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Adaptability of competitive electricity reforms : a modular analysis.

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A modular analysis

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Abstract

Competitive electricity reforms have been implemented in Europe and the US for the last 17 years. None of the reform has been put in place in a sufficiently "complete" manner from the beginning and no reform has "survived" over several years without major changes. In the face of the changing nature of electricity reforms, the question of adaptability is thus a central question. The aim of this paper is to propose an analytical framework of the adaptability of electricity reforms. In the first part of this paper we show that a specific analytical framework is needed to analyse electricity reforms. These reforms have two characteristics which shape their adaptation. Firstly, electricity reforms are "modular" objects (Baldwin and Clark [2000]). Secondly, electricity reforms are produced in an institutional process which is neither "complete" (Pistor and Xu [2003]) nor instantaneous. These characteristics explain that there is an endogenous need to adapt reforms over time. In the second part of the paper, we propose a typology of adaptations of reforms based on the framework proposed by Williamson [1991] for contracts. In case of inconsequential disturbances, reforms will adapt quasi automatically, by autonomous decisions of the governance structure. In case of middle-range or consequential disturbances, there is a risk of "misalignment". To solve the problem of misalignment, the reform participants try to adapt the rules by Coasian bargaining. Finally, in the case of strong disturbances, or when bargaining is not feasible, the adaptation of reform is in the hands of legislatives and executive institutions. These institutions can reform the reforms (Hogan [2002]). The consequence of these different kinds of adaptations is that electricity reforms follow "constrained" reform paths, where minor changes are easy to implement and bigger changes more difficult to realise although not impossible. The importance of each type of adaptation can be interpreted as a consequence of the decision rights of the different participants in the reform: regulator, stakeholders and the institutional environment.

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INTRODUCTION

Competitive electricity reforms have been conducted for the last 17 years in several countries. However, finding the best way to conduct such reforms is still an unsolved question. In the 1990's, studies of utilities' reforms stated that these reforms had to be credible in order to ensure continuing investment in these sectors (Levy and Spiller [1994, 1996]. But no "optimal" way of conducting electricity reforms could be identified (Holburn and Spiller [2002]). Sometimes, as in California in 2000, electricity reforms have experienced severe failures. Or new, unexpected problems have appeared in deregulated electricity sectors and made "reforms of reforms" necessary (Hogan [2002]).

What is our analysis on adaptability of reforms bringing to that picture? One additional criterion that electricity sector reformers should take into account. As "real" electricity reforms are always imperfect and change over time, the need for adaptations must be included in their analysis. The aim of this paper is to analyze why there is such a strong need of adaptation in electricity reforms, and how these adaptations are realized.

In the first part of the paper, we discuss why there is such a strong need for adaptable reforms. Reforms have to be adaptable both for technical reasons and for institutional reasons. Technically, reforms can be analyzed as "modular" objects. Because of the specificities of the "good" electricity, reforms cannot be realized instantaneously and in a "complete" manner. Institutionally, the "production process" of these reforms is shared among different institutions. At the definition stage of reforms, legislative and executive institutions have to decide over the ex ante design of the reform. However, for reasons of imperfect information and bounded rationality, the legislative and executive institutions cannot establish this initial design in a sufficiently precise manner. At the implementation stage, other institutions, which form the "governance structure" of the reform, have to complete its design by establishing more precise rules – rules that can be applied by the companies operating in the sector. They also have to enforce these rules. This process of defining the operation rules governing a competitive electricity sector is not instantaneous. As the production process of electricity reforms is an "imperfect" one, there is a strong need of adaptations of reforms over time.

In the second part of the paper, we propose an analytical framework for analyzing the adaptation of reforms. Adaptations are needed for different reasons. Firstly, for reasons linked to their technical and institutional production process. Secondly, adaptations are needed because of unforeseen events like the appearance of market power or a supply crisis. Each of these adaptations takes place in a certain institutional framework. It is the framework that has been built by the initial reform, a framework where certain rights have been allocated to the governance structure of the reform. But, as the adaptation needs are varying in intensity, the institutional framework of the reform can intervene in different manners. We will analyze the different roles of the institutional framework by adapting the classification made by Williamson [1991] of different types of contractual adaptations. This allows us to classify adaptations of reforms in "minor" and "major" adaptations. "Minor" adaptations are made within the institutions of the reform, while "major" adaptations are made by adapting some of the institutions of the reform. We will show that the "minor" adaptations are made by the governance structure of the reform and, if the governance structure fails, by negotiations among stakeholders. The "major" adaptations, that require and adaptation of the institutions of reform are realized by other institutions, the legislative and executive institutions.

