discussion papers

FS IV 01 – 03

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January 2001

ISSN Nr. 0722 - 6748

Forschungsschwerpunkt Marktprozeß und Unternehmensentwicklung

Research Area Market Processes and Corporate Development

Zitierweise/Citation:

Tomaso Duso, **Lobbying and Regulation in a Political Economy: Evidence from the US Cellular Industry,** Discussion Paper FS IV 01-03, Wissenschaftszentrum Berlin, 2001.

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ABSTRACT

Lobbying and Regulation in a Political Economy: Evidence from the US Cellular Industry

by Tomaso Duso*

This paper develops a political-economy model of price regulation. Firms' lobbying activity for a given regulatory status might generate a simultaneity problem between the effects and the determinants of regulatory decisions. We explicitly model this two way causality, and empirically test our model in the U.S. mobile telecommunications industry. We find support for our approach: Regulatory choice should be considered endogenous. Accounting for the simultaneity bias, we show that regulation, whenever it actually took place, did not reduce significantly cellular tariffs. However, it would have been more effective if applied in those markets which have not been regulated. To explain this finding, we show that firms' lobbying activity on regulatory choice has been successful, so that firms were able to avoid regulation in those markets where it would have been more effective. From the political economy side, we provide evidence that the probability of price regulation was higher, ceteris paribus, when the regulator was elected by politicians, when the state's governor came from the Republican Party, when the government was politically stable, and when the regulation's opportunity costs were low.

Keywords: *Price Regulation, Political Economy, Lobbying Activity, Simultaneity Bias, Endogenous Switching Regression, Mobile Telecommunications, U.S.*

JEL classification: C34, C35, D43, D78, L43, L5, L96.

* I have benefitted from challenging and in-depth discussions with Lars-Hendrik Röller. I also thank David Genesove, Paul Heidhues, Peter Reiss, Ralph Siebert, Frank Verboven, Ingo Vogelsang and seminar participants at the Humboldt University Berlin, at the WZB, at the YEC 2000, at the 2nd CEPR Conference in Applied IO, at the EEA and EARIE Conferences 2000, and at the 9th WZB-CEPR conference on IO for their useful comments. Remaining errors are my sole responsibility.

ZUSAMMENFASSUNG

Lobbying und Regulierung in einer politischen Ökonomie: Evidenz aus der US-amerikanischen Mobilfunk-Industrie

In diesem Beitrag wird ein polit-ökonomisches Modell der Preisregulierung entwickelt. Es wird explizit berücksichtigt, daß die Unternehmen die Regulierungsentscheidung der Aufsichtsbehörde beeinflussen können, um ihre Interessen zu vertreten, und deswegen kann ein Simultaneitätsproblem zwischen den Determinanten und den Wirkungen der Regulierungsentscheidung entstehen. Anhand von US-amerikanischen Daten für die Mobilfunk-Industrie (1984-1988) kann die Hypothese, daß die Regulierungsentscheidung endogen durch das Verhalten der Unternehmen am Markt mitbestimmt wird, nicht verworfen werden. Bei Berücksichtigung dieser Simultaneität kann gezeigt werden, daß die Regulierung die Mobilfunktarife nicht stark gesenkt hat, wo sie angewandt wurde. Jedoch zeigt das ökonometrische Modell, daß die Regulierung gerade in solchen Märkten effektiver gewesen wäre, die tatsächlich nicht reguliert wurden. Dieses Phänomen läßt sich durch die Theorie des Lobbying erklären. Bewirkt Regulierung große Preissenkungen, so haben die Unternehmen einen großen Anreiz durch Lobbying eine Regulierung der Mobilfunktarife abzuwehren, mit der Wirkung, daß seltener reguliert wird. Sind die Wirkungen der Regulierung hingegen gering, so sind auch die Lobbying-Anreize klein und Regulierung wird häufiger beobachtet. Außerdem zeigt sich, daß die Regulierungswahrscheinlichkeit eines Marktes – *ceteris paribus* - stieg, wenn die Regulierungsbehörde von Bürgern gewählt wurde, wenn der Gouverneur des Bundesstaats der republikanischen Partei angehörte, wenn die Regierung politisch stabil war und wenn die Opportunitätskosten der Regulierung gering waren.

"There have been wide differences between commissions and in their legislative mandates, and changes over time in the political environment in which they operate (...), however these commissions become increasingly solicitous and protective of the interests of the companies they are supposed to regulate, resistant to change, wedded to the status quo" Kahn [1988] p. 11 vol. 2.

1 Introduction

Over the last decades, economic regulation has attracted great attention among economists and policymakers, becoming one of the main issues on the political agenda. From a positive perspective, much theoretical analysis on the political economy side has been done since the seminal contribution by Stigler [1971], and following the tradition initiated by the so called "Chicago School" (Pelzman [1976], Posner [1974], Becker [1983]). This tradition assumes that the political process and the competition among differently organized interest groups drive regulatory decisions. In particular, as Stigler suggested, regulated industries (firms) might be willing to collaborate in their own regulation, in order to create or to protect their private interests.

From the empirical point of view, though, there has been little attempt to analyze these questions in such a broad framework. The large body of existing empirical literature has focused on the effects of regulation on market outcome, putting less weight on the process which determines the observed regulatory regime. However, if firms can influence the regulatory regime under which they operate, a two way causality between the effects and the determinants of regulatory decisions has to be accounted for. Studies which neglected this simultaneity can be seriously biased in their empirical findings.

This paper develops a political economy model of regulation as a first attempt to empirically study this set of questions. We shall present a re-

duced form simultaneous model for …rms pricing behavior and price regulatory choice, which encompasses economic as well as political factors to explain the role of economic regulation. The main point we will make is methodological: the endogeneity of regulatory choice, motivated by political economy reasons, has to be explicitly considered to empirically model the impact of regulation on prices. Moreover, taking this consideration into account, we want to determine the (unbiased) impact of price regulation on cellular tari¤s using U.S. data for the second half of the 1980's. Finally, we are also interested in identifying the main determinants of regulatory choice, considering variables such as the …rms' lobbying activity, consumer protection, as well as other political factors.

Because of its particular structure, the U.S. cellular telephone industry provides a unique environment to analyze the issues mentioned above. The Federal Communication Commission (FCC) divided the U.S. territory in precisely de…ned geographical markets and regulated entry allowing only two cellular operators in each area. On the other side, the jurisdiction over price regulation was left to the individual States, because of the service's local nature. Price regulatory decisions have been widely heterogenous across the di¤erent States, providing an exceptional "natural experiment" for a study on the role of regulation on prices as well as on the determinants of regulatory choice.

There are some other contributions that have empirically analyzed the impact of regulation on the price level in the U.S. cellular industry. They generally tested whether exogenous regulatory variables have a signi…cant impact on prices using a reduced form approach.[1] The results they obtained

[1]Similar analyses, which took the same kind of approach, were performed for the wireline telecommunications industry as well. See among others Mathios and Rogers [1989], Kaestner and Kahn [1989], Tardi¤ and Taylor [1993], and also Kriedel, Sappington and Weisman [1996] for a survey.

are contradictory. Ruiz [1995] found that the regulatory variables did not signi…cantly explain prices, and concluded that the analysis did not allow any policy suggestions. Shew [1994] and Hausman [1995] observed that the regulatory variables were signi…cant and that the sign of the coe¢cient was positive. This …nding suggests that prices rise with regulation.[2] The main explanation has been that regulation led to higher prices because it facilitated collusion. The regulatory body, in fact, could have acted as a cartel board which made …rms' pricing strategies common knowledge (Porter [1983a, 1983b]). This information dispersion could have made it easier for …rms to recognize if someone had chiseled, making collusion easier to sustain. Another analysis of the e¤ects of regulation in the U.S. cellular industry is Parker and Röller [1997]. They speci…ed a structural model to estimate whether the duopolistic industry structure led to a competitive outcome. The main …ndings are that the U.S. cellular industry's conduct was anticompetitive and that multimarket contact, cross-ownership, and regulation played a role in explaining this result.

All the previous empirical studies may be subject to a signi…cant misspeci…cation problem (Mathios and Rogers [1989], Teske [1991a, 1991b], and Baron [1995]). If regulated …rms have some control over the regulatory regime under which they operate, then treating regulatory variables as exogenous introduces selection bias (Heckman [1976, 1979]). It is therefore necessary to endogenize regulatory choice, which is one of the contributions of this paper.

There exists some empirical literature dealing with the endogeneity of regulatory decisions. The typical approach is to explain the discrete choice

[2] In fact, Hausman [1995] pointed out that "A possible objection that higher prices may lead to regulation, thus causing the regulation variable to be jointly endogenous, does not make economic sense in the cellular context. [...] Nevertheless, I estimated the model using instrumental variables". The endogeneity of regulation is, in his view, not determined by political economy reason like we think. The results are una¤ected by the used estimation methodology.

among di¤erent regulatory plans using political and economic variables.[3] The regulatory policy in the wireline U.S. telecommunications industry has been empirically analyzed, …rst in a static and then in a dynamic setting, by Donald and Sappington [1995, 1997]. They found evidence that both the political as well as the regulatory history were important determinants of the chosen regulatory regime. Teske [1991a, 1991b] used a rent-seeking approach to address more clearly the issue about …rms speci…c "political strategies" to achieve the desired regulatory environment in the wireline U.S. telecommunications market. In particular he showed that U.S. West, one of the "Baby Bells," seemed to have adopted the strategy of avoiding regulators, and aggressively in‡uenced legislators in order to achieve the desired deregulation of the (wired-line telecommunications) markets in which it operated. Yet, all these studies, except partially the last one, neglected the importance of …rms' strategic behavior in in‡uencing the regulatory game.

