Intra-regional diffusion of spectrum license allocation policies

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Abstract

Purpose – *This paper aims to develop a greater understanding of international telecommunications policy diffusion through preliminary, qualitative analysis of an expected utility model. The model is tested through analyses of diffusion of spectrum license allocation policies within and between regions.*

Design/methodology/approach – *A qualitative comparative case method is used. Cases are developed from secondary data from the European Union and South America, and analyzed at the national and regional levels.*

Findings – *The results suggest: the expected utility model can be used for in-depth qualitative analyses to compare effects of various diffusion mechanisms; diffusion of spectrum license allocation policies at the regional level was more strongly driven by a policy's likely effectiveness, as compared to potential payoffs for policymakers; and conversely, at the national level diffusion was driven by both payoffs for the policymakers and likely policy effectiveness.*

Originality/value – *The two academic contributions of the paper are its expansion of a unified policy diffusion model to simultaneously account for regional and national levels of governance, as well as for technological change and its application in the telecommunications domain. Practical contributions include providing a framework for systematic analysis of a telecommunications policy's benefits for the public as well as policymakers.*

Keywords *Policy diffusion, Auctions, Regionalism, European Union, South America*

Paper type *Research paper*

1. Introduction

The phenomenon of policy diffusion is an inherently dynamic and international force influencing telecommunications policymaking. Despite its wide ranging effects, policy diffusion studies are limited in number, possibly due to fragmentation of theory wherein multiple competing explanations for the diffusion process exist. A unified model, such as that proposed by political scientists Braun and Gilardi (2006), may provide a solution. Their model enables comparison of the relative influence of various diffusion mechanisms as well as the context in which they are relevant, the model unifies known policy diffusion mechanisms such as learning and imitation by focusing on the policymakers' expected utility of adopting a new policy. The model posits expected utility is based on expectations of policy effectiveness as well as the pay-off to adopting the new policy for policymakers. Its major weakness, however, is validation, as it requires knowledge of policymakers' expectations concerning both the new policy as well as the status quo.

Despite these limitations, using the model as an analytic framework for a high level, exploratory qualitative analysis can provide insight into the relative influences of various diffusion mechanisms. Here we undertake such an analysis, examining diffusion of spectrum license allocation policies as a means of assessing the model's usefulness in studying policy diffusion in the telecommunications domain. Spectrum policy is ripe for

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diffusion analysis as market pressures for increased spectrum and new technologies (e.g. cognitive radios) are continually creating demand for innovative, new policies. Also, the introduction of market-based mechanisms (auctions) for spectrum license allocation situates spectrum policy more centrally in broader debates about the role of government, the rise of the regulatory state and the costs and benefits of market mechanisms. Consequently, spectrum license policy diffusion is likely explained by a diverse range of factors.

At the same time, policy diffusion research has suggested a number of both national and international factors influencing diffusion. With the proliferation of regional blocs, regions are increasingly used to explain policymaking and diffusion (Levi-Faur, 2004; Kaiser and Prange, 2005). Building on this research, we refine Braun and Gilardi's model by considering both national and regional influences in our analysis.

In summary, this analysis sheds light on the mechanisms and variables influencing telecommunications policy diffusion by applying a unified policy diffusion model. This model, developed by political scientists, ties established diffusion mechanisms to policymaker's decision criteria through the concept of expect utility (Braun and Gilardi, 2006). Using secondary data on allocations of spectrum licenses from the European Union (EU) and South America in the period 1996-2006, we test the model through exploratory, qualitative analysis, assessing the relevance of its various elements and in turn its general explanatory power for telecommunications policy diffusion research.

Our research makes three distinct contributions. First, it identifies the strengths and weaknesses of a new policy diffusion framework for telecommunications policy research. Second, it provides insight into the factors influencing spectrum license allocation policy diffusion. Third, it contributes to the nascent telecommunications policy diffusion literature, in which much attention has been given to the spread of policies that promoted liberalization and privatization (Bartle, 2002; Schneider *et al.*, 2005; Levi-Faur, 2004), by analyzing a policy domain relatively unaffected by WTO commitments.

2. Background

2.1 Factors influencing policy diffusion

Policy diffusion research considers the entities involved in policymaking, the mechanisms of diffusion and the factors driving diffusion. Over the past several decades, similar to other sectors, the entities involved in telecommunications policymaking have changed. Whereas traditionally policymaking occurred primarily in ministries and parliaments, in recent years there has been a rapid growth in policymaking through regulatory agencies (Gilardi, 2005; Levi-Faur, 2005; Moran, 2002). Across national boundaries, partially as a result of globalization, these regulators face similar challenges, and consequently consult with one another, thereby contributing to policy diffusion. Policy diffusion is defined as ''the process by which knowledge about policies, administrative arrangements, institutions and ideas in one political system [. . .] is used [. . .] in another political system'' (Dolowitz and Marsh, 2000).

Extant research from several disciplines identifies six mechanisms of policy diffusion (Bennett, 1991; Braun and Gilardi, 2006; Keohane and Nye, 2001; Meseguer, 2005):

- learning that results from networking by experts and decision-makers;
- interdependence, which assumes ''reciprocal effects among countries or among actors in different countries'' (Keohane and Nye, 2001, p. 7);
- common norms and international regimes that influence national policymaking;
- taken-for-grantedness when a policy is seen as a ''natural'' solution to a particular problem;
- imitation of policies that have been adopted elsewhere; and

- coercion by external actors and interests that forces countries to adopt policies in the face of losing particular benefits (e.g. industry lobbying).

These mechanisms have relevance for telecommunications sector. As telecommunications regulatory agencies are composed of sectoral experts (Levi-Faur, 2005), this common base of expertise facilitates learning. Policy diffusion is also facilitated by interdependence, which in telecommunications may arise from common technologies and markets. There exist both competitive interdependencies, where nations compete for resources or benefits, and cooperative interdependencies, whereby countries adopt similar policies to achieve a common goal (Lazer, 2001). Telecommunications policy diffusion also results from common norms and regimes, explaining, for example, the diffusion of telecommunications liberalization policies (Cowhey, 1990), and challenging the notion of ''natural monopoly.'' Also, imitation, driven by the need to establish policies in complex technical domains, may spur policy diffusion. Finally, diffusion resulting from lobbying activities, wherein firms seek common regulatory environments across nations, could be seen as a factor in telecommunications policymaking.

2.2 Expected utility model

While examining mechanisms of diffusion helps explain what drives policy diffusion, the question of why it happens is typically either under-theorized or explained by a variety of incompatible theories. To answer the question of ''why,'' Braun and Gilardi (2006) proposed a unified model that focuses on the policymaker's calculus in determining the expected utility of policy change, particularly as compared with the status quo.

In their model, the expected utility is first a function of a policy's usefulness to a policymaker. This is indicated by the sum of two factors: payoffs of the policy in terms of votes and how close the policy is to the policymaker's ideal. The expected utility is also a function of the policy's effectiveness. Hence, whereas a policy may be ideal and popular, its lack of effectiveness may hinder its ultimate adoption. Thus a policy's effectiveness is its public benefits whereas payoffs are the private benefits for the policymakers. The authors emphasize this interaction between effectiveness and payoffs as a critical component of the model. Finally, policy change is also a function of the likelihood of adoption, which is represented as a weight on the expected utility, as well as the transaction costs associated with changing policies.