1. THE INTRINSICALLY ADAPTIVE NATURE OF ELECTRICITY REFORMS

Conducting a competitive electricity reform is not an easy task. The implementation of these reforms still raises many questions more than ten years after their beginning. Many countries have engaged in competitive reforms by applying a "standard prescription" which is based on the idea that all electricity sectors have in common a certain number of technical properties. But in practice, this standard prescription leads to very different reform models and to different reform paths.

Starting with the same objective of introducing competition in the sector, the national experiences often end up being very different one from another. They all evolve over time,

but in different directions. The reason for that lies in the fact that the details of the operational conception of reform matter. And these details cannot be controlled in the initial reform stage. Initial reforms often are incomplete and they must be completed over time, by adding many little rules to the initial reform.

Two reasons explain the incompleteness reform and their adaptive nature. Firstly, reforms are technically difficult to implement. They can only be realized by "cutting" them into modules. Secondly, reforms are institutionally difficult to produce. Their production process involves many participants, ranging from the legislative and executive institutions to regulators, and other public bodies, and even individual economic agents of the sector, like the transmission system operators.

1.1. Electricity reforms are modular objects

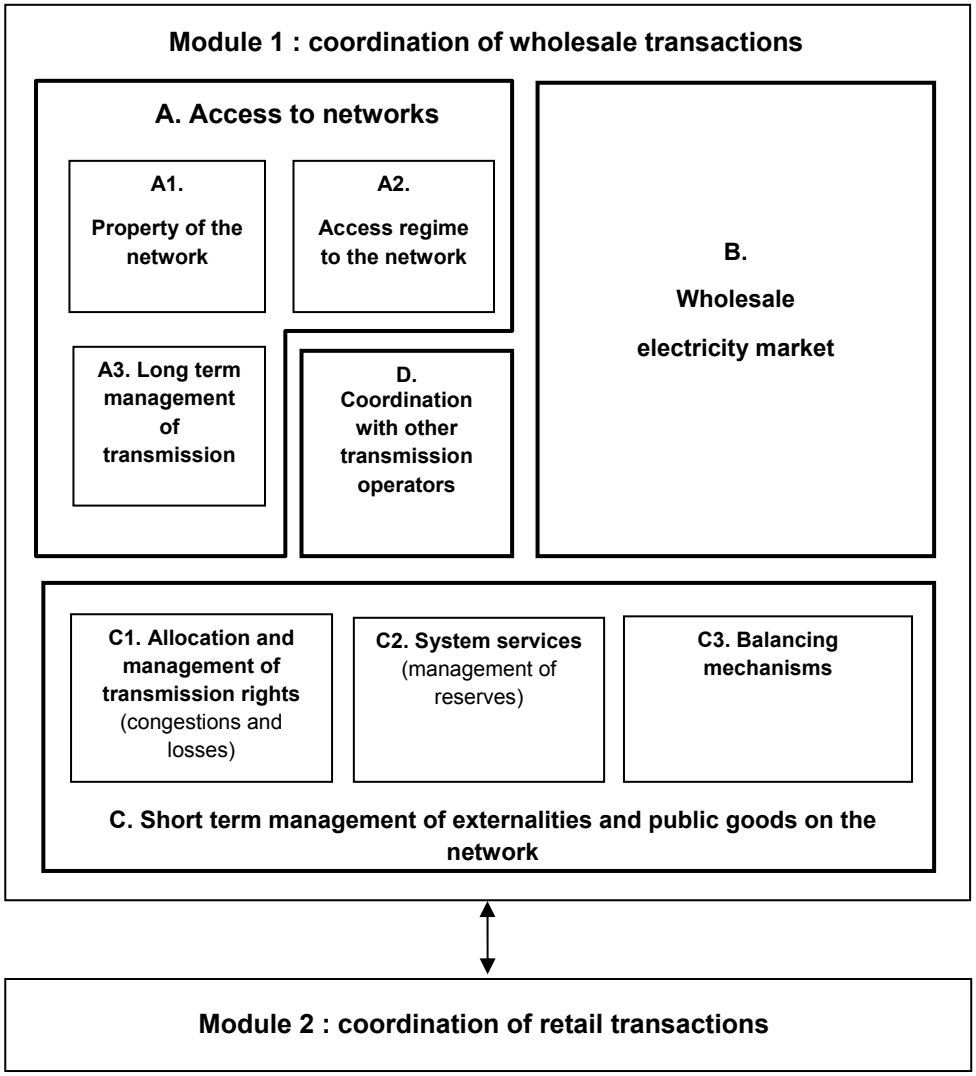
The modular nature of electricity reforms can be understood by looking at the technical specificities of electricity. Because of the specificities of electricity, markets cannot be created in that sector like in classical commodity sectors. Electricity is not a storable good. It flows on networks that are natural monopolies and have a character of essential facilities. In addition, electricity demand cannot be predicted with certainty. As the price elasticity of electricity demand is weak, the level of demand is not influenced by its price level.

