The robustness of long-term Take-or-Pay contracts:

What we can learn from the trade in gas between Brazil and Bolivia?

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Abstract[3] : Neo-Institutional Economics (NEI) has long shown that take-or-pay long-term contracts provide a robust framework for safeguarding the interests of both upstream and downstream parties in the gas industry. The case of gas trade between Brazil and Bolivia presents an opportunity to re-examine empirically and to review the robust nature of the take-or-pay framework over time. This case reveals that the positions of the contractors actually change giving rise to a veritable lifecycle of the contractual arrangement. Such a contract can be seen to span three successive phases. The first phase of the contract cycle begins when it is signed; allowing the investments to begin. The second phase starts when investments have been completed and the actual trade in gas begins. The third phase of the contract cycle comes when the increasing flow of gas comes close to saturating capacity and the volume levels for downstream market volume have been reached. These three contract phases are thus distinguished by how robust the alignment of the parties' interests is.The added value of the paper is then both empirical and analytical: the case study provides a brand new lifecycle analysis of the performance of TOP long term contracting into an NIE framework.

Keywords: *Long term contract; Gas industry; Take-or-Pay; Lifecycle; Brazil; Bolivia.*

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Introduction

After years of exploring possible arrangements, Brazil and Bolivia began trading in gas in 1999. A gigantic infrastructure was specifically constructed to make this market possible: 2900 km of pipeline, distribution networks and gas-fired equipment in Brazil where demand for natural gas rose 20 per cent annually between 1999 and 2006, and machinery for exploring and developing gas in Bolivia where production increased more than threefold between 1999 and 2006. Before all these investments were launched, two long-term contracts were signed between the upstream and downstream segments of the gas chain: one contract for the actual supply of gas, and another for the transmission service. Clauses typical of long-term gas contracts were incorporated like Take-or-Pay (ToP). A ToP contract is a firm commitment to purchase a minimum quantity downstream; and ship-or-pay: a firm commitment to provide a minimum quantity downstream. Implementation of these contracts was supported by two complementary mechanisms: self-enforcement (Williamson, 1985, 1996 & Klein, 2000, 2002;) between the two stakeholders (the up- and downstream segments of the gas chain); and recourse to a third party to guaranty the dispute settlement (Brousseau and Glachant, 2002; Laffont, 2003; Laffont, Guash and Straub, 2002).

Neo-Institutional Economics (NEI) has long shown that take-or-pay type long-term contracts provide a robust framework for safeguarding the interests of both the upstream and downstream parties (Masten and Croker, 1984, 1985; Hubbard and Weiner, 1991; Creti and Villeneuve, 2004). Of course, investments in production and transmission often had an element of asset specificity, exposing upstream investors to predatory "hold-up" practices (Williamson, 1975; Klein, Crawford, and Alchian, 1978). However, by spreading the risk and combining credible long-term incentives, this type of contract allows an alignment of the interests of the partners and a convergence of expectations regarding reciprocity in their behaviour.

The case of Brazil and Bolivia presents an opportunity to re-examine this NEI "toolbox" and empirically observe the makeup of the robust nature of the take-or-pay framework. The Brazil–Bolivia case is, in fact, a "pure" instance of the upstream and downstream having simultaneously developed around the same contract. We will be able to observe how a contract can guide two partners over the course of the development of their long-term relationship. In fact, this case reveals that the context of the contract changes over time, giving rise to a veritable lifecycle for the contractual arrangement. A contract can be seen to span three successive phases: The first phase of the contract cycle begins when it is signed, allowing the investments to begin; The second phase starts when the investments have been completed and the actual trade in gas begins. The third phase of the contract cycle begins when the increasing flow of gas comes close to saturating capacity and the projected levels for downstream market volume have been reached. These three contract phases are thus distinguished by the objective conditions of the implementation of the contract: notably, by how robust the alignment of the parties' interests is for the best contract performance, regardless of the unknowns and required mutual adaptations needed in the long run. The interests of the parties are aligned during the two first phases, when they are stable and bounded by bilateral self-enforcement. However, during the third phase, there is a significant raising misalignment. This gap creates an opens a space in which a third party can intervene to mediate the conflicts.

