WHY THE INCREASE PARTICIPATION OF LNG SHOULD AFFECT THE REGULATION OF THE NATIONAL TRANSPORT NETWORK

Marcelo Colomer[1]
Michelle Hallack[2]
Yannick Perez[3]

ABSTRACT

There is a large discussion concerning the risks of the network pipeline investors in the literature. The physical propriety of the gas network drives some market failures; the public power through regulators bodies or through direct intervention design rules to coordinate the transaction between the players in order to compensate these market failures. But sometimes the gas market and the network development decrease the asset specificities and the market failures, however the exogenous rules do not decrease its intervention power bring new risks and losses of welfare. Are the decrease of asset specificities been followed by an increase of market mechanisms to determine investment in the gas transport network?

The investment in new transport capacity involves most of the time strong asset specificities of time, site and dedicated assets. According to the Neo-Institutional theory the network industry are frequently under strong opportunism risk because the tight situation between the players. The opportunism between the players through the market can be attenuated by the centralization of the decision. This centralization can mean a vertical integration, an interference of the regulated rules or a direct intervention of the government. These solutions however generate new risks of opportunisms and it is acceptable to the society since this new risks damage less the welfare than the first one. However, the development of the network and the introduction of new technologies can decrease the asset specificity of the transaction and so decreasing the risk of market opportunism, in these cases the central coordination mechanisms should decrease gradually their importance. If a strong central coordination mechanism is kept in a situation of low asset specificities, the risks and damages generates by a coordination out of the market rules will increase the losses of welfare.

In the last two decades it has seen a fast and strong growth in the gas consume not only in Europe but around the world. Many factors can explain this natural gas industry expansion, however the dissemination and the improvement of the technologies of the transport of liquefied natural gas (LNG) can be considered as the principal drivers. The LNG is not only important in the gas industry because it pushes the expansion of the volume trade but also because it changes some characteristics of the gas offer and demand. As the gas offer

[1] PhD Student Federal University of Rio de Janeiro
[2] PhD Student University Paris-Sud 11
[3] Maître de Conférence University of Paris-Sud 11 and Researcher at Florence School o Regulation

and demand are actually the demand of gas transport, we can expect that it implies also changes in the gas transport industry.

The changes of the gas network bring by the LNG expansion do not mean only an increase of volume but also a change in technical and economic characteristics of the transport network and in the incentives to invest in the new transport capacity.

Generally the scale economy and scope conduct the gas transport industry to the natural monopolies it is why this segment of the gas industry has been strongly regulated. The regulation can aim the protection of the final consumer when this natural monopoly is vertical integrated or the introduction and protection of the gas competition when there are many real and potentials players in the gas market. Until the 90's it was the natural monopolies vertically integrated the most frequent case, through private or public enterprises. After the liberalization process and the unbundling the problem of market failure of transport services was figure out trough the design of rules, which can be made by a regulator body or directly by the government. In all these cases the introduction of rules intended to decrease the negatives effects of market failures. However these rules carry also inefficiencies as the risk of regulation opportunism.

The LNG expansion decreases some asset specificities of the transaction in the gas transport demand, as it decreases the site specificities and the dedicated asset. The geographical localization of the LNG is less *ex ante* determined if we compare with the others gas sources. Moreover it allows new relevant players to enter in the market demanding relevant amount of gas transport service, decreases the character of dedicated asset of the pipeline to few or unique transport demander. This paper wants to contribute to analyze the regulator role in the guarantee of the network investment in a liberalized environmental with increase participation of the LNG.

KEY WORD: Natural Gas Transport, LNG, Investment, Regulation, Transaction Cost

INTRODUCTION

After the 90's the participation of Liquefied Natural Gas (hereafter LNG) in the gas supply portfolio of EU countries have strongly increased. In the last 10 years the LNG supply to the west EU has increased more than 300% (EIA 2006). The increase participation of LNG can be seen in many countries as Spain, Portugal, Turkey, France and Italy. More recently, England and Greece have entered in this club (IEA 2008, Jensen 2003). Why is it a problem for gas transport investment regulation? According to the literature (Neumman 2008, Jensen 2003, 2004), LNG has an impact in the gas market, but the issue of LNG on transport regulation is not yet tackle, even in the last Energy Journal special gas issue, which have covered most of the main important issue of the gas industry. Basically, the rationale for the new investments in gas transport is to create new links between gas supply and demand, and it is efficient when the difference of the gas value between the two points is bigger than the transport cost (Micola 2005, Makholm 2007).

In Europe, gas transport networks are 'ex ante' regulated and these rules aim to coordinate the existing allocation of the transport capacity and the efficient development of new investment in transport capacity (Smeers 2008 and Klop 2009). Traditionally the decision of transport investment in Europe has been always centralized, bundled or unbundled with the other investment in the gas supply. In this context, the regulators main roles have been: 1- the guarantee that the gas transport does not constraint the gas supply competition though anti-competitive behavior; 2- the guarantee that the gas transport does not extract monopoly rents from the consumer; and 3 that the gas transport investment are sufficient to transport the new gas supply and demand. Two schemes where possible here to satisfy the last constraint. Investment can be realized by direct coordination through plans of expansion (as in Spain) or through incentive mechanisms, allowing different return rates in the investment according to the level of priority, as in French case (CRE 2008a). Why are the old regulation challenged by the LNG investment decisions?

Based in the hypothesis that the technical characteristics of gas transport needs to allow the introduction of massive LNG facilities (Gilardoni 2008), our main point in this paper is to consider that LNG introduction raises two problems in the actual transport system: First LNG introduces decentralized investment decisions in the gas supply. Second problem is that investments in LNG are uncoordinated with transport investment decisions (Pelletier and Wortmann 2008, National Grid 2008). These miss of coordination between investments can create some inefficiencies as sub-utilization of regasification infrastructures or of the gas transport network. Moreover it can also be barrier to entry to new possible suppliers. In this sense, it will be underlined the main regulatory challenges in the transport investment caused by the expansion of the LNG and we will highlight the negative impacts of possible misconceptions of regulatory rules for the LNG introduction in gas transport investments.

