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February 20, 2015

William Vance
California Air Resources Board
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Sacramento, CA 95814
William.vance@arb.ca.gov

Research Proposal Entitled:
"Maximizing the Air Quality, Climate, and Social Equity Benefits of Light-Duty Vehicle Incentive Programs: Advanced Clean Vehicle Incentives"
Principal Investigator – Professor C-Y Cynthia Lin
Requested Funds: $ 499,780.00
Period of Performance: 09/01/2015 – 02/28/2018

Dear Mr. Vance,

On behalf of The Regents of University of California, Davis, it is a pleasure to present for your consideration Professor Lin's proposal referenced above.

At the time that this proposal results in an award, we shall expect to enter into an agreement which contains terms and conditions conducive to and consistent with a public educational institution performing fundamental research.
It is expected that UC Davis will invoice in accordance with the University's accounting requirements and generally accepted accounting practices.

Please call on Dr. Lin for scientific information. Administrative questions may be directed to me at the above contact information or at jssnyder@ucdavis.edu . We request that correspondence pertaining to this proposal and any ensuing award be sent to the Office of Research and to the principal investigator.

Send Award Notice to:

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Sincerely,

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Enclosures

Please refer to SPO Project# 201502708 on all future correspondences.

DRAFT PROPOSAL

Maximizing the Air Quality, Climate, and Social Equity Benefits of Light-Duty Vehicle Incentive Programs: Advanced Clean Vehicle Incentives

Principal Investigators:

C.-Y. Cynthia Lin
Jeffrey Williams

Prepared for:

State of California Air Resources Board
Research Division
P.O. Box 2815
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February 19, 2015

Check if applicable:

Animal subjects ____
Human subjects ____

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Abstract

We propose to investigate the factors that affect the adoption of advanced clean vehicles by developing and estimating a structural econometric model of vehicle choice. We will examine how financial incentives motivate purchase decisions based on various market factors and how financial incentives types and/or amounts may need to be potentially adjusted as the market for clean vehicles grows and technologies are improved. The results will inform potential incentive structure adjustments and refinements to increase the efficacy and cost-effectiveness of light-duty incentive programs in delivering air quality and climate benefits in light of changing vehicle markets and limited resources.

The parameters we will estimate are parameters in consumers' utility and demand functions, and therefore include parameters that measure how much consumers value vehicle price; vehicle characteristics such as fuel economy, horsepower, and size; vehicle retirement and replacement incentives; and advanced clean vehicle incentives, and also how the value that consumers place on price, vehicle characteristics and advanced clean vehicle incentives vary by income, socio-economic characteristics, and demographic characteristics. These parameters enable us to estimate own- and cross-price elasticities as well as elasticities of demand with respect to vehicle attributes (such as weight or fuel efficiency). These parameters also enable us to calculate household utility and welfare. We will use the estimated parameters to simulate vehicle choices under counterfactual scenarios for government policy and economic conditions, and to simulate demand when a new advanced clean vehicle is introduced.

Our structural econometric model has several advantages over a survey approach. First, econometric models are estimated using actual data on households' actual vehicle purchase decisions, and therefore may be more accurate a depiction of household preferences, since these preferences are revealed by the actual decisions they make. In contrast, surveys are based on self-reported responses to questions and may be subject to many errors and biases that cause these responses to be inaccurate representations of the truth.

A second advantage of our econometric approach over a survey approach is that we will estimate our econometric models using a comprehensive data set on all vehicle registrations in California, and will therefore base our models and analysis on the vehicle purchase decisions of all vehicle owners in California, not just those of the households that are surveyed. Our comprehensive data set not only provides more information, but also is not subject to sample selection issues that would plague a survey of a sample of the population.

A third advantage of our econometric approach over a survey approach is that our econometric model will enable us to statistically control for multiple factors that may affect vehicle purchase decisions, including price; vehicle characteristics such as fuel economy, horsepower, and size; vehicle retirement and replacement incentives; advanced clean vehicle incentives; income; socio-economic characteristics; and demographic characteristics, in a quantitative and rigorous manner.

A fourth advantage of the structural model is that the parameters we estimate enable us to calculate household utility and welfare. A fifth advantage of our structural econometric approach is that it enables us to estimate standard errors and confidence intervals for our parameters, and therefore to ascertain whether our parameters are statistically significant.

A sixth advantage of our structural model is that we can use the parameter estimates from our structural model to simulate demand and welfare under various counterfactual policy scenarios. We use our estimates to simulate vehicle purchase decisions in absence of government policy, and in the presence of varying forms and degrees of incentives.

Introduction

In order to meet air quality and climate change goals in California, a transformation of the light-duty vehicle fleet will be necessary. Incentives have the potential to play an important role in accelerating the retirement and replacement of older, high-polluting vehicles and in increasing the adoption of advanced clean vehicles. The Air Resources Board (ARB) has been providing incentives to California consumers to support the purchase of new near-zero and zero-emission vehicles, through Clean Vehicle Rebate Project (CVRP). As the market for light-duty vehicles evolves, incentives need to adapt to changing market conditions. In addition, incentives are also critical in influencing the use of cleaner vehicles in underserved and impacted areas where air quality benefits are needed the most.

Our proposed research will focus on advanced clean vehicle incentives. Our objective is to investigate factors that impact clean vehicle adoption, assess effectiveness of different financial incentive program structures, evaluate efficient incentive funding levels, determine how incentive funding levels should change as production volumes increase and vehicle technologies improve, and describe the conditions under which the market is self-sustaining and incentive funding is no longer necessary. The results of the research will be used to evaluate the light-duty vehicle market and inform ARB decision makers about the potential options for modifying ARB's incentive programs to ensure they make the best use of limited State resources, as well as provide benefits to underserved populations and disadvantaged communities.

Zero-emission vehicles (ZEVs), including plug-in electric (PEV) and fuel cell vehicles, are expected to play a major role in achieving California's long-term air quality and climate goals. Nearly all new light-duty vehicle sales by the 2040 model year need to be ZEVs or plug-in hybrid electric vehicles (PHEVs) in order to achieve California's long term 2050 GHG reduction goals in the light-duty vehicle sector. Additionally, Governor Brown issued Executive Order B-16-2012 in March 2012 that directs for the deployment of 1.5 million ZEVs on California's roadways by 2025. Amendments to the ZEV Regulation in 2012 strengthened requirements and requires manufacturers to produce increasing numbers of ZEVs and PHEVs. Incentive funding, in combination with other monetary and non-monetary incentives, supports early consumer acceptance and adoption of clean vehicle technology to help California meet its clean vehicle goals.

The Clean Vehicle Rebate Program (CVRP), established under Assembly Bill (AB) 118 as part of the Air Quality Improvement Program, offers vehicle rebates on a first-come, first-served basis for new light-duty ZEVs, PHEVs, zero-emission motorcycles, and neighborhood electric vehicles. As the market for advanced clean vehicles grow and technologies improve, the structure and incentive amounts will need to be re-evaluated in order to ensure that they make the best use of limited State funds while remaining effective in supporting clean vehicle purchases.[1]

We propose to investigate the factors that affect the adoption of advanced clean vehicles by developing and estimating a structural econometric model of vehicle choice. We will examine how financial incentives motivate purchase decisions based on various market factors and how financial incentives types and/or amounts may need to be potentially adjusted as the market for clean vehicles grows and technologies are improved. The results will inform potential incentive structure adjustments and refinements to increase the efficacy and cost-effectiveness of light-duty incentive programs in delivering air quality and climate benefits in light of changing vehicle markets and limited resources.

As clean vehicle technology advances and the market for them matures and grows, modifications to financial incentive amounts and structure need to be evaluated to ensure incentives remain effective with limited resources. Our research will provide insight into factors that affect clean vehicle adoption, effectiveness of various incentive structures to increase market penetration, and provide insight to the market conditions that point to when a self-sustaining market may be achieved and incentives are no longer necessary.

Our structural econometric model of clean vehicle adoption will enable us to evaluate new advanced clean vehicle purchase patterns and the role that various forms of financial incentives and market conditions play in determining those patterns; and to evaluate the efficacy of various financial incentive structures and funding amounts while taking into account advancements in clean vehicle technologies and market conditions. Financial incentive types considered for this project will be determined in consultation with ARB staff, but will likely include rebates, tax credits, feebates, registration fee reductions, point of sale incentives, sales tax exemptions, and/or a combination of incentives.

[1] Additional information on CVRP can be found at: https://energycenter.org/clean-vehicle-rebate-project and http://www.arb.ca.gov/msprog/aqip/cvrp.htm.

We will use our structural econometric model to evaluate how incentives interact and can be adjusted with potential ZEV technology advancements and economic indicators to drive vehicle purchase decisions and increase vehicle uptake. ZEV advancements we will examine will include but are not necessarily limited to lower technology costs, improved vehicle performance, and new vehicle model offerings. Economic indicators we will examine will include but are not necessarily be limited to gas prices, average household income, new car sales, and unemployment rate.

Our structural econometric model will enable us to provide insight into barriers to adoption of ZEVs for various consumer demographics, including consumers in disadvantaged communities; to evaluate the role that incentives of various forms and amounts could play in mitigating barriers; to provide insight into indicators of a self-sustaining clean vehicle market without incentives; and to evaluate different scenarios including elements such as, but not limited to, cumulative advanced clean vehicle sales, economic factors, vehicle advancements, and ZEV adoption scenarios that meet the goals of the ZEV regulation, Executive Order B-16-2012, and California Governor's ZEV Action Plan, and SB 1275.

Our proposed research will build upon work by PI Professor Lin and PI Professor Williams on spatial interdependence in automobile type choice (Adjemian, Lin and Williams, 2010); and work by PI Professor Williams on smog check programs in California (Merel, Smith, Williams, and Wimberger, 2014), on analyzing motorists in traffic-congested areas in southern California (Lee, Kwok, and Williams, 2014), and on using Automated Road Travel Survey data (Lee and Williams, forthcoming).

