, there exists a point where the government will be indifferent between holding up or not. When α exceeds that point, the government will have incentives to hold up.

Our main conclusion consists in establishing a possible cause of hold-up in regulated contracts. Due to the existence of a time inconsistency between a government's and the State's priorities, the former might subjectively underestimate contract breach costs in order to gain or maintain political power. Hence, the incentives to hold up would rise as $\alpha^{1-\rho_t}$ increases.

Furthermore, hold-up incentives might depend strongly on how required investments and penalties are distributed along time, and the amount of each of them that will impact before t'. This last observation posits a warning about the required investments that investors must make periodically in order to meet an increasing demand, and not only at the beginning of the contract. Specifically, investors not only must evaluate the government's behaviour before signing an agreement, but they should also be aware of any change in both α and ρ_t variables throughout the entire contract period, and take preventive actions if possible.

3.3. Extension: Non-efficient investments

From this moment on, we acknowledge the possibility that contracts may lead to non-efficient investments. At the beginning of the contract negotiation, in order for investors to participate, the government should propose a contract where rates are high enough to cover the operating costs (c_t), investments ($I_t(K_C)$), and a normal profit. As the government would try to set the price as low as possible, it would aim to sign an efficient contract that will cover all costs, including the normal profit contained within the interest rate (Equation 10).

$$(10) \quad \sum_{t=0}^{T}\{[p_t - c_t(K_C)] \times q_t - I_t(K_C)\} \times \frac{1}{(1+r)^t} = 0$$

Incidentally, a distinction between committed costs and effective costs should be noticed. Typically, there exists asymmetric information between signers over the investment characteristics due to the fact that specialised companies know better the financial and technological requirements for a certain infrastructure (Laffont and Tirole, 1993). In this regard, as costs in the long run are uncertain, future expenses or investments may be overestimated so as not to meet unexpected losses.

Equation 11 describes how committed and effective total costs are related. Investors, which are risk averse, will only invest in a business if their forecast about the cost structure is, at most, equal as the committed one. They would sign a contract if they considered that they would be covered against reasonable future losses, including lower rates, higher taxes, a decreasing demand, higher costs or unforeseen infrastructure requirements from the regulatory agency. In other words, the effective costs considering the investor knowledge (K_I) should be equal or lower than the committed ones, which are based on common knowledge (K_C), inasmuch as the same quantity contracted (q_t) can be provided.

$$(11) \quad \sum_{t=0}^{T}[c_t(K_C) \times q_t + I_t(K_C)] \times \frac{1}{(1+r)^t} \geq \sum_{t=0}^{T}[c_t(K_I) \times q_t + I_t(K_I)] \times \frac{1}{(1+r)^t}$$

Similarly, Equation 12 reflects the same inequality in terms of relation, where $\sigma \geq 1$ represents a risk prime of the project.

$$(12) \quad \sigma = \frac{\sum_{t=0}^{T}[c_t(K_C) \times q_t + I_t(K_C)] \times \frac{1}{(1+r)^t}}{\sum_{t=0}^{T}[c_t(K_I) \times q_t + I_t(K_I)] \times \frac{1}{(1+r)^t}}$$

Taking into account Equation 12, a contract based on common information between the government and the investor could in turn be expressed using the investor's private information. While the government may expect that the agreement is fulfilled following the terms in the contract signed, the investor, which is a profit maximizer, could supply the quantity negotiated but optimizing the total cost. Therefore, Equation 13 describes the same contract in Equation 10, but expressed in terms of the investor's private information.

(13) $\sum_{t=0}^{T}\{[p_t - c_t(K_I)] \times q_t - I_t(K_I)\} \times \frac{1}{(1+r)^t} = (\sigma - 1)\sum_{t=0}^{T}\{c_t(K_I) \times q_t + I_t(K_I)\} \times \frac{1}{(1+r)^t}$

While the government expects that the contract is developed following the conditions agreed, the investor would be earning supernormal profits as long as $\sigma > 1$.