Braun and Gilardi (2006) propose the following specification, $\mathrm{EU(change)} = pnU_j + (1-p)\mathrm{mU_i} - C;\ 0 < p < 1;\ C > 0$, where the expected utility of change (EU) is the sum of the payoff U_j associated with alternative policy j and its effectiveness n, together with the expected utility U_i of the existing policy i and its effectiveness m, both of which are weighted by their likelihood of adoption p, less transaction costs C[1].

In total, the model accounts for diffusion in that the actions of others, as typically indicated in the diffusion mechanisms discussed above, influence the expected utility model's parameters. In particular, through reasoning that draws on published accounts of the effects of these mechanisms, Braun and Gilardi (2006) find that while learning, interdependence, common norms and taken-for-grantedness are all likely to influence perceptions of a policy's effectiveness, the diffusion mechanisms of coercion and imitation are more likely to influence payoffs.

However, while several diffusion studies have cited their work (e.g. Brooks and Kurtz, 2012; Sharman, 2008), none directly tests the overall model or the assertions of the relationships between the various diffusion mechanisms and their implications for effectiveness and payoffs. This study addresses this gap and a scarcity of in-depth qualitative analysis of diffusion models (Marsh and Sharman, 2009, p. 270).

While the Braun and Gilardi model provides a useful and unifying framework for analyzing policy diffusion (Marsh and Sharman, 2009, p. 269), it fails to explicitly differentiate between the sources of policy diffusion mechanisms. Consequently, the relative importance of multilateral bodies (e.g. ITU, WTO), supranational regional governments (e.g. EU) and

nation states remains unresolved (Bernauer *et al.*, 2009). In the telecommunications policymaking realm specifically the relative importance of these different bodies is as yet unclear. For example, the influence of regional bodies in telecommunications policymaking is asserted by some (Schmidt, 2006) and disputed by others, e.g. Levi-Faur (2004) in his study of liberalization in the EU and Latin America argues that the role of the EU may have been exaggerated.

3. Methodology and framework for analysis

This research applies the described model to examine diffusion of spectrum license allocation policies in two regions, the EU and South America. Through comparative analyses, this research tests and potentially extends Braun and Gilardi's original model while providing its first application in the telecommunications sector.

Each of the EU and South American cases investigates the presence and role of policy diffusion mechanisms at both regional and national levels. This is followed by a cross-case analysis. Specifically, we assess the six policy diffusion mechanisms discussed above and then analyze their implications for policy effectiveness and payoffs, which in turn enables analysis of the causes of policy diffusion.

The inter-regional comparison is performed on 25 member states of the EU as of 2012 and ten countries in South America. The EU case does not include Malta and Cyprus due to their small populations. Further, the EU case includes new member states that have had their first auctions before they joined the Union in 2004 and 2007. Policy decisions in some of these countries were made during preparations to satisfy accession conditions. The South American case investigates ten countries, the majority of which belong to two regional blocs: Mercosur and the Andean Community. The only country that does not have full membership in either bloc is Chile. Data for these cases have been gathered from public sources including the European Commission, the OECD, the GSM Association and the CDMA Group.

The cases examine three components of spectrum license allocation policies: method, timing and technology.

The allocation method is an indication of adoption of a particular allocation method. We consider two major methods: auctions and ''beauty contests'' (comparative evaluation) (Cramton, 2002; Prat and Valletti, 2003). Both methods typically involve a set of criteria the winning party should implement, including payments for the license. The primary difference between the two methods is that auctions emphasize license price competition among bidders, while in beauty contests other criteria (e.g. the speed of network rollout) may be more important (Prat and Valletti, 2003).

The major objectives of the auction process are to attract enough bidders, be robust to collusion and predatory behavior among the bidders, as well as avoid overpaying for the auctioned good (''winner's curse'') (Klemperer, 2002; Whitford, 2007; Prat and Valletti, 2003). When designing an auction, it is also necessary to consider the structure of the market that will be created as a result of the auction.

Auctions can be categorized into dynamic, where bidders submit their proposals in successive turns, and static (sealed-bid), where all bids are accepted simultaneously (Klemperer, 2002). The effectiveness of the two types is debated. Some authors contend that sealed-bid auctions are more susceptible to collusion, are less transparent and thus lead to lower revenue for the seller (Sade *et al.*, 2006). Others maintain that while dynamic auctions are more transparent, sealed-bid auctions make collusion less likely and thus may raise the revenue for the seller (Engelmann and Grimm, 2009; Klemperer, 2002). The Anglo-Dutch auction combines the two types in two stages: the first one is run as dynamic and a predetermined number of highest bidders from that stage participate in the second, sealed-bid stage (Klemperer, 1998).

Further, an auction can be run as discriminatory-price, where the winners pay their proposed bids; or as uniform-price, where the winners pay the lowest winning bid (Abbink *et al.*, 2005).

It has been shown in other domains that the discriminatory-price format is more likely to lead to a monopolistic market structure, while uniform-price may preclude large bidders from gaining large profits (Cong and Wei, 2010).

Due to the rapidly rising demand for spectrum caused in part by the proliferation of wireless devices, the use of auctions in the secondary market for spectrum has been considered (Wang *et al.*, 2010; Zhou and Zheng, 2009).

Unlike an auction, a beauty contest (also called competitive tender or administrative process) in the context of spectrum allocation invites proposals on how the spectrum will be used. The seller maintains a list of criteria, sometimes weighted, used in the evaluation of submitted proposals, and the spectrum is awarded to the most attractive proposal (Cramton, 2002). Examples of criteria used in the evaluation include mobile service pricing, quality of service, speed of network deployment and service coverage (Prat and Valletti, 2003). Because of the wide variety of evaluation criteria beauty contests can be very flexible (Prat and Valletti, 2003). At the same time, this allocation method has its disadvantages. It can be slow and susceptible to lobbying by bidders, not transparent and prone to political intervention (Cramton, 2002; Jehiel and Moldovanu, 2001). Additionally, participants have an incentive to submit unrealistic business plans to satisfy evaluation criteria, and try to ''downgrade'' them after winning (Prat and Valletti, 2003). This is unlike auctions where winning binds the bidder to pay the license cost.

However, in the case of spectrum allocation the difference between auctions and beauty contests in practice is often blurred (Prat and Valletti, 2003). Auctions often prescribe a set of criteria, in addition to license price, that the winner should fulfill. Likewise, beauty contests may include license price as one of the criteria, although not as part of competitive bidding. To ensure proper categorization we examined conditions of each license allocation event.

The timing of policy adoption is important for understanding the perceived effectiveness and payoffs of the policy as well as the pattern of diffusion. Technology is included because of its relationship to timing, which has two components. First, standardization (de facto or de jure) of technology among countries of a region may influence the timing of the policy choice. Second, technology may determine whether new spectrum, and consequently new licenses, are required to offer new services.

With respect to auctions as a method of license allocation, countries are grouped as adopters and non-adopters, i.e. countries that continue to use other allocation methods such as beauty contests. The countries are further grouped with respect to timing as:

- early adopters, or countries that were the first to adopt auctions and ran their first auctions before or in 2000;
- late adopters, or countries that held their first auctions after 2000; and
- non-adopters.

The year 2000 is a cut-off for early vs late adopters for two reasons. First, the EU decided in 1998 to establish a deadline of 2002 for allocating 3G licenses. The year 2000 falls in the middle between these two dates. Second, as Figure 1 shows, in 2000 the number of first-time allocations through auctions has reached its median value in both Europe and South America. Finally, the technology choice of the countries refers to whether they specify a technology that must be used in the allocated spectrum.