Empirically, our paper bridges between these two di¤erent approaches, accounting for the simultaneity between …rms' pricing behavior and regulatory decisions. This is not merely a question of enhancing the analysis' complexity, but rather it is an important qualitative step into the empirical modelling of the political economy of regulation. The econometric tool that is appropriate to achieve this goal is an endogenous switching regression model (Maddala and Nelson [1975], Lee [1978, 1979]), which is a simultaneous equations model with a binary qualitative variable (regulatory status) and limited dependent variables (regulated and non-regulated tari¤s).

The paper proceeds as follows. In Section 2 we give a description of the market analyzing some preliminary statistics. In Section 3 we derive

[3] For another modeling approach see the paper by Kroszner and Strahn [1999] on the economics and politics of banking deregulation. They contrasts private interest theory vs. public interest theory of regulation and empirically test them on the relaxation of bank branching restrictions in the U.S. since the 1970's.

a theoretical framework that will be our starting point for the empirical analysis. Section 4 deals with the empirical specification and the econometric analysis. We present our main results in Section 5 and close the paper in Section 6 with some concluding remarks.

2 A Description of the Market and of the Data

The regulatory environment in the U.S. cellular market is quite unique. The first regulatory decision, in the late 1970's, was to split entry and price regulations. Regulatory jurisdiction was assigned to different agencies: the Federal Government (Federal Communication Commission) kept the right to regulate entry through its authority to assign radio spectrum to cellular services providers. Despite the fact that the magnitude of economies of scale could have been substantial, the final decision of the commission in 1981 was to allow entry of two cellular service providers in each area.[4] The first ("wireline") license was typically awarded to a regional Bell operating company (the RBOC), which was operating in the same area, and the second ("non-wireline" license) was assigned mainly to independent companies.[5] Reselling

[4] The FCC divided the country into nonoverlapping markets corresponding to the 306 Standard Metropolitan and 428 Rural Statistical Areas (SMSAs and SRSAs respectively). In this paper we will concentrate only on the former which are represented in Figure 1.

[5] This decision was controversial. FCC's main concern was that of the natural monopoly nature of the industry (this view was also sustained by AT&T), which would suggest to allow only one firm operating in the market. A different approach was proposed by the Antitrust division of the Department of Justice (DOJ), which advocated the awarding of a higher number of licences (4 or 8). The concern was that, given the uncertainty about the magnitude of economy of scale, there was the risk of allowing too little entry. The main point of the Antitrust Division of the DOJ was that the market should determine the optimal number of firms which can operate efficiently.

of licences was allowed, the only prohibition being that the same operator may not own both licences in one area. The process of awarding licences took several years and some of the nonwireline licences were resold by …rms who won the lottery but were not really interested in operating in the cellular market. The long discussion about how the licences should be awarded and the length of time it took to allocate the licenses,[6] led to delays in the introduction of cellular services which implied high cost to the U.S. economy.[7] At the beginning of the 1990's in almost all of the SMSAs two operators were able to o¤er their services. Regarding the concern about market competitiveness where only two …rms operate, the FCC required cellular operators to o¤er service at wholesale prices also to "resellers". Furthermore, it imposed the prohibition of limiting the number of resellers in a market. As Shew [1994] pointed out, the positive e¤ect of reseller competition was limited in many markets.

Even if the entry policy of the FCC raised some doubts in relation to the e¤ective competitiveness, which could be reached in a duopoly market, and even though there were some concerns about the fact that wireline companies had some advantages given by their head-start position, more or less half of the States decided against the use of price regulation. In only a few States have cellular tari¤s been strictly regulated, whereas in others only loosely regulated, and in most States they have not been regulated at all. Some States even adopted some form of a regulatory ban, either at the legislative level or at the Public Utility Commission's (PUC) level. This can be accounted for, for instance, by a general skepticism against price regulation.

[6] Gruber and Verboven [1998], using OECD data, stress the signi…cant role that the timing of the licences played in explaining di¤usion of cellular services: States which …rst granted licences seem to have a fairly long persistent lead.

[7] The cost was estimated to be about 86 billion dollars (Rohlfs, Jackson, and Kelly [1991]). See also Hausman [1997] for an estimate of the welfare cost of delaying the introduction of new services in telecommunications.

The lack of information about costs was one major problem as well, a fact which would have made an assessment of proposed prices difficult. An alternative explanation, which will be the core of our analysis, is that many States adopted some form of regulatory ban, because of the lobbying activity of some firms, whose rent seeking strategy has been directed to avoid a regulated environment. Shew [1994] and Ruiz [1995] provide detailed information about the different regulatory regimes implemented in the individual States. We refer to these papers for a deeper analysis. In our work we will not concentrate on the different forms of regulation. In this first approach we want to test whether regulation, in any form, had some clear effect on firms pricing behavior compared to a non-regulation situation, and to investigate what determines the choice for a regulatory ban.[8]

Our data come from different sources and cover the time spanning December 1984 to July 1988.[9] The original data set contains information about service prices, input factor prices, demand variables, and industry structure variables. The sample contains information about 122 SMSAs. We then enlarged the original data set to encompass information about the political and regulatory environment using data from the Statistical Abstract of the United States, from the Book of the States, and information from the states' regulatory commissions. Table 1 presents the summary statistics for the relevant variables. The first column refers to the full sample, whereas the second and the third refer to the subsamples of non-regulated and regulated markets respectively.[10] In the Appendix we provide a short description of

[8] It is worth noting that different regulatory regimes may have different effects on pricing behavior. In this paper we will not consider this issue, even though later we will briefly discuss this point.

[9] We owe a particular thank to Lars-Hendrik Röller and Phil Parker for providing us with the main data set. A description of the sources as well as a deeper analysis of the data can be found in their paper (Parker and Röller [1997]). Most variables have yearly frequence, although some of the prices were collected more than once per year when avaiable.

[10] Non-regulated markets are those markets where a ban on price regulation was imposed

the variables.

We can observe that prices in regulated markets are, on average, slightly higher than in non-regulated markets.[11] In particular the price p_1; referring to "low usage" (monthly usage of 5 minutes), is on the average about 7% higher in regulated markets, whereas p_2 (monthly usage of 500 minutes) is around 2% and p_3 (monthly usage of 3000 minutes) 0.5% higher in regulated markets. However, given the high standard deviation, all price differences are not statistically significant. We do not have firm specific measures of cost, but we can relay on market specific data. One can not observe large differences among regulated and non-regulated markets, even though in the former most cost drivers take slightly higher values. Only ENERGY and PRIME are on the average higher in non-regulated markets. Significant differences can instead be observed with regard to the variable POP. In regulated markets population is on the average much higher (40%) than in non-regulated ones. Also CROSSOWN and MULTIMKT take significantly different values in the two subsamples. In particular both variables assume higher values in non-regulated markets; a fact which could suggest that in those markets collusive behavior was more probable.[12] ENTRY assumes slightly higher

by legislative or regulatory commission's action. The regulatory data were courtesely provided by W.B. Shew (see Shew [1994] Table 4.2). In Table 2 we describe the regulatory variable more in detail.

[11] The prices of a singular cellular operator are defined, as in Parker and Röller [1997], as the monthly bill paid for a given level of usage. Normally, cellular operators use nonlinear prices composed by a fixed fee, a usage fee for the "peak hours", and a usage fee for the "off-peak hours". Moreover, every operator offers different plans related to the intensity of usage (low, middle, or high usage). The prices reported represent the monthly bill calculated for different monthy usage times (5, 500, 3000 minutes) assuming that consumers chose the least expensive plan.

[12] Parker and Röller [1997], in fact, have shown that multimarket contact and crossownership were among the most important determinants of the industry's collusive conduct. See also Busse [2000] that, using the data by Parker and Röller, found multimarket contact to have risen prices by apporximately 7-10%.

values in regulated markets, meaning that the incumbent's lead over the second operator was shorter (LEAD).

Turning to institutional variables, we observe that, in the sample period, the state's governor was principally from the Democratic Party (DEM84 and DEM88). However, between 1984 and 1988, the Republicans gained back many states. Unexpectedly, the Democrats were more present in non-regulated (81%) than in regulated markets (66%) at the beginning of the sample period, but they lost more states in the regulated subsample (from 81% to 53%) than in the non-regulated one (from 66% to 64%). Around 58% of the States were politically stable during the sample period and did not experience a governor change. Also, in this case the differences between regulated and non-regulated markets are consistent: 72% of the States that adopted regulation did not experience a change in political majority during the sample period, while only 43% in the non-regulated markets subsample.

Finally, we have considered some variables directly related to regulators' characteristics. In general, we observe more appointed (APPOINT) than elected (ELECTED) regulators in all subsamples. However, the percentage of elected regulators is lower in regulated markets than in non-regulated ones.[13] The number of full-time employees in the State PUC in 1984 (STAFF84) was much larger in States that adopted price regulation.[14] Finally we also observe that in regulated markets, during the sample period, the size of the commission has been signi…cantly reduced (¢STAFF), whereas it has

[13] We would have expected to observe higher values for ELECT in the regulated markets subsample, under the presumption that elected regulators should be more pro-consumer (see Besley and Coate [2000]) and therefore should regulate more often. However, as stressed by Gormley [1981], consumers' movements seem to be more active in states with appointed regulators.

[14] This can be a sign that the cost of regulation was higher in States that did not regulate. In fact, in those States, the regulatory resources seem to have been more scarce and therefore the opportunity cost to regulate a new industry might have been higher.

increased in non-regulated markets. Notice, however, that the variability was much higher in the former than in the latter case.

Concluding, we do observe some institutional di¤erences among regulated and non-regulated markets, even though not strongly signi…cant, but we need an econometric analysis to clearly answer why were some markets regulated and what kind of e¤ects did regulation have.