As it was concluded in the previous section, an increase in the government opportunism may incentive the appropriation of the infrastructure's quasirents. For this reason, Equation 14 states that σ would increase if investors observed that government became more opportunistic (since the project risk involves the hold-up risk as well).

(14) $\frac{\partial \sigma}{\partial \alpha^{1-\rho_t}} > 0$

If the government pretended to sign an efficient contract (Equation 10) and the investor expected that $\alpha^{1-\rho_t}$ would increase, the latter would tend to underinvest where it is possible, and the real infrastructure value would be distant from the committed one, so as to compensate the increasing risk of a future hold-up. Additionally, if $\alpha^{1-\rho_t}$ was greater than 1 from the beginning, σ could not be equal to 1 (its minimum value), and there would be supernormal profits at $t = 0$.

If the expected $\alpha^{1-\rho_t}$ is greater than 1, the difference between incomes and expenses that investors are willing to obtain given a certain risk should also be wider. At the same time, this supernormal profit makes the incentive condition (Equation 1) harder to satisfy since there is a higher rent available to transfer to consumers or a lower penalty to pay in case that corruption is demonstrated[5]. In other words, the higher the profit, the stronger the stimulus is to capture it. Hence, lifting the assumption of efficient contracts may increase even more the incentives to hold up investors. This conclusion may suggest the idea that the only contracts that should be signed are the ones that

[5] In the presence of a high opportunism, the rationale based on a future lower penalty clause should not be stronger than the one based on the present value of captured profits.

could compensate the risk of a future hold-up. In turn, this may lead to less investment available in countries with a well-established tradition of opportunistic governments.

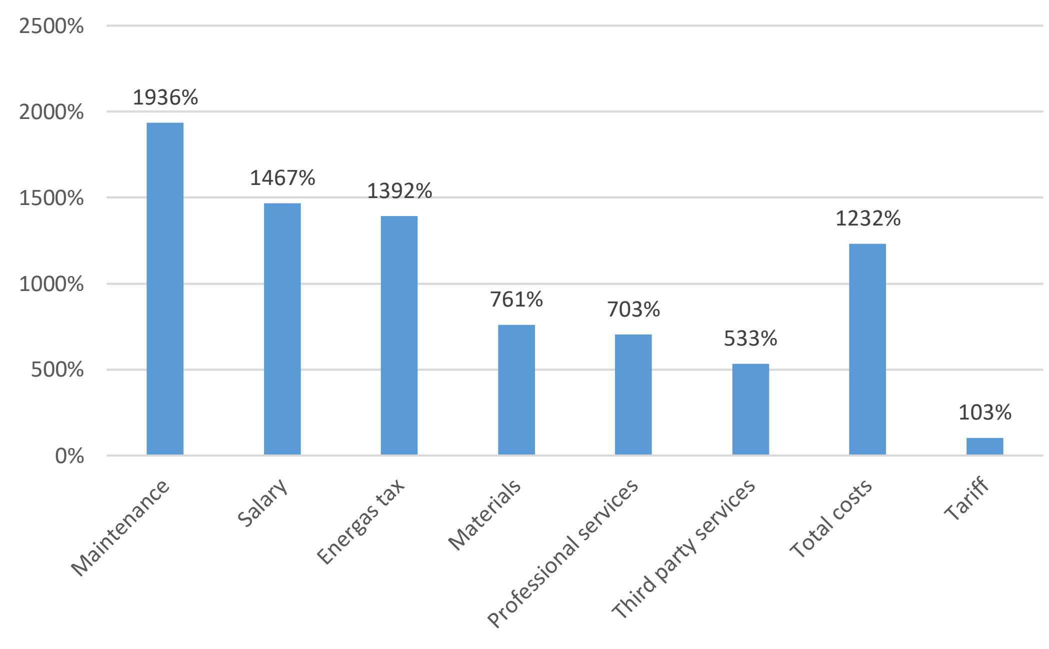
4. Case study: Argentina's natural gas transmission system