To summarize, as depicted in Figure 2, we qualitatively analyze the diffusion of spectrum license allocation policy and its three components through an application of the Braun and Gilardi's expected utility model at both the national and the regional levels in the EU and South American cases. For each case, we consider the six diffusion mechanisms and their likely implications for general notions of effectiveness and payoffs for the region as well as the nation states generally. Based on the resulting inter-regional comparison, we provide a structured assessment of the likelihood that a particular diffusion mechanism influenced

Figure 1 Number of first-time allocations of spectrum licenses through auctions in the EU and South America, 1996-2006, plotted against the ''normal'' diffusion S-curve

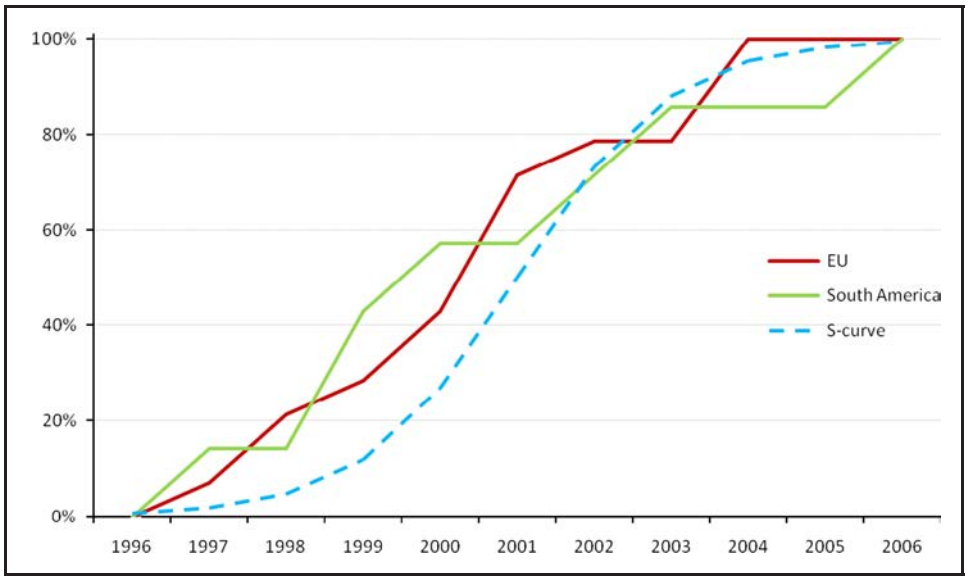
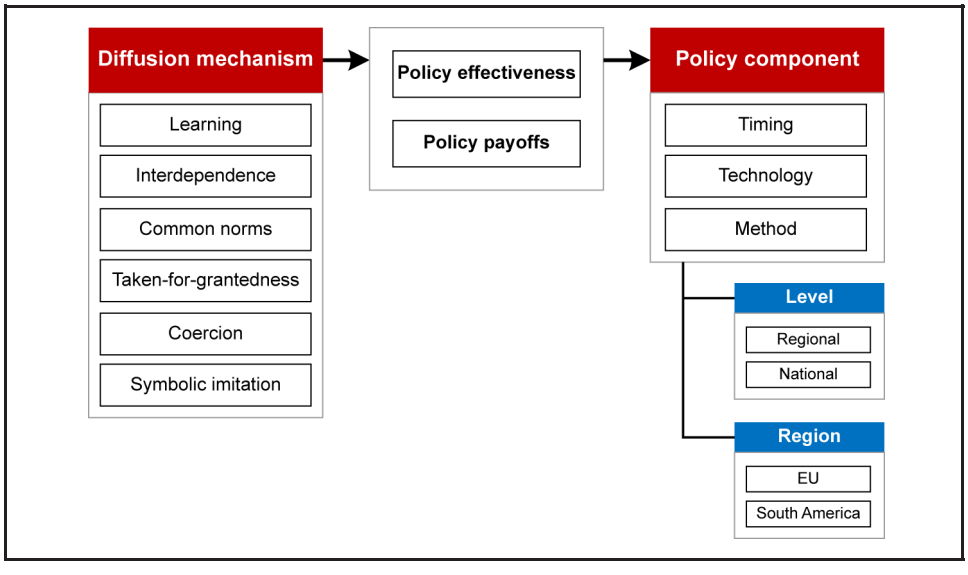


Figure 2 Framework of assessing the diffusion of spectrum license allocation policies



each policy component. These assessments then provide the basis for a more general assessment of the explanatory power of the expected utility model.

At the regional level effectiveness can be interpreted as the ability of the policy to meet telecommunications market goals of the region, as well as contribute to more general economic goals.

At the national level policy goals, or criteria for effectiveness, included the distribution of licenses in such a way that a competitive market emerged (often requiring new entrants), attracting firms that would be able to meet their license obligations (financial as well as service-oriented) – all while raising money for the government. Assessments of payoffs have more of a political component as officials are more directly affected by the electoral process than at the regional level, especially in the EU case.

4. EU case study

In spectrum license allocation activities undertaken since 1996 (for either 2G or 3G services), out of the 25 countries 11 held beauty contests and 14 held auctions (Figure 3 shows a map of 3G allocations). Six countries were early auction adopters, and eight were late adopters. The early adopters include the UK and Germany, which together raised an unexpected $80 billion and brought much attention to spectrum auctions.

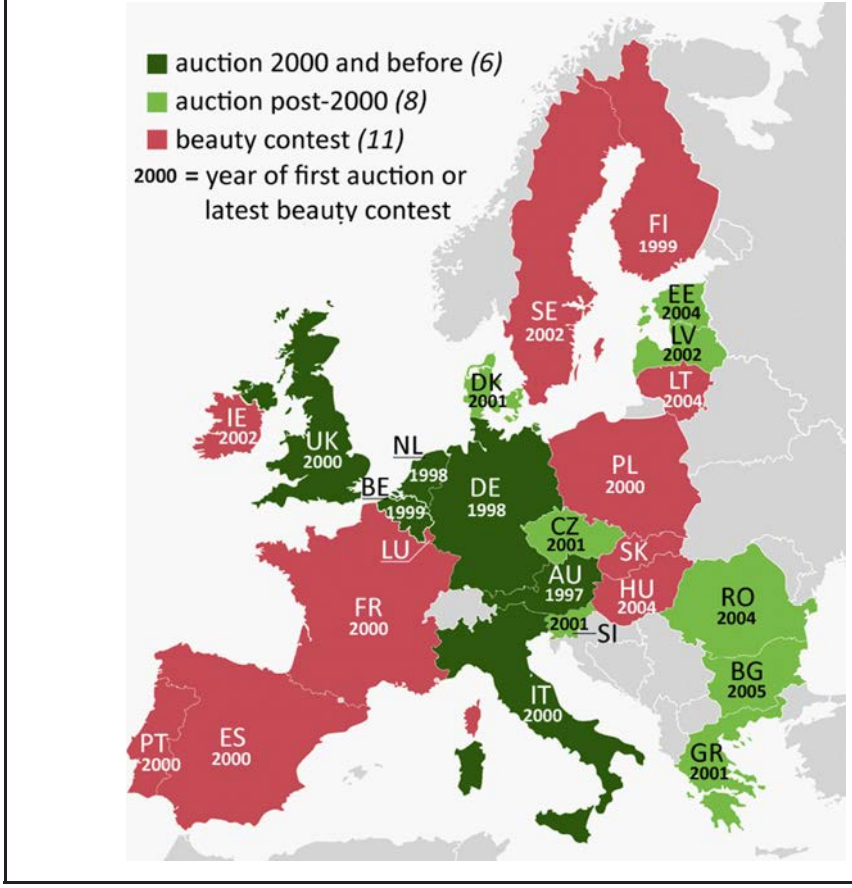
Spectrum policymaking in the EU developed as a two-staged process. First, a decision at the EU level established the framework for the regional policy. Second, this decision was implemented in the nation states. The regional and national levels are analyzed in turn.