The twofold interests of our paper are empirical and analytical: after highlighting the Brazilian -Bolivian case study, we will pave the way to the introduction of the lifecycle analysis of long term contract in the framework of NEI.

This paper is then divided into four sections. In the first section, we describe the theoretical framework generally used to deal with long term contract, and we show that it's mainly focused on the first stage of the long term contract lifecycle. In the second, we develop the theoretical framework to the case study—the trade in gas between Brazil and Bolivia and show the impact of the two other stages of the lifecycle aspect of the long term contract. Finally, we propose a new analytical framework describing the conditions for implementing a take-or-pay contract. Integrating lifecycle phases to the analysis, we emphasize the existence of a cycle of conditions for contract performance. The last section will conclude.

I - The theoretical framework: Robust take-or-pay contracts to develop long-term trade between upstream and downstream gas companies

There exists an extensive literature on the fundamental role played by long-term contracts in the international development of the natural gas industry, especially contracts of the take-or-pay. Using Creti and Villeneuve (2004) typology of the economic analysis of ToP contracts into two groups of contributions, we will present the first bunch of literature who treats the ToP clause as an incentive mechanism. After, we will present the second who present ToP as a provision for sharing risk between actors. This provides a thorough understanding of the role played by the ToP clause in framing the trade in gas between two partners located at the two extremes of the gas chain: upstream and downstream. Lastly in this section, we will present a third issue, the analysis of ToP implementing mechanisms.

1.1 *The take-or-pay clause as a performance incentive at contract implementation*

The Crocker and Masten (1985, 1988,1991) model demonstrates the importance of the ToP clause for linking upstream gas producers to downstream demand. For upstream investors in a new gas chain (production or large-scale international transmission), the ToP clause provides an effective incentive for contractual performance. According to them: "*We argue that take obligations can be viewed as a mechanism for effecting appropriate incentives for* contractual *performance* …" (Croker and Masten 1985, pag. 232). When these initial investments, which require substantial long-term commitments, are not re-deployable to other transactions (or other markets), they assume a quality of asset specificity. The market connecting the upstream to the downstream is necessarily very imperfect, and buyers and sellers are in a position of bilateral monopoly. To entrench the forecasted flows, in terms of volume and value, that underlie the economic profitability of the investment project, the partners exchange promises of upstream and downstream activity in the form of a fixed long-term contract. The precise maturity of the contract depends on the project's lifespan and the capital recovery period. In the case of gas transmitted by pipeline, requiring a lengthy two-fold investment in both production and transmission, contracts are long term. Owing to the length of these contracts, maintaining good relations between the parties requires the ability to adapt to changing circumstances. This assumes flexibility in some of the provisions of the contract.

Thus, we can readily identify a trade-off act in the maintenance of relations between parties bound by a long-term ToP clause. This trade-off lies in the flexibility in the long-term

contract performance versus the ironclad guarantee that the return sought from the invested equity will be met. The difficulty is that, the more flexible a certain long-term contract type is, the more vulnerable it will be to being distorted by one of the parties either during its execution or when its performance is being measured. This is why the ToP clause must make room for adaptation to effective variations in final demand without unduly increasing the costs associated with verifying the determinants of the parties' behaviour. Thus, this clause must provide an incentive to the buyer to take all the gas it can absorb when use of this gas is economically efficient, while curtailing the risk to the producer of making this gas available upstream. Consequently, the ToP contract is both an insurance mechanism upstream, and an incentive to efficient use of gas downstream. In the ToP contract, both producer (upstream) and buyer (downstream) are insured.

Among the first group of though, which view the ToP clause as an incentive mechanism, we now examine the contribution of Mulherin (1986). He describes downstream investments, at the level of final demand, as driven by pressure from the ToP clause. By setting a fixed volume of gas to be paid for, this clause motivates the buyer to spare no expense developing all conceivable efficient uses for gas downstream. Thus, Mulherin considers investment to be divided into several phases on the demand side, giving rise to several phases in gas consumption. At the very beginning of the relationship, during the first phase, it is foreseeable that consumption and investment on the demand side will be less than investment and the potential volume of activity, upstream, since downstream activity requires more time to mature and cannot begin before the entire upstream infrastructure is operational. This is why the ToP contract provides a strong incentive. The buyer pays for a certain quantity of gas whether or not it is used. However, if the buyer later succeeds in boosting downstream demand before a predetermined length of time expires, this volume will be available free of charge.