In order to demonstrate these points, our paper will structured in 4 sections; in the first, we will show the impact of LNG on the traditional gas supply: namely we will show that LNG increase the ability to react to market signals. In the second section, we will underline how this LNG characteristics impact the decision of new investment in gas transport network. We will show that LNG increase the price risk in terms of location signal (where to invest?), level of investment (how much?) and timing (when?) and conversely decrease the single provider risk.

So in the third section, we will analyze the relationship between the LNG and the pipeline investments. Moreover it will be discussed how the relation between the gas transporter and LNG can be modified with the introduction of new LNG supply sources and the development of the network. The aim of this section is to show that the LNG impacts the network transaction characteristics. The last section will conclude.

1 - THE LNG INCREASING PRICE ELASTICITY OF GAS SUPPLY

The gas supply through the LNG importation are actually a combination of different activities, it means different modules in the gas chain. The module concept as defined by Dubois and Glachant 2009, are blocks with relatively autonomy between them. They can be interconnected with different components through their interfaces, 'the concept of plug and play'4. Each of these parts is physically separated but it cannot be remunerated if it is not connected with all the gas chain. According to Jensen 2003 "The traditional LNG project

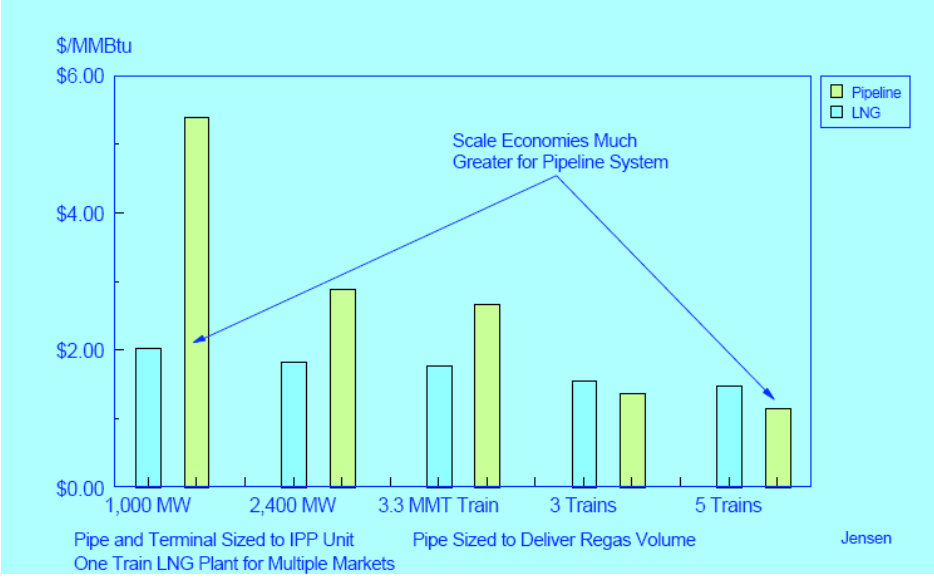
[4] Ces modules sont autant de « blocs » relativement autonomes les uns des autres, et pouvant être déclinés chacun sous plusieurs variantes derrière des interfaces standardisées. (Dubois and Glachant 2009, page 3)

has been described as a “chain” whose ultimate success is at risk to the possible failure of its weakest link. There are effectively four (occasionally five) links to the chain - field development, in some cases a pipeline to the coast, the liquefaction facility, tanker transportation and the receipt/regasification terminal. Each element is capital-intensive and the investment is usually front-end loaded so that revenue does not begin to flow until the project is complete.” (Jensen 2003, p 2). The gas chain of LNG does not finish in regasification plant. After that regasification, it needs to be delivered to the final consumer and/or to the city gates. Most of the time, in order to arrive to the final consumer, it needs to enter in the national grid. However, to have access to the final consumers, transport pipelines must have enough capacity available.

It worth’s the cost to note that the transport by ship of LNG allows a locational flexibility of gas transport. If the pipeline is physically constraint to its geographical position, the LNG can be introduced in any entry points which have the infrastructure to receive the ship and the LNG5.

This locational flexibility introduced by the LNG change the gas transport demand and consequently it affects the investment decision in the new transport pipeline. The increase locational flexibility introduced by the LNG can decrease the specificity of the national pipelines. Moreover according to Aune et al (2008), the flexibility introduced by the LNG market increases the volatility of the gas volume which is imported by the countries, as consequence of the market arbitrage possibilities. As the players can arbitrate between different markets, even the players which has long term contract may sometimes resell the gas to other markets if the difference of prices is bigger than transport costs. And this increase of gas supply market liquidity would increase the volatility of gas transport demand, which cannot offer it services to different markets.

Graphic 1 – The Effect of Market Size on the Relative Competitiveness of LNG and Onshore Pipelining
Assumption – 2.500 Kilometer Haul



Source: Jensen (2002)

Another key facture of the LNG supply in the middle and long term is the investment modularity; it means that the LNG ports and regasification plants can increase their capacity to import gas more gradually than the international gas pipelines, and even the gas sources. It is possible basically for two reasons: the parts of LNG chain are technically/physically separable and they have less scale economy. The gas pipelines are characterized by a bigger scale economy as we can see in the graphic 1, which exist in the LNG industry but it is less important. And the gas sources, there is a clear physical cap of gas extraction and it may have also a ground if it is petroleum associated. As noted by Jensen (2003): “While a very small short term LNG market has

[5] To compare the physical flexibility allowed by LNG to the gas pipeline transport, we can use the image of two other transport industries: the trains and the airplanes. The railways are constraint by the rail places, the second are more flexible and can go everywhere which there is an airport slot.

been in existence for nearly a decade, it has grown rapidly in the past several years. As recently as 1997, short term LNG transactions accounted for only 1.5% of international LNG trade. In the ensuing four years, the volume of short term transactions increased six fold and in 2001 accounted for 7.8% of international trade. Many of these transactions, particularly in the Pacific Basin are better described as "short term" sales rather than genuine "spot" sales. Rather than representing open offerings of short term volumes as is the case in the spot market at Henry Hub, for example, they represent buyers and sellers attempting to manage shorter term LNG over or under-supply through bilateral deals with other parties." (Jensen 2003, page 7)

This possibility of real flexibility of LNG has always existed. However according to Jensen (2003) until the middle of 90's the number of gas liquefaction and regasification are quite small and focused in some rigid market, this potential of physical flexibility, actually was not really utilized. The ships have been contracted to long term transport going from one point to another for 20 years6. The flexibility introduced for the LNG has become real only when the LNG has increase its participation in flexible markets. It means, the LNG flexibility has started to be exploited when it meet institutional conditions to do. The LNG started to increase the gas flexibility when it was introduced in European markets, which has passed through a liberalization process, and USA which is the most liquidity gas market (Ledesma (2009)).