The natural gas transmission system history could be divided into three periods. The first one, and the most extensive, began after the construction of the first gas pipeline in 1946. From that year to 1988, the state-controlled company called "Gas del Estado" built almost all the basic infrastructure that is still in use. However, this company was accused by the government and part of the general public of being highly inefficient (Galé, 2005). During the second period, that extended from 1989 to 2002, most of public companies were privatized. In the case of the transmission network, it was separated into north and south zones, and the assets were sold to international companies[6]. The system became regulated by the "Ente Nacional Regulador del Gas" (ENARGAS), an organism whose objectives consist in controlling the correct fulfilment of the contract and setting rates. Finally, the last period starts in 2002 when the "Convertibilidad" Law[7] (Convertibility Law), which stipulated a fixed exchange rate, was derogated. Since the prices had been originally agreed in dollars[8], the Economic Emergency Law[9] allowed the government to maintain rates at the same nominal level in local currency as they had been before devaluation[10]. In other words, while costs suffered from currency instability, the incomes remained unchanged. The main arguments to freeze rates were that price indexation could not be afforded by consumers after the strong devaluation in 2002 (Arredondo, 2007), the economic activity level decreased steeply[11], the unemployment rate was reaching alarming figures, and that there was a deep concern over an escalation in inflation (IMF, 2003).

[6] The new companies were called "Transportadora de Gas del Norte S.A." in the north and "Transportadora de Gas del Sur S.A." in the south.
[7] Convertibility Law, Law 23.928, March 1991.
[8] Decree 1.738/92. Moreover, the contract established that the transport price must have been indexed by the Producer Price Index of the United States of North America.
[9] Law 25.561. January 2002.
[10] Decree 689/2002. Export rates were not comprehended in this new scheme.
[11] Ministerio de Economía (2003). La Economía Argentina durante 2002 y evolución reciente. Report N°44.

After the economic activity restarted to soar, utility rates were not risen accordingly so as to cover the total costs. Nonetheless, the price policy in other parts of the natural gas supply chain was dissimilar. In 2004, after a shortage of investment in the production activities, there was a deficiency in the internal natural gas supply (Kozulj, 2005). Exports to boarding countries were forbidden and a new scheme of prices was introduced to stimulate the supply[12]. And yet, the transmission system price remained steady for more than a decade.

Although a re-negotiation process involving all utilities began in 2003, it was not until 2014 that transport prices were partially recomposed. The companies claimed that this raise was insufficient to cover the accumulated increase in costs caused by a decade of severe inflation (Graph 1).



Graph 1. Costs vs. rate evolution. 2001-2015.

Source: Transportadora de Gas del Norte S.A. Financial Report (2015)

There might be several causes behind this prolonged hold-up. First, there was a renegotiation process[13] in 2003 conducted by the "Unidad de Renegociacion y Analisis de Contratos de Servicios Publicos" (UNIREN) to negotiate a new price scheme (Arredondo, 2007). During this process, the government requested that the existing

[12] In April 2004, the Resolution 208/04 was sanctioned to normalize the price at the pipelines entry point.
[13] Decree 311/03.

shareholders[14] must absorb the costs from the existing arbitration lawsuits at the International Centre for Settlement of Investment Disputes (ICSID). The new investors did not accept this condition and the negotiation process continued sternly for several years. Even if this renegotiation process finally ended in 2014 with a partial upturn in prices, followed by another increase in 2015, the adjustment was still inadequate to restore the financial balance in transmission companies.

Secondly, the government also claimed that the stated-owned company was suspected of being sold at a vile price in 1992[15]. After winning the public bid, the buyers paid the purchase price with recovered public bonds, which had been acquired at a low price due to a financial crisis near the end of the eighties. Nonetheless, those bonds were accepted by the government at its nominal price (Azpiazu and Basualdo, 2004). Particularly, this argument was the government's main reason to justify its refusal to upgrade rates (Pistonesi, 2001).