1.2 The take-or-pay contract as a risk-allocation provision

In a second group of contributions, authors such as Hubbard and Weiner (1985, 1988) stress that sharing risk is the principal function of ToP clauses. Long-term vertical trade in gas between the upstream and the downstream features a price and a quantity risk. These two risks affect the revenues of the upstream seller and the downstream buyer. In principle, the upstream producer has more information, and can obtain it more easily, on production costs and the opportunity cost of production. The producer also has greater scope to respond to downstream price changes triggered by alternative energy sources. Thus, it is logical and efficient to allocate management of price risk to the producer, as ToP contracts usually do. In principle, the downstream buyer has more information, and can obtain it more easily, on effective and potential final demand, as well as on consumers' sensitivity to forms of market penetration that accelerate the expansion of consumption. Thus, the buyer is best placed to initiate the most promising strategies for stimulating new demand. It is logical and efficient that, under this contract form, the buyer assumes the quantity risk. As Hubbard and Weiner have it "*Demand risk is borne entirely by the [downstream] pipeline*" (Hubbard and Weiner, 1986, p. 74). As confirmed by the work of Chevalier (2004) and Victor, Jaffe & Hayes (2006), ToP contracts were often used during the early years of the gas industry. That is, when the infrastructure was underdeveloped and there was not yet any real possibility of a competitive gas market owing to the relative dearth of alternative agents upstream or downstream. Thus: "*Historically, long term take or pay contractual arrangements have been common in the gas industry. Such contracts protect gas producers against the possibility of*

hold up, after they made a decision to invest in facilities to exploit gas deposits". (OCDE 2000, page. 10).

1.3 The mechanism for implementing take-or-pay contracts

The importance of long-term contracts with ToP clauses for the development of long distance gas trading through pipelines is well established. This has been amply discussed in the trade literature. However, this literature always assumes the existence of a credible external framework to provide long-term guarantees that the contract between the parties will be honoured. It is, in fact, the credibility of the contract execution that convinces the partners *ex ante* that it is likely to be honoured, and further that this compliance can be relied on throughout the long payback to the substantial investments of the partners. In general, two types of security exist to back the credibility of a contractual arrangement: an exclusively bilateral commitment (with "self-enforcement") or a commitment involving a third party.

In the matter of "self-enforcement", we find two different dimensions that are well described by Klein (2000). On the one hand we find the role played by the parties' short-term interests, and on the other hand, that of their long-term interests. *Ex ante*, a strong alignment of the two partners' interests is at least as important in the long term as it is in the short term. This is because the parties then have the option of managing their short-term relations and difficulties by seeking a way to link them to their long-term interests. Thus, long-term incentives are better able to frame the evolution of the contract—over time—than short-term incentives. Another source of self-enforcement is provided by "*hostages clauses*", as described by Williamson (1983, 1985,1996). Hostages create a long-term alignment *ex ante* around the implementation of the contract. This is invaluable when the ability of one (of two) agents to economically recover an initial investment made at time t is entirely dependent on the action of the other agent at time $t+1$. Here we observe the possibility of aligning the interests of the two agents by using hostages. For example, at time t, the two agents constrain each other to commit to symmetric investments, which then depend on the actions of both agents to be profitable at time $t+1$. In this simple example, the two agents align their interests under an initial contract covering the long-term development of the joint venture. This contractual arrangement becomes all the more credible to the extent that the two agents have invested symmetrically[4].

In addition to bilateral self-enforcement, we have the third party enforcement. As emphasized by Guash, Laffont and Straub (2004), and Laffont (2003), in most large infrastructure contracts it is the legal system that generally assumes the role of third party. This is especially true when one party seeks to renegotiate the distribution of the economic quasi-rent defined by the initial contract. If the investments are in large-scale infrastructure presenting characteristics of asset specificity[5], there are significant rooms for opportunistic behaviour on behalf of one of the partners. In case studies reported by Guash, Laffont and Straub, the reference economic contract is a concession contract between a private firm and a government. Since these contracts are normally long term and incomplete by nature, the mediation by a third party, who is independent of the two partners, provides a vital safeguard for contractors. In Guash, Laffont, and Straub, these third parties are, in fact, national public institutions, such as independent regulatory bodies or the courts.

