

## Towards a political economy of industrial organization: empirical regularities from deregulation

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**Towards a Political Economy of Industrial  
Organization: Empirical Regularities from  
Deregulation**

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## ABSTRACT

### **Towards a Political Economy of Industrial Organization: Empirical Regularities from Deregulation\***

by Tomaso Duso and Lars-Hendrik Röller

This paper argues that the study of *policy incidence* in industrial organization needs to take the endogeneity of government into account. The point is made by investigating whether political considerations are important in terms of understanding the causes and effects of deregulation using data provided by the OECD. In particular, we address two interrelated questions: (i) do political and institutional factors matter in a systematic way in terms of the decision to deregulate, and (ii) if so, what does this imply in terms of the policy incidence of deregulation. Our results indicate that political considerations do matter. Most importantly, by introducing political and institutional variables into the empirical analysis of policy incidence, we find that policy conclusions are substantially different from an analysis that treats political factors exogenously. We conclude that the evidence is suggestive of the claim that a full understanding of the effect of government intervention in the marketplace implies a closer integration of political economy with industrial organization.

*Keywords: Deregulation, Political Economy, Mobile Telecommunications, Simultaneity Bias, OECD*

*JEL Classification: C31, D43, D78, L43, L51, L96*

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## ZUSAMMENFASSUNG

### **Ein politökonomischer Ansatz der Industrieökonomie: Empirische Evidenz\***

In diesem Beitrag wird die Wechselwirkung zwischen Deregulierungsentscheidungen und Marktergebnissen am Beispiel von OECD-Ländern explizit untersucht. Es wird gezeigt, warum eine „exogene“ Betrachtungsweise von Deregulierungspolitik zu einer inkonsistenten Einschätzung wirtschaftspolitischer Maßnahmen führen kann. In der Arbeit werden erste Ansätze beschrieben, die eine konsistente Analyse ermöglichen. Neben politischen Faktoren wird die Rückkoppelung des Marktergebnisses auf die Politikentscheidung berücksichtigt und anhand eines neuen Datensatzes für die OECD-Länder empirisch untersucht.

Folgenden zentralen Forschungsfragen wird anhand der OECD-Deregulierungsdaten empirisch nachgegangen. Erstens, welche politischen und institutionellen Faktoren sind bei Deregulierungsentscheidungen von Bedeutung, und zweitens, wie verändert ein simultaner Ansatz, der die Wechselwirkung zwischen Politik und Markt zulässt, die Wirkungsanalyse von wirtschaftspolitischen Maßnahmen?

*Schlagwörter: Deregulierung, Politische Ökonomie, Mobilfunksindustrie, Simultaneität, OECD*

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*“After years of reading and writing about optimal policies, one cannot help but wonder why observed trade policies are so different from the prescription of the normative literature. Of course that literature assumes the existence of a “benevolent dictator” – a species that is all too rare in the real world of economic policy making”.* Grossman and Helpman 2001.

## **1. Introduction**

This paper investigates whether political considerations are important in terms of understanding the effects and the causes of deregulation. There have been a number of important areas in economics where political economics (as it is called by Persson and Tabellini, 2000) has recently been used in order to explain policy outcomes, such as macroeconomics, trade, and public finance. The basic insight is that policy decisions are not entrusted to a “benevolent dictator”, but are endogenously determined outcomes in terms of a set of agents, their preferences and constraints.

Relatively little research has focused on introducing political considerations into the analysis of microeconomic decision making in the arena of industrial organization, such as regulation, competition policy, as well as various types of subsidies. This is insofar surprising as one may easily conjecture that decisions by politicians and governmental agencies in these areas are potentially rather sensitive to political influences and ambition.<sup>1</sup>

Why is it important to endogenize policy outcomes? We argue in this note that there are essentially two interrelated reasons as to why endogenous policy matters. The first reason is that it may be of interest to study the *determinants of policy making*. For instance in the arena of merger control, one may wish to understand the process by

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<sup>1</sup> For example, Neven and Röller (2001) provide some simple evidence to this regard. They show that over 90% of the variation in state aid during the 1980’s across EU member states can be explained by political and institutional factors.

which certain types of mergers are blocked. Is it because effective lobbying by competitors or are antitrust agencies simply maximizing consumer surplus? In the area of state aid, are subsidies given to correct a market failure, or to serve a political constituency. The second reason why endogenous policy matters, is what Besley in Case (2000) call *policy incidence*. There is a large amount of literature that addresses the impact of policy on market outcomes, assuming that the policy decision is exogenous. Policy incidence is then analyzed through comparative statics, where the (exogenous) variation in policy explains market outcomes. However, when policy is endogenous (in particular when the market outcomes causally affect the policy decision) a simultaneity bias in terms of policy incidence occurs. It is therefore generally impossible to obtain a consistent assessment of the impact of a particular policy without taking the determinants of policy making into account.