4.1 Regional level

In addition to the general policy effectiveness criteria stated above, the payoffs to regional regulators would include, on one hand, promoting their agenda of enhancing Europe's innovation capabilities, and on the other hand the self-interest of regulating officials in ensuring their re-appointment.

Deliberation on 3G spectrum license allocations in the EU began early, prior to 1998. In 1998 the Commission issued a Green Paper (European Commission, 1998a), seeking comments about how licensing should be carried out and the extent to which it should be harmonized. Subsequently, the European Parliament and the Council of Europe adopted decision 128/1999/EC (European Commission, 1998b), which mandated both the timing and the technology of license allocation in member states. Article 3 of the decision set a specific date, January 1, 2002, for allocating 3G licenses in the member states. Article 1 specified

Figure 3 Types and dates of 3G spectrum license allocation events in the EU



that UMTS technology was to be used and that service in the member states should be compatible. However, that decision did not specify an allocation method. Tellingly, in 1997 the Parliament and the Council adopted directive 97/13/EC aimed at establishing ''a common framework for general authorizations and individual licenses in the field of telecommunications services''. However, this directive, while describing general principles to which allocations should adhere, stopped short of stipulating a specific allocation method.

According to the expected utility model, the variables expected to influence the assessment of a policy's effectiveness include learning, interdependence, common norms and taken-for-grantedness. For spectrum policy, the role of learning is apparent from the history of previous generation technology (2G) rollout in Europe when the EU took a ''coordinated introduction'' approach. According to recommendation 87/371/EEC and directive 87/372/EEC (both 1987), member states had to allocate specific spectrum bands for GSM and start service in their territories by 1991. This coordinated GSM rollout was successful, and the coordination of both timing and technology in the case of UMTS was at least partly due to the aspiration to replicate that success. Thus, positive past experience increased assessments of the effectiveness of a common approach.

Mandating the time and technology can, in addition to learning, be attributed to the combined effect of competitive and cooperative interdependence. As Bohlin (2001) points out, the decision to undertake a coordinated approach was driven in part by the European Commission's desire to uphold Europe's position as a leader in mobile technologies by deploying advanced network technologies and services quickly. Further, Europe sought to reinforce its manufacturing capabilities, given its position as home to (at the time) many world leaders in mobile-equipment manufacturing, such as Nokia, Siemens, Ericsson and Alcatel. Such efforts would not only bolster the European economy, but also strengthen the European common market (Carlberg, 2001). These motivations are reinforced by cooperative interdependence as reflected in the Commission's decision that states the goal was ''to allow the development of Community-wide as well as pan-European and global services with the widest possible territorial coverage'' (decision 128/1999/EC). Hence, the influence of competitive interdependence was coupled with that of cooperative interdependence and together they increased the expected effectiveness of the common policy.

In addition to interdependence, common norms that arise from ''shared socialization and repeated interactions within networks'' can influence utility perceptions (Braun and Gilardi, 2006). Although a common European forum for regulators was not established until 2002, meetings of the Commission and other organizations (such as the European Conference of Postal and Telecommunications Administrations, CEPT, and European Telecommunications Standards Institute, ETSI) provided opportunities for interactions between national administrations and European Commission staff. This likely facilitated the establishment of common norms concerning timing and technology, which however did not quite reach the ''taken-for-grantedness'' level, as the need for consultation reflected in the Green Paper demonstrates. A common norm around allocation method, by contrast, did not evolve. This lack of a common norm is related to larger debates about the balance of authority between member states and the region.

4.2 National level

The variables influencing effectiveness and payoffs for timing, technology and allocation method are each discussed in turn.

The timing and technology components of spectrum license allocation policies were prescribed by decision 128/1999/EC (1998) and all member states complied (COM (2002) 301). While the assessment of effectiveness of the timing and technology policy components are largely similar to those at the regional level, the payoff assessment differs. Clearly, coercion played an important role in establishing expected payoffs of a policy that conformed to the date and technology specifications. Other coercive influences may have

influenced the payoffs, for example lobbying by carriers, which may partially explain the variance in licensing dates by nations within the 1998-2002 timeframe.

Assessments of expected effectiveness and payoffs for the allocation method also differ between the regional and national levels. The variance in the timing of auctions enabled learning and competitive interdependence to develop between policymakers, thereby influencing perceptions of effectiveness. The first adopters of auctions in Europe, such as Austria in 1997 and Belgium and Germany in 1998 very likely studied the experience of countries in other regions of the world, most notably New Zealand and the US that held their first spectrum license auctions in 1990 and 1993 respectively (McMillan, 1995). There was little competitive interdependence at that time. However, in 2000 the UK, Germany and Italy raised very high sums in their 3G auctions. These large sums brought increased attention to auctions as an allocation method, and it stands to reason that European governments started examining the experience of their neighbors more closely.

These auctions also caused the emergence of competitive pressures between countries to adopt auctions. Countries that had not yet allocated their 3G licenses were likely interested in emulating the fundraising success of the UK, German and Italian auctions, giving rise to competition for operators' resources. Thus, competitive interdependence likely gained power and may have influenced assessments of auctions' effectiveness: although all EU countries were governed by the same rules with respect to allocation timing and technology, they had a choice with respect to the method of allocation.

In the course of the next three years, though, it became evident that the high sums raised in the UK, Germany and Italy were an exception rather than the rule. Mobile operators pursuing a pan-European strategy, drained of resources and faced with the necessity to roll out networks for which they had bought licenses, could not afford to spend comparable amounts in later auctions. Consequently, and perhaps also due to changes in market expectations brought about the ''bursting of the dot com bubble,'' the late adopters of auctions raised significantly ($p < 0.05$) lower amounts than their early adoption counterparts.