For all these reasons, it is difficult to introduce competition in that sector. Some parts of the sector can be organized in the form of market while other remain organized as a monopoly. Because de "market part" and the "network part" of the sector are technically dependent one from each other, it is possible to create markets in that sector only by splitting electricity transactions in their different components, and to create a sequence of markets that simulate the functioning of competitive markets (Wilson [2002]). In this sequence, some markets like the market for "real time energy" (balancing markets) are closely linked to the networks (Saguan [2007]).

To create competitive markets it is thus necessary to split the reform in different "modules" (Baldwin and Clark [2000]) which can be reformed independently one from each other. Each "module" forms a coherent whole and can be organized in different ways. The different modules combine to each other more loosely, and are sometimes independent from each other. As some interdependencies exist among modules in the electricity sector, these modules can be considered as linked one with each other by relations of "weak institutional complementarity" (Aoki [2001]). This concept of weak institutional complementarity suggests that one variant of one module fits best with one specific variant of another module, but can also be combined with other variants, but at the expense of the overall efficiency of the system. One consequence of the weak institutional complementarities between modules is that a variety of different systems can exist, as many different variants of the different modules can be combined together. One possible representation of a modular organization of an electricity reform is given in figure 1 on the next page.

In such a modular representation, we first distinguish the transactions on the wholesale markets (module 1) from the transactions of the retail markets (module 2). We have developed here the first module, which is in general the first one opened to competition. This module can be divided in four main sub-modules. The first one (A) is related to the access of networks. As electricity network remain a natural monopoly, competitive reforms must first ensure open access to these networks. Then, competitive rules can be created for the wholesale electricity market (sub-module B), for example by creating organized power pools or power exchanges. A third sub-module (C) is related to transactions which have to be organized to support competitive wholesale markets. These transactions are linked with the network activities, but they can be organized in a competitive way. When they are organized as markets, they enter in the "sequence of markets" identified by Wilson [2002]. Finally, a last sub-module (D) is related to questions of interconnections of the national electricity grids. If national networks are interconnected, the coordination of different transmission system operators can improve the functioning of competitive markets, as the cross-border electricity flows create *de facto* interdependencies between national markets.

Figure 1 – a modular representation of electricity reforms



Sources: Hunt [2002], Wilson [1998 and 2002], Glachant [2003], Rious [2006]

This modular representation of electricity reforms can be used to understand the diversity of reforms and their evolving nature.

Firstly, modularity can be linked with the huge diversity of "real" reforms. This diversity results from the multiplicity of modules and of variants of each module. Consequently, each national electricity reform is a particular combination of different variants of different modules. The probability to see two identical reforms is thus very low.

Secondly, modularity is linked with the evolving nature of reforms. As reforms are not only modular but also are an innovation compared with the previous monopolistic organization of the electricity sector, they are very difficult to implement. One solution adopted by the reformers has consisted in reforming first a limited number of modules, and to progressively extend the competitive functioning of the sector to additional modules. In practice, the wholesale transactions have been reformed before the retail transactions. Within the module of wholesale transactions, the first reform measures were concerning the opening of access to networks and the creation of wholesale markets for energy. The short term management of externalities and public goods on the networks has been reformed in later stages. Thus modularity is linked with the need of reforming the electricity sector sequentially. And, as the interdependencies among modules are not known by the reformers, this can also need to reform readjustments over time.

1.2. Electricity reforms are produced in a multilevel institutional process

Conducting competitive electricity reforms raises not only technical problems related to the modularity of reforms. Electricity reforms are also difficult to produce because their institutional production process is a complex one. Different institutions participate in the definition of reforms, which explains that reforms are established progressively rather than instantaneously.