In this short paper we wish to provide some empirical evidence underscoring the relevance of including political and institutional factors into the analysis of deregulation. In particular, we address two interrelated questions: (i) do political and institutional factors matter in a systematic way in terms of the decision to deregulate, and (ii) if so, what does this imply in terms of the *policy incidence* of deregulation.

We propose to simultaneously estimate the determinants and effects of deregulation and apply this approach to a newly created data set made recently available by the OECD. We then ask whether the simultaneous approach does lead to different results in terms of the impact of deregulation on market outcomes.

It is important to point out that our approach here is purely empirical and purposefully reduced-form. We do not explicitly structure our empirical analysis with regard to the political environment in which the deregulation decisions across the OECD are taken. Rather, we simply take some prominent variables that relate to the theory developed in other fields of political economics and ask whether there is any systematic evidence for the claim that political economics is essential for policy assessment. We leave it up to future research to impose more specific structure and better measures.

Finally, it should be emphasized that the above argument applies in principle to many policy analysis in other fields.<sup>2</sup> Empirical industrial organization has recently developed a more structured approach to empirical testing by emphasizing the need to identify causal relationships through comparative statics. Similarly, the study of policy incidence in industrial organization needs to take the endogeneity of government into account. In order to understand the effect of government intervention in the marketplace, it may be necessary to integrate politics and industrial organization further, i.e. to move towards a *political industrial organization*.

The paper proceeds as follows. We start with a brief review of the literature in political economy, emphasizing empirical studies on deregulation. We then introduce an econometric approach that incorporates political and institutional factors. Finally, we illustrate the approach with the help of a new database made available by the OECD.

## **2. Political Economics**

The underlying premises of political economics is that policy is implemented by self-interested policy-makers. The explicit modeling of political considerations has emerged as an important research agenda in several areas of economics.

Starting with the private interest theory of regulation (Stigler (1971), Peltzman (1976), Becker (1983)) economists began to develop models of the political process underlying economic policy. Recently, this literature has received renewed interests expanding the microfoundations into what is referred to as *political economics*. A large body of theoretical contributions in different fields of economic theory (public finance, monetary economics, macroeconomics, trade, regulation, corporate finance) have since emerged. Given that a review of this work is well beyond the scope of our paper, we can only refer the interested reader to some recent books on the subject and the references given therein (Persson and Tabellini (2000), Drazen (2000), Grossman and Helpman

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<sup>2</sup> The importance of endogenous policy for policy incidence has recently also pointed out by Besley and Case (2000).



(2001)). Of particular importance to this literature is the electoral competition game (see also Besley and Coate (1997)), which has been developed to account for the role of different political institutions, the pressure of influence groups, and the agency problem among politicians, voters, and governmental agencies (on an agency perspective see also Laffont (1999)). Finally, we like to mention a long tradition in political science, which has looked at the role of ideology and partisanship as a mechanism that underlies policy formation (Alesina and Rosenthal (1995)).

More recently, there have been a number of empirical contributions that attempt to assess the determinants of policy. Many such studies have built on the new theoretical advances. For instance, Persson and Tabellini (1999, 2001) have made a number of empirical contributions analyzing the role of political institutions in shaping fiscal policy outcomes. Goldberg and Maggi (1999) and Gawande and Bandyopadhyay (2000) perform a structural analysis of a lobbying model for trade protection. Finally, Krozner and Strahan (1999) investigate the political factors driving the deregulation of the U.S. financial services industry. The empirical literature, however, seems to be in its infancy as compared to the state of theoretical analysis.