The LNG has pushed a creation of an international gas market, even if the prices between the countries have not completely converged. According to Neumann (2008) there are evidences of the integration of international natural gas market. And the impact of LNG to build the gas market has increased recently. Even the LNG has existed for 40 years it is in the 2000's it starts to develop from an 'infant' towards a 'maturing' industry as explains Ruester and Numann (2006) "Increasing natural gas demand and the ongoing process of liberalization and deregulation in Continental Europe lead to fundamental changes in corporate behavior. Global oil and natural gas majors as well as original distributors engage in all stages of the LNG value chain, new players enter the market. Today's industry is characterized by more flexible long-term contracts accompanied by short-term agreements…The continuing growth of LNG short-term trade accompanied by an increasing flexibility inherent in contracts enhances reshaping of the industry. In addition, players order non-dedicated vessels thereby creating uncommitted transport capacities which will be the key to exploit arbitraging profits from price differences between regions."

In summary, it is clear that nowadays the LNG increase the gas supply flexibility in different dimensions:

1. The LNG has less geophysical determinants. It means the LNG supplies entry point can be more sensitive to price signals;

2. The LNG volumes which really enter in the transport network are also more flexible and volatile because of the arbitrage possibility in the LNG market;

3. The flexibility of the regasification capacity which can increase incrementally along the time;

4. The LNG interaction with the national transport network can produce high economics inefficiencies linked with the over or under investment in the network;

5. The interaction of the LNG supply and the national networks if not well matched generates sub-utilization of the investments. The transport capacity can be build attending a bigger LNG entry, but as it is flexible supply if the market conditions are not favorable it can actually not enter in the network. The other inefficiency comes from the experience contrary, the regasification capacity exists but there is not the network transport capacity to the consumers' centers. Some examples of sub-utilization of the infrastructures can be seen in the table 1.

[6] "Asian customers in particular have been complaining about the rigidities inherent in the traditional LNG contract and welcome the possibility of negotiating for more flexible supplies." Jensen 2003 page 4.

Table 1: Example of investment inefficiency

Inefficiency on the regasification investment ➔ More LNG demand potential than gas transport infrastructure	Inefficiency on the network investment ➔ More capacity than gas supply
Barcelona case, where the capacity of regasification is limited by the transport capacity of the network.	France: decrease of LNG in 2007[7] as consequence of an increase price in international price and the deviation of the LNG from France contracts to Asian market.

Source: Own Elaboration

The next section we will discussed how this LNG 'flexibilities' can impact the national gas transport investment regulation.

2 - THE FLEXIBLE LNG AND THE INVESTMENT IN THE NATIONAL GAS TRANSPORT NETWORK:

In the beginning of the gas industry, the classical solution to decrease the risks was the vertical integration. The investment decision are done by the TSO's under the regulated rules[8] which can have several meanings from direct and completely centralized intervention as the applications of central government planning of new investment priorities.

In the 30's the American natural gas industry beginning a liberalization and disintegration process. In Europe and Latin America this process starts only in the 80's, motivated by a state reform and by a believed that competition is the most efficient way to allocate the economics resources. Following the international experiences in the gas industry, we can separate the natural gas industry in two different products: the gas commodity and the gas transport capacity.

Here we will first analyze the transactional characteristics of transport network of gas, then ….. and finally….

2.1) The transactional characteristics of transport network

The gas transport market is the service to transport gas from the entry point to the exit point. More precisely the products traded are the property rights of the high pressure pipes and the auxiliary services which allow the gas to flow in the pipeline[9]. The natural gas transports has some technical and economic characteristics that explain and constraint the investment decisions behaviors. In the words of the Transaction Cost theory, the transport assets have both high asset specificities[10] and exhibit high potential for quasi-rents expropriations.

Following Williamson (1996), we can identify three different kind of asset specificity in the natural gas transport segment: dedicated assets, site specificities and time specificity:

---

[7] En raison de la baisse de la consommation résultant du climat doux de l'année 2007 et des niveaux de gaz en stocks élevés, les prix spots européens ont été plus bas que ceux d'autres places de marchés durant presque toute l'année 2007. Le GNL étant en partie un élément d'ajustement de la chaîne d'approvisionnement, l'arbitrage a été favorable aux marchés asiatiques ou nord-américains. En conséquence, les quantités déchargées en 2007 ont été en recul par rapport à 2006. (CRE 2008b)

[8] Thus the regulatory mechanisms have guaranteed 'fair' revenue to the investments through regulated tariffs and as consequence it has decreased uncertainty and the opportunism risk.

[9] The auxiliary services are based on the short term decision and are crucial to the transport as explained by Codognet (2006).

[10] The asset is specific when its maximum value is achieved only in a specific kind of transaction; outside this transaction the value strongly decrease. (Makholm, 2007)

The gas pipelines are pledged by dedicated assets characteristic: gas pipelines are the set of ducts, valves and compressions stations that cannot be used for other proposed than the gas transport, at least without expensive investments. The small redeployment of the infrastructure to the other industries and the big scale economies explains that the remuneration of the infrastructures is frequently dependent of a small number of players. It means that the transport infrastructures are often asset dedicated to one or small numbers of possible transactions; once the number of transport capacity consumers increases the transport company dependence reduce.

The site specificity is consequence of the pipeline immobility: Once the investment in the gas transport network is done it becomes almost impossible to displace the infrastructure[11].