[4] Also, it must appear very unlikely to both of them that they will be able to find a new partner capable of profitably replacing their initial partner, the exit option is then close..
[5] capital that is difficult or expensive to redeploy

When there is an independent third party who is credible and capable of imposing the key elements of the contract on both partners, then contractors should act in accordance with the spirit of the contract since each will expect the other partner and the third party to do the same. No substantial benefit can be obtained from acting otherwise. Thus, both parties will seek to adhere to the provisions of the contract binding them. In this case, the contract will more easily and reliably coordinate the partners and provide them with incentives conducive to efficiency. However, similar contracts can be entered into between parties from two different countries who do not share a common normative space. In this case, neither partner can fall back on shared formal rules or integrated or harmonized national institutions to bring an external credibility to implementation of the contract. If these parties cannot construct an exclusively bilateral framework for credible performance of the contract, other supports for credible boundaries will need to be mobilized.

2 – *The empirical case: A story of three steps between two countries*

Brazil and Bolivia are two neighbouring countries interested in trading gas on the basis of their complementary profiles. To develop its industries, Brazil desired an energy source that is less expensive than its domestic resources and is relatively clean. Bolivia, in turn, has the potential to produce vast quantities of natural gas, but little domestic demand. These two countries thus have the capacity to develop both the upstream and the downstream of a strong gas market. However, connecting this upstream and downstream requires the construction of nearly 3000 km of pipeline. Bolivia is landlocked. Therefore, any gas exports must involve a neighbouring country. Bolivia has five neighbours: Chile, Argentina, Brazil, Paraguay, and Peru. Chile could be a significant market for gas from Bolivia, but an intractable diplomatic conflict stands in the way. At the end of the 19th century, Bolivia's outlet to the see was annexed by Chile after the "War of the Pacific". In the early 1990s Argentina, Peru, and Paraguay were exporters, or potential exporters, of energy. Thus, they had no particular interest in buying gas from Bolivia. However, exporting from Bolivia to Peru and then re-exporting as LNG was a feasible scenario, but this was more expensive than exporting to Brazil. Also, it required an even more sophisticated institutional framework to ensure the upstream investments in Bolivia, the pipeline for transporting gas between Bolivia and Peru, the liquefaction terminal in Peru, and finally contracts for shipping by LNGC and regasification at the port of destination. It is also the case that in the early 1990s the LNG market was less mature than it is today. Conversely, long-term contracts for new gas production facilities were more common. Thus, from the perspective of Bolivia, exporting gas to Brazil was the only realistic solution for developing its gas industry.

For Brazil, available alternative gas resources were limited to domestic production, importing LNG, or importing via pipeline from Argentina, Venezuela, or Bolivia. Domestic production was not viewed as a practicable solution since most of Brazil's known gas reserves are associated with oil and located at sea under conditions making extraction difficult. Also, relative to international oil and gas prices, Brazilian gas reserves were too expensive to develop and transport. Similarly, importing LNG was more expensive that importing via pipeline. The pipeline required to bring gas from Venezuela would have been even longer than the Bolivian pipeline. Construction of a Venezuelan pipeline was also complicated because it would have crossed a large part of the Amazonian rainforest. In addition, its location is remote from the locus of Brazilian consumption—the south / south-east region. Argentina is nearer this central location. However, being a major consumer itself, its export capacity was inadequate for meeting Brazil's potential demand. Consequently, importing from Bolivia appeared to be the best option for provisioning Brazil with gas.

Thus, Brazil and Bolivia had complementary interests in gas. However, this trade presupposes enormous initial investments in production upstream, in distribution and consumption downstream, and also in the pipeline. These investments entailed a great deal of asset specificity, since—in the short and medium term—there was no potential alternative use for the up- or downstream equipment, or for the pipeline, aside from the Bolivia-Brazil transaction. Consequently, once the Bolivia-Brazil investments were made, neither of the two countries had the option of changing partner in the short or medium term. The Brazil–Bolivia gas market became a bilateral monopoly[6].

