

# Research Statement

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My research is in the field of Industrial Organization, with emphasis on regulation and competition policy issues. A common thread of my work has been to understand the interaction between market rules and market power. In particular, I have shown that seemingly small changes in market design can have important consequences on market performance as they give rise to different types of strategic interaction. The link between market rules and market power is further strengthened in the long-run: as market rules affect firms' investment incentives, they also determine market structure and thus the scope for exercising market power. As well as efficiency considerations, my work also highlights the distributional effects of certain market interventions.

A significant part of my research has been motivated by the performance of electricity markets, which provide a unique setting in which to analyze market power issues as well as other questions of general economic interest. In addition, electricity markets are a source of rich and highly disaggregated data, which has allowed me to combine applied theory models and empirical work. Below I summarize the main contributions of my research.

## **Cost Pass-Through**

The measurement of cost pass-through has long attracted the attention of economists in various fields. Most of the relevant papers deal with the pass-through of exchange rate fluctuations, though similar issues arise when measuring tax incidence, or when assessing the welfare effects of mergers in the presence of efficiency gains. This literature documents that in most markets pass-through is very low, both in the short and in the long-run.

In "Pass-Through of Emissions Costs in Electricity Markets" (with M. Reguant, AER 2014), we present one of the few cases where one sees very high (almost complete) pass-through. In particular, we quantify the pass-through rate of emissions costs to electricity prices, and disentangle its determinants using micro-level data. To do so, we investigate the response of Spanish electricity firms to the introduction of the emissions regulation, taking advantage of the cost shocks induced by changes in emission permits. Our findings demonstrate that 80% of the increase in emissions costs is passed-through to electricity prices. The extent of pass-through demonstrates that electricity producers substantially benefited from both the free permit allocation as well as from the increase in market prices.

The existing literature has identified several channels of incomplete pass-through. By analyzing why these channels are not at play in electricity markets, we contribute to the

understanding of the determinants of pass-through more generally. In contrast to other industries, our finding of an almost complete pass-through is explained by electricity producers' weak incentives to adjust markups after an increase in emissions costs. The reason is three-fold: first, electricity is traded through high-frequency auctions in which many buyers have very inelastic demand; second, cost shocks are highly correlated across firms; and third, the costs of price adjustment are very small.

## **Auctions and Market Design**

A significant part of Industrial Organization has been developed in the context of traditional consumer markets in which firms compete by posting prices. However, an increasing number of markets are now best understood as bidding markets, in which goods or services are supplied through procurement auctions. Given the close connection between the two types of markets, a better understanding of bidding markets may shed light on traditional IO questions. My work on auctions and market design in electricity markets contributes to that end.

Electricity wholesale markets differ in numerous dimensions, but until recently most of them have been organized as uniform-price multi-unit auctions. I have devoted several papers to understanding the impact of this market design choice on market performance. In "Designing Electricity Auctions" (with N.-H. von der Fehr and D. Harbord, RAND 2006) we characterize equilibrium bidding behavior in a model that reflects key features of decentralized electricity markets. We analyze and compare a number of different market design elements, including (i) the two commonly considered pricing rules associated with the uniform-price and discriminatory (or pay-as-bid) auctions; (ii) bid duration; (iii) the number of admissible steps in the bidding functions; and (v) price-caps. We also assess the impact of market structure and demand responsiveness on the performance of these markets.

We find that the uniform-price format yields higher average prices than the discriminatory format. However, their ranking in terms of productive efficiency remains ambiguous. Our analysis supports the view that simplifying bid formats - both with regards to duration and structure - is likely to improve market performance, and shows that price-caps may intensify competition even if they are not binding. From a methodological point of view, we show that the 'implicitly collusive' equilibria found in the uniform-price auction when bidding functions are infinitely divisible do not arise when they are discrete- as is the case in virtually all real-world examples.

In "How to Allocate Forward Contracts: the Case of Electricity Markets" (with M.-A. de Frutos, EER 2012) we generalize the equilibrium characterization of uniform-price multi-unit auctions to allow for an arbitrary number of firms and technologies. We show that all the candidate equilibrium outcomes depict similar features: one firm (referred to as the price-setter) chooses the price that maximizes its profits over its residual demand, and the remaining firms (referred to as non-price-setters) bid as if they were bidding at marginal costs. This greatly simplifies the search for an equilibrium, allowing us to characterize equilibrium outcomes in very general settings. We show that asymmetries across firms - including asymmetries

in firms' forward contract positions - affect equilibrium existence and multiplicity, and thus have a non-trivial effect on the comparative statics of prices. From a policy point of view, we show that for forward contract obligations to be pro-competitive they should be allocated across firms in order to virtually reduce their existing asymmetries.

