



REPSOL YPF-HARVARD KENNEDY SCHOOL FELLOWS

2003 – 2004

COLLECTED RESEARCH REPORTS

November 2004

Repsol YPF-Harvard Kennedy School Fellows Program

Center for Business and Government
John F. Kennedy School of Government
Harvard University

The Repsol YPF-Harvard Kennedy School Fellows Program for energy policy research, established in the Spring of 2003, provides opportunities for outstanding scholars to develop careers that will address the most challenging problems at the center of energy policy debates.

In the aftermath of the oil shocks in the 1970s, there was an explosion of activity in energy markets and a burst of activity in the energy policy research, which launched a new generation of energy experts throughout the world. In the new century, another accelerated pace of change presents renewed demand to develop both ideas and people who can explain and clarify the complex topics that permeate energy policy. The transformed setting of international security and the expanded challenge of international terrorism profoundly affect the operation and importance of energy markets. Dramatic change in energy industries, advances in technology, and restructured energy markets present new choices and problems. There is a sense that an era of easy solutions of to excess supply capacity, robust infrastructure, and low cost environmental improvements may be coming to an end. Stresses as diverse as global climate change, energy market liberalization, and greater integration of energy companies produce extended policy debates.

Supported by a generous gift from the Fundación Repsol YPF, the Fellows Program responds to these opportunities and challenges by making an investment in intellectual capital through support of the research of another generation of energy policy scholars.

The first year of operation demonstrated the validity of the vision and the value of the Fellows Program. As summarized here, the research covers many topics, from important conundrums in environmental policy to the complex details of restructuring energy markets. A common thread is the high standard of excellence and relevance.

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REPSOL YPF-HARVARD KENNEDY SCHOOL FELLOWS 2003-2004

Senior Fellow

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Pre-Doctoral Fellow

Mr. Joseph Aldy
Ph.D. Candidate in Economics
Harvard University

Pre-Doctoral Fellow

Mr. Darby Jack
Ph.D. Candidate in Public Policy
Harvard University

Pre-Doctoral Fellow

Ms. Cynthia Lin
Ph.D. Candidate in Economics
Harvard University

JUAN ROSELLÓN

Juan Rosellón, Senior Fellow and Fulbright scholar at Harvard's Kennedy School, is Professor of Economics at the Centro de Investigación y Docencia Económicas (CIDE) in Mexico City. As director of the program on energy economic regulation at CIDE, he researches regulatory policy problems that decision-makers face in Mexico. From 2000 to 2001, he was the editor of *Economía Mexicana*, one of the leading journals on the Mexican economy. He served as secretary of the Mexican chapter of the IAEE from 1999 to 2001 and has been a member of its advisory board ever since. Professor Rosellón was Chief Economist at the Mexican Energy Regulatory Commission (1995-1997), and was a faculty member in the Program on Privatization, Regulatory Reform and Corporate Governance at Harvard University (1997-2000), and at Princeton University (2001). He has been a member of the Mexican National System of Researchers (SNI) since 1994, the same year in which he received the National Award in Economics from Mexican president Ernesto Zedillo. Professor Rosellón earned a Ph.D. in Economics from Rice University. He won the Gabino Barrera Medal, the highest student honor granted by the National University of Mexico. Professor Rosellón has published widely on energy regulatory reform issues in journals such as *Energy Journal*, *Energy Economics*, and *Review of Network Economics*. At the Repsol YPF-Harvard Kennedy School program, he researched the reform of the Mexican electricity industry.

DR. ROSELLÓN REVIEWS HIS YEAR AS A REPSOL YPF-HARVARD KENNEDY SCHOOL FELLOW

During my year as a Repsol-YPF Harvard KSG fellow, I developed various research topics that materialized in eight research papers and in two future research projects. My completed papers addressed electricity transmission expansion mechanisms, resource adequacy, a political-economy analysis of the Mexican electricity reform, and natural gas regulation in Mexico. Most of these projects were of course motivated by specific public-policy problems the Mexican energy sector faces.