2.1 The first step toward establishing the contractual relationship: the 1996–1999 ex ante investment phase

Over the course of this first phase, the two partners shared a strong interest in developing the infrastructure for their future gas market. Their shared goal was to simultaneously develop the demand for, and supply of, gas. To accomplish this, the partners had to define target prices and volumes acceptable and profitable for both parties, *a priori*. Because of the nature of the asset specificity of the investments in the different elements of the gas chain, there was 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. Nonetheless, partners can also find themselves with strong reciprocal ties, through bilateral hostages—in the sense of Williamson. On the demand side, all downstream investments were made: in distribution networks, in the creation of teams of professionals, and in the solicitation of a customer base, before the actual trade could begin. During this same start-up period, other *ex ante* investments were made upstream in production and transmission. Before undertaking all these investments contracts were signed. In these contracts parties established firm trading targets, in volume and price. The targets include planning the investments in order to coordinate activities *ex ante* and *ex post* along the different parts of the chain—thus sharing the risk.

During this initial phase the interest of both parties lay in negotiating a "realistic" price and volume providing an incentive to the development of the industry and the gas market. As emphasized by von Hirschhausen (2005), the long-run price elasticity of gas is high. Relatively attractive prices for the energy itself and for gas-fired equipment are required to motivate the switch to gas consumption. Conversely, the short-run price elasticity of gas is low. For those already equipped to consume gas, there is little incentive to abstain when the price increases, especially since the switch to another energy source is neither quick nor easy. In this configuration, the long-term interests of the upstream producer and the downstream reseller are aligned during the first phase of the contract. Both have an interest in developing the infant gas industry as much as possible. Also, they will be in agreement as to implementation of the contract's clauses.

2.2 – The second step of the contract: first gas trades, 1999–2005

During this second period the infrastructure is in place. However, there is still far too much capacity for effective demand. Because there are significant economies of scale in the construction of infrastructure, it is already designed to meet forecasted demand in the medium and long term. In this configuration, both parties have a strong interest in developing

[6] Viewed from both perspectives, Brazilian demand and Bolivian supply, the other potential partners where less interesting, while also requiring *ex ante* investments.

all related activities—downstream demand and upstream supply—to make the best possible use of the capacity that is already online and to accelerate it's yielding a profit. Long-term maximization of the producer's and demander's revenues assumes that they are able to identify the best price / quantity mix for fostering the development of their industry. The bases for this price / quantity mix are fixed in the contract clauses: for quantity, a take-or-pay clause; for price, formulae based on the "netback price" mechanism computed from the price of the dominant energy that gas seeks to replace. In the case of Brazil-Bolivia, the Brazilian firm Petrobras assumed the quantity risk. The ToP clause of the contract specified that 80 per cent of the volume contracted always had to be paid, regardless of real downstream gas consumption. The Bolivian firm YPFB assumed the price risk. The transfer price formulae for Bolivian gas ensured that the Brazilian buyer/reseller would always be able to compete with substitute energies on Brazil's downstream final consumption market.

During this second phase of the contractual relationship, we observed several signs of maladaptation of the initial contract. These maladaptations were essentially attributable to the fact that demand grew more slowly than initially expected. This difficulty directly affected the core of the take-or-pay mechanism. The Brazilian firm Petrobras, burdened with the obligation to buy, sought to renegotiate the minimum volumes provided for in the contract. However, since the contract was very clear on these quantities and the clause at issue was at the very heart of the initial agreement, the Bolivian firm had no reason to reopen the contract. The cost to Petrobras of reneging on the contract would have been greater than the cost imposed by the maladaptation of these initial ToP demand forecasts. Ultimately, for four years Petrobras was forced to pay for volumes of gas that were not consumed (cf. Table 1).

Table 1: Imports of Bolivian gas by the transmitter (in Billions of BTU/day)

Year	Gasbol	(A) Volume taken by Petrobras	(B) Volume contracted	(C) % in take-or-pay	(D) = B*C Minimum contractual volume	(A) – (D) Difference in volume	% Variation to attain the minimum volume
2000	5.746	5.746	9100	60%	5460	286	-5%
2001	10398	10068	13300	65%	8645	1423	-14%
2002	11844	10345	24600	70%	17220	-6875	+66%
2003	14183	13995	30000	75%	22500	-8506	+61%
2004	19997	19544	30000	80%	24000	-4456	+23%
2005	23030	22395	30000	80%	24000	-1605	+7%

Source: BNDES, 2006.