The dynamic structural model we develop will build upon the dynamic structural models PI Professor Lin has developed to analyze wind turbine owners' decisions about scrapping or replacing their turbines and the effects of government policies on these decisions (Cook and Lin, 2014); investment decisions in offshore petroleum production (Lin, 2009; Lin, 2013); and ethanol investment, production, entry, and exit decisions and the effects of government policy on these decisions (Lin and Thome, 2015; Lin and Yi, 2015a; Lin and Yi, 2015b; Yi, Lin and Thome, 2015). Our research will also build upon the work of PI Professor Lin on analyzing spatial externalities and strategic interactions in groundwater extraction (Pfeiffer and Lin, 2012; Lin and Pfeiffer, 2015). In ongoing work, PI Professor Lin is also developing and estimating

structural models of demand and supply of automobiles, including clean vehicles, in the U.S. and China.

Objectives

The objectives of our proposed research are the following:

1. Develop and estimate a structural econometric model of vehicle choice in California.

2. Evaluate new advanced clean vehicle purchase patterns and the role that various forms of financial incentives and market conditions play in determining those patterns.

3. Evaluate the efficacy of various financial incentive structures and funding amounts while taking into account advancements in clean vehicle technologies and market conditions.

4. Evaluate how incentives interact and can be adjusted with potential ZEV technology advancements and economic indicators to drive vehicle purchase decisions and increase vehicle uptake.

5. Analyze how financial incentives motivate purchase decisions based on various market factors and how financial incentives types and/or amounts may need to be potentially adjusted as the market for clean vehicles grows and technologies are improved.

6. Determine barriers to adoption of ZEVs for various consumer demographics, including consumers in disadvantaged communities.

7. Evaluate the role that incentives of various forms and amounts could play in mitigating barriers.

8. Provide insight into what conditions would indicate that a self-sustaining clean vehicle market may be achieved and incentives are no longer necessary.

9. Evaluate different scenarios including elements such as, but not limited to, cumulative advanced clean vehicle sales, economic factors, vehicle advancements, and ZEV adoption scenarios that meet the goals of the ZEV regulation, Executive Order B-16-2012, and California Governor's ZEV Action Plan, and SB 1275.

10. Examine what clean vehicle adoption rates would have been without government incentives.

11. Determine the barriers and opportunities and the costs and benefits of introducing new fuels and vehicles.

12. Evaluate the effects of government policy on vehicle demand.

Our results will be beneficial to ARB in several ways. First, our research will provide insight into factors that affect clean vehicle adoption, effectiveness of various incentive structures to increase market penetration, and provide insight to the market conditions that point to when a self-sustaining market may be achieved and incentives are no longer necessary.

Second, our results will inform potential incentive structure adjustments and refinements to increase the efficacy and cost-effectiveness of light-duty incentive programs in delivering air quality and climate benefits in light of changing vehicle markets and limited resources.

Third, our evaluation of modifications to financial incentive amounts and structure will enable ARB to ensure that its incentives remain effective with limited resources. The optimal design of incentive funding, in combination with other monetary and non-monetary incentives, would help support early consumer acceptance and adoption of clean vehicle technology and help California meet its clean vehicle goals.

Technical Plan

We propose to investigate the factors that affect the adoption of advanced clean vehicles by developing and estimating a structural econometric model of vehicle choice. We will examine how financial incentives motivate purchase decisions based on various market factors and how financial incentives types and/or amounts may need to be potentially adjusted as the market for clean vehicles grows and technologies are improved. The results will inform potential incentive structure adjustments and refinements to increase the efficacy and cost-effectiveness of light-duty incentive programs in delivering air quality and climate benefits in light of changing vehicle markets and limited resources.

Our structural econometric model has several advantages over a survey approach. First, econometric models are estimated using actual data on households' actual vehicle purchase decisions, and therefore may be more accurate a depiction of household preferences, since these preferences are revealed by the actual decisions they make (Zin, 2013). In contrast, surveys are based on self-reported responses to questions and may be subject to many errors and biases that cause these responses to be inaccurate representations of the truth ("The Top 5 Errors and Biases in Survey Research", 2013). For example, surveys are subject to response bias, which biases the response from the correct, honest, accurate response. Response bias includes the socially desirable or faking-good response; the opposite faking bad (or mad); acquiescence or yea-saying (the tendency to agree irrespective of the question) or its opposite or nay saying; extremity response set (always choosing extreme opposites) or its opposite, mid-point response set, etc. (Furnham, 1986). Responses to surveys are also subject to faking, lying and dissimulating, each of which refers to the fact that the respondent is concealing the truth under a feigned semblance of something different (Furnham, 1986). Particularly with surveys regarding government programs and government regulations, participants may give misleading responses in order to please the researcher, whom they may feel represents or communicates with the government or the regulator.

A second advantage of our econometric approach over a survey approach is that we will estimate our econometric models using a comprehensive data set on all vehicle registrations in California, and will therefore base our models and analysis on the vehicle purchase decisions of all vehicle owners in California, not just those of the households that are surveyed. Our

comprehensive data set not only provides more information, but also is not subject to sample selection issues that would plague a survey of a sample of the population.

A third advantage of our econometric approach over a survey approach is that our econometric model will enable us to statistically control for multiple factors that may affect vehicle purchase decisions, including price; vehicle characteristics such as fuel economy, horsepower, and size; vehicle retirement and replacement incentives; advanced clean vehicle incentives; income; socio-economic characteristics; and demographic characteristics, in a quantitative and rigorous manner.

A fourth advantage of the structural model is that we are able to estimate demand-side parameters that measure how much consumers value vehicle price; vehicle characteristics such as fuel economy, horsepower, and size; advanced clean vehicle incentives, and also how the value that consumers place on price, vehicle characteristics and advanced clean vehicle incentives vary by income, socio-economic characteristics, and demographic characteristics. These parameters enable us to estimate own- and cross-price elasticities as well as elasticities of demand with respect to vehicle attributes (such as weight or fuel efficiency). These parameters also enable us to calculate household utility and welfare.

A fifth advantage of our structural econometric approach is that it enables us to estimate standard errors and confidence intervals for our parameters, and therefore to ascertain whether our parameters are statistically significant.

A sixth advantage of our structural model is that we can use the parameter estimates from our structural model to simulate demand and welfare under various counterfactual policy scenarios. We use our estimates to simulate vehicle purchase decisions in absence of government policy, and in the presence of varying forms and degrees of incentives.

We propose to develop and estimate a structural econometric model of vehicle choice in California. We will estimate demand parameters for all vehicles in California by estimating a model of the California automobile industry using annual data on sales, prices and characteristics of the majority of vehicle makes and models in California. In addition to price, we will collect data on vehicle characteristics, such as power, fuel efficiency, vehicle type (e.g., sedans, SUVs, pick-ups, etc.), and displacement for the majority of vehicle makes and models in California. We will include plug-in electric vehicles, hybrid vehicles, alternative-fueled, and fuel cell vehicles in our model. We will combine our data on vehicle characteristics with data on

consumer characteristics such as income and education. Our model will enable us to estimate demand-side parameters, and own- and cross-price elasticities for clean vehicles.

The parameters we estimate will tell us what factors affect the demand for vehicles in California, and how consumers in California trade off various characteristics with each other and with price. We will use the model to simulate the demand for new vehicles.

Our proposed research follows the work of Berry, Levinsohn and Pakes (1995), who develop a model for empirically analyzing demand in differentiated products markets and then apply these techniques to analyze the U.S. automobile industry. Their framework enables one to obtain estimates of demand parameters for a class of oligopolistic differentiated products markets. Unlike traditional logit demand models, their random coefficients model allows for interactions between consumer and product characteristics, thus generating reasonable substitution patterns. Estimates from their framework can be obtained using only widely available product-level and aggregate consumer-level data. They apply their techniques to the U.S. automobile market, and obtain demand parameters for (essentially) all models marketed over a twenty year period. On the demand side, they estimate own- and cross-price elasticities as well as elasticities of demand with respect to vehicle attributes (such as weight or fuel efficiency).

This research will innovate upon the Berry et. al (1995) work by applying their model to more recent individual-level data on all vehicle registrations in California and including clean vehicles so that in addition to demand parameters relating to gasoline-fueled vehicles, demand parameters relating to clean vehicles can be estimated.

We will also build upon the work of Petrin (2002) on quantifying the benefits of new products by quantifying the benefits of new clean vehicles; the work of Berry, Levinsohn and Pakes (2004) on using micro-level data by using individual data; the work of Sexton and Sexton (2014) on conspicuous conservation and the willingness to pay for the green signal provided by the Toyota Prius; and the work of Berry and Haile (2014) on identification in differentiated products markets using market level data. Time permitting, we hope to begin to extend our model to allow for dynamic behavior, building upon the work of Dube, Fox and Su (2012).

Also time permitting, we hope to begin to extend our model to allow for strategic interactions between consumers that may arise if, for example, consumers are more likely to purchase a clean vehicle if their neighbor does or if a consumer learns more about clean vehicles

from their neighbors. Such a model of strategic interactions, peer effects and learning would build upon the work of PI Professor Lin and PI Professor Williams on spatial interdependence in automobile type choice (Adjemian, Lin and Williams, 2010); the work of PI Professor Lin on strategic interactions in offshore petroleum production (Lin, 2009; Lin, 2013); groundwater extraction (Pfeiffer and Lin, 2012; Lin and Pfeiffer, 2015); and ethanol investment, production, entry and exit (Lin and Thome, 2015; Lin and Yi, 2015a; Lin and Yi, 2015b; Yi, Lin and Thome, 2015);

Let x_j be a vector of observable vehicle characteristics with components x_{jk}, ξ_j be a vector of unobservable vehicle characteristics, p_j be the price, β_k be the mean taste parameter for vehicle characteristic *k*, and ζ_{ik} be a characteristic of consumer *i* that affects *i's* taste for vehicle characteristic *k*. The random coefficients specification for the utility of consumer *i* for vehicle model *j* is given by:

$$u_{ij} = \delta_j + \nu_{ij},$$

where δ_j is the mean utility level of vehicle model *j* and is given by:

$$\delta_j = x_j\beta - \alpha p_j + \xi_j,$$

and where the first term in ν_{ij} interacts consumer and product characteristics:

$$\nu_{ij} = \sum_k x_{jk}\sigma_k\zeta_{ik} + \varepsilon_{ij}.$$

The demand side estimation equation is the calculated mean utility, which is given by the inverse market share function:

$$\delta_j(s) = x_j\beta - \alpha p_j + \xi_j,$$

where s_j is the share of consumers who purchase vehicle model *j*. The demand side equation will be estimated using instruments for the endogenous price and market share variables via generalized method of moments.