3 A Theoretical Framework

In this Section, we will present a theoretical background on which we will base our empirical analysis, and from which we will derive some hypotheses to test. It will not be a structural but rather a reduced form model. Despite the fact that this approach lacks a rigorous micro foundation, it has the advantage of being more general and of not relying on speci…cal functional form's assumptions.[15] One should consider our approach as a …rst attempt to empirically analyze the issue, which should help in understanding the economics and politics of regulation and which could be followed by a more rigorous micro founded analysis.[16]

3.1 The Regulatory Choice

As a starting point, we assume that the regulatory agency uses a simple rule to determine whether a market should be regulated or not on the basis of

[15] Recently a micro-founded "common agency" framework based on Bernheim and Whinston [1986] has been developed to study the political determinants of governmental policies. A path-breaking theoretical application to trade policy is Grossman and Helpman [1994]. See also Goldberg and Maggi [1999] and Gawande and Bandyopadhyay [2000] for an empirical implementation.

[16] For a …rst attempt of a micro-founded model of the political economy of regulation in a multiprincipal setting see Spiller [1990]. A more recent model, based on the Bernheim's and Whinston's approach, has been developed by Trillas [2000].

the regulation's e¤ects on prices. If regulation is thought to decrease prices "enough", then it is adopted. One can think to this rule as representing a kind of optimality condition for a regulator that maximizes a sum of total welfare and of private interests. At the optimum the regulator weights marginal bene…ts of regulation to its marginal costs. We can then write a reduced form equation which constitutes the decisional criterion for the regulator:

$$R^{\alpha}_{ts} = \beta_0 + \beta_1 \left(\log \left(p^1_{ts} \right) - \log \left(p^0_{ts} \right) \right) + \beta_2 RSC_{ts} + \beta_3 PV_{ts} + \beta_4 RC_{ts} + \varepsilon_{ts}: \tag{1}$$

where $[\log (p^1_{ts}) - \log (p^0_{ts})]$ is the di¤erence between non-regulated and regulated prices, RSC is a vector of characteristics speci…c to the regulator, PV is a vector of political variables, and RC is a measure of the cost of regulation.[17] One does not observe the variable R^{α}_{ts}, which is latent, but rather a binary variable that indicates whether a market is regulated ($R_{ts} = 1$) or not ($R_{ts} = 0$). One can thus interpret equation (1) as a probit model: Market s will be regulated in time t (and thus we observe $R_{ts} = 1$) if and only if $R^{\alpha}_{ts} > 0$ and will not be regulated otherwise.

The coe¢cient β_1 plays a crucial role in our empirical analysis, since it allows us to identify the role of …rms' lobbying activity vs. consumers protection. Assuming a benevolent regulator, which cares principally of the consumer surplus (that is the welfare standard adopted in the U.S. antitrust policy), one would expect to observe a signi…cant and positive value for the coe¢cient β_1: regulation is more probable when the bene…ts that it implies

[17] One can think more formally to the problem in the following way: regulate if $\frac{p^0_{ts} - p^1_{ts}}{p^0_{ts}} > r_{ts}$: On the right hand side one has the di¤erence between non-regulated (p^0_{ts}) and regulated (p^1_{ts}) prices and, on the left hand side, a maximal price di¤erence accepted by the regulator. This level r_{ts} can be made dependent on variables which should determine regulator's willingness to regulate.

in terms of lower prices are larger.[18] On the other hand, one can also assume that the regulatory agency is not benevolent but rather self-interested, and that interest groups, as well as individual …rms, can directly in‡uence its decision through lobbying activity. High prices are in the …rms' interest. Therefore, if …rms' lobbying activity is successful, one should expect a negative coe¢cient β_1: the probability of regulation should be lower when regulation puts much downward pressure on prices since lobby intensity against a regulated environment would be higher. The price di¤erence's coe¢cient should thus measure the relative weight that the regulator assigns to …rms' lobbying and to consumers' protection. In our model we do not exactly specify what lobbying is; we assume that it is any action taken by the interest group (e.g. the …rm) to in‡uence regulator's decision.

The only measures for regulator speci…c characteristics we could use is whether the regulator was appointed by the state's governor, or directly elected. Besley and Coate [2000] gives a theoretical rationale for the importance of this issue and, in particular, they show that elected regulator should be more "pro-consumer". This would mean that, whenever regulation does not increase prices, one should observe a positive relationship between the probability of regulation and the fact of being elected rather than appointed by politicians.

We insert the political variables to account for di¤erent e¤ects. First, in many states the regulatory ban was imposed at the legislative level, therefore the governor's political orientation should account for its speci…c preferences in the regulatory policy. Second, the political orientartion of the party in power can be seen, according to Donald and Sappington [1995, 1997], as a measure of the political costs of choosing a regulated regime for the mobile industry. Third, one may want to control for political variables because the

[18] As long as the consumer surplus is included in the welfare function maximized by the regulator, the coe¢cient β_1 cannot be negative.

political environment shapes …rms' rent seeking strategy, as shown by Teske [1991].

We also control for regulation's costs as proxied by the number of full time employees in the PUC. The main idea is that large PUCs should bare a smaller opportunity cost to set up a regulatory regime in a new industry than smaller ones, for their resources are less scarce. Our expectation is thus to observe higher probability of regulation in states with larger PUCs. Finally, we also use the change in the PUC's composition as a regressor, since it should be more di¢cult to capture a regulator when the PUC's composition widely varies, because of the lack of long standing relationships.

The main problem with the presented approach is that, for each observation, we observe either the regulated price or the non-regulated one, while in (1) we need to compare both prices for each observation. In each regime we need a measure for the price which is not observed, i.e. the price that …rms would have chosen if the other regime had prevailed. Our empirical speci…cation will help us to overcome this problem.

3.2 Firms Pricing Behavior

Because prices are endogenously chosen by …rms, we also need to model …rms' pricing behavior and determine a reduced form price equation. It is a well known result in the theory of tacit collusion in supergame that the monopoly price can be part of a tacitly collusive equilibrium outcome for certain conditions on the discount factor (Porter [1983a]). The cellular price in market s at time t (p_{ts}) should be a mark up ($^1_{ts}$) over marginal costs (MC_{ts}): $p_{ts} = MC_{ts} ¢ ^1_{ts}$. Taking logs of both sides we otain a linear relation:

$$\log p_{ts} = \log MC_{ts} + \log {}^1_{ts}: \qquad (2)$$

Since we can not directly observe marginal costs and mark-up, we need to model them through an equation. We assume that the marginal cost is a

function of cost drivers (CD) and of …rms speci…c dummies ($firm_i$) which should capture the possible heterogeneity in …rms' technology:

$$\log(MC_{ts}) = \log MC(CD_{ts}; firm_{its}) \tag{3}$$

Similarly, we assume that the mark-up depends on the level of demand (Q) and on vector of market structure variables (MSV) such as multimarket contact, crossownership, the competitive pressure as generated by the second …rm entering the market, and the status of the wireline/non-wireline pair ($Pair\_j_{ts}$), which should capture the argument that some …rms' pairs achieve collusive agreements easier than others. We then have:

$$\log(\mu_{ts}) = \log \mu_{ts}(Q_{ts}; MSV_{ts}; Pair\_j_{ts}) \tag{4}$$

Since demand is endogenous we also need an equation which explains the demanded quantity:

$$Q_{ts} = Q_{ts}(p_{ts}; DD_{ts}); \tag{5}$$

where DD are demand drivers. Assuming linearity and substituting equations (3), (4), and (5) into equation (2), we obtain a reduced form price equation as follows:

$$\log p_{ts} = \gamma_0 + \gamma_1 CD_{ts} + \gamma_2 DD_{ts} + \gamma_3 MSV_{ts} + \gamma_4 firm_{its} + \gamma_5 Pair\_j_{ts} + u_{ts}; \tag{6}$$

where u_{ts} is an error term. We also expect that regulation might have an impact on …rms' pricing behavior, since di¤erent regulatory regimes should provide cellular operators with di¤erent incentives. To account for the fact

that the independent variables should have a di¤erent impact on prices, depending on which regime prevails, we specify one reduced form price equation for each regime and allow coe¢cients to di¤er in the two regimes. Furthermore, the adopted econometric model also involves the use of a correction term in the price equations, which should account for the selectivity bias that arises from the fact of being in one particular regime.

4 Speci…cation and Empirical Implementation

As we mentioned before, regulated …rms often have in‡uence over the regulatory regimes under which they operate. We take this issue into account in our empirical analysis by estimating a model of endogenous switching (Maddala and Nelson [1975], Lee [1978]). This is a simultaneous equations model with a binary qualitative variable for the regulatory status and limited (censored) dependent variables: the prices. The empirical implementation of the theoretical framework analyzed in the previous Section implies thus the speci…cation of equation (1), and of two price equations like (6), one for each of the two subsamples:

$$R^{\alpha}_{ts} = \beta_0 + \beta_1 \left(\log p^0_{ts} - \log p^1_{ts} \right) + \beta_2 Z_{ts} + \varepsilon_{ts} \qquad (7)$$

$$R_{ts} = 1 \quad \text{if } R^{\alpha}_{ts} > 0 \quad \text{and} \quad R_{ts} = 0 \quad \text{otherwise}$$

$$\log p^1_{ts} = \gamma^1_0 + \gamma^1_1 X^1_{ts} + u_{1ts} \quad \text{if } R_{ts} = 1 \qquad (8)$$

$$\log p^0_{ts} = \gamma^0_0 + \gamma^0_1 X^0_{ts} + u_{0ts} \quad \text{if } R_{ts} = 0 \qquad (9)$$

$$Cov\,(u_{1ts}; u_{0ts}; {}^{2}{}_{ts}) = \begin{bmatrix} {}^{3}\!/\!_{4}{}_{1}^{2} & {}^{1}\!/\!_{2}{}_{10}{}^{3}\!/\!_{4}{}_{1}{}^{3}\!/\!_{4}{}_{0} & {}^{1}\!/\!_{2}{}_{1}{}^{3}\!/\!_{4}{}_{1} \\ & {}^{3}\!/\!_{4}{}_{0}^{2} & {}^{1}\!/\!_{2}{}_{0}{}^{3}\!/\!_{4}{}_{0} \\ & & 1 \end{bmatrix}: \qquad (10)$$