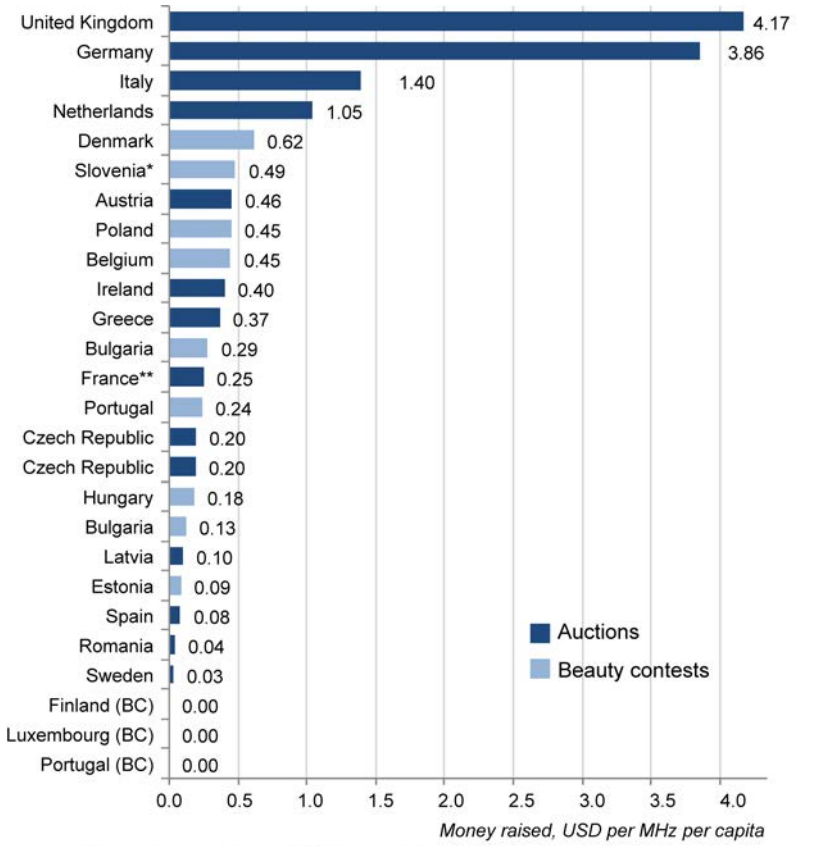
These developments likely reduced the intensity of competitive interdependence around 2002-2003. The incentive of competitive pressures to introduce auctions diminished as the amount of money raised in auctions (beyond the top four countries) became comparable to that raised in beauty contests (see Figure 4). This was in addition to changes in market expectations in general and in the varying market sizes of countries, and consequently their attractiveness to operators.

Thus, learning and competitive interdependence very likely played a role in the diffusion of spectrum license allocation policies. However, what is the reason for the continuing use of beauty contests? Further, given the significant decline in revenues from auctions, why did countries continue to adopt auction policies?

To answer these questions we turn to the role of the state in the economy. Preliminary evidence suggests that countries with high levels of state involvement are more likely to choose beauty contests (see Figure 5), possibly because the payoffs to switching to more market-oriented policies is lower than in other countries. For example, Carlberg (2001) finds that France's decision to license its 3G spectrum using a beauty contest was influenced by its history of the dirigiste model, through which the central government directs the country's economy. The model values bureaucratic oversight and management and in many cases rejects the exclusive reliance on market forces.

An examination of the value of state-owned enterprises as proportion of GDP, a proxy for state involvement, suggests such a relationship may indeed exist. Figure 5 displays the distribution of asset values of state-owned enterprises in countries for which OECD data are available. It shows that four of the five countries with the highest proportion of state-owned enterprises have not held auctions. Although the difference between auction adopters and non-adopters is not statistically significant, this might be due to the small number of countries for which data are available. Thus, a relationship between the role of the state in the economy and use of beauty contests may exist but requires further analysis.

Figure 4 Final price of UMTS licenses at allocations in Europe, USD per MHz per capita



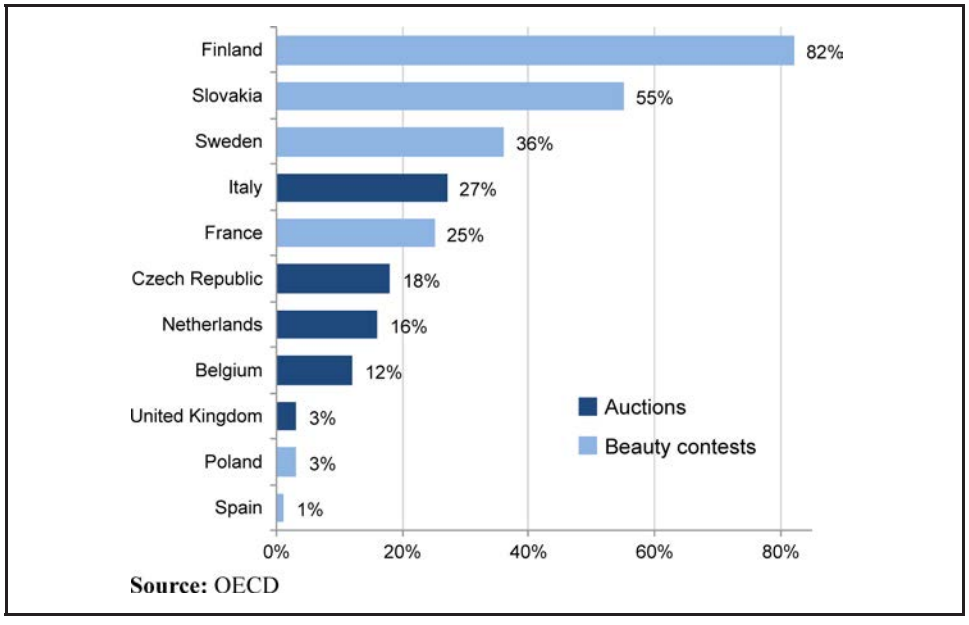
Notes: *Slovenian auction of 2001 was able to attract only one company, Mobitel, and was cancelled. Starting price is shown. Mobitel bought a license several months later; **France had two beauty contests, which are shown combined

A second way in which payoff assessments may have influenced policy choices is through symbolic imitation. As Braun and Gilardi (2006) argue, sometimes by adopting a particular policy countries show ''they are acting in a proper and adequate manner,'' in other words, strive for legitimacy. Wilks and Bartle (2002) illustrate this point by analyzing the creation of independent competition agencies in Europe, highlighting the ''symbolic component'' of creation of these agencies.

This may explain the spread of auction policies, at least in some countries of the EU. As Figure 3 shows, all early adopters of auctions (those that held their first auctions before or in 2000) are old EU members. Most of the late adopters, on the other hand, are new members that joined in 2004 or 2007: Czech Republic, Slovenia, Estonia, Latvia, Romania and Bulgaria. After the fall of communism in Eastern Europe, these countries had undergone a transition from planned to market economies. Although a market economy is a formal precondition of joining the EU as laid out in the Copenhagen membership criteria (European Commission, 2011), some of the new members might have opted for an auction as a more transparent procedure (Cartelier, 2003) to attract additional interest from investors even in spite of quite dim prospects of raising substantial sums from it. Additionally, these countries might have shown that they are indeed acting to achieve the goal of entering the EU: the first auctions in all these countries were held before the EU accession date.

To examine this assertion, we analyzed differences in scores on two dimensions of the Global Competitiveness Index (World Economic Forum, 2005) between early, late adopters and non-adopters of auctions. The selected dimensions were market efficiency and

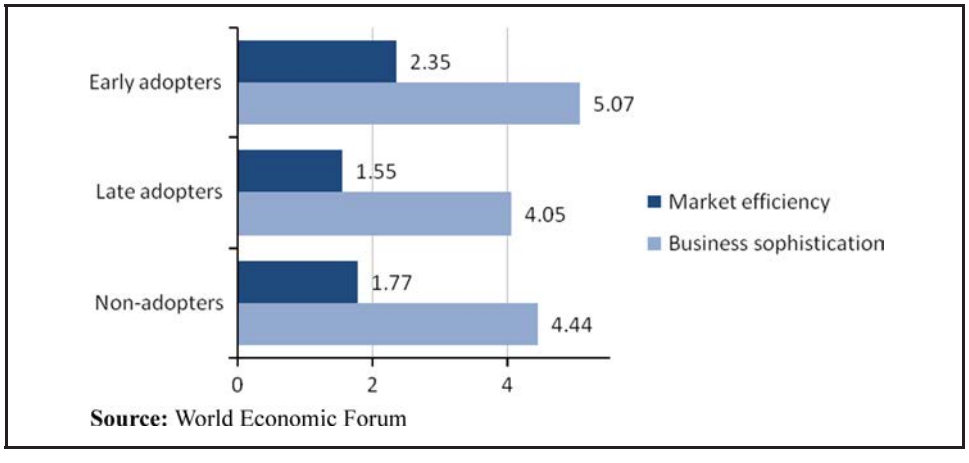
Figure 5 Asset value of state-owned enterprises as proportion of GDP in selected countries in 2003



business sophistication (see Figure 6). The former measures market orientation of the economy and includes productiveness of allocation of goods, labor and finance in the economy, while the latter shows the quality of a country's business elites management and is measured as capabilities of business leaders.