To change the sites where ducts, valves and pressure station were laid is very expensive; it is why most part of the time there is no economic gains to demolish the infrastructure built if it is not utilized. The site specificity explains the dependence relation between the transport companies and the other players which can physically access the facilities. The network development increasing the number of interconnections, and the third party access (Glachant, 2002) contribute to the decrease of the site specificity because more players can have physical access to the infrastructure. The time specificity constraint is real in the gas industry. It comes from the need of synchronization between demand and offer and the limited storage capacity compared to the overall volume of consumption. If we compare now the time needed to build a pipelines to the construction time of LNG regasification capacity, we have a new problem to solve. As the innovation process makes faster the LNG installation[12], we faced a "hidden emergency" situation. As show by Rious (2007) in the electricity sector, the investment in the transport needs to be done before the investment in the generation, because transmission takes 10 years to be done and generation 3 years. Rious (2007) shows that in this situation, decision of transport investment '*ex ante'* make restrictions of the value to invest in a new generation plant '*ex post'*, and in the other hand, that the decision of investment 'ex post' constraints the real economic value of the transport investment which is done "ex ante". In the gas sector, there is the same anticipation requirement between the infrastructure and the gas production and the building decision of the slower complementary asset need to be done first.

According to the Neo-Institutional Theory[13] the asset specificities and consequently the interdependency between the players incentives the conflict between the economic agents in order to appropriate the quasi-rent[14]. However, the lock in situation added of uncertainty increases the opportunisms risks[15]. The transaction characteristics of the transport capacity market increase the investment risk in the build of new capacity.

2.2) From bilateral to multilateral gas offers: the reduction of site specificity and dedicated assets

The strong introduction of new technologies in the demand and offer side is changing the gas trade characteristics' and consequently it has affected the market of transport capacity. The gas transport market needs to face the increasing number of gas suppliers demanding gas transport capacity and services, the new needs of gas price management as key factor of the gas transport demand, and the economics relation between the LNG and the pipelines.

As the LNG technologies becomes cheaper, the number of players in this LNG market have strongly increased and the new players ask for transport capacity. As a consequence, the increasing number of gas suppliers (or potential suppliers) decreases the specificity of the transaction in the gas capacity market, because the LNG entry points play the role of fostering network interconnection. The potential of new players and site interconnections bring by the LNG depends also of the preexistent network development and the other

[11] The displace of some network pieces can happened in some rare cases, but it is a costly process and atypical.
[12] All the conception and build of an new regasification plant can be done in 2,5 years as has been showed by Northeast Gateway example in USA. http://www.excelerateenergy.com/2008/05/excelerate-energy-delivers-first-lng.html, and it would say that even faster if it is considered the new technologies where of shipboards regasification system where the ships have the ability to discharge gaseous methane directly into a pipeline grid.
[13] Williamson (1981, 2000)
[14] The quasi-rent can be defined as the difference between the economic value of the same asset if it employed in an asset specificity transaction or not. The asset specificity investment generates a possibility of a bigger surplus as counterpart of the bigger interdependency between players
[15] Two hypotheses concerning the agents' behavior are done by this theoretical approach: bounded rationality and opportunism behavior.

institutional features as the propriety rights[16], but the addition of new players and interconnections decreases both the site specificity and dedicated features of the *ex ante* pipeline investment.

However, if the biggest flexibility of gas supply decreases the opportunism risks of the transport investor as consequence of biggest site flexibility and bigger number of players, this same flexibility increases the volume risk associated to the gas prices and so, it increases the need of price risk management.

2.3) The cost of Price Risks Management mechanism

Here we want to highlight a very important trade-off: if in the one hand the LNG decreases the typical opportunisms risks associated of few market suppliers, in the other hand it increases the volume volatility associated to the gas prices.

The LNG presents bigger capacity of prices arbitration between different markets. These possibilities of arbitration increase the volatility of the actual gas supply which enters in the national gas transport network, since the gas can be exported to others countries even if it was in the beginning contracted elsewhere. Thanks to LNG, the gas supply is more sensitive to the prices fluctuations. According to Codognet (2006)[17], the LNG contracts allows the spot delivery of natural gas if the price differences between any other gas market (which has regasifications facilities) and the gas market which has initially contract the LNG are bigger that the transport cost between the two regions.

As an example, the increase of the US spot gas price can change the final destination of some LNG cargos originally going to European gas market towards the US gas market.

Indeed, in this case, this gas price arbitrage would end in a decrease of the gas transport demand in the place where it should be delivered if the cargo was not deviated to other market. It brings to the gas transport capacity demand market logic, where investments need be allocated where it seems to be more efficient, and the efficiency of the resources used are signalized by prices. The increase of market logic of the gas transport demand can generate inefficiency to the transport trade if the logic of transport of capacity offer does not insert market signals and market tools to coordinate investment. The insertion of more gas market signal need to be inserted in order to included the signal market of LNG gas supply, in the LNG transport demand. The tools need to aim the allocation of risks and revenues of two different markets, the gas supply each time more volatile and flexible, with a network industry.

The market risk becomes a problem when the agents cannot answer by the market mechanism. And in the gas transport capacity the regulatory process can incentive or block the insertion of the market mechanisms to deal with these new prices volatilities/flexibilities introduced by GNL.

3 - THE LNG AND THE NATIONAL PIPELINES: FROM COMPLEMENTARITIES TO SUBSTITUTION?

In a pure logical frame, investments in LNG and in pipelines can be seen as complementary infrastructures or substitutive infrastructures. Determining how and when this investments need to be seen as cooperative (complementary way) or as competititve (substitution) is a key issue in the understanding of the LNG impact in the development of the transport network and to assure an efficient regulatory policy.

[16] As developed by Glachant and Hallack (2009) the topology and the components of the network are also key issues to determine the possibilities and the costs of transactions in the network development. Another important issue that has been neglected in this work is the role of gas demand change, which for methodological reasons will be treated in next works. This paper, however, aims to underline how the effect of changing in the gas offer features can imply in change in transport transaction and why the regulators rules need to adapt to the new transactions features.