### **3. The Causes *or* Effect of Deregulation: single equation approaches**

In terms of the determinants (the cause) of deregulation there are relatively few empirical studies. Amongst all industries, it is the telecommunications industry that has attracted most interest. Levy and Spiller (1994) perform a descriptive analysis of the role of different regulatory institutions in determining the regulatory design for the telecommunication industry. Kaserman et al. (1993) and Donald and Sappington (1995, 1997) are the first econometric studies, which analyze the role of political variables and regulatory history in shaping the deregulation and the choice of the price regime in the U.S. telecommunications industry (see also Krozner and Strahan (1999) for a study of deregulation of bank branching restrictions in the U.S.).

The main conclusion from this literature is that political and regulatory institutions, as well as lobbying, matter significantly for the deregulation process. However, the

approach is generally a single equation framework, which is not sensitive to simultaneity bias stemming from private interest models of regulation. We will pick up on this below. Besides, many empirical investigations focus on U.S. industries only, thereby not exploring any variation in political and regulatory institutions in an international context.

In terms of the effects of deregulation there exist a vast number of empirical studies in industrial organization – some structured, some not - that attempt to shed some light on the impact of government policies on prices, productivity, or profitability of firms. A prominent survey paper with many references that assess the impact of deregulation is Winston (1993). The conclusion from this paper is that deregulation has generally benefited both consumers and producers (see Winston (1993), Table 6 page 1284), namely through reducing prices and increased quality and service as well as increased productivity.

Many such studies of policy incidence assume that deregulation is exogenous. Allowing for the policy of deregulation to be endogenous, may produce be rather different results. This is the topic of this paper.

#### **4. Towards a Political IO Approach**

In this section we integrate the approach of endogenous policy with the study of policy incidence. In particular, we propose to introduce political economy considerations into models of industrial organization. Our main objective here is to provide empirical support for the importance of political factors.

The basic set-up involves a simultaneous system of at least two equations. One equation, the ‘policy equation’ is grounded in political economy. It serves to endogenizes the policy decision in terms of political, constitutional and other institutional factors, agency issues, as well as perhaps ideology (for instance the political orientation of the government). Another factor that determines political

decision making is the market outcome itself. For instance, in the context of a representative democracy model (Besley and Coate (1997)), a policy maker might not get elected, unless her policy does have a desired effect (by the electorate) on productivity or output. In this sense, aspects of benevolent policy making may play an important role as well.

Let the policy decision be denoted by  $s$  and let the market outcome be denoted by  $q$ . The policy equation may then be given by,

$$s = f(\text{Political Institutions, Regulatory Institutions, Ideology, } q) + \varepsilon \quad [1]$$

One issue in estimating [1] is that  $q$  is potentially endogenous: the policy often does affect the economic outcome. This implies that OLS-type estimation will generally not provide an unbiased assessment of the underlying determinants of policy making. A possible solution is to estimate a reduced-form version of [1] by dropping  $q$ . Unfortunately this does not allow the estimation of the impact of  $q$  on  $s$ .

Note that the specification of [1] is not very structured. In fact, the extent to which theory enters into [1] is primarily through the types of variables that determine the political environment. Nevertheless, it should be clear that more theory-based specifications of the political game can also be accommodated.

The second equation, the ‘market equation’ accounts for the effect of the policy on the market outcome. For simplicity, we abstract from a more structural specification of the market game. Staying with the empirical IO perspective we postulate that the market output ( $q$ ) is determined by demand, costs, and market structure variables (such as the number of firms). The (reduced form) market output equation can then be written as,<sup>3</sup>

$$q = g(\text{Demand, Costs, Market Structure, } s) + v \quad [2]$$

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<sup>3</sup> Alternatively, [2] could be two equations in the tradition of the structural empirical IO approach. In other words, one could specify a demand equation and a first-order condition, with the policy ( $s$ ) affecting either or both sides of the market.

One of the main objectives in estimation of [2] is to obtain the impact of  $s$  on  $q$ , i.e. the *policy incidence*. The problem with estimating [2] by OLS is that  $s$  is endogenous and single equation approaches will be subject to a simultaneity bias. Nevertheless, there is a large literature in empirical economics that attempts to estimate equation of the type of [2]. Policy suggestions based on this kind of analysis are potentially very misleading. We will provide some evidence to this regard below.