Lastly, the natural gas transport capacity was large enough to meet the demand at the end of the Convertibility Law, and only after 2004 there was a real need to increase it at some specific points. As companies claimed that prices were not high enough to invest in new capacity of transport, two fiduciary funds were created in 2004 and 2006[16] to finance the infrastructure needed. The repayment was assigned and included directly in consumers' bills and, therefore, the government successfully eluded to rise the transmission price. Hence, this mechanism allowed the government to significantly delay the renegotiation process.

In terms of the proposed model, there was evidence in favour of holding up the transmission companies by freezing prices. First of all, natural gas pipelines are highly specialized. According to Williamson (1983), they pose a site and a dedicated specificity. In other words, this infrastructure cannot be moved or used for any other purposes than

[14] It is essential to mention that once the Convertibility Law was derogated and utility rates were frozen, most of the transmission companies' shareholders took legal actions and sold their shares.
[15] The legislative process of the company's sale was also suspected of being corrupted. The law that approved the privatisation was passed by employing a false member of the Congress, known as the "Diputrucho". This case is considered a symbol of the corruption concerning all the privatization processes of Argentine state-controlled companies.
[16] Decree 180/04.

transporting natural gas. What is more, it is essential to mention that once the Convertibility Law was derogated and utility rates were frozen, most of the transmission companies' shareholders initiated legal actions against the State and sold their shares. Since pipelines are irreplaceable for the natural gas industry, some upstream companies (i.e. Petrobras, Pampa) took over both parent societies in spite of the lack of profitability.

Regarding Equation 1 evaluated in 2002, the cost side had a low discounted value owing to the time required in the ICSID hearings[17] and a temporary decline in the internal demand of gas due to an economy in recession. In other words, the former meant that the penalty would not have been an immediate problem, and the latter could have implied that new infrastructure was not needed in the very short term because of the depressed internal market[18]. Likewise, the succeeding governments might have considered the possibility to avoid increasing rates (more specifically, updating the investment component) due to the fact that the infrastructure required could be financed by the financial trusts created in 2004 and 2006.

On the other hand, the Breach Benefit could be measured by the idea that the inflation threat and social impoverishment were contained by keeping the costs related to energy under control. After the devaluation in 2002, and since energy is an essential input in almost every economic activity, immobilising energy prices served as a mechanism to curb inflation. Thus, there has been a rent transference, in real terms, from the transmission companies to customers, on account of the effect of the inevitable inflation on costs.

The opportunistic behaviour (α) can be approximated by using an index that evaluates the quality of the regulatory governance. Even though the Global Competitiveness Index from the World Economic's Forum was selected, similar results could be obtained if other indicators were applied.

[17] For instance, the case "Enron Creditors Recovery Corporation (formerly Enron Corporation) and Ponderosa Assets, L.P. v. Argentine Republic" (ICSID Case No. ARB/01/3) was still pending at the end of 2016.

[18] ENARGAS (2002). Report ENARGAS 2002.

Since our model predicts the chances of breaching a contract due to governmental behaviour, α should not comprise any perception regarding property rights in order to avoid endogenity. Hence, the "Public trust in politicians" subindex[19], a proxy for opportunism, reveals the Argentina's opportunistic profile compared to other countries (Table 1). Taking into account the number of individuals participating in this survey, Argentina ranks in the last positions since the first published report.