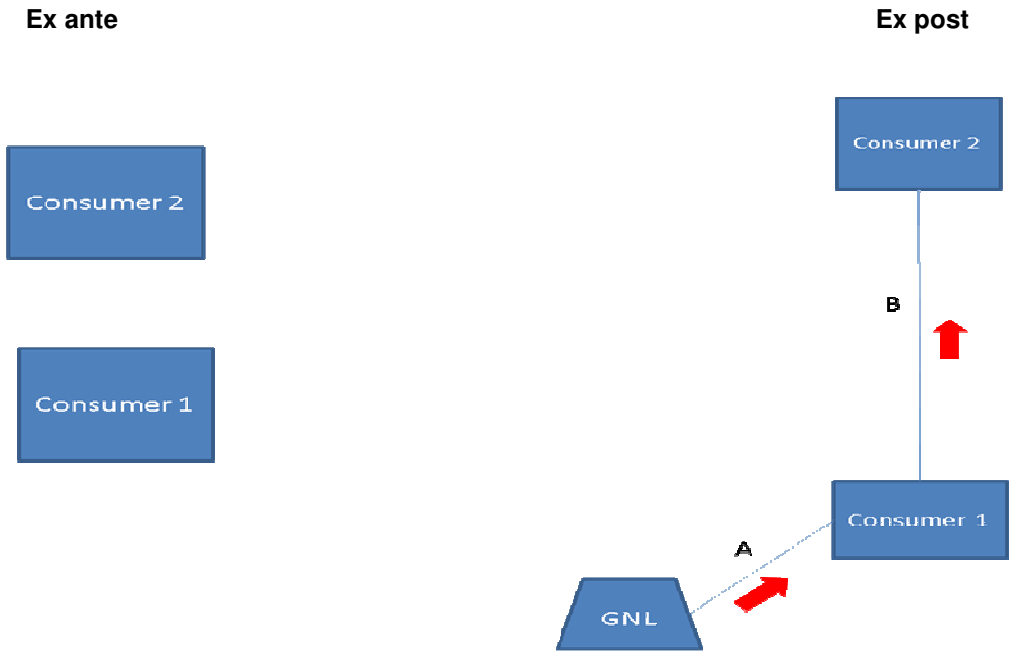
[17] It is concerning the LNG contract, which allows the gas spot delivery, price arbitrages and contracts of swap, and so it allows the gas price arbitrage. « Ils concernent notamment les contrats de GNL. Ces contrats permettent des livraisons spot de gaz naturel. Les fournisseurs peuvent parfois modifier les destinations des méthaniers (swaps) pour rediriger les navires vers des zones où le prix du gaz (y compris le coût de transport) est supérieur au prix du gaz de la destination initiale (CRE [2002], CRE [2001a]). Ainsi, des méthaniers peuvent être détournés de leur route initiale pour servir des marchés où le prix est relativement élevé. Ainsi, des arbitrages de prix entre marchés gaziers peuvent être réalisés.»

3.1) Complementary investment case: the need of anticipation?

Once a regasification plant has been installed, it needs be connected to the network to make the investment profitable unless the plant is located extremely close to a consumption area. Usually, the regasification plants are located far from the consumption areas what explain the importance of the connection with the network. In this case, both investment (LNG and pipeline) are complementary and need a high level of coordination.

If the regasification plant is finished before the new pipeline is build, it will be not possible to sell the gas. The complementarities between the regasification plant and the new pipeline that connect it to the network are very high. In this case, the asset specificity of the new pipeline is not reduced with the LNG entrance, once the flow of the gas will be always from the regasification plant to the network. That is the case of the figure 1.

Figure 1 – Additional Investments

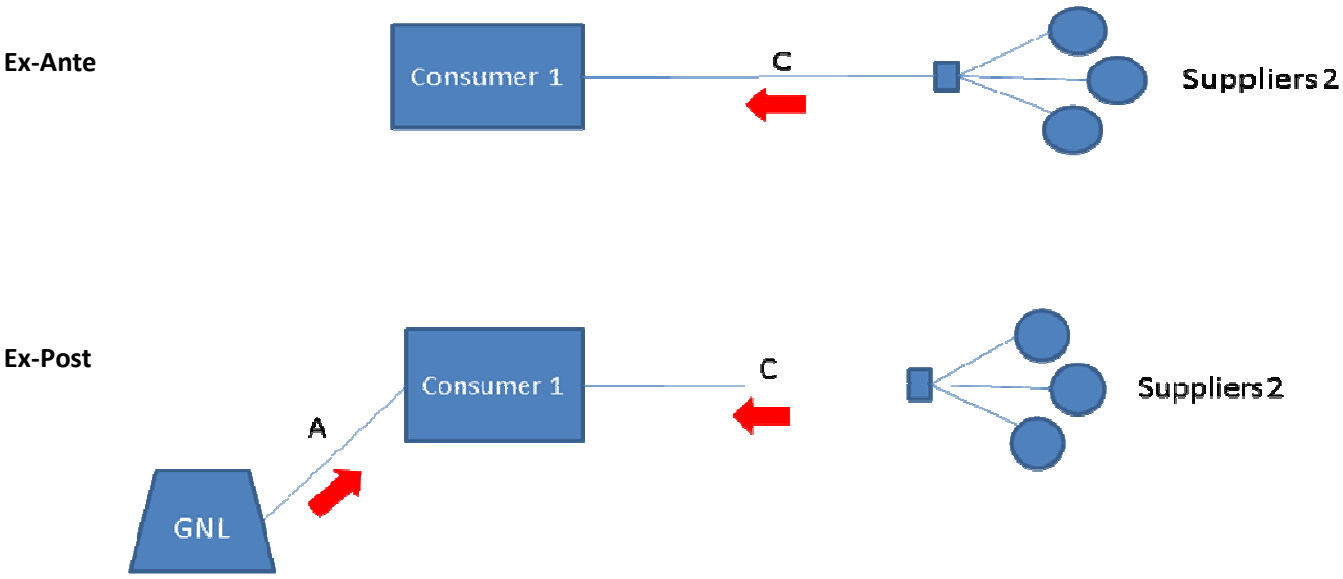


In the example, the LNG project and the pipes projects A and B are additional investments. The only way to the LNG project supply the markets 1 and 2 is through the pipes A and B.