The parameters we will estimate are parameters in consumers' utility and demand functions, and therefore include parameters that measure how much consumers value vehicle price; vehicle characteristics such as fuel economy, horsepower, and size; and advanced clean vehicle incentives, and also how the value that consumers place on price, vehicle characteristics and advanced clean vehicle incentives vary by income, socio-economic characteristics, and

demographic characteristics. These parameters enable us to estimate own- and cross-price elasticities as well as elasticities of demand with respect to vehicle attributes (such as weight or fuel efficiency). These parameters also enable us to calculate household utility and welfare. We can use the estimated parameters to simulate vehicle choices under counterfactual scenarios for government policy and economic conditions, and to simulate demand when a new advanced clean vehicle is introduced.

To estimate our model, we will use a detailed confidential data set received by PI Professor Williams from ARB while he was on the smog check board on all vehicle registrations in California, including registrations of clean vehicles, from 1998 to 2011. The registration data consists of approximately 650 million records covering about 55 million vehicles, about 23 million of which are current at any moment. The vehicle registration data will enable us to determine the clean vehicle adoption decisions of each household in each year. If ARB is willing to share the more recent data from 2012 to the present, we would greatly benefit from the more recent data as well, as it will have more coverage of clean vehicles and also more years of data under the Clean Vehicle Rebate Program (CVRP).

Our structural econometric model of clean vehicle adoption will enable us to evaluate new advanced clean vehicle purchase patterns and the role that various forms of financial incentives and market conditions play in determining those patterns; and to evaluate the efficacy of various financial incentive structures and funding amounts while taking into account advancements in clean vehicle technologies and market conditions. Financial incentive types considered for this project will be determined in consultation with ARB staff, but will likely include rebates, tax credits, feebates, registration fee reductions, point of sale incentives, sales tax exemptions, and/or a combination of incentives.

We will use our structural econometric model to evaluate how incentives interact and can be adjusted with potential ZEV technology advancements and economic indicators to drive vehicle purchase decisions and increase vehicle uptake. To do so, we will use our structural econometric model to simulate the outcomes, choices, and household welfare that would arise under different amounts and forms of incentives, different ZEV advancements, and different economic indicators. ZEV advancements will include but are not necessarily limited to lower technology costs, improved vehicle performance, and new vehicle model offerings. Economic

indicators will include but are not necessarily be limited to gas prices, average household income, new car sales, and unemployment rate.

Our structural econometric model will enable us to provide insight into barriers to adoption of ZEVs for various consumer demographics, including consumers in disadvantaged communities; to evaluate the role that incentives of various forms and amounts could play in mitigating barriers; to provide insight into indicators of a self-sustaining clean vehicle market without incentives; and to evaluate different scenarios including elements such as, but not limited to, cumulative advanced clean vehicle sales, economic factors, vehicle advancements, and ZEV adoption scenarios that meet the goals of the ZEV regulation, Executive Order B-16-2012, and California Governor's ZEV Action Plan, and SB 1275.

Our estimates of parameters in the demand for alternative vehicles will help us determine the barriers and opportunities and the costs and benefits of introducing new fuels and vehicles. Our estimates of the effects of government policies on the demand for conventional vehicles will enable us to evaluate the effects of government policy on vehicle demand and. Our estimates of the effects of government policies on the demand for alternative vehicles will enable us to determine which strategies are proving effective for alternative vehicle rollouts and which are not.

By using our structural econometric model to simulate the outcomes, choices, and household welfare that would arise under different amounts and forms of incentives, our model will enable us to analyze the market for ZEVs, and the role that financial incentives, charging infrastructure, and other benefits (e.g., high-occupancy vehicle lane access, free parking or charging for ZEVs) play in driving the market. Our model will also enable us to better understand how financial incentives motivate purchase decisions based on various market factors and how financial incentives types and/or amounts may need to be potentially adjusted as the market for clean vehicles grows and technologies are improved.

Our research is significant for industry, government and society. Our model of the demand in the California automobile market will be significant for industry, particularly car manufacturers interested in better targeting cars, particularly alternative vehicles, for the California market. Our estimates of the factors that affect demand in the California automobile market is significant for policy-makers interested in developing incentive policies to increase

market penetration of alternative vehicles with potential environmental and climate benefits. Our modeling outcomes can be used to help inform decision-making and policy design.

Our major tasks therefore consist of the following:

Task 1: Develop and estimate a structural econometric model of vehicle choice in California.

Task 2: Analyze the results of the model in order to evaluate new advanced clean vehicle purchase patterns and the role that various forms of financial incentives and market conditions play in determining those patterns.

Task 3: Use our structural model to simulate the choices of households that would have arisen in the absence of government policy in order to examine what clean vehicle adoption rates would have been without government incentives.

Task 4: Use our structural econometric model to simulate the outcomes, choices, and household welfare that would arise under different amounts and forms of incentives. In particular, we will:

- Evaluate the efficacy of various financial incentive structures and funding amounts while taking into account advancements in clean vehicle technologies and market conditions.
- Evaluate how incentives interact and can be adjusted with potential ZEV technology advancements and economic indicators to drive vehicle purchase decisions and increase vehicle uptake.
- Analyze how financial incentives motivate purchase decisions based on various market factors and how financial incentives types and/or amounts may need to be potentially adjusted as the market for clean vehicles grows and technologies are improved.
- Determine barriers to adoption of ZEVs for various consumer demographics, including consumers in disadvantaged communities.
- Evaluate the role that incentives of various forms and amounts could play in mitigating barriers.
- Evaluate the effects of government policy on vehicle demand.

Task 5: Use our structural econometric model to simulate the outcomes, choices, and household welfare that would arise under different scenarios including elements such as, but not

limited to, cumulative advanced clean vehicle sales, economic factors, vehicle advancements, and ZEV adoption scenarios that meet the goals of the ZEV regulation, Executive Order B-16-2012, and California Governor's ZEV Action Plan, and SB 1275.

Task 6: Use our structural econometric model to simulate the outcomes, choices, and household welfare in the future in order to provide insight into what conditions would indicate that a self-sustaining clean vehicle market may be achieved and incentives are no longer necessary.

Task 7: Use our structural econometric model to simulate the outcomes, choices, and household welfare that would when new fuels are introduced in order to determine the barriers and opportunities and the costs and benefits of introducing new fuels and vehicles.

Task 8: Write draft of final report.

Task 9: Revise final report.

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Yi, Fujin, C.-Y. Cynthia Lin, and Karen Thome. (2015). An analysis of the effects of government subsidies and the Renewable Fuel Standard on the fuel ethanol industry: A structural econometric model. Working paper, University of California at Davis. URL: http://www.des.ucdavis.edu/faculty/Lin/ethanol_subsidy_paper.pdf

Zin, D.M. (2013). Revealed preference theory. Encyclopeida Britannica. [online: web]. Accessed 2 February 2015. URL: http://www.britannica.com/EBchecked/topic/1952214/revealed-preference-theory

Project Schedule

Task 1: Develop and estimate a structural econometric model of vehicle choice in California.

Task 2: Analyze the results of the model in order to evaluate new advanced clean vehicle purchase patterns and the role that various forms of financial incentives and market conditions play in determining those patterns.

Task 3: Use our structural model to simulate the choices of households that would have arisen in the absence of government policy in order to examine what clean vehicle adoption rates would have been without government incentives.

Task 4: Use our structural econometric model to simulate the outcomes, choices, and household welfare that would arise under different amounts and forms of incentives.

Task 5: Use our structural econometric model to simulate the outcomes, choices, and household welfare that would arise under different scenarios.

Task 6: Use our structural econometric model to simulate the outcomes, choices, and household welfare in the future in order to provide insight into what conditions would indicate that a self-sustaining clean vehicle market may be achieved and incentives are no longer necessary.

Task 7: Use our structural econometric model to simulate the outcomes, choices, and household welfare that would when new fuels are introduced in order to determine the barriers and opportunities and the costs and benefits of introducing new fuels and vehicles.

Task 8: Write draft of final report.

Task 9: Revise final report.

	TASK									
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P = Deliver quarterly progress report by end of month

D = Deliver draft final report by end of month (to be submitted 6 months prior to contract expiration)

F = Deliver final report by end of month

M = Meeting with ARB staff

C.-Y. Cynthia Lin

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FACULTY APPOINTMENTS

Associate Professor (with tenure) July 2013 to present
Department of Agricultural and Resource Economics, and Department of Environmental Science and Policy
University of California at Davis

Assistant Professor July 2006 to June 2013
Department of Agricultural and Resource Economics, and Department of Environmental Science and Policy
University of California at Davis

OTHER APPOINTMENTS

President, U.S. Association for Energy Economics Bay Area Chapter	June 2012 to present
Member, California State Controller's Council of Economic Advisors	April 2007 to present
Faculty Affiliate, UC-Davis Institute of Transportation Studies	November 2006 to present
Faculty Member, UC-Davis Graduate Group in Transportation Technology and Policy	March 2007 to present
Faculty Member, UC-Davis Graduate Group in Applied Math	March 2007 to present
Faculty Member, UC-Davis Graduate Group in Ecology	October 2007 to present
Member, Bioenergy Research Group at UC-Davis	December 2006 to present
Faculty Associate, UC-Davis Air Quality Research Center	December 2006 to present
Member, Giannini Foundation for Agricultural Economics	July 2006 to present
Member, California Biomass Collaborative	October 2007 to present
Faculty Expert, UC-Davis John Muir Institute of the Environment	September 2008 to present
Associated Faculty, UC-Davis Center for Environmental Policy and Behavior	July 2010 to present
Affiliated Faculty, University of California Center for Energy and Environmental Economics	June 2011 to present
Research Associate, Harvard University John F. Kennedy School of Government	June 2006 to Oct. 2013
Fossil Fuels Track Director, Sustainable Transportation Energy Pathways Program, UC-Davis Institute of Transportation Studies	Dec. 2006 to Sep. 2012

EDUCATION

Harvard University Cambridge, MA
Ph.D. in Economics, June 2006.

Harvard University Cambridge, MA
A.M. in Economics, November 2005.

Harvard University Cambridge, MA
A.B. *summa cum laude* in Environmental Science and Public Policy, June 2000.