Statistically significant differences were found in scores of early and late adopters, as well as early adopters and non-adopters on both market efficiency ($p < 0.01$) and business sophistication ($p < 0.05$). Early adopters have better mean values on these two dimensions. A possible explanation for their higher scores is that the market method provided by auctions is consistent with the high level of sophistication of their markets and businesses. The countries with lower levels of market efficiency and business sophistication might have chosen auctions because of the need for legitimacy. Non-adopters, because of their relatively high scores, could afford not to conduct auctions to increase their legitimacy, and might have chosen to continue conducting beauty contests.

Figure 6 Mean index scores for market efficiency and business sophistication for adopter categories



4.3 Summary

At the regional level it was found that learning, interdependence and common norms likely played a role in the choice of regional spectrum licensing policy. At the national level, similar to the regional level, learning and competitive interdependence were at play, but instead of common norms, symbolic imitation was more likely to influence diffusion. Learning and competitive interdependence likely influenced effectiveness, whereas payoffs might have been influenced by the role of the state in the economy and symbolic imitation.

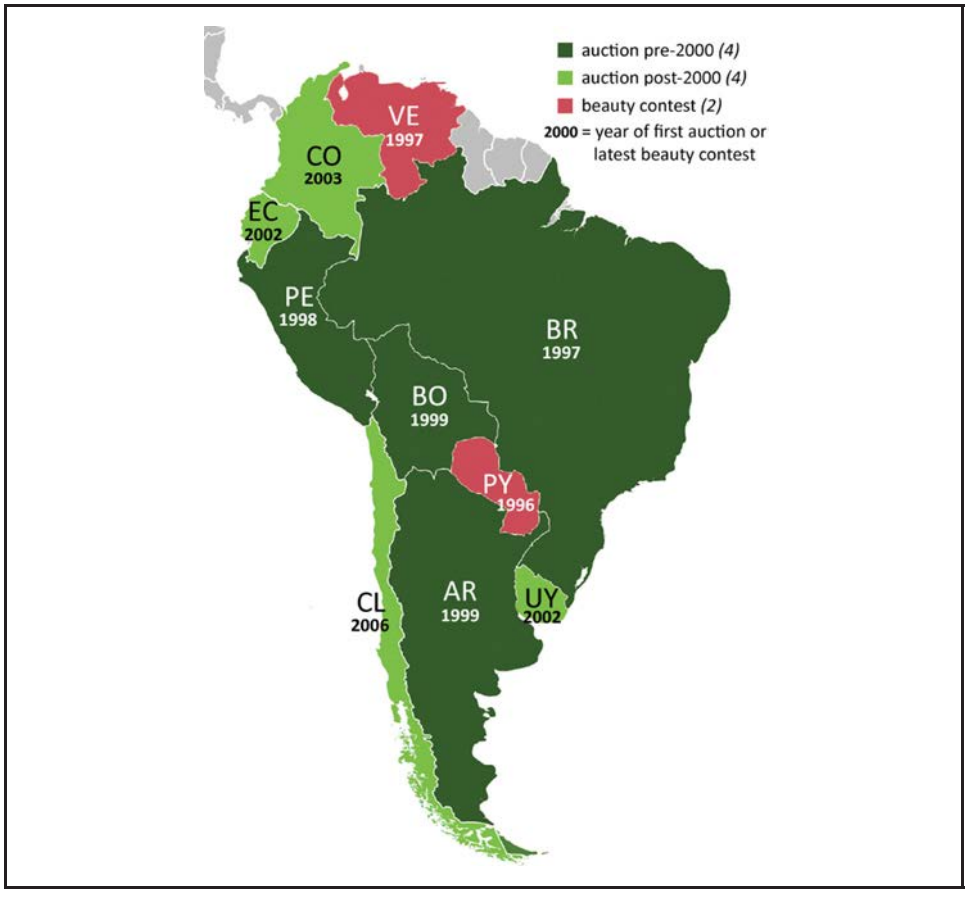
5. South America case study

Unlike the EU, where the policy base is much more coherent across its members, countries in Mercosur and the Andean Community, the two regional blocs in South America, have seen less top-down integration. Thus this case, similar to the approach of Levi-Faur (2004) who performed a cross-regional analysis of telecommunications policies between the EU and South America, enables a more substantive test of the expected utility model. The South American case is also beneficial because it addresses the gap in the literature of coverage of South American spectrum license allocation policies.

5.1 Regional level

Regional blocs in South America took a more *laissez-faire* approach to the method and timing of spectrum license allocation than the EU. Of the ten countries, eight had auctions and two had beauty contests (see Figure 7). Unlike in the EU, the regional blocs in South America (Mercosur and Andean Community) did not impose deadlines on adoption of 2G or 3G technologies among their member countries. Nor did the regional blocs mandate a

Figure 7 Types and dates of license allocation events in South America



particular technology or allocation method. Since there was no regional policy, effectiveness and payoffs at the regional level were not established. The lack of formal regional-level harmonization of telecommunications policy is not unexpected. Mercosur, for example, has been experiencing difficulties in policy coordination even in its core areas of economic coordination (Levi-Faur, 2004) and harmonization of monetary policies (Carranza, 2003).

5.2 National level

As of 2007, eight of the ten countries had held their first auction license allocations. Similar to the EU, South American countries that held auctions relatively early (i.e. in 1997-1998) might have been learning from the New Zealand (1990) and US (1993) auctions (Seselovsky, 1998). As auction policies were adopted by more South American countries, intra-continent learning, parallel to the EU case, might have taken place.

The choice of 3G technology by individual countries has been less consistent than in the EU. Typically, the use of a particular technology in the country depends both on frequency bands being allocated and on mobile operator's choice. Some technologies have traditionally used particular frequencies, e.g. 450, 800 and 1900 MHz bands are often used for CDMA2000 (McMillan, 1995). The resulting 3G technology use has not been consistent, with some countries and operators first adopting UMTS while other opting for the competing CDMA2000. In some countries, such as Brazil, operators have been rolling out 3G technology although no bands have been allocated specifically for 3G (operators are using their 2G bandwidth instead). Furthermore, unlike in the EU, technology choice was not imposed on countries by regional bodies. However, the pattern of technology use in South American countries appears harmonized (see Table I): most countries use GSM 850/1900 and CDMA2000 as the 2G and 3G technology of choice, respectively, with UMTS introduced in 2007-2008.

With respect to 2G, most countries have been using GSM in the 850 or 1900 bands, or both, with the exception of Brazil and Venezuela. In the EU, by comparison, bands used for GSM are 900 and 1800 (compatibility between the two groups of GSM bands is possible, but not many devices supported it until mid-2000s). Such choice reflects a *de facto* harmonization of technology not only across South America, but across the American continent as a whole (the US and Canada have also predominantly used GSM 850 and 1900 bands). An additional benefit is that CDMA2000 can be deployed over the 1900 MHz spectrum band, which in South America was often allocated to GSM. This allowed some South American carriers to upgrade their networks without new spectrum.