3.2) Substitutions effects

But, if we analyze the relation between the regasification plant and the other pipeline in the network when there are other supply sources, the investment in different gas transport capacity can be substitutable as we can see in the figure 2.

Figure 2 - Investments Substitutes

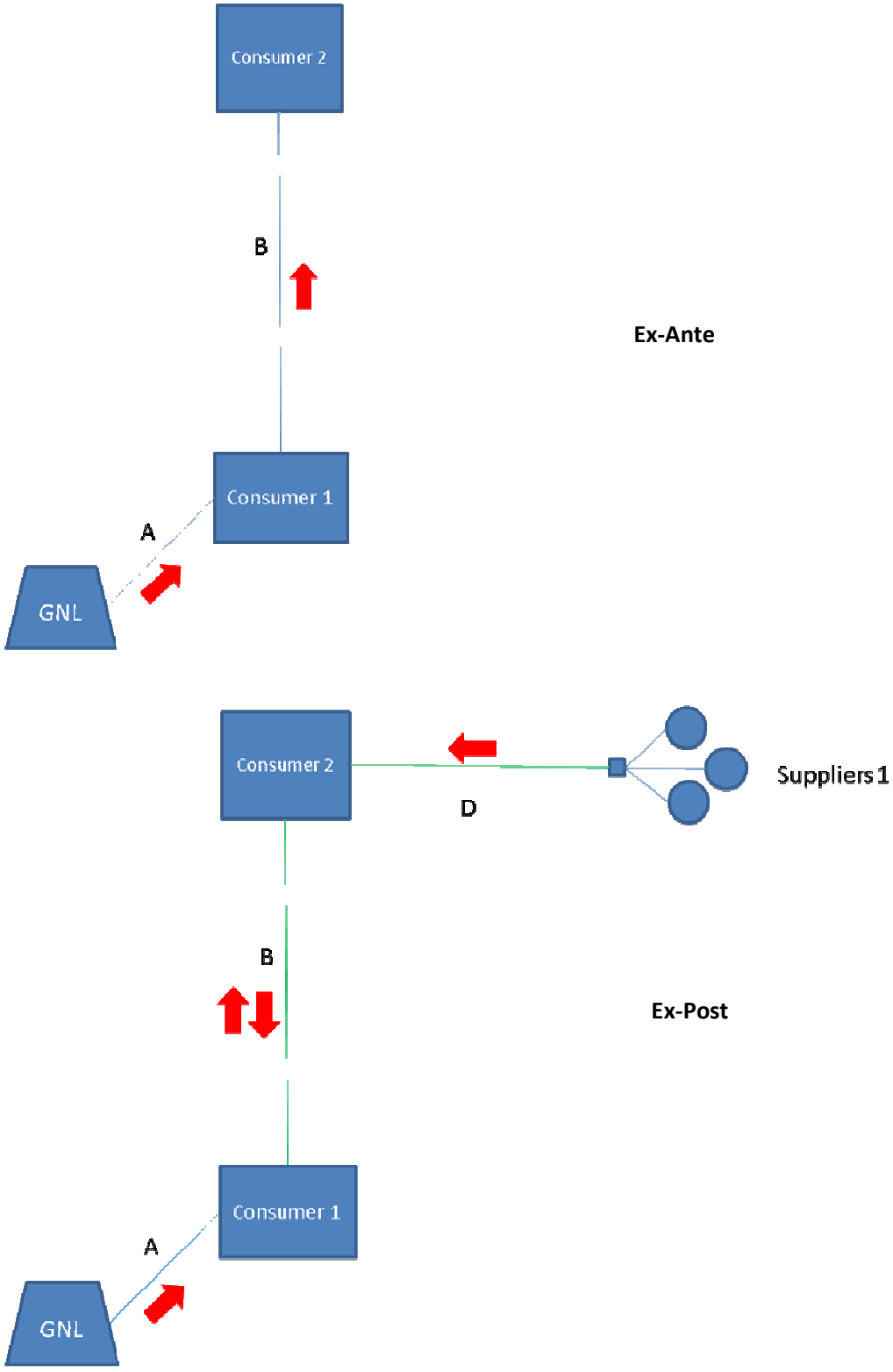


The regasification project and the pipelines C are substitutable investment once they will supply the same market. In this case the LNG project associated with the pipe A dispute with the pipe C the same market what increasing the competition in the network. In this case, the consumer 1 can be supplied by the pipelines A and C.

3.3) Substitutions and complementary effects

The complementarities and the substitutability of the investments depend on the number of supplies as the flow of the gas in the network. In this way, the increase of the number of supplies and the alteration of the gas flow can change the relationship between the LNG and the pipes investments. The figure 3 show how the appearance of a new supply source and the inversion of the gas flow of the pipe B change the complementary relation between the LNG investment and the investments in the pipes.