FIELDS OF INTEREST

Environmental and natural resource economics
Energy economics
Industrial organization
Applied econometrics
Applied microeconomics

HONORS, AWARDS, FELLOWSHIPS

Gordon and Betty Moore Foundation Data-Driven Discovery Investigator Competition semi-finalist (2014)
Associated Students of University of California at Davis Excellence in Education Award nominee (2012)
University of California at Davis Hellman Fellow (2011)
International Society for New Institutional Economics Award for the Best Ph.D. Dissertation (2006)
Stone Fellow Award for Best Paper Written by a Doctoral Student in Environmental and Resource Policy (2006)
Repsol YPF–Harvard Kennedy School Fellows Program Conference Travel Grant (2006)
The Partnership University Fellow (2005-2006)
Environmental Economics Program at Harvard University Pre-Doctoral Conference Travel Grant (2004)
Repsol YPF–Harvard Kennedy School Fellows Program Conference Travel Grant (2004)
1st Lindau Meeting of the Winners of the Bank of Sweden Prize in Economic Sciences in Memory of Alfred Nobel, young economist participant, selected to give closing remarks on behalf of students (2004)
Harvard University Department of Economics Research and Travel Award (2004)
Repsol YPF–Harvard Kennedy School Fellows Program Research Travel Grant (2004)
Harvard Committee on Undergraduate Education Certificate of Distinction in Teaching (Fall 2003)
Repsol YPF–Harvard Kennedy School Pre-Doctoral Fellowship in energy policy (2003)
Jens Aubrey Westengard Scholarship (2003)
Harvard Graduate School of Arts and Sciences Summer Research Award (2002)
Harvard Committee on Undergraduate Education Certificate of Distinction in Teaching (Fall 2002)
National Science Foundation Graduate Research Fellowship (2001)
Jacob K. Javits Fellowship (2001, declined in favor of EPA fellowship)
Environmental Protection Agency Science to Achieve Results Graduate Fellowship (2000-2003)
Rita Ricardo-Campbell Fellowship in Economics (2000)
Environmental Economics Program at Harvard University Pre-Doctoral Fellow (2000-2006)
Thomas Temple Hoopes Prize for the top 64 Harvard senior theses (2000)
Donald and Cathleen Pfister Prize for excellence in the natural sciences (2000)
Junior-year Phi Beta Kappa (1999)
Morris K. Udall Scholarship for excellence in environmental policy (1999)
Harvard College Research Program research fellowship (1999)
President Chao Nee Memorial Scholarship (1999)
John Harvard Scholarship (1997, 1998, 1999, & 2000)
Elizabeth Cary Agassiz Scholarship (1997, 1998 & 1999)
Detur Book Prize (1997)
First Place Grand Award at International Science and Engineering Fair (1996)

PEER-REVIEWED PUBLICATIONS

Jardine, Sunny L., C.-Y. Cynthia Lin, & James N. Sanchirico. (forthcoming). Measuring benefits from a marketing cooperative in the Copper River Fishery. American Journal of Agricultural Economics.

Pfeiffer, Lisa, & C.-Y. Cynthia Lin. (forthcoming). The effects of energy prices on groundwater extraction in agriculture in the High Plains Aquifer. American Journal of Agricultural Economics.

Lin, C.-Y. Cynthia, & Lisa Pfeiffer. (2015). Strategic behavior and regulation over time and space. In Kimberly Burnett, Richard Howitt, James A. Roumasset, and Christopher A. Wada (Eds.), Routledge Handbook of Water Economics and Institutions (pp. 79-90). New York: Routledge.

Ghandi, Abbas, & C.-Y. Cynthia Lin. (2014). Oil and gas service contracts around the world: A review. Energy Strategy Reviews, 3, 63-71.

Lin, C.-Y. Cynthia, & Jieyin (Jean) Zeng. (2014). The optimal gasoline tax for China. Theoretical Economics Letters, 4 (4), 270-278.

Pfeiffer, Lisa, & C.-Y. Cynthia Lin. (2014). Does efficient irrigation technology lead to reduced groundwater extraction?: Empirical evidence. Journal of Environmental Economics and Management, 67 (2), 189-208.

Bremson, Joel, Alan Meier, C.-Y. Cynthia Lin, & Joan M. Ogden. (2013). New approach to modeling large-scale alternative fuel and vehicle transitions. Transportation Research Record, 2385, 61-69.

Herath Mudiyanselage, Nisal, C.-Y. Cynthia Lin, & Fujin Yi. (2013). An analysis of ethanol investment decisions in Thailand. Theoretical Economics Letters, 3 (5A1), 14-20.

Lin, C.-Y. Cynthia. (2013). California's agriculture-related air pollution policy. Journal of Environmental Protection, 4 (8A1), 24-27.

Lin, C.-Y. Cynthia, & Jieyin (Jean) Zeng. (2013). The elasticity of demand for gasoline in China. Energy Policy, 59, 189-197.

Lin, C.-Y. Cynthia, & Lea Prince. (2013). Gasoline price volatility and the elasticity of demand for gasoline. Energy Economics, 38, 111-117.

Lin, C.-Y. Cynthia, & Erich J. Muehlegger. (2013). On the use of heuristics to approximate competitors' private information. Journal of Economic Behavior and Organization, 86, 10-23.

Lin, C.-Y. Cynthia. (2013). Strategic decision-making with information and extraction externalities: A structural model of the multi-stage investment timing game in offshore petroleum production. Review of Economics and Statistics, 95 (5), 1601-1621.

Lin, C.-Y. Cynthia, & Zachary D. Liscow. (2013). Endogeneity in the environmental Kuznets curve: An instrumental variables approach. American Journal of Agricultural Economics, 95 (2), 268-274.

Lin, C.-Y. Cynthia. (2012). Using spatial econometrics to measure ozone pollution externalities. Journal of Environmental Protection, 3 (9A), 1117-1123.

Pfeiffer, Lisa, & C.-Y. Cynthia Lin. (2012). Groundwater pumping and spatial externalities in agriculture. Journal of Environmental Economics and Management, 64 (1), 16-30.

Ghandi, Abbas, & C.-Y. Cynthia Lin. (2012). Do Iran's buy-back service contracts lead to optimal production?: The case of Soroosh and Nowrooz. Energy Policy, 42, 181-190.

Leighty, Wayne, & C.-Y. Cynthia Lin. (2012). Tax policy can change the production path: A model of optimal oil extraction in Alaska. Energy Policy, 41, 759-774.

Lin, C.-Y. Cynthia. (2011). Learning an opponent's strategy in Cournot competition. International Journal of Strategic Management, 11 (1), 94-112.

Lin, C.-Y. Cynthia. (2011). Estimating supply and demand in the world oil market. Journal of Energy and Development, 34 (1), 1-32.

Corderi, David, & C.-Y. Cynthia Lin. (2011). Measuring the social rate of return to R&D in coal, petroleum and nuclear manufacturing: A study of the OECD countries. Energy Policy, 39 (5), 2780-2785.

Pfeiffer, Lisa, & C.-Y. Cynthia Lin. (2010). The effect of irrigation technology on groundwater use. Choices, 25 (3).

Lin, C.-Y. Cynthia. (2010). A spatial econometric approach to measuring pollution externalities: An application to ozone smog. Journal of Regional Analysis and Policy, 40 (1), 1-19.

Adjemian, Michael K., C.-Y. Cynthia Lin, & Jeffrey Williams. (2010). Estimating spatial interdependence in automobile type choice with survey data. Transportation Research Part A: Policy and Practice, 44, 661-675.

Lin, C.-Y. Cynthia. (2010). How should standards be set and met?: On the allocation of regulatory power in a federal system. B.E. Journal of Economic Analysis and Policy: Topics, 10 (1), Article 51.

Lin, C.-Y. Cynthia. (2010). Instability, investment, disasters, and demography: Natural disasters and fertility in Italy (1820-1962) and Japan (1671-1965). Population and Environment, 31 (4), 255-281.

Lin, C.-Y. Cynthia, & Lea Prince. (2009). The optimal gas tax for California. Energy Policy, 37 (12), 5173-5183.

Farinelli, Barbara, Colin A. Carter, C.-Y. Cynthia Lin, & Daniel A. Sumner. (2009). Import demand for Brazilian ethanol: A cross-country analysis. Journal of Cleaner Production, 17, S9-S17.

Lin, C.-Y. Cynthia. (2009). Estimating strategic interactions in petroleum exploration. Energy Economics, 31 (4), 586-594.

Lin, C.-Y. Cynthia, Haoying Meng,, Tsz Yan Ngai, Valeria Oscherov, & Yan Hong Zhu. (2009). Hotelling revisited: Oil prices and endogenous technological progress. Natural Resources Research, 18 (1), 29-38.

Lin, C.-Y. Cynthia. (2009). Insights from a simple Hotelling model of the world oil market. Natural Resources Research, 18 (1), 19-28.

Lin, C.-Y. Cynthia. (2008). An evaluation of Keynes' projected possibilities. American Journal of Economics and Sociology, 67 (2), 315-329.

Lin, C.-Y. Cynthia, & Gernot Wagner. (2007). Steady-state growth in a Hotelling model of resource extraction. Journal of Environmental Economics and Management, 54 (1), 68-83.

Lin, C.-Y. Cynthia. (2005). The investment timing game in petroleum production: An econometric model. Physica A, 355 (1), 62-68.

Lin, C.-Y. Cynthia, Daniel J. Jacob, & Arlene M. Fiore. (2001). Trends in exceedances of the ozone air quality standard in the continental United States, 1980-1998. Atmospheric Environment, 35, 3217-3228.

Lin, C.-Y. Cynthia, Daniel J. Jacob, J. William Munger, & Arlene M. Fiore. (2000). Increasing background ozone in surface air over the United States. Geophysical Research Letters, 27 (21), 3465-3468.

OTHER PUBLICATIONS

Lin, C.-Y. Cynthia. (forthcoming). California's nitrogen-related air quality regulations. In California Nitrogen Assessment. University of California Press.

Ghandi, Abbas, & C.-Y. Cynthia Lin (2015). Is resource nationalism on the rise?: Evidence from service contracts in eight countries. International Association for Energy Economics Energy Forum, 24 (1), 35-37.