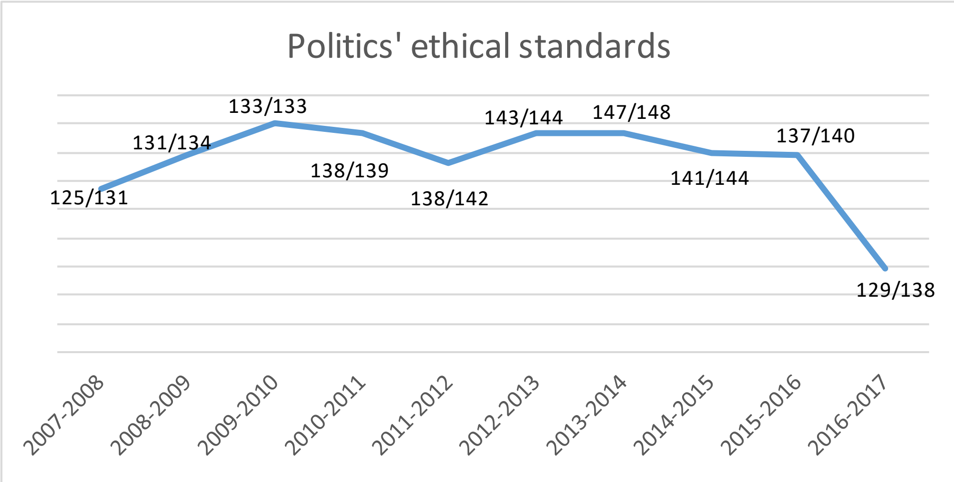


Table 1. Global Competitiveness Index: Public trust in politicians. Rank

Source: World Economic's Forum

Incidentally, when the ruling party took the decision of freezing rates of utilities, the country was immerse in an atmosphere of widespread hostility against all political parties[20] (Dinerstein, 2003). In fact, after the resignation of President De la Rua, there have been three presidents in office, who lasted 11 days in total. In other words, there would have been a feeling of a reasonable uncertainty regarding the continuity of any succeeding government. Consequently, this fact may have implied that the costs of hold-up could have been subjectively negligible ($\rho_{2002+} \rightarrow 0$) compared to the need of ensuring social peace and political stability.

Finally, supernormal profits could be detected in the 1990s[21]. The government claimed that there was evidence, based on reports from the National General Court of Accounts

[19] The "Public trust in politicians" subindex measures the social perception of politics' ethical standards.
[20] "¡Que se vayan todos!" (Everyone leave!) was a popular slogan widely adopted in popular demonstrations circa 2001.
[21] During the 1990s, Net utilities represented nearly 40% of the operating incomes (Pistonesi, 2001).

(SIGEN) and National General Audit Office (AGN), according to which the companies had inflated costs and deferred investments (UNIREN, 2004). In addition, the bidding in 1992 was paid with national bonds at par value, previously bought under par due to a financial crisis in the preceding years (Galé, 2005). This means that the actual return on investment was even higher than the one agreed (r), which was already considered using an elevated price in order to attract investors (UNIREN, 2004). Therefore, the evidence related to the existence of a non-efficient contract may have been used as additional reason for holding up the transmission companies.

In conclusion, we were able to provide a possible justification for a sustained hold-up over a long period. The elements that compose the investor's worst scenario took place in 2002, and most of them persisted for more than a decade.

5. Final comments and discussion

The objective of this paper is to analyse the conditions that may lead to hold-up in the relationship between a government and a private company. A critical factor of these conditions is the government's preference for polices that might improve its electoral performance in its own term over those that are optimal in the long term. We have introduced these effects within a game-theoretic model using a political stability variable ($\alpha^{1-\rho_t}$).

Additionally, inefficient contracts increase the risk of holding up. This situation may happen because the actual total cost, rather than the initially specified, is lower than the expected income and, therefore, the government is tempted to capture this greater profit.

We have shown the usefulness of the model through the study of the Argentinian case. We were able to provide a possible justification for a sustained hold-up over a long period. One application of this approach is to guide policy-makers in the redesign of Argentinean regulatory governance structure. In that context, an important topic for future research is the formalization of the calibration process for the policy stability parameter.

Incidentally, extensions of our framework may consider a multi-sectoral effect. If there were two or more regulated private companies, holding up only one of them could cause a similar result to the one described in Section 3.3. Throughout the policy stability parameter (α), the other companies may recognize the hold-up threat in a particular activity, and this may discourage future investments in all other sectors in order to compensate the new level of risk (σ) perceived.

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