“Pricing Electricity Transmission in Mexico,” *Mime*, proposed an incentive regulatory framework to expand the large interregional links of the Mexican transmission network. I used a two-part tariff model within a combined merchant-regulatory approach and the “shadow” Mexican electricity system. Results suggest the best institutional structure for expanding the Mexican transmission grid would be a single transmission firm charging even tariffs along the national territory.

“A Merchant Mechanism for Electricity Transmission Expansion,” *Journal of Regulatory Economics* (with Tarjei Kristiansen), proposed a merchant mechanism to expand electricity transmission based on long-term financial transmission rights (FTRs). Due to network loop flows, a change in network capacity might imply negative externalities on existing transmission property rights. The system operator thus needs a protocol for awarding incremental FTRs that maximizes investors' preferences and preserves certain currently unallocated FTRs (or proxy awards) so as to maintain revenue adequacy. In this paper, we defined a proxy award as the best use of the current network along the same direction as the incremental awards. We then developed a bi-level programming model for allocation of long-term FTRs according to this rule and applied it to different network topologies. We found that simultaneous feasibility for a transmission expansion project crucially depends on the investor-preference and the proxy-preference parameters.

Likewise, for a given amount of pre-existing FTRs the larger the current capacity the greater the need to reserve some FTRs for possible negative externalities generated by the expansion changes.

“Different Approaches to Supply Adequacy in Electricity Markets,” *Mimeo*, studies the long-run problem in electricity market design of ensuring enough generation capacity to meet future demand (*resource adequacy*). Worldwide reform processes have shown that it is difficult for the market alone to provide incentives to attract enough investment in capacity reserves, due to market and institutional failures. I studied several internationally proposed measures to cope with this problem, including strategic reserves, capacity payments, capacity requirements, and call options. I also discussed the analytical and practical strengths and weaknesses of each approach.

“The Mexican Electricity Sector: Economic, Legal and Political Issues,” Center for Environmental Science and Policy, Stanford University, Working Paper 05 (with Víctor Carreón and Armando Jiménez), aimed to explain the motivations and strategies for reform in the Mexican electricity sector. We focused on the effects of politically organized interests, such as unions and parties, on the process of reform. Our paper showed how particular forms of institutions—notably state-owned enterprises (SOEs) within the power sector as well as the state firm that supplies most fuels for electricity generation—shape the possibilities and pace of reform. The tight integration of these SOEs with the political elite, opaque systems for cost accounting, and schemes for siphoning state resources explain why these institutions have survived and why the progress of reform has been so slow. Private investors have only been allowed into the market at the margin through the “independent power producer (IPP)” scheme—an oxymoron, since the purchase agreements and dispatch rules determining payment to these IPPs are state dominated.

“Strategic Behavior and the Pricing of Gas,” *The Energy Journal* (with D.L. Brito), looked at various models that address strategic behavior in the supply of gas under a netback pricing regulatory regime. We obtained three very strong technical results. First, the netback pricing rule used in Mexico might lead to discontinuities in Pemex’s revenue function. Second, when Pemex must pay for the gas it uses and flares, the value of the Lagrange multiplier associated with the gas processing constraint increases. Third, if the gas processing constraint is binding, forcing Pemex pay for the gas it uses and flares does not change the optimal short-run solution to the optimization problem, so it will have no impact on short-run behavior.

“Price Regulation in a Vertically Integrated Natural Gas Industry: The Case of Mexico,” (with Dagobert L. Brito). The Comisión Reguladora de Energía of Mexico has implemented a netback rule for linking the Mexican natural gas price to the Texas natural gas benchmark price in an industry structure characterized by a vertically integrated state-owned monopoly. This paper shows that in an open economy where agents can choose between gas and alternative fuels, and where the density function describing the distribution of agents along the pipeline can have mass points, the netback rule is Pareto optimal.