Lin, C.-Y. Cynthia. (2014). The benefits of investing in energy research and development. California State Controller John Chiang Statement of General Fund Cash Receipts and Disbursements, 8 (8). URL: http://www.sco.ca.gov/eo_2014_08_summary_analysis_guest_column.html

Lin, C.-Y. Cynthia (2014). Modeling ethanol investment decisions. In Alberto Adrego Pinto and David Zilberman (Eds.), Modelling, Dynamics, Optimization and Bioeconomics I (pp. 487-497). Springer.

Pfeiffer, Lisa, & C.-Y. Cynthia Lin. (2014). Perverse consequences of incentive-based groundwater conservation programs. Global Water Forum, Discussion Paper 1415.

Lade, Gabriel E., & C.-Y. Cynthia Lin. (2014). Controlling compliance costs for California's LCFS with a price ceiling. Policy brief, University of California at Davis Institute of Transportation Studies.

Lin, C.-Y. Cynthia. (2014). Strategic interactions during oil exploration in the Gulf of Mexico. In Morena J. Acosta (Ed.), Advances in Energy Research, Volume 20 (pp.201-212) New York: Nova Science Publishers, Inc.

Lin, C.-Y. Cynthia. (2013). Containing the costs of California's low carbon fuel standard. California State Controller John Chiang Statement of General Fund Cash Receipts and Disbursements, 7 (12). URL: http://www.sco.ca.gov/eo_2013_12_summary_analysis_featured_column.html

Lade, Gabriel E., & C.-Y. Cynthia Lin. (2013). A report on the economics of California's low carbon fuel standard and cost containment mechanisms. Prepared for the California Air Resources Board. Institute of Transportation Studies, University of California at Davis, Research Report UCD-ITS-RR-13-23.

Lin, C.-Y. Cynthia. (2013). Paradox on the Plains: As water efficiency increases, so can water use. California WaterBlog. URL: http://californiawaterblog.com/2013/08/13/paradox-on-the-plains-as-water-efficiency-increases-so-can-water-use/

Lin, C.-Y. Cynthia. (2013). The unintended consequences of incentive-based groundwater conservation programs: A study using spatial data. Energy Dimensions. URL: http://www.energydimensions.net/the-unintended-consequences-of-incentive-based-groundwater-conservation-programs-a-study-using-spatial-data/

Lin, C.-Y. Cynthia. (2013). Incentive-based groundwater conservation programs may have unintended results. California State Controller John Chiang Statement of General Fund Cash Receipts and Disbursements, 7 (6), 5-6.

Yi, Fujin, C.-Y. Cynthia Lin, & Karen Thome. (2013). An analysis of the effects of government subsidies and the renewable fuels standard on the fuel ethanol industry. Policy brief, University of California at Davis Policy Institute for Energy, Environment and the Economy.

Lin, C.-Y. Cynthia. (2013). On designing and analyzing policies for renewable fuels. Energy Dimensions. URL: http://www.energydimensions.net/on-designing-and-analyzing-policies-for-renewable-fuels/

Lin, C.-Y. Cynthia. (2013). Activities of the newly-formed Bay Area Chapter in Northern California. U.S. Association for Energy Economics Dialogue, 21 (2).

Lin, C.-Y. Cynthia. (2013). Instability, investment and natural disasters. In Biljana Raskovic & Svetomir Mrdja (Eds.), Natural Disasters: Prevention, Risk Factors and Management (pp.243-258). New York: Nova Science Publishers, Inc.

Lin, C.-Y. Cynthia. (2012). An analysis of ethanol investment decisions. In Roy I. Henry & Billy P. Woods (Eds.), Ethanol: Production, Cellular Mechanisms and Health Impact (pp. 121-128). New York: Nova Science Publishers, Inc.

Lin, C.-Y. Cynthia. (2012). California should raise its gasoline tax. Energy Dimensions. URL: http://www.energydimensions.net/california-should-raise-its-gasoline-tax/

Lin, C.-Y. Cynthia. (2012). On designing and analyzing policies for renewable fuels. California State Controller John Chiang Statement of General Fund Cash Receipts and Disbursements, 6 (12), 4-5.

Lin, C.-Y. Cynthia. (2011). An assessment of the effectiveness of California's local air pollution controls on agricultural sources. In Mohamed K. Khallaf (Ed.), The Impact of Air Pollution on Health, Economy, Environment and Agricultural Sources (pp. 323-330). InTech – Open Access Publisher.

Heres del Valle, David R., & C.-Y. Cynthia Lin. (2011). Sub-national state's climate policy: The case of California. In Ibon Galarraga, Mikel Gonzalez-Eguino, & Anil Markandya (Eds.), Handbook of Sustainable Energy (pp. 555-573). United Kingdom: Edward Elgar.

Lin, C.-Y. Cynthia. (2011). Fossil fuels. World Book Encyclopedia. Chicago: World Book.

Lin, C.-Y. Cynthia. (2011). The effects of an E10 ethanol-blend policy on California. California State Controller John Chiang Statement of General Fund Cash Receipts and Disbursements, 5 (5), 6-7.

Lin, C.-Y. Cynthia. (2011). A Hotelling model of steady-state growth in coal extraction. In James J. Stewart (Ed.), Coal Extraction (pp. 147-154). New York: Nova Science Publishers, Inc.

Lin, C.-Y. Cynthia. (2010). Gasoline price volatility. California State Controller John Chiang Statement of General Fund Cash Receipts and Disbursements, 4 (11), 6-8.

Lin, C.-Y. Cynthia, Wei Zhang, Omid Rouhani, & Lea Prince. (2009). The implications of an E10 ethanol-blend policy for California. Agricultural and Resource Economics Update, 13 (2), 1-4.

Lin, C.-Y. Cynthia. (2009). Biofuels for transport: Global potential and implications for sustainable energy and agriculture (book review). American Journal of Agricultural Economics, 91(4), 1155-1157.

Pfeiffer, Lisa, & C.-Y. Cynthia Lin. (2009). Incentive-based groundwater conservation programs: Perverse consequences? Agricultural and Resource Economics Update, 12 (6), 1-4.

Lin, C.-Y. Cynthia. (2008). On the distribution of regulatory power between state and local governments. In Albert Tavidze (Ed.), Progress in Economics Research, Volume 12 (pp. 189-208). New York: Nova Science Publishers, Inc.

Lin, C.-Y. Cynthia. (2007). California's gasoline tax. California State Controller John Chiang Statement of General Fund Cash Receipts and Disbursements, 1 (7), 5-8.

Lin, C.-Y. Cynthia. (2006). Environmental federalism and regulatory delegation: An incomplete contracting approach. In Raimund Bleischwitz & Oliver Budzinski (Eds.), Environmental Economics: Institutions, Competition, Rationality (pp. 129-149). Berlin: VWF.

Lin, C.-Y. Cynthia. (2006). Oil prices, stock effects and endogenous technological progress. In Cordelia L. Frankhouse (Ed.), Economics of Agriculture and Natural Resources (pp. 111-125). New York: Nova Science Publishers, Inc.

Lin, C.-Y. Cynthia. (2006). Three essays on the economics of the environment, energy and externalities. Ph.D. dissertation, Harvard University.

Lin, C.-Y. Cynthia. (2005). Estimating annual and monthly supply and demand for world oil: A dry hole? In William W. Hogan (Ed.), Repsol YPF – Harvard Kennedy School Fellows 2003-2004 Research Papers (pp. 213-249). Cambridge, MA: Harvard University.

Lin, C.-Y. Cynthia. (2005). The multi-stage investment timing game in offshore petroleum production: A framework for an econometric model. In William W. Hogan (Ed.), Repsol YPF – Harvard Kennedy School Fellows 2003-2004 Research Papers (pp. 201-211). Cambridge, MA: Harvard University.

Lin, C.-Y. Cynthia. (2005). Optimal world oil extraction: Calibrating and simulating the Hotelling model. In William W. Hogan (Ed.), Repsol YPF – Harvard Kennedy School Fellows 2003-2004 Research Papers (pp. 251-266). Cambridge, MA: Harvard University.

Lin, C.-Y. Cynthia. (2004). Regulatory delegation: Theory and application to environmental federalism. In Gregory T. Papanikos (Ed.), Competition, Regulation and Protection: Essays from an International Conference on Industrial Organization, Law and Economics (pp. 79-90). Athens: Athens Institute for Education and Research.

Lin, C.-Y. Cynthia. (2001). The scholar as activist: A colloquium explores these dual roles. Harvard Graduate School of Arts and Sciences Bulletin, XXX (9), 1-3.

Lin, C.-Y. Cynthia. (2000). Trends in ozone smog. Senior thesis, Harvard University.

WORKING PAPERS

"Mandating green: On the design of renewable fuel policies and cost containment mechanisms", with Gabriel E. Lade

"On the design of driving restrictions: Theory and empirical evidence", with Wei Zhang and Victoria I. Umanskaya (revise and resubmit, Journal of Environmental Economics and Management)

"Wind turbine shutdowns and upgrades in Denmark: Timing decisions and the impact of government policy", with Jonathan A. Cook (under review)

"Evaluating public transit investment in congested cities", with Justin Beaudoin and Y. Hossein Farzin (under review)

"Policy shocks and market-based regulations: Evidence from the Renewable Fuel Standard", with Gabriel E. Lade and Aaron Smith

"An analysis of the effects of government subsidies and the renewable fuels standard on the fuel ethanol industry: A structural econometric model", with Fujin Yi and Karen Thome

"Does employment growth increase travel time to work?: An empirical analysis using military troop movements", with Geoffrey M. Morrison

"Market power in the world oil market: Evidence for an OPEC cartel and an oligopolistic non-OPEC fringe" (under review)

"Investment in corn-ethanol plants in the Midwestern United States: An analysis using reduced-form and structural models", with Karen Thome

"The rate of return to research and development in energy", with David Corderi (under review)

"Market power in nonrenewable resource markets: An empirical dynamic model", with Wei Zhang (under review)

"What factors affect the decision to invest in a fuel ethanol plant?: A structural model of the ethanol investment timing game", with Fujin Yi

"On the rate of return and risk factors to international oil companies in Iran's buy-back service contracts", with Abbas Ghandi (under review)

"Ex-post costs and RIN prices under the Renewable Fuel Standard", with Gabriel E. Lade and Aaron Smith