Thus the diffusion of the technology choice at the national level, even though not formally imposed by regional bodies, was caused by mechanisms that allowed achievement of a common goal without mandating it. Cooperative interdependence and common norms likely influenced the diffusion of technology. Development of common norms might have been facilitated by discussions among regulators within South America (for example, at Regulatel,

Table I 2G and 3G technologies used in South American countries as of 2008

Country	*2G technology*	*3G technology*
Argentina	GSM 850/1900	UMTS and CDMA2000
Bolivia	GSM 850/1900	UMTS**
Brazil	GSM 900/1800 and GSM 850 (Vivo only)	UMTS*, CDMA2000 and CDMA2000 1xEV-DO
Chile	GSM 1900	UMTS and CDMA2000
Colombia	GSM 850/1900	UMTS** and CDMA2000
Ecuador	GSM 850	UMTS** and CDMA2000 1xEV-DO
Paraguay	GSM 850/1900	UMTS*
Peru	GSM 850/1900	UMTS**, CDMA2000 and CDMA2000 1xEV-DO
Uruguay	GSM 1800 and GSM 850/1900	UMTS*
Venezuela	GSM 900 and GSM 850 (planned)	UMTS**, CDMA2000 and CDMA2000 1xEV-DO

Notes: Service started in: *2007, **2008; Unmarked 3G service started before 2007
Sources: gsmworld.com; umtsworld.com; cdg.org; umts-forum.org; Informa Telecoms and Media; WCIS; 3G Americas)

a Central and South American regulatory forum) and at the pan-American level (e.g. at CITEL, which includes all countries of the Americas), as well as by the ''technological path'' that allowed 3G technology to be rolled out using 2G spectrum.

The third component of licensing policies is the method of allocation. Figure 7 shows that eight out of ten countries in South America have used auctions.

While South American countries show significant diversity amongst themselves, when compared with the EU they are more similar in terms of GDP per capita and transparency (see Table II). Not only are they more similar among each other, they are also on average more poor and less transparent than EU countries. Thus it can be expected that attaining legitimacy in the international arena and showing that they act ''in a proper and adequate manner'' (Meyer and Rowan, 1977) may rank high on the agenda of most South American policymakers. Holding auctions instead of beauty contests, which are generally perceived as less transparent, can signal a commitment to market values to the international community and investors. Therefore, symbolic imitation was likely an important factor in the diffusion of auctions. Additionally, the first auction in South America was held in Brazil in 1997, and the government raised over $8 billion as a result. Few subsequent auctions in the region have earned more than $100 m. Another Brazilian auction held in 2002 raised $99.8 m, while auctions in Peru, Colombia, Ecuador and Chile had reserve or final prices of $20 m to $60 m in 2000-2006. This resembles the EU case, where the first auctions were very lucrative, but subsequent ones raised substantially smaller sums. Therefore, it can be expected that after the first auctions, expectations for raising funds through auctions were greatly reduced, and at least in some cases countries opted for auctions out of the strive for legitimacy rather than seeking to raise money.

Further, after the financial and economic crisis of the late 1990s public attitudes toward market-based economies in South America dramatically worsened, giving way to a preference for a larger role of the state (Piragibe, 2001, p. 158). Of the two countries using beauty contests (Paraguay and Venezuela), Venezuela particularly is known for the considerable degree of state involvement of the economy. In general, South American countries have been left-leaning both before and after the crisis. However, many of them are ''modern, reformist and internationalist'' (Franko, 2007), and our data indicate that many countries in the region continued to use auctions into 2000s. This can be explained by the need to attract investment into mobile infrastructure, which is usually prohibitively costly for the government and requires private investments. Thus auctions were used primarily because of their effectiveness as a policy, rather than because of their payoffs for policymakers. This is in line with the above mentioned preference for the role of state in the economy.

Because of the relative coherence in the level of development across South American countries, symbolic imitation might have led to development of common norms across the continent. Indeed, if auctions were perceived as a way of attaining additional legitimacy, a consensus across the continent might have emerged regarding the usefulness of this method. As part of a broader trend in the adoption of market-oriented policies one might expect to see an improvement in transparency following an auction. And while the direct benefits in terms of perceived transparency that auctions might provide are nearly impossible to measure, all seven South American countries for which the Transparency International's Corruption Perceptions Index data are available maintained or increased their

Table II Minimum and maximum GDP per capita (USD) and corruption perceptions index in the EU and South America and corresponding means and standard deviations in 2006

Region	*Minimum*	*Maximum*	*Mean*	*Standard deviation*
EU, GDP per capita	4,120	89,923	28,502	19,807
South America, GDP per capita	1,197	8,921	4,559	2,446
EU, transparency	3.1	9.6	6.65	1.96
South America, transparency	2.3	7.3	3.86	1.77

Sources: GDP per capita, International Monetary Fund; corruption perceptions index, Transparency International)

scores in their the year following their first auction. The proposition that symbolic imitation has transformed into a common norm is further supported by the fact that Chile, the most advanced country of the region, joined in and held its first auction in 2006.

Common norms might have emerged not only as a result of symbolic imitation, but also because of learning. The broad timeframe over which auctions were adopted suggests as countries progressively saw the positive externalities (such as increased transparency and legitimacy), this method of allocation was adopted.

5.3 Summary

The diffusion of the three components of license allocation policies in South America can likely be attributed to the following policy diffusion mechanisms. Timing was probably only influenced by learning; with respect to technology choice cooperative interdependence and common norms likely played an important role; and learning, common norms and symbolic imitation were important mechanisms in diffusion of the method of allocation.

The South American case suggests the absence of regional governance may not significantly affect the outcome of telecommunications policies. Further, the case demonstrates that despite a lack of formal harmonization instruments, South America is at least partially harmonized on timing, technologies and allocation method, with auctions being adopted by 80 percent of South American countries as compared with only 56 percent in the EU. The following section compares these two cases.

6. Analysis and discussion

The case studies presented above provide the basis for both an inter-regional comparison and analysis of the potential explanatory power of the Braun and Gilardi's expected utility model for the telecommunications domain. Each is discussed in turn in the following sections.

6.1 Cross-case comparison

As depicted in Table III, the potential influence of those variables associated with effectiveness differed both by policy component (time, technology and allocation method) and by region. For example, whereas timing in South America was arguably influenced by learning alone, in Europe interdependence and common norms were important factors as well. Differences across the regions were also found in the technology choice. In South America interdependence and common norms were the likely influences, whereas in the EU, in addition to these, learning from previous coordinated adoption of GSM is proposed to be a factor as well. Regional differences were also suggested with respect to the allocation method, with learning and common norms at work in South America and learning and interdependence playing a role in Europe.