“Implications of the Elasticity of Natural Gas in Mexico on Investment in Gas Pipelines and in Setting the Arbitrage Point,” *Mimeo* (with D.L. Brito), studies the optimal timing of investment in gas pipelines when the demand for gas is stochastic. While this problem can be solved in theory, we showed that the practical solution depends on functions and parameters that are either subjective or cannot be estimated. We then reformulated the problem in a manner that can Pareto rank investment strategies. These strategies could be implemented with reasonably

straightforward policies. The demand for gas is inelastic, and thus the welfare losses associated with small deviations from a first best optimum are minimal. This implies that the gas pipeline system can be regulated with a relatively simple set of rules without any significant loss of welfare. Regulation of the gas pipeline system can then be transparent and as a result, some institutional arrangement might be found to ensure a substantial private investment in gas pipelines.

The Repsol YPF-Harvard Kennedy School Fellows program made possible the development of the described research through generous financial support, as well as through access to the impressive resources of the Kennedy School, including research information, conferences and seminars, and feedback with innumerable brilliant colleagues. My research under the program also motivates my research agenda for the next few years. Two of the topics that I plan to develop – and that I have started working on with Bill Hogan – include the welfare implications of long-term FTRs and the development of a combined merchant-regulatory mechanism for transmission expansion.

JOSEPH ALDY

Joe Aldy is a doctoral candidate in the Department of Economics at Harvard University whose academic interests include environmental and public economics. His current research addresses the value of reducing mortality risk as related to age and the relationship between economic development and carbon dioxide emissions. Before coming to Harvard, Joe served on the staff of the President's Council of Economic Advisers from 1997 to 2000 where his portfolio included a wide range of environmental and natural resource issues, including climate change policy, air quality regulations, world oil and refined petroleum markets, electricity restructuring, environmental issues in China, and sustainable development. He was the lead author for the 1998 report "The Kyoto Protocol and the President's Policies to Address Climate Change: Administration Economic Analysis" and participated in bilateral and multilateral workshops and meetings on climate change policy in Argentina, Bolivia, China, France, Germany, Kazakhstan, Korea, Israel, Mexico, and Uzbekistan as well as at COP-4, COP-5, and the OECD. He was a Presidential Management Intern from 1996 to 1998. Joe received a Master of Environmental Management degree from the Nicholas School of the Environment in 1995 and a Bachelor of Arts degree from Duke University in 1993.

MR. ALDY REVIEWS HIS YEAR AS A REPSOL YPF-HARVARD KENNEDY SCHOOL FELLOW

Over the past year, I have completed drafts of two papers based on my research on the relationship between carbon dioxide emissions and economic development:

- 1) Divergence in Per Capita Carbon Dioxide Emissions
- 2) An Environmental Kuznets Curve Analysis of U.S. State-Level Carbon Dioxide Emissions

The Divergence paper addressed two key questions: Have per capita carbon dioxide emissions been converging in the past? and, Should we expect them to converge in the future? Understanding the distribution of emissions is important in determining countries' incentives to participate in multilateral climate change policies. Developing countries may not adopt emissions obligations that they perceive as inequitable given that developed countries have per capita emissions that are one to two orders of magnitude greater. Developed countries may not agree to allocation rules, such as per capita allocation schemes, designed to appeal to developing countries if the distribution of emissions differs significantly from the distribution of population.

The Divergence paper uses publicly available data for carbon dioxide emissions from 88 countries and carbon dioxide emissions data constructed by the author for the 50 U.S. states. The analysis shows the lack of convergence in per capita carbon dioxide emissions among nations (between 1960 and 2000) and the divergence in emissions among the U.S. states (between 1960 and 1999). A special analysis of U.S. state-level emissions focuses on the difference between production-based and consumption-based emissions by accounting for the net effects of interstate electricity trade. The increasing dispersion in state-level per capita emissions over time is much larger with the production-based measure than with the consumption-based measure. This suggests that some states are exporting emissions-intensive industrial activity and importing the finished goods and services from these industries. The paper forecasts future distributions of per capita carbon dioxide emissions for the 88-country data set and the U.S. states data set, and shows very little convergence over the next 50 to 100 years. It concludes with an analysis of the shortcomings

of reduced-form parametric models (environmental Kuznets curve analyses) and structural models for forecasting future distributions of emissions. This paper should address the gap in the existing literature by providing the first characterization of the distribution of carbon dioxide emissions. In addition, it should help inform policymakers who have advocated for per capita emissions allocations without a solid understanding of past, current, or future distributions of emissions.