"The effects of energy policies in China on energy consumption", with Ming-Jie Lu and Song Chen

"The macroeconomic rebound effect in China", with Jiangshan Zhang (under review)

"Driving in force: The influence of workplace peers on commuting decisions on U.S. military bases", with Geoffrey M. Morrison (under review)

"A theory of regulatory federalism" (under review)

"An analysis of the economic efficiency of Iraq's oil service contracts", with Abbas Ghandi (under review)

"The producer surplus associated with gasoline fuel use in the United States", with Yongling Sun, Mark A. Delucchi and Joan M. Ogden

"The effects of energy policies in China on GDP, industrial output and new energy profits", with Ming-Jie Lu and Song Chen

"Quantity and price controls for the correction of externalities under uncertain damages: Evidence from a laboratory experiment", with David R. Heres del Valle

"A nonparametric instrumental variable approach to estimating the environmental Kuznets curve for water pollutants at the global level", with Krishna P. Paudel and Mahesh Pandit (under review)

"Ethanol plant investment in Canada: A structural model", with Fujin Yi

"Property rights and groundwater management in the High Plains Aquifer", with Lisa Pfeiffer (under review)

"The conditional relationship between risk and return in Iran's stock market", with Mahdieh Rezagholizadeh, Kazem Yavari and Bahram Sahabi (under review)

"The effects of innovation on income inequality in China", with Qingchun Liu (under review)

"The design and economics of low carbon fuel standards", with Gabriel E. Lade (under review)

"Public transit investment and sustainable transportation: A review of transit's impact on traffic congestion and air quality", with Justin Beaudoin and Y. Hossein Farzin (under review)

"Using observed ozone-temperature relationships to project the effect of future climate change on ozone exceedances in the northeastern United States", with Loretta J. Mickley, Katharine M. Hayhoe, Ed P. Maurer, Christian Hogrefe, Patrick L. Kinney, and Daniel J. Jacob

GRANTS

National Center for Sustainable Transportation Federal Research Seed Grant ($25,000). Principal Investigator: C.-Y. Cynthia Lin. Awarded July 2014.

Resources for the Future Retrospective Studies of Regulatory Performance Grant ($37,686.94). Principal Investigators: Aaron Smith, C.-Y. Cynthia Lin, and Gabriel E. Lade. Awarded September 2013.

Giannini Foundation of Agricultural Economics minigrant ($24,851). Principal Investigator: C.-Y. Cynthia Lin. Awarded June 2012.

UC-Davis Committee on Research Academic Senate Faculty Research Grant ($12,000). Principal Investigator: C.-Y. Cynthia Lin. Awarded June 2012.

UC-Davis Sustainable Transportation Center Faculty Research Grant ($59,995.99). Principal Investigator: C.-Y. Cynthia Lin. Awarded August 2011.

Giannini Foundation of Agricultural Economics minigrant ($24,585). Principal Investigator: C.-Y. Cynthia Lin. Awarded June 2011.

UC-Davis Sustainable Transportation Center Seed Grant ($9,919.34). Principal Investigator: C.-Y. Cynthia Lin. Awarded June 2011.

UC-Davis Hellman Fellowship ($20,638). Awarded May 2011.

ITS Multi-campus Research Program and Initiative on Sustainable Transportation grant ($17,000). Principal Investigator: C.-Y. Cynthia Lin. Awarded January 2011.

UC-Davis Chevron Research Grant ($301,037). Principal Investigator: C.-Y. Cynthia Lin. Awarded December 2007.

UC-Davis Chevron Research Grant ($369,308). Principal Investigator: C.-Y. Cynthia Lin. Co-PIs: Mark Delucchi, Christopher Knittel, and Daniel Sperling. Awarded February 2007.

TEACHING EXPERIENCE

University of California at Davis
ARE 175/ESP 175: Natural Resource Economics (2008 - present)
ARE 254: Dynamic Optimization Techniques with Economic Applications (2011 - present)
ARE 255 (formerly ARE 276 and ARE 298): Applied Dynamic Structural Econometric Modeling (2007 - present)
ECL 298: Environmental Policy and Human Ecology Core Course (Winter 2010)
ARE 199: Special Study for Advanced Undergraduates (2007 - present)
ECN 194HB: Honors Thesis in Economics (2011-2012)
Faculty Mentor, Vertical Integration of Research and Education in the Mathematical Sciences (VIGRE) Research Experiences for Undergraduates (Summer 2007)
Guest Lecturer, ARE 176: Environmental Economics (November 17, 2009)
Guest Lecturer, Engineering Civil and Environmental (ECI) 269: Transportation – Air Quality (May 2, 2007)
Guest Lecturer, Engineering Biological Systems (EBS) 216: Energy Systems (March 14, 2007)

Harvard University
Participant in Discussion Leading Master Class, Harvard University Derek Bok Center for Teaching and Learning (2005-2006)

Teaching Fellow for Prof. Martin Weitzman, Economics 1690: "Theory of Capital and Income" (Fall 2002 and Fall 2003)

PRESENTATIONS

"The economics of energy: Dynamic behavior, strategic interactions and government policy." CITRUS@Berkeley Research Exchange Seminar. Berkeley, CA. November 2014.

"Wind turbine shutdowns and upgrades in Denmark: Timing decisions and the impact of government policy." Harvard Environmental Economics Program Research Workshop. Cambridge, MA. October 2014.

"Wind turbine shutdowns and upgrades in Denmark: Timing decisions and the impact of government policy." Texas A&M. College Station, TX. September 2014.

"Market power in the world oil market: Evidence for an OPEC cartel and an oligopolistic non-OPEC fringe." 37th International Association for Energy Economics International Conference. New York City. June 2014.

"Dynamic optimization and dynamic games in economics." Graduate Group in Applied Math Mini-Conference. University of California at Davis. January 2014.

"The effects of energy prices on groundwater extraction in agriculture in the High Plains Aquifer." American Economic Association Annual Meeting. Philadelphia. January 2014.

"Strategic decision-making with information and extraction externalities: A structural model of the multi-stage investment timing game in offshore petroleum production." Georgia Institute of Technology. Altlanta, Georgia. August 2013.

"Energy prices and groundwater extraction in agriculture." Association of Environmental and Resource Economists Conference. Banff, Canada. June 2013.

"An analysis of the effects of government subsidies on the fuel ethanol industry: A structural econometric model." Berkeley Bioeconomy Conference. Berkeley, CA. March 2013.

"Strategic decision-making with information and extraction externalities: A structural model of the multi-stage investment timing game in offshore petroleum production." American University. Washington, DC. February 2013.

"Strategic decision-making with information and extraction externalities: An empirical analysis of investment timing decisions in offshore petroleum production." American Economic Association Annual Meeting. San Diego. January 2013.

"The effects of policy and strategic factors on investment in fuel-ethanol plants." American Economic Association Annual Meeting. San Diego. January 2013.

"Strategic decision-making with information and extraction externalities: An empirical analysis of investment timing decisions in offshore petroleum production." 31st United States Association for Energy Economics (USAEE) — International Association for Energy Economics (IAEE) North American Conference. Austin. November 2012.

"Strategic decision-making with information and extraction externalities: An empirical analysis of investment timing decisions in offshore petroleum production." University of Wisconsin-Madison. September 2012.

"An analysis of ethanol investment decisions." 3rd Annual All-UC Conference on Energy and Environmental Economics. Berkeley. June 2012.

"Research highlights." UC-Davis Sustainable Transportation Energy Pathways Advisory Board Meeting. University of California at Davis. June 2012.

"Economic, policy and business strategy in energy." Brightsource Energy. Oakland, CA. March 2012.

"The effects of policy and strategic factors on investment in fuel-ethanol plants." Berkeley Bioeconomy Conference. Berkeley, CA. March 2012.

"Climbing gas prices." Insight, Capital Public Radio. March 2012.

"Endogeneity in the environmental Kuznets curve: An instrumental variables approach." American Economic Association Annual Meeting. Chicago. January 2012.

"Gasoline demand elasticities, gasoline price volatility, and the optimal gas tax for California." Sacramento Economics Roundtable. September 2011.

"The effects of policy and strategic factors on investment in fuel-ethanol plants." Rice University. September 2011.

"The effects of policy and strategic factors on investment in fuel-ethanol plants." Association of Environmental and Resource Economists Conference. Seattle. June 2011.

"Do firms interact strategically?: An empirical analysis of investment timing decisions in offshore petroleum production." University of California at Riverside. April 2011.

"Have OPEC producers colluded?: An empirical dynamic model of OPEC and non-OPEC." OPEC at 50: Its past, present and future in a carbon-constrained world. National Energy Policy Institute/University of Tulsa. March 2011.

"Global energy issues." UC-Davis International Relations Student Association Guest Speaker. University of California at Davis. February 2011.

"Investment in biofuels: The role of oil companies." UC-Davis Sustainable Transportation Energy Pathways (STEPS) Symposium. University of California at Davis. January 2011.

"The effects of policy and strategic factors on investment in fuel-ethanol plants." IO Fest 2010: The Annual Berkeley-Stanford Conference in Industrial Organization. Stanford University. November 2010.

"Do firms interact strategically?: An empirical analysis of investment timing decisions in offshore petroleum production." University of Alberta. October 2010.

"Investment in corn-ethanol plants in the Midwestern United States." Duke University. October 2010.

"Do firms interact strategically?: An empirical analysis of investment timing decisions in offshore petroleum production." Triangle Resource and Environmental Economics Seminar. North Carolina. October 2010.

"How should standards be set and met?: On the allocation of regulatory power in a federal system." University of Nevada at Reno. October 2010.

"Investment in fuel-ethanol plants." Research Sketch. National Bureau of Economic Research (NBER) Summer Institute Environmental and Energy Economics Workshop. July 2010.

"The economics of investment in biofuels." Third Berkeley Conference on the Bioeconomy. Berkeley, CA. June 2010.

"The optimal gas tax for California." U.S. Energy Policy in Transition conference. Gainesville, FL. March 2010.

"Strategic behavior and government policy." Graduate Group in Applied Math Mini-Conference. University of California at Davis. January 2010.

"Gasoline demand elasticities, gasoline price volatility, and the optimal gas tax for California." 11th Occasional California Workshop on Environmental and Natural Resource Economics. Santa Barbara. October 2009.