The first type of reform producers are the legislative and executive institutions of the states. These institutions play a role in the launching of the reform because, for a reform to get started, participants in these institutions must consider it desirable (World Bank [1995]). They also play a role in the definition of the initial characteristics of the reforms. Only reform measures that are institutionally feasible will be realized (Heller, Keefer and McCubbins [1997]). The legislative and executive institutions thus play an initial role in the production process of the reform. They often establish the initial reform law. But the initial reform law is always "incomplete" (Pistor and Xu [2003]) for two main reasons.

Firstly, these institutions have a very limited specific knowledge on the electricity sector. Because they are "political" decision makers, they are unable to know what are precisely the technical and economic complementarities between the different modules. At the beginning of the reform, they even ignore what are the modules of a reform. Therefore they are unable to define the precise characteristics of reforms. They can only define reforms in their broad lines i.e. establish their *ex ante* design.

Secondly, the legislative and executive institutions cannot play their rulemaking function frequently. In most countries, electricity reform laws and their important modifications are decided in intervals of 5 years or more. This is the normal rhythm for changing legislations. But modularity imposes more frequent changes of the rules. Because of the uncertainties concerning the complementarities among modules, some "fine tuning" is needed to adapt reforms.

For these two reasons, reform laws never define the new sector rules in a sufficiently precise manner for the companies to start operating competitive transactions. The reform law modifies the rights and obligations of the different economic agents, but the definition of these rights is incomplete. The exact nature of the rights and obligations produced by the reform will be known only in the process of reform implementation, when these rights and obligations are exercised. And to exercise their rights, a more precise definition of the rules is necessary, else competitive transactions cannot start.

Therefore, a second type of reform producers plays an important role in electricity reforms. These producers are the "governance structure" of the reform (Levy and Spiller [1994]). The governance structure is established at the starting of the reform, by the legislators. In most European countries, sector-specific regulators have been created. In the US, the federal regulator FERC and the public utility commissions of the states that were existing since the beginning of the 20th century took over the functions of a governance structure. They exercise some rulemaking powers and of course they have strong enforcement powers of the reforms. But the regulators are not the only participants in the governance structure. The competition authorities can also participate by defining some rules (Glachant et al. [2007]). And in the electricity sector, an important rulemaking function is in the hands of the stakeholders themselves. For example, in the British electricity reform of 1990, the UK Power Pool was an organization controlled by stakeholders. The Pool was self-regulated. It was especially free to define its own operating rules (Glachant [1998]). In many countries, the transmission rules are defined by the transmission system operators (TSO) themselves. This rule production by the stakeholders is justified because many technical aspects of the reforms must be known to define precise reform rules. And the regulator has not the sufficient technical expertise to deal with these questions. Therefore, the precise rules of electricity reforms are co-produced by a variety of actors.

This production process is neither immediate nor perfect. The different reform producers define the sector rules over a long time frame. These rules have to be modified frequently, as the precise interdependencies among modules are known only *ex post*. Some

misalignments can appear, rendering modifications necessary. And in practice, these modifications are observed very often in the electricity sector.

To conclude, there are two important reasons explaining the need of adaptation of electricity reforms. The first one is a technical reason. As electricity sectors have strong technical specificities, reforms can only be made by re-creating artificially competition in a sector where competition cannot appear spontaneously. This is done by splitting the reforms into different "modules". And these modules have to be reformed sequentially. The second reasons is linked to the production process of the reform. This production process involves legislative and executive institutions as well as sector-specific regulators and stakeholders. This multi-layer production process imposes a progressive reform process and also adaptations to readjust the reform in case of misalignments.

2. THE MODES OF ADAPTATION OF ELECTRICITY REFORMS

The adaptation needs of electricity reforms have different origins. A first origin is endogenous. It is linked with the modularity of reforms and the specificities of their production process. A second origin of the adaptation needs of reform is the context of radical uncertainty in which reforms take place. This radical uncertainty can lead to small or to major adaptation needs. Supply shortages can appear, like in the hydro-electricity based system of Norway in 2003. Problems of market power can increase prices dramatically, like in California in 2000 and 2001.

The institutions of the reform respond to the adaptation needs in different manners, depending both on the types of adaptations that are required and on the allocation of rights to the different institutions playing a role in reforms. The allocation of rights is important because only the institutions who own these rights can adapt the reforms. They are the decision makers of the reform adaptations.