The EKC paper uses the same U.S. state-level carbon dioxide emissions data to evaluate whether per capita CO₂ emissions follow an inverted-U shape with respect to per capita income. The standard story about the environmental Kuznets curve is that emissions are low at low levels of economic development, but increase as an economy develops (e.g., transitions from agriculture to manufacturing). At some point, as the economy grows further and becomes based on services, emissions begin to decrease. This paper takes aim at three issues: (1) What is the role of trade in emissions-intensive goods? (2) What effect do climate and historic energy endowments have on an economy's per capita emissions? and, (3) How robust are the estimated environmental Kuznets curves to various econometric specifications?

The EKC paper shows that trade in emissions-intensive goods (in this case, electricity) impacts estimated EKC curves significantly. EKC curves peak at higher incomes for consumption-based EKC curves (post-trade) than for production-based EKC curves (pre-trade), and in some specifications the consumption-based models do not have in-sample peak incomes (which suggests that the income-emissions relationship may not take an inverted-U shape). Models that account for winter heating and summer cooling demand as well as historic endowments of coal, crude oil, and hydropower show that these all impact per capita emissions, but usually modestly (for most states, they account for less than ten percent of per capita emissions). The states carbon dioxide EKC models are not especially robust to various specifications, which suggests that future work should aim to expand the analysis to structural models that can better explain the relationship between development and emissions.

The EKC paper has been accepted by the Environmental Protection Agency for inclusion in a special issue of the *Journal of Environment and Development*, arranged by the EPA on cover applications of the environmental Kuznets curve to greenhouse gas emissions. This special issue will aim to provide additional guidance to the EPA and other related policymakers on the relationship between greenhouse gas emissions and economic development.

I presented preliminary versions of these papers to the Energy Policy Fellowship seminar in the fall of 2003 and to the Environmental Economics Program at Harvard University lunch seminar in the Spring of 2004. I plan to propose a presentation of this work at Camp Resources, an annual environmental economics workshop sponsored by North Carolina State University (Kerry Smith's workshop).

The fellowship provided two primary benefits. First, the stipend allowed me to focus exclusively on my research this year. The financial support freed me of teaching responsibilities that can divert time and attention from research. Second, the opportunity to present early stages of my research to the other fellows and faculty associated with the program yielded valuable insights that will guide the next steps in the research. Follow-up conversations with the other fellows also assisted my research.

DARBY JACK

Darby Jack is a doctoral candidate in Public Policy at the Kennedy School. His research centers on the economic analysis of human-environment interactions in developing countries. Currently, he is analyzing the determinants of household energy technology choices by poor families in Latin America and the linkages between energy, indoor air pollution, and human health. Darby received a bachelor's degree from Williams College in 1997. After college, he spent two years analyzing strategies to promote sustainable forest management in Guatemala, Chile, and Bolivia as a Watson Foundation Fellow. Darby then worked for the Mountain Institute in Huaraz, Peru, and helped start a consultancy that advises landowners and conservationists in Latin America on matters related to climate change. Darby has received several awards and fellowships, including the Thomas Hardie Prize from Williams College, a Joseph Crump Fellowship from Harvard University, and the Watson Fellowship. At Harvard he is affiliated with the Center for International Development, the Belfer Center for Science and International Affairs and the Environmental Economics Program.

MR. JACK REVIEWS HIS YEAR AS A REPSOL YPF-HARVARD KENNEDY SCHOOL FELLOW

My research analyzes economic factors that shape how people in developing countries choose how to meet their household energy needs. The primary motivation for my work is to illuminate the economic antecedents of indoor air pollution in developing countries, a problem that kills over 1.6 million people each year according to World Health Organization (WHO) estimates. To put that figure in context, WHO estimates that HIV/AIDS kills about 2.8 million people each year, dirty drinking water about 1.7 million, and urban air pollution about 0.8 million. Virtually all indoor air-related deaths in developing countries occur from cooking with wood and other biomass fuels in poorly ventilated rooms.