Where X_{ts}^{R}, R = 0; 1, contains cost drivers CD_{ts} (OPERATE, ENERGY, WAGE, RENT, and PRIME) demand drivers DD_{ts} (POP and BUSINESS), and a time trend (T) to control for market growth. Furthermore, we insert some variables to control for market structure (MSV_{ts}): a dummy equal to one if the second carrier has already entered market s in time t (ENTRY), variables related to cross-ownership and multimarket contact (CROSSOWN and MULTIMKT), a variable controlling for the monopolist's lead over the second entrant (LEAD), …rm speci…c dummies ($FIRM_i$) for the major carriers, and some dummy variables to control for market structure (BELLBELL, INDBELL, and INDIND).[19] The vector Z_{ts} contains regulator speci…c variables RCV_{ts} (ELECT and APPOINT), political variables PV_{ts} (GOVCHANGE and DEM), as well as two proxy for the cost of regulation CR_{ts} (STAFF and ¢STAFF). As already mentioned we assume that the independent variables' coe¢cients in (8) and (9) are di¤erent, allowing complete interaction in the price equations. This assumption, which should capture the di¤erent incentives faced by …rms in the di¤erent regimes, will be tested in the next Section. We assume that the error terms are jointly normally distributed, with a variance-covariance matrix given by (10).[20]

[19] According to Parker and Röller [1997], each of these dummy variables (see the Appendix for a de…nition) "signi…es the status of the wireline-nonwireline pair." Note that we do not insert the dummy BELLIND because there is a constant term in our equation. BELLIND represents thus our reference market structure. Ee eliminate one …rm dummy (CENTEL), as well.

[20] The terms ρ_i (i = 0; 1) represent the correlation co¢cient between error terms u_{its} (i = 0; 1) and ν_{st}. Note that $Cov\,(u_{its}; \nu_{ts}) = \rho_i \sigma_i \sigma_2 = \rho_i \sigma_i$ because $\sigma_2 = 1$. Note also that the correlation between the error terms of the two price equations (ρ_{12}) is not estimable

As Heckman [1976] and others pointed out, there exists a selectivity bias problem that leads to inconsistent parameter estimates when estimating the price equations separately by OLS, for $E[u_{its} | R_{ts} = i] \neq 0$ $(i = 0;1)$. To overcome this problem, one needs to correct for the endogeneity of regulation. Following Lee [1978], we can construct two selectivity bias terms as follows:

$$E[u_{1ts} | R^{\alpha}_{ts} > 0] = \rho_1 \sigma_1 [\phi(\alpha' z_{ts}) / \Phi(\alpha' z_{ts})] \text{ and}$$
$$E[u_{0ts} | R^{\alpha}_{ts} \quad 0] = \rho_0 \sigma_0 [-\phi(\alpha' z_{ts}) / (1 - \Phi(\alpha' z_{ts}))]$$

for the regulated and non-regulated markets subsamples respectively, where $\phi(\cdot)$ and $\Phi(\cdot)$ are respectively the density and the cumulative function of a standard normal distribution.

The estimation procedure is as follows. Equation (7) accounts for the separation criterium and can be consistently estimated by a probit ML method. Because we do not observe both prices for each observation, in the first stage we estimate a reduced form of the probit equation where we substitute (8) and (9) in (7). Once we get consistent estimates of the α's, we can compute $\hat{\gamma}_{1ts} = \phi(\hat{\alpha}' z_{ts}) / \Phi(\hat{\alpha}' z_{ts})$ and $\hat{\gamma}_{0ts} = -\phi(\hat{\alpha}' z_{ts}) / (1 - \Phi(\hat{\alpha}' z_{ts}))$, using the estimated instead of the real parameters' values. After inserting the selectivity bias terms as a control in the pricing schedules, we can then consistently estimate the $\bar{\ }$, the ρ_i, and the σ_i terms by simultaneously estimating (7), (8) and (9) by FIML (Kenny, Lee, Maddala, and Trost [1979]). The last step consists of estimating by ML the structural probit, where we insert the estimated prices instead of the real values.[21]

The typical test of selectivity bias is to analyze whether the coefficients of γ_{its} $(i = 0;1)$ are significantly different from zero. But from the sign and size of the coefficient estimates we can learn even more, namely how the selectivity

since each observation comes from one regime. For references see Maddala [1987].

[21] One could also try to estimate the model in one step. Although the estimates' efficiency would be higher, the method is operationally cumbersome.

terms in‡uence pricing behavior, since they represent the covariance between the error terms of the price equations and of the separation criterion. As Maddala [1987] pointed out, "[...] we ought to observe $½_0 ¡ ½_1 > 0$, but the two covariances can have any sign. It is also important to estimate the mean values of the dependent variable for the alternative choices." In our model this would mean estimating the price in regulated markets had they not been regulated and vice versa. In this way we can determine regulation's e¤ects on prices.

5 Results and Interpretation

In this section we analyze the results of the full information ML estimation of the switching regression model. We …rst present the results concerning the two pricing relations. In order to enrich our analysis, and to observe whether regulation had di¤erent e¤ects on di¤erent cellular tari¤s, we will propose di¤erent speci…cations in which we use as the dependent variable the three available price measures. In this way we also will capture the di¤erent …rms's strategies in di¤erent market segments.

Table 3 reports the coe¢cient estimates for the reduced form price equation in the subsample of regulated markets while Table 4 reports the results relative to the non-regulated markets.

Before analyzing in detail the coe¢cient estimates for the other independent variables, we want to observe the role of the selection bias in both subsamples, since this is one of the main points of our analysis. The selectivity terms' coe¢cients are given by the product between $½_i$ and $¾_i$, $i = 0; 1$. In the regulated markets' subsample both $½_1$ and $¾_1$ are strongly statistically signi…cant in all speci…cations. In particular, the product of the two coe¢cients is negative, implying that the fact of being in a regulated market has put some downward pressure on cellular tari¤s. Later we will precisely

quantify this effect. In non-regulated markets the selectivity bias correction's coefficient is highly significant as well. Both ρ_0 and σ_0 are statistically significant in the first and third specifications, while only the variance σ_0 is significant in the second one. In this case we observe a positive coefficient's estimate for the selection terms which means that a lack of regulation should have increased prices. The significance of these terms in both subsamples and in all specifications is the first compelling result of our analysis: the endogeneity of regulatory choice must be accounted for. The price estimate that we would obtain without correcting for selectivity bias would in fact be inconsistent and biased. Furthermore, we obtain a first result which seems to go in the opposite direction than previously observed by the literature. Later we shall analyze this point more in depth.

Now we turn to the description of the regression's results relative to firms' pricing behavior. We start with the regulated markets' subsample (Table 3). The first interesting point is that there are evident differences in pricing behavior among low usage time tariffs on the one hand, and middle and high usage time tariffs on the other.[22] Particularly compelling is the finding that entry pressure (ENTRY) led to significantly lower usage tariffs only in the lower market segment, whereas it did not affect prices for middle and high usage times. Moreover, the only determinants of regulated prices for higher usage, apart from the selectivity bias term, are some demand drivers and, only partially, demand drivers and market structure variables. Surprisingly almost none of the cost drivers is statistically significant in all specifications. The only exception are WAGE in the second specification, which is unexpectedly negative, and RENT in the third which is, instead,

[22] This is not surprising. The sample period corresponds to the very early phase of cellular telecommunications in the U.S.. During that period, most of the customers were business people who probably made a more extensive usage of cellular services. Firms' pricing behavior, thus, is likely to have followed different paths in the different market segments.

positive.

Demand drivers are more signi…cant, though coe¢cients' sign, size, and signi…cance vary widely across speci…cations as well. The population size (POP) had a positive impact on prices which is signi…cant only in the …rst speci…cation. In all speci…cations one observes a positive coe¢cient's estimate for BUSINESS, which is signi…cant only for the middle usage segment. As expected, the time trend (T) is negative in all speci…cations, since demand should expand and become more price elastic with time, but it is signi…cant only in the middle usage and high usage speci…cations. The market growth generated downward pressure on prices only in the business segment, which was the fastest developing in the sample period.

Market structure variables are also partially signi…cant in the regulated market subsample. In the middle usage segment the head start advantage of the …rst license owner (LEAD) led to a small increase in cellular tari¤s, whereas it did not a¤ect low usage prices. Low usage tari¤s, instead, depend signi…cantly on multimarket contact (MULTIMKT) and on cross-ownership (CROSSOWN), but the two e¤ects go in opposite directions. While MULTIMKT seems to have increased tari¤s, as expected, cross-ownership seems to have decreased them.

Firm speci…c terms and …rms-pair dummies are not signi…cant at all in the second and third speci…cations. Only in the low usage segment the market structure where a ROBOC entered a market with an independent incumbent put some downward pressure on tari¤s. In regulated markets the kind of …rms pair operating in the market did not strongly in‡uence the price level.

One possible interpretation of our …ndings is that regulated prices were not set by …rms but rather by the regulator. This is because …rms speci…c characteristics do not seem to have in‡uenced regulated prices, while those variables that should explain, at least partially, consumer surplus - like demand drivers, and the selectivity bias correction to account for regulation-

are the main signi…cant cellular tari¤s' determinants.