"Gasoline demand elasticities, gasoline price volatility, and the optimal gas tax for California." 2009 Harvard Environmental Economics Alumni Workshop. September 2009.

"Research on natural resources." Visiting Delegation from Henan Province of P.R. China. University of California at Davis. September 2009.

"Understanding, modeling and analyzing energy markets." UC-Davis Sustainable Transportation Energy Pathways Advisory Board Meeting. Asilomar. July 2009.

"How should standards be set and met?: On the allocation of regulatory power in a federal system." University of California at Riverside. June 2009.

"An empirical dynamic model of OPEC and Non-OPEC." Harvard University. February 2009.

"An empirical dynamic model of OPEC and Non-OPEC." University of California at San Diego. January 2009.

"Energy outlook: Prospects and policies." California State Controller Council of Economic Advisors meeting. Sacramento. December 2008.

"Dynamic and strategic decision-making in the energy industry." Exxon-Mobil campus visit. Institute of Transportation Studies, University of California at Davis. July 2008.

"How should standards be set and met?: On the allocation of regulatory power in a federal system." 10th Occasional Workshop on Environmental and Resource Economics. Santa Barbara. March 2008.

"Do firms interact strategically?: A structural model of the multi-stage investment timing game in offshore petroleum production." University of California at Berkeley. February 2008.

"Do firms interact strategically?: A structural model of the multi-stage investment timing game in offshore petroleum production." American Economic Association Annual Meeting. New Orleans. January 2008.

"An empirical dynamic model of OPEC and Non-OPEC." 1st International Association for Energy Economics (IAEE) Asian conference. Taipei. November 2007.

"Modeling OPEC and non-OPEC behavior: A structural econometric approach." IO Fest 2007: The 13th Annual Berkeley-Stanford Conference in Industrial Organization. Berkeley Haas School of Business. October 2007.

"Estimating and testing a dynamic model of OPEC and non-OPEC." 27th United States Association for Energy Economics (USAEE) — International Association for Energy Economics (IAEE) North American Conference. Houston. September 2007.

"Business and investment strategies for clean tech commodities." Panel on Biofuels: Successful Business Models for Clean Tech Commodities. Clean Technology Group, Entrepreneurship Program, MIT Club of Northern California. Google, Mountain View, CA. September 2007.

"Fossil fuels research highlights." UC-Davis Sustainable Transportation Energy Pathways Advisory Board Meeting. Asilomar. August 2007.

"Strategic behavior and government policy." Research Sketch. National Bureau of Economic Research (NBER) Summer Institute Workshop on Public Policy and the Environment. July 2007.

"Managing energy markets: Policies and implications." Swedish Parliament visit: New Energy and Techniques for a Better Future. University of California at Davis. June 2007.

"Energy: A Giannini jingle." Annual Meeting of the Giannini Foundation of Agricultural Economics. UC-Berkeley. May 2007.

"A theory of regulatory delegation, with a framework for application to ozone smog regulation." Ronald Coase Institute Conference on Institutional Research. Chicago. Dec. 2006.

"Do firms interact strategically?: An empirical analysis of investment timing decisions in offshore petroleum production." 9th Occasional Workshop on Environmental and Resource Economics. Santa Barbara. Nov. 2006.

"How should standards be set and met?: An incomplete contracting approach to delegation in regulation." University of California at Berkeley. Oct. 2006.

"How should standards be set and met?: An incomplete contracting approach to delegation in regulation." University of California at Davis. Oct. 2006.

"Do firms interact strategically?: An empirical analysis of investment timing decisions in offshore petroleum production." 3rd World Congress of Environmental and Resource Economists. Kyoto. July 2006.

"How should standards be set and met?: An incomplete contracting approach to delegation in regulation." 3rd World Congress of Environmental and Resource Economists. Kyoto. July 2006.

2003-2006:

International Industrial Organization Conference, 2006
University of California, Berkeley, 2006
University of California, Davis, 2006
University of Hawaii, Manoa, 2006
Rice University, 2006
Soka University, 2006
Repsol YPF – Harvard Seminar on Energy, 2005
Harvard University Environmental Economics and Policy Seminar, 2005
Harvard Environmental Economics Workshop, 2005
Interdisciplinary Spatial Statistics Workshop, 2004 (Paris)
INFER Conference 2004: Environmental Economics: Institutions, Competition, Rationality, 2004 (Wuppertal, Germany)
First Bonzenfreies Colloquium on Market Dynamics and Quantitative Economics, 2004 (Alessandria, Italy)
NBER Summer Institute Workshop on Public Policy and the Environment, 2004 (research sketch)
Second World Congress of the Game Theory Society, 2004 (Marseille)
International Conference on Industrial Organization, Law and Economics, 2004 (Chalkidiki, Greece)
Harvard University Environmental Economics and Policy Seminar, 2004
Repsol YPF – Harvard Seminar on Energy, 2003
NBER Summer Institute Workshop on Public Policy and the Environment, 2003 (research sketch)

WORKSHOPS, SUMMER PROGRAMS AND OTHER PROFESSIONAL MEETINGS

National Bureau of Economic Research Summer Institute Econometrics Minicourse (2007)
Stanford University Woods Institute for the Environment Inter-University Scholars Program: Engaging with California Government on Climate Change (2006)
Harvard University Christensen Discussion-Leading Seminar (2005-2006)
Ronald Coase Institute Workshop on Institutional Analysis (2004)

EAERE-FEEM-VIU Summer School: Dynamic Models in Economics and the Environment, scholarship recipient (2004)
XIV Seminario Repsol YPF ~ Harvard, A Coruña (2004)
EAERE-FEEM-VIU Summer School: Political Economy of the Environment (2003)
Interuniversity Centre for Game Theory and its Applications Summer School on Game Theory and the Environment, fellowship recipient (2002)
Social Science Research Council Program in Applied Economics Summer Workshop: Risk and Uncertainty (2002)
Social Science Research Council Program in Applied Economics Summer Workshop (2001)

SERVICE

Professional

Reviewer, University of Texas at Austin Bureau of Economic Geology promotion case (2015)
Member, Program Committee for the 4th Annual Summer Conference of the Association of Environmental and Resource Economists (2015)
Presidential Advisor, U.S. Association for Energy Economics (2014- present)
Reviewer, Columbia University Center on Global Energy Policy (2014)
Reviewer, Resources for the Future Senior Fellow promotion case (2014)
Reviewer, Handbook of Water Economics and Institutions (2014)
Guest editor, Research in Transportation Economics Special Issue on Sustainable Transportation (2014-present)
Reviewer, National Science Foundation economics grant (2013)
Reviewer, three-volume set on Public Economics: The Government's Role in American Economics (2013)
Member, U.S. Association for Energy Economics Membership Committee (2013-present)
President, U.S. Association for Energy Economics Bay Area Chapter (2012-present)
Member, Energy Dimensions Advisory Panel (2012-present)
Associate Editor, Environmental Studies, Versita (2012-2013)
Session chair, Association of Environmental and Resource Economists session, Agricultural and Applied Economics Association Annual Meeting (2012)
Session chair, American Economic Association Annual Meeting (2012)
Member, U.S. Association for Energy Economics Bay Area Chapter Steering Committee (2012)
Reviewer, National Science Foundation economics grant (2012)
Reviewer, Annual Meeting of the Western Agricultural and Resource Economics Association (2012)
Associate Topic Editor, CAMEL (Climate, Adaption, Migration, Electronic Learning) (2011- present)
Referee, University of California Transportation Center research grant (2011)
Peer reviewer, EPA grant on "Research on the Design of Policies for Pollution Control Using Market Mechanisms" (2009)
Member, California State Controller's Council of Economic Advisors (2007-present)
Session chair, 3rd World Congress of Environmental and Resource Economists (2006)
Session chair, International Industrial Organization Conference (2006)
Referee, American Journal of Agricultural Economics [6]
Referee, Australian Journal of Agricultural and Resource Economics
Referee, American Journal of Economics and Sociology
Referee, B.E. Journal of Economic Analysis and Policy
Referee, Canadian Journal of Economics
Referee, Contemporary Economic Policy
Referee, Empirical Economics
Referee, Energy Economics [4]
Referee, Energy Journal [2]
Referee, Energy Policy [7]
Referee, Energy Research and Social Science
Referee, Energy Strategy Reviews
Referee, European Economic Review

Referee, International Journal of Agricultural Management and Development
Referee, International Journal of Production Economics
Referee, Journal of Agricultural and Applied Economics
Referee, Journal of Agricultural and Resource Economics
Referee, Journal of Comparative Economics
Referee, Journal of Environmental Economics and Management [8]
Referee, Journal of Environmental Economics and Policy
Referee, Journal of Political Economy
Referee, Journal of the Association of Environmental and Resource Economists
Referee, Journal of Urban Economics
Referee, Land Economics
Referee, Public Choice
Referee, Review of Development Economics
Referee, Review of Environmental Economics and Policy
Referee, Society of Petroleum Engineers Economics and Management [3]
Referee, Theoretical Economics Letters
Referee, Transportation Research Part A: Policy and Practice
Referee, Water Resources and Economics [2]
Referee, Water Resources Research

University of California at Davis
Chair, Institute of Transportation Studies Outstanding Thesis Award committee (2014)
Judge, Economics and Business Student Association Business Plan Competition (2014)
Member, Selection Committee for the Provost's Dissertation Year Fellowships (2013)
Speaker, Passport to Air Quality and Health, Santa Rosa Girl Scouts UC-Davis visit (2009)
Panelist, Gender and the job market panel (2007)

UC-Davis Agricultural and Resource Economics Department
Member, Applied Econometrics Faculty Search Committee (2014-2015)
Member, AES proposal ad-hoc review committee (2014)
Member, Graduate Administrative Committee (2013-present)
Member, Ad-hoc appraisal review committee (2013)
Member, Econometrics Faculty Search Committee (2012-2013)
Chair, Seminar Committee (2012-present)
Reviewer, Econometrics Prelim Committee (2012)
Member, Environmental and Resource Economics Field Courses Committee (2012)
Member, Best Dissertation Selection Committee (2012)
Member, Mock interviewer for job market candidate (2011)
Member, AES proposal ad-hoc review committee (2011)
Member, AES proposal ad-hoc review committee (2010)
Member, Undergraduate Advisory Committee (2006-2013)
Member, Environmental and Resource Economics Field Courses Committee (2009-2010)
Member, Economics of Agricultural Sustainability Faculty Search Committee (2006-2007)