However, even in the presence of this type of maladaptation problem, it remained in the long-term interest of both parties—Petrobras and YPFB—to continue executing the contract together. The substantial investments made by both parties *ex ante* motivated them to strive for the long-term development of the gas trade in order to fully utilize their installed capacity in the future. During this phase of demand development, long-term incentives to both parties were always strongly aligned, directing rational behaviour of the partners toward a bilateral implementation of the initial contract.

2.3 – The third step of the contract: toward capacity saturation, after 2006

During this third period the incentives changed significantly. Transmission capacity approached saturation. No expansion in capacity was now possible without substantial

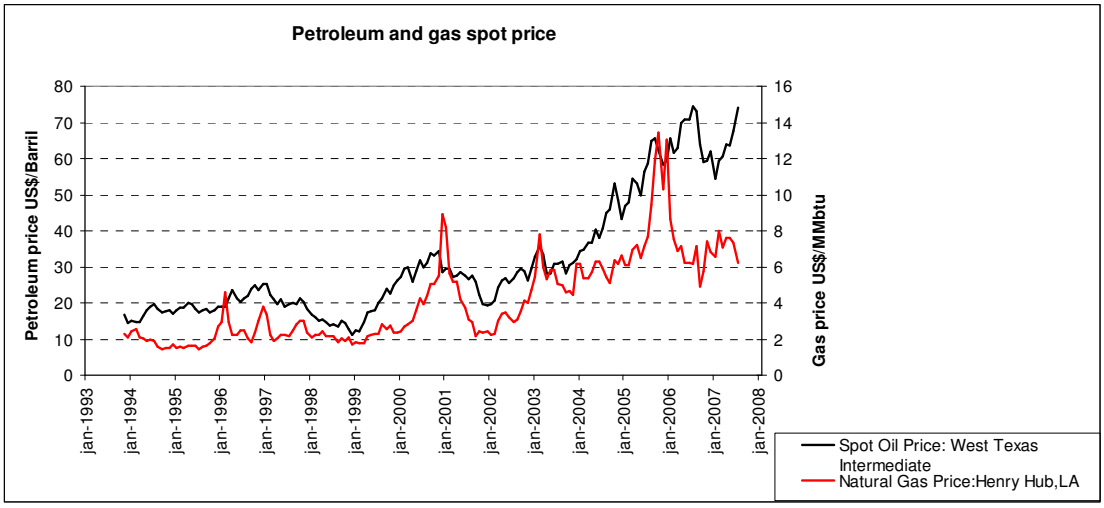
additional investments. The parties' long-term goal of maximizing revenue was no longer tied to quantity expansion, since the corresponding demand had already been captured … or was soon to be. Volume could no longer grow significantly with existing infrastructure capacity. Conversely, downstream consumers were now more predisposed to pay for gas since they had invested in gas-fired equipment. Their sensitivity to the price of gas was now lessened, since any resort to substitute energies would require making another investment. In the short term, consumers would not react to hikes to the price of gas that fell below a certain threshold. This threshold was situated where the price of natural gas exceeded the price of the substitute fuel plus the discounted cost of the required new equipment. In the long-run, the price of gas plus the discounted price of the equipment that burns it can be as high as the price of the substitute fuel plus the discounted cost of its associated equipment.

In this third phase of the contract, incentives tied to the elasticity's of consumers' behaviour had changed. Since long-term potential demand had been fully attained, the partners no longer sought to increase demand or production in the long term. The long-term goal of the agents no longer included increasing the quantity of gas sold. On the demand side, a price decline would not significantly increase the quantity demanded, in either the short or long term. Also, a price hike would not significantly curb real short-term demand relative to potential demand. The relationship between short-term and long-term price elasticities had been inverted, since potential long-term gas demand had now been fully realized. On the side of the producer, production equipment has been in place for a long time. Thus, a fall in the price should not reduce production, as long as the price is greater than the marginal cost.

Let $p0$ be the price set in the initial contract. Also, let $p1$ be the threshold price at which demand starts to significantly switch to substitute energy, and p_{-1} the producer's marginal cost. By definition, $p_{-1} < p0 < p1$.