Disentangling the long-run impact of market rules on market performance is difficult given that market structure is endogenous. In "Market Design and Investment Incentives" (with N.-H. von der Fehr and M.-A. de Frutos, EJ 2011), we address such endogeneity by analyzing a two-stage game of capacity pre-commitment followed by price competition, where we again compare uniform-price versus discriminatory auctions. An important insight of the paper is that there need not be a negative relationship between the intensity of competition and the incentives to invest. For investment decisions, what matters is not firms' absolute (expected) profit level but rather the profitability of capacity additions. Indeed, while on average returns to investment are lower with a discriminatory format, at the margin investment incentives are not necessarily weaker. Thus, the relative supremacy of the discriminatory auction as far as prices are concerned tends to be true even when we allow for endogenous capacities. In "Endogenous Capacities and Price Competition: the Role of Demand Uncertainty" (with M.-A. de Frutos, IJIO 2010) we extend this analysis by providing a complete characterization of equilibrium outcomes under various assumptions regarding demand uncertainty. We find that demand uncertainty has a non-trivial effect on the set of equilibria and leads to asymmetric capacity choices that differ from those of the related Cournot game with demand uncertainty.

Despite the importance of auction-based wholesale electricity markets, there is also a large volume of electricity that is traded bilaterally between the electricity providers and the large electricity consumers. In "Bilateral Contracting: the Case of the Chilean Electricity Market" (with J.P. Montero and M. Reguant), we are able to analyze such bilateral transactions in detail thanks to access to a rich data set that includes all the private contracts signed in the Chilean electricity market for a three year period. We exploit variation across consumers and across time to understand the determinants and outcomes of bilateral contracting, including prices, contract length, and indexation. We also develop a search model which is able to replicate the stylized facts reported in the data. Our plan is to extend the scope of this project by comparing the bilateral market with the default service auctions used to procure electricity to medium-sized firms and households in Chile. We thus aim to contribute to the general understanding of bilateral trading and to the comparison between auctions versus negotiations in regulated environments.

## **Collusion and Antitrust**

Collusion is probably among the most widely studied topics in Industrial Organization. Not only because of its empirical relevance, but also because it illustrates the beauty of strategic interaction. However, while there is a vast literature analyzing collusion from a theory viewpoint, there is less work devoted to the analysis of collusion in specific markets. My early work on collusion in electricity markets was motivated by the fact that these seem particularly vulnerable to tacit collusion (e.g. there is daily interaction among a small number

of capacity-constrained firms, bid functions and capacity declarations are publicly available, and firms have accurate information on their rivals' costs). We find empirical evidence consistent with collusion in "Price Wars and Collusion in the Spanish Electricity Market" (with J. Toro, IJIO 2006). In particular, we find evidence showing that firms could have followed some sort of tacit agreement *à la* Green and Porter, in which certain regulatory arrangements in place played a key role in determining the collusive scheme. The analysis of the variables that triggered price wars is in line with the theoretical predictions regarding firms' deviating and punishing incentives.

In "Tacit Collusion in Repeated Auctions: Uniform versus Discriminatory" (JIE 2003) I assess the role played by auction design in affecting the scope for collusion in electricity markets. I find that the uniform-price format used in virtually all electricity auctions enhances collusion possibilities in an infinitely repeated game of capacity-constrained price competition. Switching to a discriminatory auction format would increase firms' deviation incentives, thus reducing the scope for collusion in these markets. Capacity constraints might also have a crucial impact on the pattern of collusive pricing in electricity markets, particularly so because these are subject to cyclical demand fluctuations. Indeed, in "Collusion with Capacity Constraints over the Business Cycle" (IJIO 2006) I show that the level of firms' capacities determines whether periods of increasing or decreasing demand are critical for the sustainability of collusion.

Most recently, I have focused my work on the effects of various antitrust policies on cartel deterrence and cartel sustainability. In particular, I have studied the effects of leniency and whistle-blower programs in models that take into account the principal-agent relationships that exist within the firm. In "Rewarding Whistle-Blowers: a Principal-Agent Approach" (with C. Avramovich, in progress), we characterize the optimal contract between a firm owner and an employee in a model in which the latter can obtain rewards from reporting cartel evidence to the antitrust authority. The optimal contract is affected by the level of rewards given that gathering cartel evidence comes at the cost of devoting less productive effort. We find that the deterrence effect of whistle-blower programs is non-monotonic: on the one hand, more generous rewards encourage the employee to gather cartel evidence; on the other hand, to offset such incentive, they also induce the firm owner to overpay productive effort. While supporting the deterrence effect of whistle-blower programs, this research shows that their design should take into account their impact on firms' contracting decisions.

In a related work, we gather lab data to explore the complementarity between leniency and whistle-blower programs. In "Leniency and Whistle-Blower Programs: Complements or Substitutes?" (with A. G. Manganelli) we report results of a lab experiment in which we compare four treatments: corporate fines only, leniency program, whistle-blower program, or leniency plus whistle-blower programs. We show that the two programs combined reduce cartel formation and cartel prices when corporate fines are high enough. Otherwise, firm owners prefer to apply for leniency rather than to bribe workers for not reporting through increased wages. In sum, this research highlights that the various antitrust instruments cannot be designed in isolation.