The main point we wish to make in this note is that consistent policy analysis of the form of [2] is naturally done by jointly estimating [1] and [2]. In other words, the political environment in which policy decisions are made matter for the measurement of policy incidence. Simultaneous estimation of [1] and [2] provides consistent estimates of both the determinants of policy making, as well as of the impact of policy on market performance. Econometrically, the above set-up provides for an additional set of instruments, namely the political and institutional factors that determine the policy through [1]. Given that institutions are rather long lived, they may be as exogenous as any other instruments that have traditionally been used in empirical IO.

There is also a small variant of the above set-up. Suppose that the market outcome does not affect the policy decision at all. We then have a recursive system of the form,

$$\begin{aligned} s &= f(\text{Political Institutions, Regulatory Institutions, Ideology}) + \eta & [3] \\ q &= g(\text{Demand, Costs, Market Structure, } s) + \mu \end{aligned}$$

This is the set-up studied by Besley and Case (2000). In the next section we will compare all three specifications: the “traditional” single equation approach (OLS), and the two approaches that combine political economy with markets (recursive and simultaneous estimation).

Before we turn to the evidence, we like to mention two other points. First, it should be clear that the above set-up can be applied in a number of different circumstances of economic policy making. Take for instance competition policy, in particular merger control. The decision by an antitrust agency to block or perhaps allow a merger with remedies is dependent on the economic consequences that a merger triggers, such as the

impact of the merger on equilibrium price (consumer surplus). In other words, the decision by the agency depends on price, while the price also depends on the decision of the agency.<sup>4</sup> We therefore have relationships of the form of [1] and [2]. As a second example consider the policy decision to grant state aid. Clearly state aid is given with the intention to correct for a market failure, such as to increase productivity in R&D. In other words, state aid should affect R&D productivity. Moreover, R&D productivity also affects the likelihood of obtaining state aid, the direction of which depends on the precise political economy model that one has in mind here. In any case, we have to content with a simultaneous relationship in order to assess the impact of state aid policies on R&D productivity.<sup>5</sup>

A second point we like to raise is that the endogeneity of policy is a valid concern not only for empirical analysis of markets, but also for theory. Treating government action as exogenous by investigating the comparative statics of a particular model is subject to the same criticism. In fact, the same simultaneity bias exists in theoretical analyses.

## **5. Telecommunication Deregulation in the OECD: an empirical example**

This section is an empirical example, which employs the different approaches discussed above. The objective is to investigate in the particular context of deregulation whether a simultaneous political economy approach does in fact matter empirically.

For this purpose we are using a new database created by the OECD (the OECD International Regulation Database), which contains data on deregulation in the mobile telecommunication industry from 1993-1997 (see Duso (2001) for a more complete description of the data). The OECD database provides information on two measures of deregulation, which are based on market structure (see Table 1). The first measure of deregulation (ENTRY) takes on the value of 1 if the market structure in digital mobile

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<sup>4</sup> For a lobbying approach to merger control see Neven and Röller (2001).

<sup>5</sup> For an application to infrastructure allocation using a lobbying approach for equation [1], see Cadot et al. (1999).

telephony is a monopoly, 2 if duopoly, and 3 otherwise. The second measure (DEREGULATION) is an index composed of the number of foreign operators, market shares of new entrants, and the ENTRY index defined above.<sup>6</sup> Our policy measure of deregulation does not address issues such as privatization, price regulation, or state subsidies.

For our policy variable ( $s$ ), we thus use both DEREGULATION and ENTRY. Next, we specify the instruments in equation [1], i.e. the political environment of deregulation in the OECD (see Table 1). We do this by drawing on the existing theory summarized in Section 2.<sup>7</sup> For political institutions we use the identical data as Persson and Tabellini.<sup>8</sup> a dummy variable indicating whether the electoral system is a majoritarian or proportional (MAJORITARIAN) and secondly a dummy indicating whether the political system is a presidential or parliamentary regime (PRESIDENTIAL) (see Persson and Tabellini (1999) for details). As a final variable we use information as to whether the government is a coalition or one-party government (COALITION).

The second set of variables entering [1] are based on agency issues (see Table 1). The OECD data provide information on the regulatory agency in mobile communications. A variable capturing the accountability of the regulatory agency (ACCOUNTABILITY) is defined as an indicator of whether there is a report duty - usually to either the legislature or the relevant ministry. A second variable in the arena of regulatory institutions indicates whether the regulatory decision can be overturned by another body and is a proxy for the independence of the agency (INDEPENDENCE). One potential issue with using these variables is that they may be more relevant for other types of deregulation, such as price regulation.