My empirical approach uses longitudinal data from Peru to explain household energy technology choices and to provide a reliable basis for formulating policies that will influence these decisions. I am concerned with a simple question: *Why do people with alternatives use household energy technologies that kill them?* This research also improves our understanding of the transition from traditional to modern energy carriers and thus improves our ability to predict future household energy demand in India, China, and other biomass-dependent regions. Finally, insight into energy use by poor households sheds empirical light on persistent questions about economic behavior in developing countries.

Explaining the persistence of traditional fuels: three hypotheses

The rational choice perspective presumes that households invest in clean household energy technologies until the benefits of cleaner air would be more than offset by the loss of utility due to the additional cost of cleaner technology. This behavioral postulate—the *poor but efficient hypothesis*—constitutes the theoretical foundation of the handful of previous papers on the determinants of energy technology choice in poor households.

My research so far suggests that this hypothesis fails to explain the facts. The data show that income does not predict fuel choice, once we control for location, access to fuels, and other relevant household characteristics (using a random effects logit model). This surprising result contradicts findings from South Africa, Pakistan, and other countries where researchers have

found significant correlations between income and fuel use. These other studies have suffered from a lack of longitudinal data, inadequate controls, and inappropriate statistical frameworks. Additional research will elucidate the cause and implications of this discrepancy, but at present I interpret my results as evidence against the poor but efficient hypothesis.

My research also investigates two ways in which actual behavior may depart from a simple household demand model, and weighs the policy implications of these departures. Features of the decision context, including uncertainty regarding consequences and interactions between decision-makers, suggest that the optimal decision hypothesis may miss important elements of the true decision process. These concerns lead to two additional hypotheses regarding the basic economic structure of energy technology choices.

The information hypothesis. People may be ignorant of the health consequences of dirty household energy. This is particularly plausible in areas where all or nearly all families use dirty technologies, and most women and children suffer from chronic respiratory infections. In the absence of a “control group” of clean technology users, people may be slow to draw inferences about the consequences of indoor air pollution. I study the role of information by estimating a Bayesian social learning model in which poor households learn about the health consequences of available technologies by observing their neighbors’ technology choices and health outcomes.

Preliminary results show that, *ceteris paribus*, households that observe that their neighbors experience health benefits after switching to cleaner fuels are more likely to switch than households that observe switching but see no health improvement. This suggests that information about health consequences is a significant factor, and that households lack complete information. I am currently developing a more refined model that accounts for the dynamics of the learning process and thus better controls for spurious correlation.

The family structure hypothesis. The optimal decision hypothesis views households as unitary actors. In reality, households comprise individuals with different stakes and different abilities to affect joint decisions. Women and children, who spend more time indoors near the hearth, bear the brunt of the health impacts of indoor air pollution. Men, in contrast, are less affected by indoor air pollution but tend to control household budgets. This mismatch may lead to underinvestment in clean energy technologies. I test this hypothesis by studying how the probability of switching to a cleaner technology changes in response to changes in men’s and women’s incomes.

Policy implications

A major goal of my research is to help lay the foundation for public policy that is genuinely welfare-enhancing and that constitutes an intelligent response to preferences and decision-processes of the rural poor. Thus the final stage of my research is to analyze my findings against a range of policy interventions that purport to reduce exposure to indoor air pollution. This analysis will feed into an outreach effort targeting government policymakers in Peru.

The Repsol YPF-Harvard Kennedy School Fellows Program gave me the opportunity to present my research in our seminar; I enjoyed and learned from the interchanges with the other Fellows as well as with Bill Hogan and Adrian Lajous on these occasions. Further, I very much appreciated the funding for travel in support of my research.