The third phase of the contract's lifespan is characterized by the fact that the volume of demand is fixed while the price can vary between p_{-1} and $p1$. Since the volume is fixed, the producer has an interest in increasing the transfer price of gas to $p1$. The demander, on the other hand, wishes to drive this price down to p_{-1}. Consequently, now, in this third phase, the partners have widely divergent interests with respect to the transfer price between them and the initially contracted price. In this third phase, the economic characteristics of the first and second phases have disappeared, or significantly paled. In this third phase the essence of the alignment of the parties' interests has been lost: the pressure of unused capacity and the threat of the long-term price elasticity of consumers. Throughout the third phase, the volume risk is much less, since potential demand has already been reached. The risk linked to cost has also fallen, since fixed and variable costs are better known now. However, a new type of "price risk" appears. The incentives to the two parties with respect to movements in the transfer price of gas have changed. One important source of conflicts arises between the partners to the contract.

Figure 1Evolution of the price of gas and oil in North America (Texas) between 1994 and 2007



Source: ***AIE***

Table 2 Comparison of the price of gas in Bolivia and the United States

Quarter	Bolivian price prior to entry into Brazil[7] $US/MMbtu	Average future price (Nymex)[8] $US/MMbtu
2°/ 2007	2,25	7,65
1°/ 2007	2,39	7,73
4°/ 2006	2,59	7,24
3°/2006	2,52	6,18
2°/2006	2,26	6,64
1°/ 2006	2	7,84

Computed from data: Petrobras (http://www2.petrobras.com.br/portal/frame_ri.asp?pagina=/ri/port/index.asp&lang=pt&area=ri) and AIE (http://tonto.eia.doe.gov/dnav/ng/ng_pri_fut_s1_d.htm)

In the case of the gas trade between Brazil and Bolivia, this third phase of potential tension over the transfer price began when global gas and oil prices rose dramatically, as we see in Figure 1. As a result, the price of substitutes for gas in Brazilian demand increased sharply, and the limit price *p1* was much higher. The difference between *p–1* and *p1* grew significantly. At the point in time when the volume of gas consumption in Brazil reached its initial contractual target, a spike in the transfer price became possible without permanently threatening the installed base of gas consumers. During this third phase, and quite aside from any political or bilateral or broader politico-diplomatic considerations, it is in the interest of the Bolivian firm YPFB to renegotiate the price clauses of the contract. In fact, in 2006 YPFB

[7] This is the final price to industry minus the transmission price in Brazil. The transmission price was calculated on the basis of the formula of the ANP described by Pereira (2006).
[8] This is the average daily Nymex "future" price, according to the AIE.

effectively opened up this new scenario by requesting a renegotiation of the price. Unable to reach an agreement in this matter with Petrobras, YPBF brandished the threat of cutting off the supply to obtain an increase. This incident reveals the misalignment of interests between the parties, making it difficult to resolve conflicts in an exclusively bilateral framework.

During this third phase, the existence of an independent third party can play an important role in ensuring compliance with the contract, in limiting deviations from the contract during renegotiation, or even in guaranteeing continuity in trade. However, in the Brazil-Bolivia case, there is no third party aside from the political institutions of the two countries. Furthermore, there is no institutional framework shared by the two countries—which remain entirely independent. The sole institutional framework for addressing major contractual conflicts between firms from these two countries is thus direct diplomatic relations between their respective presidents[9]. In fact, the political framework played an important role during the third stage of the contract in matters of conflict mediation and government decisions regarding arbitration between the two parties. We can truly say that summit negotiations between the two presidents played the role of Supreme Court for implementation of the take-or-pay contract. Thus, during the third phase, there is no longer—as during the first two phases—a robust alignment of the two parties' interests around the take-or-pay arrangement. Through the contractual lifecycle, ToP clauses are very robust during the two first phases, but they are less robust during the third phase if there is no credible third party.