Finally, we use two indicators of the government's general ideology. These variables have been used heavily in political sciences and are drawn from the European Consortium for Political Research. RILE is defined as the overall political position of

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<sup>6</sup> The index has been developed and kindly provided by Boylaud and Nicoletti (2000)

<sup>7</sup> This theory is developed for other type of policy decisions, besides deregulation. Nevertheless, it may be argued that aspects the analysis carry over to an environment where deregulation is the relevant policy decision at stake. However, more theory is needed here.

<sup>8</sup> We like to thank Persson and Tabellini for allowing us to use their data.

the government in terms of left vs. right scale, while PROREG indicates the governments position vis-a-vis deregulation.

Before we turn to equation [2] let us briefly discuss the OLS results of the policy equation [1], i.e. estimation of the specification [3]. Due to space constraints we do not present these results here.<sup>9</sup> The main conclusion from these estimations is that the above political and regulatory variables are very significant in terms of explaining deregulation (we can explain as much as 60% of the variation). This is, of course, consistent with the other empirical studies cited above. Moreover the signs of the effects are broadly consistent with the theory. Overall, we take these finding as additional evidence indicating the importance of incorporating political economy consideration into the study of policy incidence.

We now turn to the specification of the market equation [2]. In terms of market outcome ( $q$ ) two alternative measures are provided in the OECD database. The variable PRICE is defined as the total revenue in mobile telecommunications divided by the total number of subscribers, i.e. average revenue. The second variable we use is a productivity index (PRODUCTIVITY), defined as total subscribers per employee. For the exogenous variables we use a number of control variables that are meant to proxy demand and cost conditions: GDP, Population, investment per employee, wage expenditure per employee, and a time trend. It should be emphasized that there is scope for improving the sophistication of the data and the specification underlying [2], for instance toward a more structural approach. However, the purpose here is to provide an empirical example and provide some first evidence.

### ***5.1 Empirical Findings***

Given the above data we have estimated a number of specifications, depending on the treatment of the error terms ( $\varepsilon$ ,  $v$ ,  $\eta$ ,  $\mu$ ). Tables 2 and 3 report the most relevant results

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<sup>9</sup> The interested reader is referred to Duso (2001). Duso also reports results that are controlled for a number of econometric issues stemming from the treatment of  $\eta$  and the fact that the regulatory variables are discrete. However, the findings we report here are remarkably robust.

for our purposes. In particular, the tables only report on the simultaneity between  $q$  and  $s$ , ignoring all the other parameter estimates. For instance, the first row in Table 2 indicates the impact of PRICE on DEREGULATION in the policy equation [1] for the various econometric models (OLS, OLS with random effects, 2SLS, GMM). Similarly, the second row reports on the impact of PRODUCTIVITY on DEREGULATION, while the last two rows indicate the impact on ENTRY.

Comparison of the various columns of Table 2 (the policy equation [1]) allows us to investigate whether the simultaneity between politics and market outcomes matters as far as the determinants of policy is concerned. As can be seen, when using the PRICE variable, the results between the OLS and the GMM are considerably different. For example, the impact of PRICE on the decision to deregulate (which is negative and therefore inconsistent with consumer surplus maximization) is much larger and more significant for the simultaneous model. In fact the parameter estimate is nearly 4 times larger under the GMM (-0.23), as compared to the simple OLS specification (-0.06). For the ENTRY variable the effect is also roughly 4 times larger (increased from  $-0.17$  to  $-0.67$ ) and now significant. On the other hand, PRODUCTIVITY is not found to be related to the decision to deregulate and hardly affected by simultaneity.

Overall, it appears that the simultaneity of politics and markets may matter significantly in terms of the determinants of policy decision-making.<sup>10</sup>

Results pertaining to the market equations [2] and [3] are given in Table 3.<sup>11</sup> As can be seen the impact of simultaneity changes the results dramatically. For the PRICE effect of deregulation, we find that the traditional OLS results are reversed when the political economy is taken into account. For example, the “traditional” finding under OLS that deregulation lowers prices and raises productivity are either reversed (first two rows in Table 3 with regard to price effects) or become insignificant (last two rows in Table 3 with regard to productivity), when the political environment is taken into account.

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<sup>10</sup>We should mention that the political and regulatory factors are generally robust and significant across the various specification.