We will now present a framework for analyzing the adaptations of reform. This framework is based on the distinction of two main types of adaptations. The first one is realized by the governance structure of the reform and by stakeholders. They adapt the reform by negotiating changes of the rules. The second one is realized by the institutional environment, i.e. the legislative and executive institutions. When adaptations of the first type fail or are impossible, these institutions can intervene to realize another type of adaptation. This type of adaptations can consist in modifications of the rights of the governance structure. Therefore the second type of adaptation can realize a "reform the reform" (Hogan [2002]). We call the first type of adaptation "minor" adaptations and the second one "major" adaptations.

2.1. The different types of adaptations of electricity reforms

Adaptation needs can result from the "natural" evolution of reforms, which consists in deepening the competitive intensity of the reform by extending competitive rule through modules. Adaptation needs can also arise when there are "misalignments" between the different modules or as a consequence of external disturbances on the reform.

The process of adapting reforms is very similar to the process of adapting contracts described by Williamson [1991]. In case of "inconsequential" adaptation needs, reforms are adapted by the governance structure without any negotiation because the governance structure owns all the necessary rights. But, as reforms are initially defined in an incomplete manner, the allocation of rights to the governance structure is also incomplete because the legislator was initially unable to imagine what could be the future scope of the tasks of the regulator.

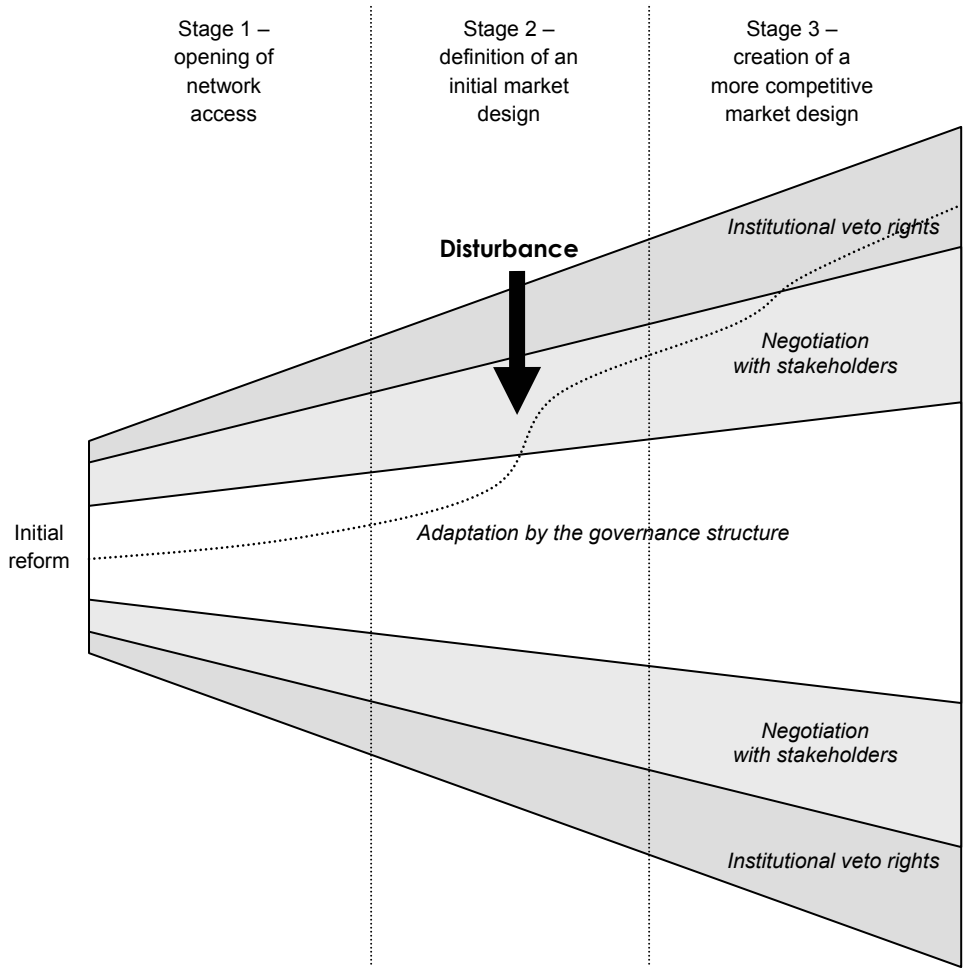
In case of more consequential adaptation needs, the rights of the governance structure are not sufficient to realize the necessary adaptations. A formal renegotiation of some characteristics of the reform becomes necessary. In the electricity sector, there is an area of decisions where the stakeholders own rights on the definition of additional rules of the reforms. They can use these rights to modify some rules of the game. For example, the rights of defining rules on the modules related to the transmission network are often *de*

facto in the hands of the transmission system operators (TSO) (Barker, Tenenbaum et Woolf [1997]). Thus the TSOs are to intervene in any adaptation concerning these modules.