CYNTHIA LIN

Cynthia Lin is a doctoral candidate in Economics at Harvard University. She is interested in applying the theories and methods used in industrial organization, microeconomic theory, public economics, and labor economics to environmental issues. For her Ph.D. dissertation, she is researching offshore petroleum production. Cynthia received a bachelor's degree, *summa cum laude*, in Environmental Science and Public Policy from Harvard College in 2000. Her undergraduate atmospheric chemistry thesis on trends in ozone smog was awarded a Thomas Temple Hoopes Prize. She was elected to Phi Beta Kappa in her junior year. In addition to the Repsol YPF–Harvard Kennedy School Pre-Doctoral Fellowship, Cynthia's graduate honors include an EPA Science To Achieve Results (STAR) Fellowship, a National Science Foundation (NSF) Graduate Research Fellowship, a Rita Ricardo-Campbell Fellowship in Economics, a Jens Aubrey Westengard Scholarship, and a Harvard Committee on Undergraduate Education (CUE) Certificate of Distinction in Teaching. Cynthia is currently a Pre-Doctoral Fellow in the Environmental Economics Program at Harvard University.

MS. LIN REVIEWS HER YEAR AS A REPSOL YPF-HARVARD KENNEDY SCHOOL FELLOW

I am interested in applying the theories and methods used in industrial organization, microeconomic theory, and econometrics to analyze the oil industry. I am currently pursuing three main research projects related to the oil industry.

The first research project is on offshore petroleum production. For this project, I am developing a structural econometric model to analyze the investment timing game in offshore petroleum production that ensues on wildcat tracts in U.S. federal lands off the Gulf of Mexico.

Offshore petroleum production requires two irreversible investment decisions. First, a firm decides whether and when to invest in the rigs needed to begin exploratory drilling. Second, after it has explored a tract, a firm decides whether and when to invest in the production platforms needed to develop and extract the reserve.

When individual firms make their exploration and development investment timing decisions, there are two types of externalities that they do not internalize. The first type is an information externality. Because tracts within the same area may be located over a common pool, firms acquire information about their own tracts when other firms explore and develop neighboring tracts. This information externality may lead to a non-cooperative timing game, which may cause firms to inefficiently delay production.

A second type of externality is an extraction externality. When firms have competing rights to a common-pool resource, extraction may occur at an inefficiently high rate. While information externalities induce firms to inefficiently delay production, extraction externalities induce firms to produce too quickly. Thus, owing to information and extraction externalities, offshore petroleum production on wildcat tracts may be inefficient.

I am currently in the process of developing and estimating a structural econometric model of the investment timing game in offshore petroleum production. Estimates of the structural parameters of my model will enable me to answer the following questions, among others. First, do firms care about what their neighbors do? In other words, how important are the information

and extraction externalities described above? Second, can the federal government increase ex ante tract value by changing the lease term or the tract size?

The primary goal of this research will be to determine the socially efficient timing policy for oil exploration, development, and extraction on offshore wildcat tracts. Using the optimal policy as a benchmark, one can then quantify the inefficiencies of the current OCS leasing program as well as the potential inefficiencies of various counterfactual institutional mechanisms. A second goal of this research project will be to design an institutional mechanism that induces a more socially efficient policy. Possible modifications to the current OCS auction mechanism might include: changing the lease terms; encouraging unitization of exploration programs, perhaps by limiting the amount of non-unitized acreage that a firm can possess; requiring firms to make their seismic reports publicly available; changing the quantity, size, or location of the tracts offered in each lease sale; using multi-unit auctions; or making the contractual environment more conducive to coordination.

A mechanism that induces socially optimal offshore petroleum production will not only increase efficiency and potentially enhance both firm and government revenues, but will also better account for environmental and strategic concerns as well.

In addition to my work on offshore petroleum production, I am pursuing a second project, developing an econometric model of the world oil market. As with any other commodity, one of the fundamental questions economists would want to address concerning about oil is: How do we model the world market for oil? In particular, what determines the supply for oil, what determines the demand for oil, and by what equilibrium process are oil prices and quantities determined?

Although there have been countless empirical studies of the world oil market, none has produced a satisfactory model that adequately explains historical data, much less accurately predicts future developments. Moreover, the preponderance of these studies were conducted over two decades ago. For this research project, I have re-examined the timeless issue of oil supply and demand estimation using instrumental variables techniques under a static framework. I am currently developing an econometric model of the world oil market that accounts for the dynamic nature of oil supply.