<sup>11</sup>The table present the results for the analysis without the agency variables. Including the agency variables reduces the number of observations from 93 to 71, which does not affect the overall conclusion, but reduces the significance.



Our main finding is thus that the political economy does matter significantly. It matters for both the determinants of policy decision-making, but also for the analysis of policy incidence.

## **Conclusion**

In this paper we have argued for an integration of political economy considerations into the analysis of empirical industrial organization. In particular, we provide some empirical evidence regarding two interrelated questions: (i) do political and institutions factors matter in a systematic way in terms of the decision to deregulate, and (ii) if so, what does this imply in terms of the *policy incidence* of deregulation.

Our results indicate that political considerations do matter. Most importantly, by introducing political and institutional variables into the empirical analysis of policy incidence, we find that policy conclusions are substantially different from an analysis that treats political factors exogenously.

There are a number of implications of the above findings. First, political and regulatory factors introduce a new set of instruments that potentially allow identification of industrial organization issues. This undoubtedly requires a more careful treatment of identification and the associated comparative statics than the stripped down version of an empirical IO model given in [2]. However, variation in political institutions may trigger strategic responses by firms that can be used to identify structural parameters. Second, and very much related, there is a clear need for more “testable” theory in this area. The relationship between political and regulatory environments and the conduct of firms is still an under-researched area of economics. Finally, and again very much related, there is a need for better data on political and institutional measures as well as linking those to data sets in empirical industrial organization.

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**Table 1 - POLITICAL ECONOMY VARIABLES USED IN THE ANALYSIS**

Deregulation	Index: internationalization, market share of entrants, entry in mobile telephony
Entry	1 if monopoly, 2 if duopoly, 3 if competition (digital mobile telephony)
Majoritarian	Majoritarian electoral system (vs. proportional)
Presidential	Presidential regime type (vs. parliamentary regime)
Coalition	Coalition government (vs. one-party government)
RILE	Index: government right-left position
Proreg	Index: government pro-regulation position
Accountability	Report duty (legislature/ministry)
Independence	Decisions cannot be overturned

Sources: OECD International Regulation Data Base, Persson and Tabellini (1999), European Consortium for Political Research.

**Table 2 - POLICY EQUATION**

Dep. Variable	OLS	OLS Random Eff.	2SLS	GMM	Indep. Variable
Deregulation	-0.0574 (0.0199)***		-0.1049 (0.0464)**	-0.23364 (0.0528)***	Price
Deregulation	0.0007 (0.0004)		-0.0006 (0.0006)	-0.0002 (0.0006)	Productivity
Entry	-0.1695 (0.1108)	-0.5550 (0.9274)	-0.2416 (0.2480)	-0.6652 (0.2535)**	Price
Entry	0.0084 (0.0021)***	0.0056 (0.0015)***	0.0099 (0.0031)***	0.0083 (0.0033)**	Productivity

The control variables are: GDP, Population, Majoritarian, Presidential, RILE, Proreg, Coalition, Accountability, Independence. Standard errors in parentheses. Observations = 78 when using the productivity measure. Observations = 71 when using the price measure. \*\*\* and \*\* represent significance at the 1% and 5% level respectively.

**Table 3 - MARKET EQUATION**

Dep. Var.	OLS	OLS Random Eff.	2SLS Recursive	2SLS	GMM	Indep. Variable
Price	-0.6350 (0.3587)	-0.7344 (0.6745)	0.75684 (0.5308)	1.3077 (0.6803)**	1.7694 (0.5132)	Dereg.
Price	-0.1687 (0.1060)	-0.0791 (0.1406)	-0.01483 (0.1838)	0.4831 (0.2552)*	0.5594 (0.1922)***	Entry
Productivity	1.2626 (0.3465)***	1.2187 (0.7066)*	0.2301 (0.5471)	-0.2816 (0.6378)	0.1543 (0.4306)	Dereg.
Productivity	0.4379 (0.0954)***	0.0944 (0.1065)	0.2596 (0.1814)	-0.0991 (0.2325)	0.0526 (0.1614)	Entry

The control variables are: GDP, Population, time trend, log(investment/employees), log(wage expenditure / employees). Standard errors in parentheses. Observations = 86 in the Price equation. Observations = 93 in the Productivity equation. . \*\*\*, \*\*, and \* represent significance at the 1%, 5%, and 10% level respectively.



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