3 *A new analytical perspective: the lifecycle of the contract's credibility*

In economic theory, the role of the long-term contract is to align the interests of the parties and to facilitate realization of their commitments. However, as our case study shows, the interests of agents vary over the course of the contract's lifecycle. Consequently, the manner in which the contract guides their behaviour must also change. During the three phases of the contract's lifecycle we have described, the underlying security can be divided into two types: self-enforcement mechanisms and recourse to a credible third party: During the first phase of the contract, the infrastructure is being built and both parties have a strong interest in maintaining the contract. This is because all their expected profits are still in the future, in the form of a ToP clause for the volume and a "netback price" for the price. The scale of the partners' investments, *ex ante*, in production and in the transmission pipeline, up- and downstream, is determined jointly in accordance with the shared promise of long-term trade. Thus, during this first phase, the self-enforcement mechanism provides the essential guarantee of the implementation of the contract.

Effective trade in the commodity begins during the second phase of the contract. The volume of capital invested in the infrastructure during the first phase, *ex ante*, has already become a hostage mechanism with considerable weight. Since all this invested capital must be made profitable as soon as possible, the financial burden associated with these capital hostages can only be reduced by saturating the capacity of the available equipment as thoroughly and quickly as possible. This presupposes rational exploitation of demand. Hostages constructed in the first phase exercise pressure in the same direction as the incentives from the take-or-pay and "netback price" contract clauses. The combination of capital hostages and contract clauses thus strongly aligns the interests of both parties for a cooperative implementation of the contract and its long-term adaptation. The fact that the

[9] Both of these nations are governed by presidential systems.

upstream monopolistic producer voluntarily accepts "reasonably low" downstream sales prices during the second phase has a theoretical basis. As Neuhoff & Hirschhausen (2005) stressed : "*in the long-term both industry and consumers invest in new production facilities and renovate heating installations. This typically determines the fuel type. Thus, the expected long-term energy price of gas…*". The behaviour of the upstream monopolist is dictated by the consumer's price elasticity. It's important to remember that the consumer's price elasticity is very low in the short term, but much higher in the long term (Neuhoff & Hirschhausen, 2005) and, in order to create sufficient demand to render investments made *ex ante* profitable, the monopolistic producer must respect the long-term price-elasticity constraint[10].

When entering the third phase of the contract, the relationship between the partners reaches maturity. Infrastructure capacity nears saturation. This interjects a misalignment between the interests of the partners, between upstream production and downstream reselling. It is no longer possible to significantly boost future incomes by increasing the volume of consumption, except by making new investments. Symmetrically, since the price elasticity of short-term demand is low, an increase in the downstream price cannot block demand at a very low level. Thus, strong pressures to renegotiate contract clauses appear upstream, for the producer to increase the commodity's transfer price. According to Laffont (2003), private infrastructure investments can prove to be uncertain, in the long term, when there is no independent third party capable of guaranteeing continual performance of the initial contract. The existence of an independent third party can thus play a key role when incentives to the parties become misaligned with respect to the initial promises of the take-or-pay and "netback price" clauses. Over the lifecycle of the contract, there is a clear trend toward that kind of misalignment during the maturity phase, when infrastructure capacity is saturated, and when the prospect of opening a new contracting cycle of capacity expansion does nothing to reconcile the expected benefits of the upstream and downstream partners.

Conclusion

On the basis of a study of long-term gas contracts, we have underscored the existence of a contract lifecycle in the case of a new relationship requiring investments in infrastructure with asset specificity. The existence of this contractual lifecycle contributes an important rational dimension to our understanding of the appearance of divergent interests and eventual conflicts between the upstream and the downstream. This lifecycle also explains the various contractual safeguard mechanisms that are most relevant to each of the different phases of the cycle.

During the first and second phases of the contract lifecycle, take-or-pay clauses and complementary "netback prices" are sufficient to align the interests of the partners and hasten the development of trade. The fundamental safeguards here come from self-enforcement, with bilateral hostages, risk sharing, and appropriate incentives. However, during the final, mature period of the contract cycle there is a change to the strength and consistency of the bilateral "self-enforcement" mechanisms—is they hostages, the initial allocation of risks, or the initial alignment of incentives. The changes operating at the end of the cycle give rise to conflicts of interest between the upstream and the downstream of the industry. They enhance

[10] This is all the more true since considerable financial costs, attributable to *ex ante* investments, make a faster growth in revenue flows more important.

the importance of the existence of an independent third party to support the long-term application of the initial ToP contract.

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