Figure 3 – Complementarities and/or Substitutability between Investments

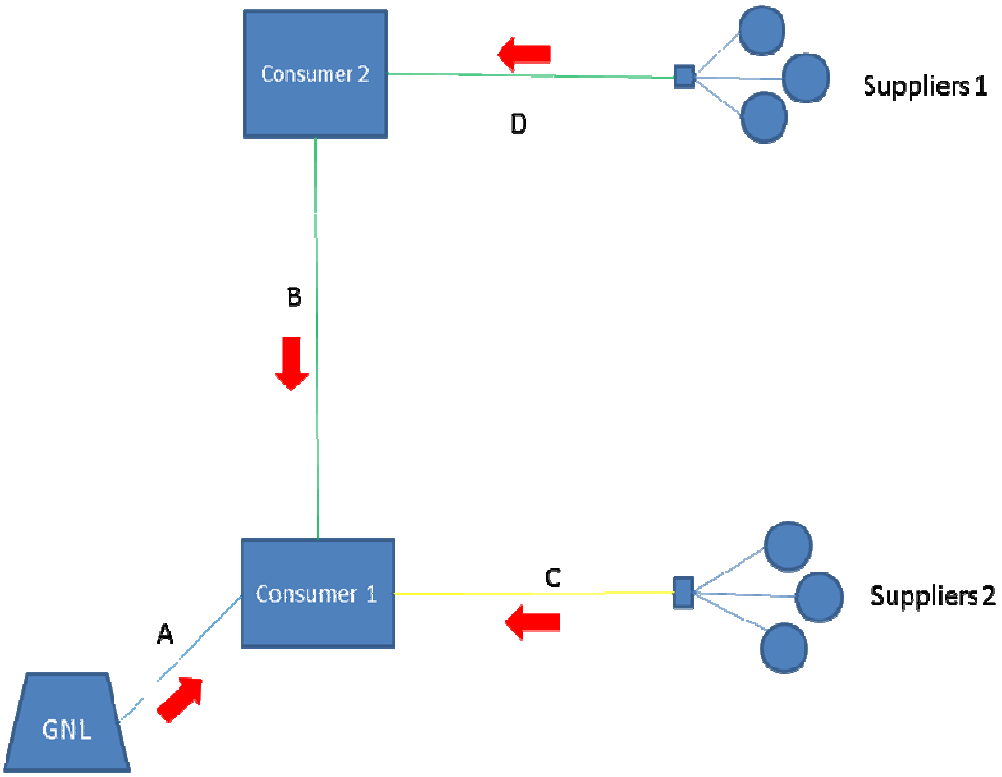


The regasification project and the pipeline B will be complementary or substitutable depending of the gas flow. In the figure 3 ex-post example they can be substitutable or complementary although in figure 3 ex-ante they are complementary. The increasing of the supply numbers and the connection of the different markets augmented the competition in the network. In this sense, the LNG projects increase the concurrence between the pipes what

reduces the assets specificity of the new investments in the network.

Considering a situation where there is only one supply source (suppliers 1) and two markets (A and B) a LNG project, as described in the examples above, will reduce the assets specificity of the pipe B. Before the LNG project, the pipeline B depends on the capacity demand of the suppliers 1 only. After the build of the LNG plant one more potential consumer of pipeline B capacity appeared what reduces the risk of opportunistic behaviors. In figure 4 we can see that the increase of the suppliers number augment the competition among the pipes.

Figure 4 – Increasing Competitions between pipelines capacity



We can conclude that the LNG impact on the network transaction characteristics must be analyzed in concrete cases. But, if we consider the impact over the role network, we can conclude that as the LNG projects increase the concurrence between the pipes, it reduces the assets specificity of the pipelines and the opportunism risk.

3.4) From this simplified models what is the regulation lessons:

The introduction of LNG capacity can change the transport network, its changes depends if the investment of network needed to integrate the LNG supply actually is a complementary investment or a substitute investment. It means the transport capacity investment of the network lines are a complement of the existent as the case of the figure 1, or it is substitute as the figure 2. It is not only a competition of gas supply but also a competition in the gas transport capacity investment. The investment in the transport capacity goes with the investment in the gas supply and the choice of one or other investment has risks linked with the competition. The choice of the investments also is a key a factor to determine where the new gas supplies will enter and what gas will enter.

In most common cases (developed networks as the case of European countries) the investment in the new pipelines have the two characteristics, they are complementary and substitute. It means as in the figure 3 and 4,

they can be a complement of some part of the network and it can be substitute of others parts. Moreover, it can push the reverse flows. What it means?

If the investment in the LNG infrastructures can insert competition also in the gas transport market, it needs to be take account by the regulators. Nowadays the EU regulators, and the EU Commission when regulate the gas transport development are only concern with this impact in gas supply.

The EU Commission hypothesis is excluded the possibility and the importance of the competition between gas transport infrastructures and so their regulatory framework is exclusively concerning the gas supply market, as showed by Spanjer 2008 “The second-best option is competition on the infrastructure. Consequently, chapter six of the Directive, comprising Articles 14-23, focuses on introducing competition on the existing infrastructure through imposing third party access (TPA) to the system. This is supposed to grant entrants access to the essential facility”.

We can conclude the same logic of EU commission if it is analyzed their exemptions process. The example of BBL is a good one “The commission considers that exemption should not extend beyond what is needed for the project to go ahead. The Commission considers the presence of competing pipelines or the open season procedure insufficient to justify a longer exemption.” Commission Response 12 July 2005: the amendments, CEC 2005.

So, we could say that in the case where the investment of new transport capacity is only a complement of all network infrastructures it is justifies the concerning only with the gas supply issue. But where the new investment in gas transport are a substitutive choice of other networks or complement and substitute the two markets should be considered in the regulatory decision the gas market and the gas transport market. It seems still more important in the nowadays context that we showed in the first part of this paper, the demand of transport capacity coming from LNG have important prices signals that only market tools in the gas transport market can have an efficient match.

Table 2: The regulatory tools to the different investment effects

Investments features	Regulators Concerning
Complementary	Gas Supply market
Substitute	Transport and gas supply market
Complementary and Substitute	Transport and gas supply market

4 - CONCLUSION

This paper have underlined that the introduction of LNG in the gas supply has not changed only the gas market as it has fully discussed by the literature and policies makers, it has also changed the gas transport market. It is a logical consequence of the change in the gas market, because the gas commodity and the gas transport are different product but with complementary demand.

So this paper shows how the increase of the LNG participation modified the characteristics of the transactions in the transport capacity market. The flexibility features of the regasification plant increase the number of suppliers what reduced the asset specificity of the transport facilities.

The main contribution aimed by this work is underlined these new feature of gas transport demand to the regulators, who has a key role to define the investment rules and policies in the national networks. In this sense, the transport regulation needs to keep up with the new characteristics of the investment in pipelines to promote the development of the gas industry. If the regulation overlooks the LNG flexibility features and the substitution affects of gas transport investment it incentive the players to take no efficient decisions and the costs will be share by all the consumers. As we have described the decisions of investment in the transport capacity has become a complex issue involving an increase number of players and potential players. Moreover the need of

flexibility demanded by the consumers of gas transport services, which the decisions are each time more market oriented need also to be taken account by the regulators'.