We now turn to the non-regulated markets' subsample. Here we observe some di¤erences among the di¤erent speci…cations as well, which suggest different pricing strategies in the di¤erent market's segments. In the second and third speci…cations prices are very signi…cantly dependent on …rm speci…c e¤ects. Not only are the …rms' dummies very signi…cant, but also the wireline/non-wireline pairs' dummies present highly signi…cant coe¢cient estimates.[23] In particular, it seems that markets where an independent carrier owned the wireline license were more competitive in the sense that prices were lower with respect to the reference group, which includes the BELLIND pair. The presence of two baby Bells in the same non-regulated market has instead considerably increased prices in the middle and high usage segments, meaning that two baby Bells could have been better able to collude. On the other side, however, this market structure led to more price competition in the low usage segment (BELLBELL's coe¢cient estimate is negative and signi…cant). Also, it is interesting to note that multimarket contact (MULTIMKT) has a positive impact on tari¤s but is signi…cant only in the …rst speci…cation.

A last minor but interesting comment may be done with regard to the entry policy. Competitive pressure imposed by the second …rm entering the market did not push downwards middle and high usage time tari¤s. The negative and signi…cant impact of entry in the low usage segment could have been motivated by a more aggressive pricing strategy by entrant …rms, in order to enlarge the non-business costumers base.

Before moving to the direct analysis of the price regulation's e¤ects on tari¤s, we want to statistically test whether coe¢cient estimates di¤er among

[23] The most of …rms' speci…c dummies are strongly signi…cant in all speci…cations (PACTEL, BELLSTH, AMERTECH, SWBELL, and MCCAW); USWEST, REST, GTE, and CONTEL are signi…cant only in some, while only NY NEX is not signi…cant at all .

the two subsamples using a Wald test.[24] We strongly reject the hypothesis that the same coe¢cients apply to the two subgroups for all speci…cations at any usual con…dence level. This means that the explanatory variables in the two subgroups have di¤erent e¤ects on the …rms' pricing strategy, since they interact with the fact of being regulated or not: …rms' behavior is in‡uenced by price regulation.

Previous studies suggested that regulation should have increased cellular tari¤s, since the regulatory dummies have a positive impact on prices. To asses more directly the regulation's impact on cellular tari¤s, we can ask which the prices in regulated markets would have been, had these markets not been regulated. We must then determine $E[\log p_{ts}^{NR} | R_{ts} = 1] = \lambda_0' x_{ts}^1 + \rho_0 \sigma_0 [\phi(\alpha_0' z_{ts}) / \Phi(\alpha_0' z_{ts})]$.

We can now use the consistent estimates of λ_i, ρ_i, and σ_i, $i = 0; 1$, and calculate the predicted regulated and non-regulated prices for the regulated markets' subsample. Table 5 reports the summary statistics for the predicted prices in regulated markets ($\hat{p}^1$), in regulated markets had they not been regulated ($\hat{p}^{1;0}$), and for the di¤erence between the two. The predicted regulated prices are on average lower than the predicted non-regulated prices in every speci…cation. This would mean that (on average) regulation has decreased prices by 14%, 10%, and 14% ca. for low, middle, and high usage tari¤s, respectively. This would reverse the results obtained with dummy variables models. However, we can also note that the standard deviation of the difference between the two prices is very large. Hence, to reach a more precise conclusion, we can test the null hypothesis $\hat{p}^1 = \hat{p}^{1;0}$. We can not accept the null hypothesis at any usual con…dence level for any of the used price measures. In Figure 2, we plot the sample distribution of the price di¤erences in

[24] We compute the statistic $W = \left(\hat{\alpha}^0 - \hat{\alpha}^1\right)' \left[Var\left(\hat{\alpha}^0\right) + Var\left(\hat{\alpha}^1\right) \right]^{-1} \left(\hat{\alpha}^0 - \hat{\alpha}^1\right)$ which is distributed as a chi-squared with J degrees of freedom, where J is the number of restrictions we are testing. See Green [1993].

the di¤erent subsamples.

This …nding would then mean that regulation, where it was applied, did not have very evident e¤ects on reducing prices: in some markets it was e¤ective, in other not. Yet, our main simplifying assumption is to consider regulation as a single entity. This is indeed not the case. As we already mentioned regulatory plans vary widely across States. There is then much heterogeneity in regulatory decisions that is not encompassed in our approach and that could be an important element to explain the observed result that e¤ective regulation did not have a strong impact on prices.[25]

We can also do the same exercise for non-regulated markets and ask what the prices in these markets would have been, had they been regulated ($\hat{p}^{0;1}$).[26] In Table 6 we report our results. Predicted prices in non-regulated markets, had regulation occurred, would have been lower than predicted non-regulated prices in all speci…cations (8.5%, 3%, and 8% for low, middle, and high usage tari¤s, respectively). We can again perform a simple test of the null hypothesis $\hat{p}^{0;1} = \hat{p}^{0}$. Now we can accept the null hypothesis at the 10% con…dence level for middle and high usage tari¤s, but not for low usage ones. This means that regulation would have signi…cantly decreased prices for those customers who made extensive use of cellular services in non-regulated markets. The second line of Figure 2 represents the sample distribution for the price di¤erence in the non-regulated markets' subsample. The positive e¤ects, which regulation would have had, are clearly evident in the middle and high usage tari¤s case. There is almost no observation above the zero line: in almost all markets these prices would have fallen.

[25] A possible extension of our model, which would take this issue into account, would be the use of a nested logit approach to explain regulatory choice, instead of the simple probit analysis as we did. This would allow us to consider that, once the regulator has chosen to regulate, it must also choose which kind of regulation to apply. In this way we would be able to account for the di¤erent regulatory choices that the authority has to take.

[26] We calculate $E[p^1_{ts} | R_{ts} = 0] = \beta^{10} x^0_{ts} + \beta_1 \beta_1 \left[\lambda\left(\beta^0 z_{ts}\right) - \left(1 - \Phi\left(\beta^0 z_{ts}\right)\right) \right]$.

Summarizing, we observed that regulation was not very e¤ective in reducing cellular tari¤s in regulated markets, probably also because of the heterogeneity of the regulatory schemes that we encompass under the label "regulated markets". On the other hand, it seems that cellular tari¤s would have fallen signi…cantly, even if not substantially, if regulation had been adopted in non-regulated markets, especially for the business sector segment. Where the wrong markets regulated?

To answer this question we estimate the structural probit by ML, where we use as regressors the di¤erence between predicted non-regulated and regulated prices as well as other political and regulatory variables, as we derived in the previous Section. As we already noted, we use the three estimated price di¤erences simultaneously as regressor to account for di¤erent …rms' lobbying intensity in di¤erent market segments. The coe¢cient of the di¤erence between the non-regulated and regulated prices should help us to disentangle two e¤ects: …rms lobbying activity, which would imply a negative coe¢cient, and consumers' protection, which would instead imply a positive coe¢cient's estimate.

We present di¤erent speci…cations depending on the set of control variables that we used. First, we use the exogenous variables alone. We then propose a speci…cation which controls for …rms' …xed e¤ects and one which controls for regional e¤ects to try to capture, at least partially, possible market unobserved heterogeneity.[27] We then insert some interaction terms between the price di¤erences and the other exogenous variables, in order to control for the interaction between …rms, politicians, and the regulatory agency.[28]

[27] We could not exploit the panel component of our data set since the dependent variable, the regulatory dummy, did not vary along the time dimension during the sample period. The probit regression is thus run on a cross section.

[28] The variables that we use are the following: $\log \frac{pi^0_{ts}}{pi^1_{ts}}$¤DEM84, $\log \frac{pi^0_{ts}}{pi^1_{ts}}$¤GOVSTAB, $\log \frac{pi^0_{ts}}{pi^1_{ts}}$¤ELECT, $\log \frac{pi^0_{ts}}{pi^1_{ts}}$¤STAFF84, $\log \frac{pi^0_{ts}}{pi^1_{ts}}$ ¤ ¢STAFF where $i = 1; 2; 3$. Precise results about these variables can be obtained from the author upon request.

Finally, we try a richer speci…cation where all control variables are used at once.

Table 7 reports our results. The main interest here is in the sign and signi…cance of the price di¤erence variables. In all speci…cations the three price di¤erences are strongly signi…cant. This is a second compelling result of our analysis. However, both consumer protection and …rms' lobbying activity seem to have played a role in the regulatory regime's choice. The …rst and third price di¤erences' parameter estimates present, in fact, a negative sign, while the second has a positive sign.

This …rst set of results would suggest that …rms concentrated their rent seeking strategies in those markets where regulation would have hurt more, i.e. those markets where most of the customers were long-time cellular service users, and where competition was expected to be tougher because of the low demand for low usage time. Our …ndings are also consistent with the fact that the regulator might have concentrated its action in those markets where …nal consumers, and not intermediate customers such as business people, were more important, since the positive sign on the middle usage prices di¤erence. One cannot say much concerning the magnitude of the coe¢cients' estimates, which represent the marginal e¤ect with respect to the overall means of the data set. The sign of the coe¢cient determines the direction of the e¤ect and the e¤ect tends to be larger, the larger is the coe¢cient. In the last two speci…cations, however, one should bare in mind that the overall price di¤erence's e¤ect should account also for the marginal e¤ects obtained through the interaction terms.

Turning to the other explanatory variables, almost each is highly signi…cant in every speci…cation. If the State governor in 1984 came from the Democratic Party, the probability to observe price regulation was lower. This result is unexpected, given that the Democratic Party is supposed to pur-

sue a more consumer-oriented policy.[29] On the other hand, the probability of regulation was higher in States that did not experience a political change during the sample period. This fact might re‡ect the idea that States in which political changes occurred were more open toward an innovative regulatory policy, such as full price liberalization. These results concerning the political environment are quite robust: both sign and signi…cance level do not vary much across the di¤erent speci…cations. Only the direct e¤ect of government stability disappears in the best speci…cation, though the interaction terms between GOVSTAB and the price di¤erences are all very signi…cant in that speci…cation.