Table III Possible importance of policy diffusion mechanisms in three components of spectrum license policy (timing, technology and allocation method) in the EU and South America

	European Union						*South America*					
	Regional			*National*			*Regional*			*National*		
	Timing	*Techn.*	*Method*	*Timing*	*Techn.*	*Method*	*Timing*	*Techn.*	*Method*	*Timing*	*Techn.*	*Method*
Effectiveness												
Learning	✓	✓	–	–	–	✓	–	–	–	✓	–	✓
Interdependence	✓	✓	–	–	–	✓	–	–	–	–	✓	–
Common norms	✓	✓	–	–	–	–	–	–	–	–	✓	–
Taken-for-grantedness	–	–	–	–	–	–	–	–	–	–	–	–
Payoffs												
Coercion	–	–	–	✓	✓	–	–	–	–	–	–	–
Symbolic imitation	–	–	–	–	–	✓	–	–	–	–	–	✓

Notes: ✓ mechanism is likely important; – likely unimportant

In terms of payoffs, this research suggests that coercion by the regional government in the EU (but not in South America) was an important factor for timing and technology at the national level. Allocation method in both regions was potentially influenced by symbolic imitation. This last finding was relevant in the less developed countries of both the EU and South America, and it suggests that the variables influencing policy diffusion are related to the level of economic development. The argument that countries with low levels of market development choose auctions to bolster their credibility is further supported by two findings. First, the South American countries' scores on the World Competitiveness Report measures of market efficiency and business sophistication are roughly the same as those of the late adopters in Europe. Second, these competitiveness measures of auction adopters improved after the first auction. The average market efficiency over five years after the first auction increased compared with the score in the year of the first auction, and that difference was statistically significant at 0.5 level. The score on business sophistication also increased, but that difference was not statistically significant.

6.2 Analysis of the expected utility model

The expected utility model, with its specifications of different mechanisms related to effectiveness and payoffs, serves as a useful tool for analyzing telecommunications policy diffusion. Its application allows for simultaneous consideration of a variety of diffusion mechanisms and, by including payoffs, suggests a range of factors not typically included in telecommunication policy diffusion studies. However, as recognized at the outset, the model consists largely of difficult-to-quantify variables, thereby generating somewhat prospective results. However, these results can inform future studies, eliminating unnecessary variables and providing a more efficient analytic framework.

As an example, our analysis of spectrum license allocation policy diffusion suggests mechanisms of learning, interdependence and common norms primarily influence effectiveness, while coercion and symbolic imitation largely affect payoffs. Taken-for-grantedness appears to have had little effect. Further, regional level diffusion was likely driven primarily by policy effectiveness, while at the national level both effectiveness and payoffs appear to matter.

The model is also useful in that allows for disaggregation of policy components, enabling researchers to avoid analyses in which diffusion is considered a binary state (adopt/not adopt). Our analysis provided such a disaggregation, viewing the timing, technical and licensing method components. Similarly, the model allowed for inclusion of both regional and national levels.

Consideration of multi-level governance is beneficial, given the likely power and resource differentials between the levels, particularly in highly integrated regions. It also answers calls for simultaneous consideration of national and international factors in policy diffusion (Braun and Gilardi, 2006; Marsh and Sharman, 2009). Additionally, in the case of spectrum license allocation policies, interdependence in both the political and technical spheres likely influenced diffusion. The need for cross-border technical compatibility that facilitates roaming is an important source of revenues for the industry, as well as consumer satisfaction, and likely influenced regional and national decision making.

Given its breadth and flexibility, the model naturally requires care in its implementation. Accordingly, we found several factors that should be taken into account First, in comparative analyses of public versus regulatory policymaking diffusion, it is likely payoffs will be less significant in the latter as regulators are typically less accountable to voters than their parliamentary counterparts. Similarly, in assessing the role of regional versus national influences, it is necessary to understand how regional policymakers come to their positions (e.g. assigned by national governments or through elections).

Second, future studies may find it useful to expand the taken-for-granted diffusion mechanism to include the embedded technological base, a factor that is not frequently considered in political science diffusion studies. For example, in South America the embedded base of GSM 850/1900 might have influenced the choice of CDMA2000 as the

next-generation platform, since it can be deployed at the same frequency bands. Hence, certain policy domains may require greater attention to particular mechanisms that might otherwise be difficult to assess.

Third, the analysis should establish the relation of the policy to broader political and economic factors. Our analysis suggests that telecommunications policy reflects and potentially supports a broader agenda: in some cases adoption of auctions appears to have been influenced by the desire to build credentials as a market-oriented government. Establishing credentials with the adoption of auction policies is part of what Grabel refers to as ''policy credibility'' (Grabel, 2000; van Gorp and Maitland, 2007). Policy credibility, through which states seek to obtain credibility either from other states or a limited group of stakeholders, privileges free-market economic policies (collectively labeled as the Washington Consensus), which are often adopted without due consideration of the specific social and political environment. This point highlights a significant source of value of the model – that it is not only the rational, legal and economic-based reasoning influencing policy diffusion, but that political factors influencing pay-offs play a role as well.

Overall, the Braun and Gilardi model presents several advantages for the research of policy diffusion, including research in specific domains such as telecommunications. Building on that model, this paper showed the differing impact of diffusion mechanisms on a policy's effectiveness and payoffs. It also showed that the model is applicable to the regional level.

7. Conclusion

Telecommunications policymaking is taking place in an increasingly complex international environment, being driven by both international and dynamic forces. As an example, this paper examines international diffusion of spectrum license allocation policies, disaggregating the policies into three components (timing, technology and allocation method), and providing comparative analyses in two regions, the EU and South America.

The case studies were informed by the policy diffusion framework of Braun and Gilardi (2006). Applying this framework enabled a systematic analysis of early and late adopters and non-adopters of auctions. It also suggests reasons why some developed countries have been using beauty contests, in spite of auctions' advantages in terms of efficiency, transparency and in some cases a higher fundraising potential. This might be caused by both internal factors, such as a high level of involvement of the government in the economy, and external pressures such as the need to enhance legitimacy in the international arena.

These results were achieved through application and testing of Braun and Gilardi's (2006) policy diffusion model, which proposes that policy effectiveness and payoffs influence the expected utility of policymakers in the decision making process. Mechanisms that were at play at the regional level exclusively influenced effectiveness, while many of those at the national level also influenced payoffs. In areas where diffusion occurred both at the regional and the national levels, it is likely that diffusion mechanisms at the national level only influenced payoffs.

Both academics and policymakers may find these results useful. Of academic interest is that the expected utility model was applied in the telecommunications domain for the first time. The study showed the relevance of this framework to studies of diffusion of spectrum license allocation policies. Additionally, while some academic studies of spectrum license allocation policies focus on optimal auction design and innovative licensing methods, a bridge between theoretical findings and practical policymaking is sometimes missing. This research demonstrated the necessity to situate studies of the diffusion of spectrum license allocation policies within broader social, economic and political trends.

In practical terms, the results suggest that similarities between markets should be taken into account in policymaking. Efforts in policy harmonization should take into consideration the ability of market mechanisms to deliver what can be labeled *de facto* harmonization. In other words, the outcomes that harmonization aims to achieve can occur even in the absence of the appropriate regulatory framework, driven primarily by market forces.

Certainly, this research is not without shortcomings. It explores only two geographic regions and one type of policy. Further research is needed to understand whether policies in other telecommunications domains (e.g. fixed or Wi-Fi policies), as well as other areas, such as water and electricity, exhibit similar diffusion characteristics. This research provides a basis on which such comparisons can be made.

Note

1. The mathematical representation of these relationships is consistent with that proposed by Braun and Gilardi (2006) and is meant to provide only a concise summation of relationships that are complex and potentially difficult to observe and/or quantify. Similar use of mathematical notation independent of quantitative analyses is found in New Institutional Economics (see for examples Williamson, 1996; Joskow, 2005).

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