Finally, in case of big disturbances or big adaptation needs, neither the governance structure nor the stakeholders are able to realize adaptations. This impossibility to adapt the reform is a consequence of lacking rights on some decisions or of the impossibility to decide changes by mode of negotiation. The legislative and executive institutions are then the only ones able to realize the necessary changes. This was for example the case in the UK at the end of the 1990's. In the second half of the 1990's, the prices on the UK Power Pool rose as a consequence of market power of electricity producers. To solve these problems of market power, a change of the rules of the wholesale market was necessary. But, the Pool was controlled by stakeholders, and these stakeholders were unable to agree on a modification of the rules of the Pool. In that case, a reform of the reform was initiated by the British government. At the beginning of 2001, a new wholesale market, the NETA (New Electricity Trading Arrangement) was launched. When there are "big" adaptation needs, the rights of the governance structure and of the stakeholders make it impossible to realize adaptations "in" the reform. Using the rights of the legislative and executive institutions, which are veto rights, is the only way to realize the necessary adaptations.

These three modes of adaptation of reforms are represented in figure 2. This figure also represents the reforms as an evolutionary process. In this process, the reforms go through three main stages, corresponding to the extension of competitive rules through modules. In the first stage, the minimum conditions of a competitive reform are set up. In the second stage, an initial market design is defined. Finally, in the third stage, the competitive rules are extended to an even bigger number of modules. The reform process can then be described as a path, where different owners of rights participate in the adaptation process.

Figure 2 – Reform paths must repeatedly be adapted



We call the adaptations made by the governance structure and by the stakeholders "minor" adaptations because they are made within the institutional framework set up by the intial reform. The adaptations made by the legislative and executive institutions are "major" adaptations because they permit important changes of the reform rules, including changes in the allocation of rights of the governance structure.

In the remaining of this article, we analyze the characteristics of these "minor" and "major" adaptations. The two types of adaptations differ not only by the characteristics of the owners of the rights. They also differ by their mode of interaction.

2.2. Minor adaptations consists in a change of rules "within" the reform

The institutions of reforms can respond to adaptation needs by deciding changes of some rules of the sector. These "minor" adaptations can be done in two ways. First, the governance structure, in general the regulator, has authority to modify some rules. Second, the stakeholders can negotiate so that some rules can be adapted to changing circumstances;

In practice, the possibility of the governance structure to adapt reforms is limited by the definition and the allocation of rights that has been made at the initial reform stage. As the reform law is very incomplete, the powers of the regulator are limited to the questions covered by the initial reform law. Therefore, "minor" adaptations are often made by negotiations with the stakeholders.

These negotiations are often made on a voluntary basis, by Coasian bargaining (Coase [1960]) among stakeholders. The role of this type of bargaining is often neglected in the analysis of reforms. However, in practice, this bargaining can play an important role in electricity reforms. This is especially true in countries where there have initially been weak regulators. For example, in Norway and Sweden, many adaptations could be made by the stakeholders, including the creation and modification of a common Nordic electricity pool, the Nordpool. Even the supply crisis of the summer 2003 in Norway, where problems of market power had been observed, has been solved within the institutional framework of the reform. Similarly, Germany, where no regulator had been created by the 1998 reform law, has been able to implement a competitive reform, with a 100% opening of access to networks. Between 1998 and 2002, two adaptations of the initial reform design have been made by negotiations among stakeholders only. These examples show that the adaptability of reforms based on "minor" adaptations can be very strong.

But there are also cases where this "minor" adaptability is much weaker. In the Californian crisis of 2000 and 2001, the "minor" adaptations of the reform were impeded by a series of factors linked with the definition and allocation of rights on the reform. In presence of strong problems of market power, a quick adaptation of the reform was impeded by an allocation of rights on the reform where regulatory powers were shared between the federal regulator, the FERC, who had jurisdiction over the wholesale market, and the state regulator, the CPUC, who was responsible for regulating the retail market. When prices on the wholesale market rose to dramatic levels, FERC was unwilling to reform the rules of this market. At the same time, the state regulator was unable to change the price setting rules in order to link the retail prices to the wholesale prices. As a consequence, the market power on the wholesale market could continue, and electricity distributors went bankrupt.