In addition to my empirical work on offshore petroleum production and world oil markets, I am pursuing a third research project on the development of a theoretical model of oil extraction that is consistent with historical data on world oil prices and production. The basic Hotelling model of nonrenewable resource extraction predicts that the shadow price of the resource stock, which is an economic measure of the scarcity of the resource, should grow at the rate of interest. This prediction is now known as the “Hotelling rule.” If the natural resource market is perfectly competitive, the Hotelling rule implies that the market price minus marginal costs must grow at the rate of interest, and therefore the natural resource price should increase over time if marginal costs are constant. In contrast to Hotelling’s theoretical prediction, however, empirical studies have shown that mineral prices have been roughly trendless over time. For my third research project, I am attempting to reconcile Hotelling’s theoretical model with empirical evidence on world mineral prices.

I have benefited from the Repsol YPF-Harvard Kennedy School Pre-Doctoral Fellowship in numerous ways. The Repsol fellowship put me in touch with many people who have been invaluable to my research. Though the contacts I have been fortunate enough to make are too numerous to list, several deserve special mention. First, Adrian Lajous, who regularly attended

the Repsol seminars, not only provided me with valuable feedback on my work, but also provided helpful information about the OCS auctions. Second, Juan Badosa Pagés took the time to talk with me about the role of risk in oil production. Third, William Hogan has been extremely supportive of my research; he not only takes the time to give detailed comments on my work, but has also been extremely helpful in helping me acquire the data, connections, and information I need. Fourth, and perhaps most important, it was through the Repsol Fellowship that I met Bijan Mossavar-Rahmani, who arranged for my January visit to Apache Corporation's headquarters in Houston and a drilling rig and production platform offshore of Louisiana. The trip was an incredible experience for me; the knowledge I gained and connections I made during the visit have not only helped me with my current research projects, but have also given me ideas for several other projects I hope to pursue in the near future.

The Repsol Fellowship program has provided me with a wealth of resources, contacts, and information that have and will continue to enhance my efforts to explore and develop research on the economics of oil. As an aspiring academic economist, I have benefited tremendously from the opportunity to meet and learn from people directly involved in the oil industry, and my experiences as a Repsol Fellow have better equipped me to apply my knowledge of academic economics to real-world policy-relevant issues relating to energy and petroleum.

COLLECTED RESEARCH REPORTS

November 2004

Papers available at

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Juan Rosellon

1. "Pricing Electricity Transmission In Mexico"
2. "A Merchant Mechanism for Electricity Transmission Expansion," with Tarjei Kristiansen, *Journal of Regulatory Economics*, Second Revision and Resubmit
3. "Different Approaches to Supply Adequacy in Electricity Markets"
4. "The Mexican Electricity Sector: Economic, Legal and Political Issues," with Victor G. Carreón-Rodríguez, Armando Jiménez SanVicente, under revision to be published in a book edited by Stanford University
5. "Strategic Behavior and the Pricing of Gas in Mexico," with Dagobert L. Brito, *The Energy Journal*, Revision and Resubmit.
6. "Price Regulation in a Vertically Integrated Natural Gas Industry: The Case of Mexico," Dagobert L. Brito, *The Review of Network Economics*, Forthcoming
7. "Implications Of The Elasticity Of Natural Gas In Mexico On Investment In Gas Pipelines And In Setting The Arbitrage Point," with Dagobert L. Brito

Joseph Aldy

1. "An Environmental Kuznets Curve Analysis of U.S. State-Level Carbon Dioxide Emissions"
2. "Divergence in Per Capita Carbon Dioxide Emissions"

Darby Jack

1. "Income, Household Energy And Health"

Cynthia Lin

1. "The Multi-Stage Investment Timing Game In Offshore Petroleum Production: Preliminary Results From An Econometric Model"
2. "Estimating Annual and Monthly Supply and Demand For World Oil: A Dry Hole?"
3. "Optimal World Oil Extraction: Calibrating and Simulating The Hotelling Model"