New regulatory demands arise with the increases of LNG participation in the industry: the inclusion of tools that include the price signal in the decision of transport use and the regulations concerning the competition between the potential investments in transport capacity. The reduction of the uncertainties and of the opportunism risk allows the regulatory body to reduce its intervention in the transport market. As we seen, the price signals became more active with the diversification of the supply sources.

In a context of liberalized gas industry, the risks related to increasing LNG participation can be decreased by an increase participation of market signals in the process of investment in transport.

REFERENCES

Asche, F., P. Osmundsen, and R. Tveteras (2001): Market Integration for Natural Gas in Europe. International Journal of Global Energy Issues, Vol. 16, No. 4, pp. 300-312.

Asche, F., P. Osmundsen, and R. Tveteras (2002): European Market Integration for Gas? Volume Flexibility and Political Risk. Energy Economics, Vol. 24, No. 3, pp. 249– 265.

Alvarez O., Casanova J., Carranza H. and Casares C. (2001), "Natural Gas Power Generation Basic Pipeline Design Requirements "

Aune, F.R., K.E. Rosendahl, and Sagen E. L. (2008): Glbalisation f natural gas market – effects on prices and trade patterns" Discussion Papers No. 559, Statistics Norway, Oslo.

Codognet, Marc-Kévin. (2006) « L`Analyse Économique des Contrats D`Access aux Réseaux dans les Réformes Concurrentielles Gazières »

Cornot-Gandolphe, S. (2005): LNG Cost Reductions and Flexibility in LNG Trade add to Security of Gas Supply. In: IEA (2005): Energy Prices and Taxes, Quarterly Statistics. First Quarter 2005, OECD, Paris.

Commission of the European Communities - CEC (2005), *Commission's amendment decision regarding BBL*, 12 July, Brussels

CRE (2008a). Proposition tarifaire de la Commission de régulation de l'énergie du 10 juillet 2008 pour l'utilisation des réseaux de transport de gaz naturel.

-----(2008b) « Rapport d'activité annuel 2008 »

Dubois U. and Glachant JM (2009) "« Les reformes concurrentielles de l'électricité : des objets modulaires »

Energy Information Administration (EIA) (2003): The Global Liquefied Natural Gas Market: Status & Outlook. US Department of Energy, Washington DC, DOE/EIA-0637.

Energy Journal (2009) "The Quarterly Journal of the IAEE'S Energy Economics Education Foundation Volume 30, Special Issue.

Gilardoni A. (2008) "The World Market for Natural Gas: Implications For Europe"

Glachant and Hallack (2009) "The gas network development: a 'lego' game … what does it means?" Working Paper

Hégaret G.; Siliverstovs B; Neumann A; Hirschhausen C. 2003. "International Market Integration for Natural Gas? : A Cointegration Analysis of Prices in Europe, North America and Japan," Discussion Papers of DIW Berlin 393, DIW Berlin, German Institute for Economic Research.

Honoré A. (2006) "Future Natural Gas demand in Europe: The importance of the Power Sector" OIES http://www.oxfordenergy.org/pdfs/NG10.pdf

IEA Statistics -Natural Gas Information 2008

IEA (2008) Energy Policies of IEA Countries – Japan

Jensen, J. (2002). Presentation in The Geopolitics of Gas Meeting Sponsored by Stanford University and Rice University, Palo Alto, CA.

Jensen T. J. (2003) The LNG revolution Energy Journal of the International Association for Energy Economics Volume 24, Number 2

---------- (2004) “The development of Global LNG Market” OIES- Oxford

Klop M. (2009)”Charting the gaps: EU regulation of gas transmission tariffs in the Netherlands and the UK” OIES.

Ledesma D. (2009) “LNG in the next Decade. Where are we Headed?” FSR Training Course on Natural Gas Markets.

IEA, (2002) “Flexibility in Natural Gas Supply and Demand”, Paris, France 179pp.

Makholm J. D. (2007) “Seeking Competition and Supply Security in Natural Gas: The US Experience and European Challenge”

Micola A. R. 2005 “Interrelationship Models in Energy Markets”, thesis submitted to University of London, UK

Ministerio de Industria, Turismo y Comercio (Espana) – Subdireccion Genral de Planification Energetica (2008) “Planificcacion de los sectores de electrcidad y Gas 2008-2016 – Desarrollo de las redes de transporte” http://www.mityc.es/energia/planificacion/Planificacionelectricidadygas/Desarrollo2008/DocTransportes/planificacion2008_2016.pdf

Moreno A. R. 2005 “Planta de regasificacion de ENAGAS en Barcelona: la construccion del sexton anque de GNL.”

National Grid (2008) “Transporting Britain’s Energy 2008 – Development of NTS Investment Scenarios”

Neumann, A. B. Siliverstovs, and C. von Hirschhausen (2006) Convergence of European spot market prices for natural gas? A real-time analysis of market integration using the Kalman filter, *Applied Economics Letters*, **13**, 727-732.

Neumann A. (2008) “Transatlantic Natural Gas Price Convergence; Is LNG Doing Its Job?

Pelletier C. and Wortmann J.C. (2009) “A risk analysis for gas transport network planning expansion under regulatory uncertainty in Western Europe” *Energy Policy, Volume 37, Issue 2, February 2009, Pages 721-732*

Quast Oliver.- Les fondements des modèles successifs d'organisation de l'industrie gazière : analyse des conditions d'introduction de la concurrence dans une industrie de réseau.- Thèse de doctorat de l'Université des Sciences économiques de Grenoble : Economie appliquée : IEPE, 1997, 307

Rious V. (2007) « Le développement du réseau de transport dans un système électrique libéralisé, un problème de coordination avec la production»

Smeers Y. (2008) “Gas models and three Difficult Objectives” Working Paper Ecore, Belgium.

Spanjer (2008) “Structural and Regulatory reform on the European gas market: Does the current approach secure the public service obligations?”

Williamson O. E. (1981) “The Modern Corporation: Origins, Evolutions, attributes”, Journal of Economic Literature, vol. 19, 1981

---------- (2000) “The New Institutional Economics”, Journal of Economic Literature, vol. 38, 2000.