The adaptability of reforms is thus very different from one country to another. However, in any case, the capacity to adapt reforms by Coasian bargaining among stakeholders will be limited after a certain time. One condition for the success of this type of bargaining is the existence of a common "area" where an agreement can take place. In competitive reforms, there is a strong probability that this area gets empty after a few years of reform. While some voluntary agreements can be reached in early stages of reforms to improve the economic efficiency of the reformed sector, these types of agreements will not be reached anymore when the objective of adaptations is to deepen competition in the sector. As further intensifications of competition create winners and losers, the losers in the pro-competitive process will not accept to enter into further renegotiations. The pro-competitive adaptation by negotiation is thus limited in time. If further adaptations are needed, they will

require "major" adaptations, i.e. the intervention of the legislative and executive institutions.

2.3. Major adaptations consist in "reforming the reform"

"Major" adaptations are undertaken by the legislative and executive institutions of the states. When the "minor" adaptation process is blocked and further adaptations of the reform are needed, these institutions can intervene, especially when a change in the definition and the allocation of rights on the reform is necessary. But this change will always remain incomplete, for the same reasons that explain why initial reform laws are incomplete. A "reform of the reform" is thus the starting point of a new process of implementation of vague rules.

For "major" adaptations to be adopted, they must be supported by the participants in the legislative process. In this process, different institutions hold veto rights over adaptations. Therefore, the decisions over major adaptations take the form of veto player games (Tsebelis [2002]). In these games, the outcome of the decision process is determined by the preferences of the different veto players. The locations of these preferences determine whether a given adaptation will be preferred over the status quo. And the number of veto players influences the possibilities of adaptation too. When many different veto players have to decide an adaptation and the preferences of these players are very different from each other, then the stability of the reform is probably strong, which reduces the feasibility of adaptations.

Therefore, "real" reforms have very different properties in terms of "major" adaptability. When the possibilities of "major" adaptations are limited, the reform process can be stuck. Consequently, some reforms will not be able to reach the more competitive stages of the reform process unless the feasibility of "major" adaptations gets improved.

CONCLUSION

Adaptability is an important property of competitive electricity reforms. Reforms need to be adapted over time because they are modular and can therefore be fully implemented only over a long time frame. In modular frameworks, initial reforms must be incomplete. They are implemented and completed sequentially. The need to adapt reforms over time is also a consequence of their institutional production process. The production of reforms is first in the hands of legislative and executive institutions who define the reform law. It is then in the hands of a governance structure. Therefore, the process of defining the different aspects of a reform is not instantaneous.

Electricity reforms are realized in different stages. They are first realized on a limited number of modules. Then, when competitive transactions develop in the sector, they are extended to a larger number of modules. During this reform process, some needs of adaptation will necessarily appear, either to take into account the growing role of interdependencies among modules or in reaction to disturbances. The adaptation process that will be realized is not mainly determined by "technical" aspects. It is an institutional process and its characteristics are determined by the definition and allocation of right "in" and "over" the reform. Depending on the definition and allocation of rights, reforms can either be adjusted by "minor" adaptations or by "major" adaptations.

Different conclusions can be drawn from this analysis. The first one is that reformers should take into account the need of adapting reforms over time. Credibility is thus not the only criterion of good institutional practice. Reforms experience severe problems when they are credible but too inflexible. They must be built to be not only credible but also adaptable. The second conclusion is that the reform process can be stuck for institutional reasons. When stakeholders refuse to negotiate further adaptations, it is impossible to realize "minor" adaptations. When the institutional veto players are then not willing to reform the reform, the pro-competitive process can be stopped. This is one of the problems faced by many European electricity reforms. A third conclusion is that this type of reform process is even more difficult to realize when different national reforms have to be harmonized. This is especially the case in Europe. Each national reform has been started with its own "modular" specificities. Each national reform has different characteristics in

terms of “minor” and “major” adaptability, the definition and allocation of rights being specific to each country. Therefore it will be very difficult to harmonize the different national reforms to create a single European electricity market. A focus on the institutional properties of reforms could help improving the feasibility of a more competitive European electricity market.

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