Also, the regulator speci…c characteristics and regulation's costs had signi…cant impact on regulatory choice, but these results are less robust. Looking at the …rst column we observe that elected regulators increased the probability of regulation compared to the reference group containing APPOINT, even if not signi…cantly. However, when we insert …rm dummies, this variable turns out to be signi…cant also. Our …ndings would then be in line with those by Besley and Coate [2000]: elected regulators are supposed to be more pro-consumer, and therefore should more often regulate, under the assumption that regulation reduces prices. However, the e¤ect of elected regulators on regulatory choice is not very signi…cant.[30] The variable STAFF, which should proxy for regulation's costs, presents the expected positive and significant sign in the …rst, third and last speci…cations. A regulator with higher resources (larger PUCs) was expected to regulate more often, for its opportunity cost of regulating a new market should be lower. This e¤ect is anyway quantitatively very small. Also, the negative and signi…cant sign of ¢STAFF

[29] This view is also expressed in Posner [1970] where Democratic amministrations are assumed to be "pro-consumer" while Republican ones to be "pro-business".

[30] This is also in line with the …dnings by Teske [1991a, 1991b] and Donald and Sappington [1995, 1997], who did not …nd elected regulators to signi…cally impact regulatory decisions.

means that the larger were the changes in the commission's composition the lower was the probability of regulation. A possible explanation for this fact is that large changes in the commission's personnel could have make less easy to capture the regulator, because of the lacking of long standing relationships.

Furthermore, it is worth stressing the role of the di¤erent speci…cations. First, the introduction of the interaction terms, which should more precisely capture the "political game" among …rms, politicians, and regulator has a very signi…cant impact on our results.[31] Not only are almost all these terms highly signi…cant and the overall …t of the model greatly improves once one accounts for them, but also some qualitatively new results appear as, for instance, we noticed for the signi…cance of the regulation's cost proxy or for the role of government stability. This is, in our opinion, an important issue that calls for a more precise model of these interactions.

The introduction of …rm speci…c terms has an important impact as well. Almost all …rm speci…c dummies are highly signi…cant in the third and last speci…cations.[32] This …nding reinforces our belief that lobbying for regulation by individual …rms matters. Finally, also regional variables are partially signi…cant. This would suggest the need of a more precise econometric analysis, since these dummies should, at least partially, capture some market unobserved heterogeneity that seems to matter.[33]

Our last speci…cation, which is also our best one, predicts the right outcome for the 92.21% of the cases that makes us quite con…dent about the exactness of our model.

[31] Spiller [1990] presents a multiple-pricipals theoretical model of the interactions among politicians, interest groups and regulators, as well as some empirical evidence.

[32] USWEST and SWBELL are not signi…cant in the second speci…cation, while only USWEST is not signi…cant in the last one.

[33] To fully exploit the panel nature of our data set and use a random or …xed (state) e¤ect model, we should enlarge the data in the time dimension to observe some time variability in the regulatory status (see Donald and Sappington [1997]).

6 Conclusions

This paper investigates the political economy of regulation bridging two different approaches of the empirical literature on regulation, and empirically analyzing the simultaneity between the price regulatory choice and …rms' pricing behavior. We used data from the U.S. mobile telecommunications industry because of its unique regulatory environment. The industry under consideration is quite homogenous for product characteristics, …rms' technology and demand, but heterogenous for the adopted price regulation. Some States adopted strict price regulation, some loose price regulation, and others even banned price regulation. The study had di¤erent aims. First, we wanted to prove that the endogeneity of regulation is an important issue to account for because …rms do in‡uence the choice of the regime under which they operate. Second, we wanted to determine the impact of price regulation on cellular tari¤s, after correcting for the simultaneity bias. Finally, we wanted to identify the main determinants of regulatory choice. The econometric method we adopted consists of the estimation of a endogenous switching regression model (Maddala and Nelson [1975], Lee [1978]). To enrich the analysis we considered three measures for cellular prices, corresponding to di¤erent usage times, which allowed us to take into account di¤erent …rms' strategies in the di¤erent market's segments.

We provided evidence that the selectivity bias problem, i.e. the endogeneity of regulation, is an important issue to account for. Controlling for the simultaneity problem, we have shown that prices in regulated markets were, on average, lower than the prices …rms would have set, had these markets not been regulated. But the impact of regulation is not observed to be statistically signi…cant: price regulation, where applied, has not been very e¤ective. On the other hand, however, we observed that prices in non-regulated markets would have signi…cantly fallen, if regulation would have been adopted.

Our approach enabled us to explain this unexpected result, since we also modeled the regulatory choice, using a probit analysis. After controlling for other important factors such as the political environment, regulator speci…c characteristics, and the regulation's cost we provided some robust evidence that …rms' lobbying activity against a regulated environment was successful. Also, we provided evidence that regulator's characteristics, political variables, as well as the interactions between …rms, politicians, and regulators have very high explanatory power for the regulatory choice. Elected regulators, ceteris paribus, enhanced the probability of regulation more than appointed ones. Furthermore, States where the governor came from the Republican Party, whose government was politically stable in the sample period, and where regulation's opportunity cost have been lower were more favorable to some kinds of price regulation. Finally, the more pronounced the changes in the public utility commission's composition, the lower the probability of regulation, all other things being equal.

We can then conclude that our empirical approach, which allows the explicit modelling of the political economy of regulation, leads to new results in comparison to those already observed in both streams of the related literature. We do provide some evidence that price regulation, per se, did not worked in the wrong direction, increasing cellular tari¤s. E¤ective regulation, though, did not have a signi…cant impact, because of the …rms's lobbying activity to avoid a regulated environment.

Some major caveats apply to our analysis. First, there are still some important facts that have not been considered in the analysis for lack of data. For instance, we do not have more precise regulator's individual characteristics, which might be important determinants of the regulatory choice. Second, we limited our analysis to the dichotomous regulatory choice, not considering that di¤erent kinds of price regulation were actually adopted, that could have had very di¤erent impacts on prices. In particular, this con-

sideration might help to understand more clearly which kinds of regulatory schemes did not work. Third, regulatory decisions are not only related to the simple choice whether to regulate a market or not; the regulatory commissions, in fact, must also decide on many other issues, which are likely to have an in‡uence on the choice of whether to regulate or not. These issues could therefore be simultaneously studied in a more general model of regulation, but in this case new data and a di¤erent econometric modeling approach would be necessary. Finally, in this paper we adopted a reduced form approach to the political economy of regulation as well as to …rms' strategic behavior, whereas both issues could be approached in a more structural way. In particular, one should try to provide a rigorous micro foundation for the interaction among regulatory commissions, legislators, and interest groups. Hence the results we reported do not have to be considered de…nitive, even if we believe that they are a …rst important step into a deeper understanding of the political economy of price regulation.

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Appendix: Variables De…nition

Variables	De…nition	Vector	Source
$p_1; p_2; p_3$	Monthly bill calculated for di¤erent monthly usage times (5, 500, 3000 minutes)		Parker-Röller [1997]
ENERGY	Average monthly cost per square foot ($ per kilowatt hour)	CD	
PRIME (lagged)	One period lagged prime lending rate		
RENT	Average monthly rent per square foot of o¢ ce space		
WAGE	Average weekly salary per employee for the cellular industry		
OPERATE	Average monthly general overhead and operating expenses per square foot		
POP	Market Population in millions	DD	
BUSINESS	Number of high potential business establishments (divided by 100)		
T	Time trend in months		
ENTRY	Dummy=1 after the second carrier enters into the market	MSV	
CROSSOWN	Dummy=1 when the two competitors in one market are partner in any other market		
MULTIMKT	Total number of markets where the two competitors face each other		
LEAD	Length of the monopoly period in months		
BELLBELL	Dummy=1 if both wireline and nonwireline competitors are RBOCs	Pair_j	
BELLIND	Dummy=1 if the wireline is a BELL and the non-wireline is an independent carrier		
INDBELL	Dummy=1 if wireline is an independent carrier and the non-wireline is a BELL		
INDIND	Dummy=1 if both wireline and nonwireline competitors are an independent …rm		
Firm Dummies	Us West Cellular, Bell South Mobility, Ameritech Mobile, Nynex Mobile,	Firms_i	
	South West Bell Mobile,Gte Mobilenet, Contel Cellular, Mccaw, Century Cellular, Rest		
REG	Dummy=1 if no regulatory ban was imposed in the market		Shew [1994]
DEM84, DEM88	Dummy=1 if the State's Governor was from the democratic party in 1984 and 1988 respectively	PV	US Statistical abstr
REP84, REP88	Dummy=1 if the State's Governor was from the republican party in 1984 and 1988 respectively		
GOVSTAB	Dummy=1 if in both elections in the sample period the Governor came from the same party		
ELECT	Dummy=1 if the regulator was elected	RSC	The Book of States
APPOINT	Dummy=1 if the regulator was appointed by politicians		
STAFF	Number of full-time employees in the State Public Utility Commission in 1984	RC	
¢STAFF	Change in the number of full-time employees in the State Public Utility Commission (86-84)		

Tables

TABLE 1. SUMMARY STATISTICS

Variables	Full sample		Sub-sample Regulation		Sub-sample No Regulation	
	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.
p_1	17.223	10.600	16.908	11.927	17.543	9.061
p_2	196.126	39.418	197.787	40.596	194.434	38.182
p_3	1025.402	233.428	1029.426	220.473	1021.304	246.274
ENERGY	1.778	0.438	1.783	0.528	1.773	0.322
PRIME (lagged)	9.518	1.069	9.456	1.087	9.582	1.050
RENT	16.062	5.032	16.901	6.252	15.206	3.153
WAGE	519.598	119.172	521.617	101.292	517.534	135.197
OPERATE	6.724	1.724	6.825	2.181	6.622	1.072
POP	0.193	0.278	0.225	0.365	0.161	0.135
BUSINESS	2253.494	406.391	2227.075	457.181	2280.407	345.901
T	21.463	11.842	21.763	11.925	21.158	11.771
ENTRY	0.727	0.446	0.783	0.413	0.670	0.471
CROSSOWN	0.341	0.475	0.239	0.427	0.446	0.498
MULTIMKT	3.571	2.805	2.960	1.809	4.195	3.437
LEAD	10.696	8.047	9.798	7.310	11.611	8.653
REG	0.505	0.500	1.000	0.000	0.000	0.000
DEM84	0.733	0.443	0.658	0.475	0.809	0.394
DEM88	0.583	0.494	0.636	0.482	0.528	0.500
REP84	0.267	0.443	0.342	0.475	0.191	0.394
REP88	0.417	0.494	0.363	0.482	0.472	0.500
GOVSTAB	0.579	0.494	0.721	0.450	0.434	0.497
ELECT	0.200	0.401	0.154	0.362	0.247	0.432
APPOINT	0.800	0.401	0.846	0.362	0.753	0.432
STAFF	271.308	227.115	322.320	268.281	219.341	160.085
¢STAFF	-27.410	161.857	-73.092	212.731	19.127	50.729
Obs.	539		272		267	

TABLE 2. REGULATORY STATUS BY STATE

(Table 4.2. from Shew [1994])

Regulatory Status	States
Regulatory Ban	AL, CO, DE, FL, GA, IA, IL, KS, MI, MN, MO, MT, NE, NJ, OR, PA,TN, TX,WA, WI
Tari¤ Regulation	AZ, CA, CT, HI, IN, KY, LA, MA, MS, NV, NM, NY, OH, OK, RI, SC, VA
Not in the Sample	AK, ID, ME, ND, SD, VT, WV, WY

FIGURE 1. THE METROPOITAN AREAS

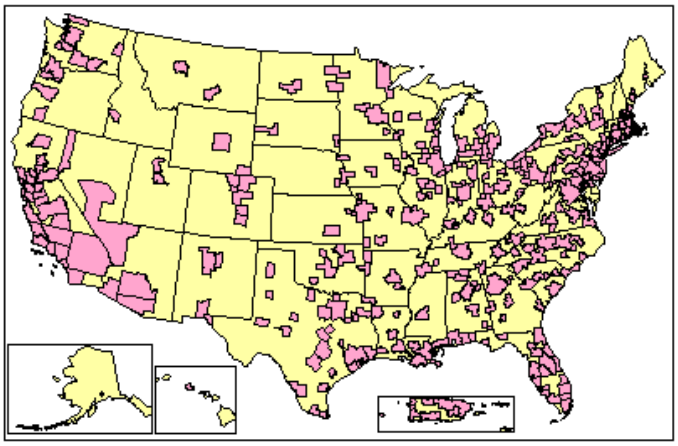


TABLE 3. FIML ESTIMATES: PRICE EQUATION
REGUALTED MARKETS

Dep. Variable	Low Usage Tari¤ (lnp_1)		Middle Usage Tari¤ (lnp_2)		High Usage Tari¤ (lnp_3)	
	Coe¤.	S.E.	Coe¤.	S.E.	Coe¤.	S.E.
CONSTANT	2.700 ¤¤¤	1.017	5.192 ¤¤¤	0.435	6.665 ¤¤¤	.418
OPERATE	0.64E-01	0.41E-01	0.17E-01	0.23E-01	0.16E-01	0.23E-01
ENERGY	-0.110	0.198	-0.65E-01	0.51E-01	-0.80E-01	0.56E-01
WAGE	0.18E-03	0.97E-03	-0.57E-03 ¤¤	0.25E-03	-0.22E-03	0.27E-03
RENT	-0.75E-03	0.14E-01	0.86E-02	0.58E-02	0.13E-01 ¤¤	0.59E-02
PRIME (lagged)	-0.76E-01	0.58E-01	0.58E-02	0.21E-01	0.17E-01	0.22E-01
POP	0.278	0.201	0.139 ¤	0.82E-01	0.72E-01	0.90E-01
BUSINESS	0.99E-04	0.13E-03	0.10E-03 ¤¤¤	0.37E-04	0.36E-04	0.34E-04
T	-0.951E-04	0.53E-02	-0.55E-02 ¤¤¤	0.18E-02	-0.46E-02 ¤¤	0.21E-02
CROSSOWN	-0.464 ¤¤	0.205	-0.43E-01	0.73E-01	0.40E-01	0.85E-01
MULTIMKT	0.74E-01 ¤	0.43E-01	-0.18E-01	0.20E-01	-0.21E-01	0.21E-01
LEAD	0.78E-02	0.81E-02	0.55E-02 ¤	0.28E-02	0.41E-02	0.28E-02
ENTRY	-0.476 ¤¤¤	0.167	0.28E-01	0.65E-01	0.35E-01	0.69E-01
BELLBELL	-0.685	0.648	0.136	0.174	0.187	0.162
INDBELL	-1.478 ¤¤¤	0.370	-0.24E-02	0.111	-0.163	0.137
INDIND	0.13E-01	0.558	-0.19E-01	0.153	-0.97E-01	0.138
Firms dummies	¤ (3=9)		(0=9)		¤ (1=9)	
¾1	0.620 ¤¤¤	0.31E-01	0.142 ¤¤¤	0.11E-01	0.220 ¤¤¤	0.14E-01
½1	-0.949 ¤¤¤	0.41E-01	-0.641 ¤¤¤	0.147	-0.932 ¤¤¤	0.50E-01
Adj. R^2	0.7913		0.5551		0.5960	
Obs.	272		272		272	

¤¤¤;¤¤ ;¤ represent signi…cance at the 1%, 5%, 10% levels respectively

TABLE 4. FIML ESTIMATES: PRICE EQUATION
NON-REGUALTED MARKETS

Dep. Variable	Low Usage Tari¤ (lnp_1)			Middle Usage Tari¤ (lnp_2)			High Usage Tari¤ (lnp_3)		
	Coe¤.		St.Err.	Coe¤.		St.Err.	Coe¤.		St.Err.
CONSTANT	4.071	¤¤¤	1.256	4.831	¤¤¤	0.278	6.545	¤¤¤	0.407
OPERATE	-0.89E-01		0.75E-01	-0.14E-01		0.17E-01	-0.20E-02		0.26E-01
ENERGY	-0.80E-01		0.226	0.30E-01		0.53E-01	0.33E-01		0.75E-01
WAGE	0.99E-04		0.18E-03	0.10E-04		0.12E-03	-0.27E-04		0.18E-03
RENT	0.12E-01		0.23E-01	0.17E-02		0.61E-02	-0.22E-02		0.90E-02
PRIME (lagged)	-0.34E-01		0.78E-01	0.52E-01	¤¤¤	0.18E-01	0.49E-01	¤	0.28E-01
POP	0.502		0.583	0.263	¤	0.152	0.173		0.215
BUSINESS	0.20E-03		0.23E-03	0.37E-04		0.46E-04	0.45E-04		0.76E-04
T	-0.72E-02		0.78E-02	0.23E-02		0.17E-02	0.35E-02		0.26E-02
CROSSOWN	0.28E-03		0.202	-0.14E-02		0.47E-01	-0.102		0.69E-01
MULTIMKT	0.97E-01	¤¤	0.45E-01	0.12E-01		0.84E-02	0.20E-01		0.14E-01
LEAD	-0.95E-02		0.10E-01	-0.29E-03		0.22E-02	-0.83E-03		0.36E-02
ENTRY	-0.392	¤¤	0.178	0.11E-01		0.48E-01	0.103		0.69E-01
BELLBELL	-0.793	¤¤	0.346	0.375	¤¤¤	0.83E-01	0.235	¤¤	0.114
INDBELL	-0.73E-01		0.392	-0.128	¤	0.87E-01	-0.344	¤¤	0.136
INDIND	0.418		0.365	-0.179	¤¤¤	0.72E-01	-0.319	¤¤¤	0.113
Firms dummies		¤ (3=9)			¤¤¤ (6=9)			¤¤¤ (7=9)	
$¾_0$	0.467	¤¤¤	0.30E-01	0.148	¤¤¤	0.11E-01	0.155	¤¤¤	0.17E-01
$½_0$	0.835	¤¤¤	0.65E-01	0.245		0.485	0.445		0.372
Adj. R^2	0.46127			0.6060			0.6172		
Obs.	267			267			267		

¤¤¤;¤¤ ;¤ represent signi…cance at the 1%, 5%, 10% levels respectively

Table 5. PREDICTED PRICES WITH and WITHOUT REGULATION: REGUALTED MARKETS

	Low Usage Tari¤	Middle Usage Tari¤	High Usage Tari¤
$\hat{p}^1$	16.364	196.030	1020.101
	(11.647)	(33.346)	(179.141)
$\hat{p}^{1;0}$	19.022	217.621	1188.160
	(10.658)	(69.706)	(407.524)
$\hat{p}^{1;0} - \hat{p}^1$	2.659	21.5909	168.059
	(17.691)	(66.651)	(404.421)

Standard errors in parenthesis

Table 6. PREDICTED PRICES WITH and WITHOUT REGULATION: NON-REGUALTED MARKETS

	Low Usage Tari¤	Middle Usage Tari¤	High Usage Tari¤
$\hat{p}^0$	21.269	200.979	1086.774
	(10.439)	(34.747)	(205.602)
$\hat{p}^{0;1}$	19.456	194.976	997.696
	(8.761)	(34.202)	(185.043)
$\hat{p}^{0;1} - \hat{p}^0$	-1.813	-6.002¤	-89.078¤
	(4.862)	(4.276)	(55.988)

Standard errors in parenthesis

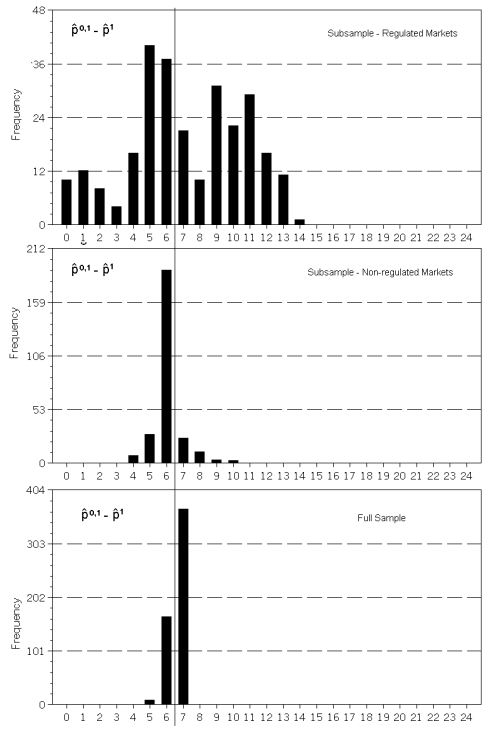
¤ represents signi…cance at the 10% level

TABLE 7. ML ESTIMATES OF THE STRUCTURAL PROBIT: THE PROBABILITY OF REGULATION

Variables	Coe¤.		S.E.	Coe¤.		S.E.	Coe¤.		S.E.	Coe¤.		S.E.	Coe¤.		S.E.
CONSTANT	-0.356	¤¤¤	0.164	1.227	¤¤¤	0.289	-0.400	¤¤¤	0.280	1.989	¤¤¤	0.531	5.152	¤¤¤	1.959
$\log \frac{p1^0_{ts}}{p1^1_{ts}}$	-0.350	¤¤¤	0.74E-01	-0.250	¤¤¤	0.80E-01	-0.846	¤¤¤	0.158	-10.417	¤¤¤	1.997	-31.501	¤¤¤	6.1275
$\log \frac{p2^0_{ts}}{p2^1_{ts}}$	3.310	¤¤¤	0.968	3.337	¤¤¤	1.014	2.874	¤¤¤	1.485	157.515	¤¤¤	30.805	652.4819	¤¤¤	111.155
$\log \frac{p3^0_{ts}}{p3^1_{ts}}$	-2.939	¤¤¤	0.764	-4.472	¤¤¤	0.859	-4.546	¤¤¤	1.139	-113.807	¤¤¤	22.865	-447.452	¤¤¤	75.9895
DEM84	-0.290	¤¤¤	0.130	-0.821	¤¤¤	0.154	-0.489	¤¤¤	0.150	-0.305		0.298	-8.418	¤¤¤	1.491
GOVSTAB	0.492	¤¤¤	0.146	0.461	¤¤¤	0.164	0.894	¤¤¤	0.196	-1.491	¤¤¤	0.451	-0.945		1.145
ELECT	0.81E-01		0.179	-0.198		0.200	0.656	¤¤¤	0.223	-1.237	¤	0.686	-0.322		1.069
STAFF84	0.15E-02	¤¤¤	0.32E-03	0.42E-03		0.35E-03	0.23E-02	¤¤¤	0.44E-03	-0.86E-03		0.62E-03	0.64E-02	¤¤	0.28E-02
¢STAFF	-0.20E-02		0.13E-02	-0.76E-02	¤¤¤	0.15E-02	-0.36E-02	¤¤¤	0.16E-02	0.76E-03		0.35E-02	-0.34E-01	¤¤¤	0.12E-01
Regional E¤ects				YES	¤¤¤								YES	¤¤¤	
Firm Fixed E¤ects							YES	¤¤¤					YES	¤¤¤	
Interaction Terms										YES	¤¤¤		YES	¤¤¤	
Log likelihood	-320.2546			-286.6652			-257.6257			-183.3153			-52.4511		
Chi squared	102.5729			169.7516			227.8306			376.4513			638.1797		
Obs.	537			537			537			537			537		
Correct Predictions	68.16%			70.20%			72.81%			80.63%			97.21%		

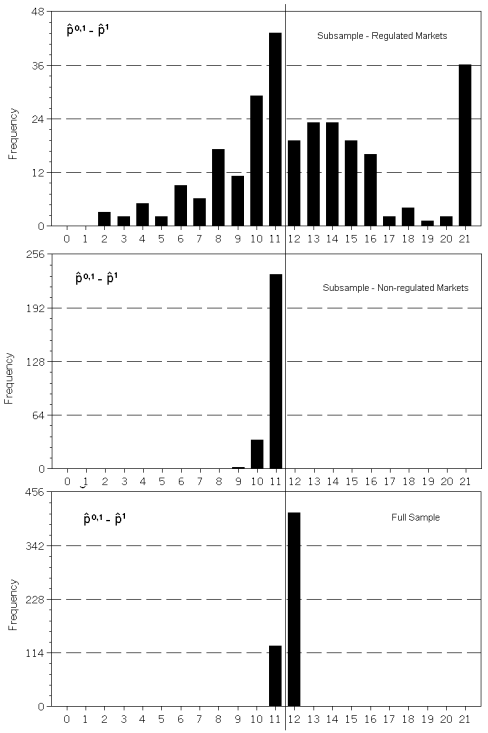
The dependent variable is R_{ts} (dummy=1 if no regualtory ban was imposed in the market). Coe¢cients' estimates represent the marginal e¤ect with respect to the overall means of the data set. ¤¤¤, ¤¤, and ¤ represent signi…cance at the 1%, 5%, and 10% level respectively

FIGURE 2. SAMPLE DISTRIBUTION OF THE DIFFERENCE BETWEEN NON-REGULATED AND REGUALTED PRICES



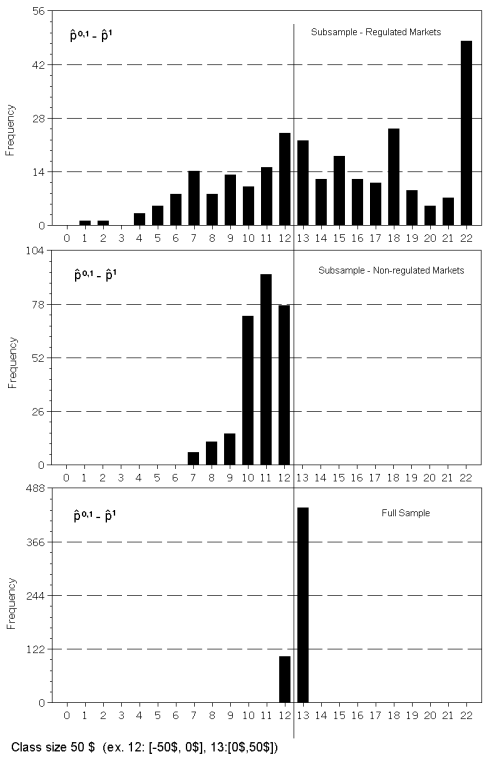
Class Size 5$ (ex. 6: [-5$,0$], 7: [0$,5$])

Low Usage Tari¤



Class Size 10$ (ex. 11: [-10$,0$], 12: [0$,10$])

Middle Usage Tari¤



Class size 50 $ (ex. 12: [-50$, 0$], 13:[0$,50$])

High Usage Tari¤

Bücher des Forschungsschwerpunkts Marktprozeß und Unternehmensentwicklung

Books of the Research Area Market Processes and Corporate Development

(nur im Buchhandel erhältlich/available through bookstores)

Tobias Miarka
Financial Intermediation and Deregulation: A Critical Analysis of Japanese Bank-Firm-Relationships
2000, Physica-Verlag

Damien J. Neven, Lars-Hendrik Röller (Eds.)
The Political Economy of Industrial Policy in Europe and the Member States
2000, edition sigma

Jianping Yang
Bankbeziehungen deutscher Unternehmen: Investitionsverhalten und Risikoanalyse
2000, Deutscher Universitäts-Verlag

Horst Albach, Ulrike Görtzen, Rita Zobel Eds.)
Information Processing as a Competitive Advantage of Japanese Firms
1999, edition sigma

Dieter Köster
Wettbewerb in Netzproduktmärkten
1999, Deutscher Universitäts-Verlag

Christian Wey
Marktorganisation durch Standardisierung: Ein Beitrag zur Neuen Institutionenökonomik des Marktes
1999, edition sigma

Horst Albach, Meinolf Dierkes, Ariane Berthoin Antal, Kristina Vaillant (Hg.)
Organisationslernen – institutionelle und kulturelle Dimensionen
WZB-Jahrbuch 1998
1998, edition sigma

Lars Bergman, Chris Doyle, Jordi Gual, Lars Hultkrantz, Damien Neven, Lars-Hendrik Röller, Leonard Waverman
Europe's Network Industries: Conflicting Priorities - Telecommunications
Monitoring European Deregulation 1
1998, Centre for Economic Policy Research

Manfred Fleischer
The Inefficiency Trap
Strategy Failure in the German Machine Tool Industry
1997, edition sigma

Christian Göseke
Information Gathering and Dissemination
The Contribution of JETRO to Japanese Competitiveness
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1995, edition sigma.

David B. Audretsch
Innovation and Industry Evolution
1995, The MIT Press.

Julie Ann Elston
US Tax Reform and Investment: Reality and Rhetoric in the 1980s
1995, Avebury

Horst Albach
The Transformation of Firms and Markets: A Network Approach to Economic Transformation Processes in East Germany
Acta Universitatis Upsaliensis, Studia Oeconomiae Negotiorum, Vol. 34
1994, Almqvist & Wiksell International (Stockholm).

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