UC-Davis Environmental Science and Policy Department
Member, Ad-hoc fiscal-year term review committee (2013)
Member, Ad-hoc merit review committee (2013)
Member, Ad-hoc merit review committee (2013)
Member, Ad-hoc merit review committee (2012)
Member, AES proposal ad-hoc review committee (2012)
Member, Ad-hoc appraisal review committee (2011)
Member, Ad-hoc merit review committee (2011)
Member, Ad-hoc merit review committee (2010)
Member, Ad-hoc merit review committee (2009)

Harvard University Department of Economics
Panelist, Job market panel (2006)

MEDIA CITATIONS

"Five myths about California's drought". Washington Post, 29 August 2014. URL: http://www.washingtonpost.com/opinions/five-myths-about-californias-drought/2014/08/29/6a6b8ed4-2c69-11e4-994d-202962a9150c_story.html

"Odd odd-number experiment has odd consequences. What are the odds?". Institute for Research in Economic and Fiscal Issues, 27 March 2014. URL: http://en.irefeurope.org/Odd-Odd-Number-Experiment-Has-Odd-Consequences-What-Are-The-Odds,a0983

"A report on the economics of California's Low Carbon Fuel Standard and cost containment mechanisms", Resources for the Future Library Blog, 2 January 2014. URL: https://rfflibrary.wordpress.com/2014/01/02/a-report-on-the-economics-of-californias-low-carbon-fuel-standard-and-cost-containment-mechanisms/

"UC Davis report finds LCFS compliance costs may rise rapidly; recommends offsetting measures", Green Car Congress, 30 December 2013. URL: http://www.greencarcongress.com/2013/12/20131230-lcfs.html

"UC Davis report addresses compliance costs of California's LCFS", Biodiesel Magazine, 30 December 2013. URL: http://www.biodieselmagazine.com/articles/9475/uc-davis-report-addresses-compliance-costs-of-californias-lcfs

"Report addresses compliance costs of California's LCFS", Ethanol Producer Magazine, 27 December 2013. URL: http://www.ethanolproducer.com/articles/10596/report-addresses-compliance-costs-of-californias-lcfs

"Big changes in California LCFS are called for in a new report", The Barrel, Platts, 19 November 2013. URL: http://blogs.platts.com/2013/11/19/lcfs-report/

"UC Davis report examines economics of LCFS, cost containment mechanisms", UC-Davis Institute of Transportation Studies, November 2013. URL: http://www.its.ucdavis.edu/research/research-findings/uc-davis-report-examines-economics-of-lcfs-cost-containment-mechanisms/

"Whiskey is for drinking; water is for fighting", AgChallenge2050, Farm Foundation, 26 July 2013. URL: http://www.agchallenge2050.org/adaptability-resilience/2013/07/whiskey-is-for-drinking-water-is-for-fighting/

"Programs to reduce ag's water use must be strengthened, not cut," AgMag BLOG, Environmental Working Group, 28 May 2013. URL: http://www.ewg.org/agmag/2013/05/programs-reduce-ag-s-water-use-must-be-strengthened-not-cut

"Wells dry, fertile plains turn to dust," New York Times, 19 May 2013. URL: http://www.nytimes.com/2013/05/20/us/high-plains-aquifer-dwindles-hurting-farmers.html?pagewanted=all&_r=0

"Profile: C.-Y. Cynthia Lin, 2011 Hellman Fellow, Agricultural and Resource Economics, UC Davis," Hellman Fellows Program 2011 Annual Report, Dec. 2012.

"Sex, lies and natural disasters," The Guardian, 27 Jan. 2012. URL: http://www.guardian.co.uk/lifeandstyle/2012/jan/28/shortage-of-school-places-floods-gloucestershire

"Climbing gas prices," Insight, Capital Public Radio, 5 March 2012.

"Research leader focus," STEPS Newsletter, Nov. 2009, p.4.

"ARE Faculty Profile: C.-Y. Cynthia Lin," Agricultural and Resource Economics Update, 12 (4), Mar./Apr. 2009.

"Chiang names new economic advisory council," 27 Apr. 2007.

"Dutch energy company opens American branch in West Sacramento," The California Aggie, 9 Feb. 2007.

"Academia boot camp," The Sacramento Bee, 3 Dec. 2006.

"New ways to look for work." Harvard Magazine, May-June 1998. URL: http://harvardmagazine.com/1998/05/alumni.new.html

MISCELLANEOUS

Results from Lin et al. (2001) featured in Denman, K.L., et al. (2007). Couplings between changes in the climate system and biogeochemistry. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., et al., (eds.)]. Cambridge: Cambridge University Press.

FORMER GRADUATE STUDENTS

Michael Adjemian
Ph.D., Agricultural & Resource Economics, 2009
Economist, USDA Economic Research Service

Joel Bremson
Ph.D., Transportation Technology & Policy, 2012

Michael Castelhano
Ph.D., Agricultural & Resource Economics, 2014
Market Monitoring Analyst, California ISO

Jonathan A. Cook
Ph.D., Agricultural & Resource Economics, 2013
Senior Consultant, Nexant

Joeri de Wit
Ph.D., Agricultural & Resource Economics, 2013
Energy Economist, World Bank

Barbara Farinelli
M.S., Agricultural & Resource Economics, 2008
Energy consultant, World Bank

David Heres del Valle
Ph.D., Agricultural & Resource Economics, 2009
Assistant Professor, Department of Economics, Center for Research and Teaching in Economics (CIDE), Mexico

Sunny Jardine
Ph.D., Agricultural & Resource Economics, 2013
Assistant Professor, School of Marine Science and Policy, University of Delaware

Wayne Leighty
M.S., Transportation Technology and Policy, 2008
Commercial Regulatory Analyst, Shell Oil Company

Ana McPhail
Ph.D., Civil and Environmental Engineering, Rice University, 2014
Socially Responsible Investment Planning Assistant, Communitas Financial

Geoffrey Morrison
Ph.D., Transportation Technology and Policy, 2013
M.S., Agricultural and Resource Economics, 2011
ORISE Fellow, Office of Fuel Cell Technologies, Department of Energy

Lisa Pfeiffer
Ph.D., Agricultural & Resource Economics, 2009
Economist, NOAA National Marine Fisheries Service Northwest Fisheries Science Center

Karen Thome
Ph.D., Agricultural & Resource Economics, 2012
Postdoctoral scholar, Agricultural & Resource Economics, 2012-2014
Research Agricultural Economist, USDA Economic Research Service

Fujin Yi
Ph.D., Agricultural & Resource Economics, 2011
Postdoctoral scholar, Agricultural & Resource Economics, 2012
Associate Professor, College of Economics and Management, Nanjing Agricultural University

Jieyin (Jean) Zeng
M.S., Transportation Technology and Policy, 2014
Tax Associate, Economic and Valuation Services, KPMG

Wei Zhang
Ph.D., Agricultural & Resource Economics, 2013
Postdoctoral scholar, University of California Agricultural Issues Center, 2013-2014
Assistant Professor, Department of Economics, Connecticut College

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Agricultural and Applied Economics Association
American Economic Association
Association of Environmental and Resource Economists
Canadian Economics Association
Econometric Society
International Association for Energy Economics
Royal Economic Society
U.S. Association for Energy Economics
U.S. Association for Energy Economics Bay Area Chapter

PREVIOUS WORK EXPERIENCE

Harvard University, Research Assistant in Economics for Prof. Dale Jorgenson	Summer 2001
Harvard University, Research Assistant in Atmospheric Chemistry for Prof. Daniel Jacob	9/1998 to 9/2000
Environmental Policy Intern for Massachusetts State Senator Lois G. Pines	Summer 1998
Harvard University, Radcliffe Research Partner for Barbara Goldoftas	Summer 1998
Biotech Investment Consultant for Wiltshire Associates, Ltd.	Summer 1997

CONSULTING

Economic and Planning Systems, Inc. (wind energy) (2010)

SKILLS

Computer languages: IDL, R/S-Plus, Matlab, C, Fortran, TSP, Stata.

Foreign languages: Proficient in Mandarin and French.

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updated February 16, 2015

JEFFREY WILLIAMS

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Davis, CA 95616

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Fields of Interest

Commodity Markets, Financial Markets, Finance, Public Finance, Econometrics, Mathematical Programming, Economic History

Education

B.A. 1975, Williams College

M.A. 1977, M.Phil. 1978, Yale University

Ph.D. 1980, Yale University, Dissertation: "The Economic Function of Futures Markets," William Parker, principal advisor

Positions Held

Intern for the Office of Income Security Policy, U.S. Department of Health, Education, and Welfare, 1975–76

Research Assistant for Professor Stephen DeCanio, Yale University, under NSF grant for study of 19th–century American agriculture, 1977

Post-doctoral Research Associate, Yale School of Organization and Management, under NSF grant for study of U.S. agricultural policy, 1980–81

Assistant Professor, Department of Economics, Brandeis University, 1981–87

Visiting Economist, Servizio Studi, Banca d'Italia, fall 1986

Associate Professor, Food Research Institute, Stanford University, 1987–95

Chair of Ph.D. Oversight Committee, Food Research Institute, 1992–96

Professor, Food Research Institute, 1995–98

Director, Food Research Institute, June 1996–August 1998

D. Barton DeLoach Professor, Department of Agricultural & Resource Economics, University of California, Davis, from September 1997

Chair of Graduate Administrative Committee, ARE, UCD, 1999–2002

California Inspection & Maintenance Review Committee, 2002-2011, Vice-chair July 2007–December 2007, acting Chair, January 2008–2011

Executive Committee, UCD, College of Agricultural & Environmental Sciences, Vice-chair 2006–7 and 2008–2009, Chair, 2007–2008 and 2010-2011

Fellowships, Honors, and Awards

Phi Beta Kappa, 1974

Highest Honors in Economics, *magna cum laude*, Williams College, 1975

Alfred P. Sloan Research Fellowship, 1985–87

Quality of Research Discovery award, American Agricultural Economics Association, 1992, for *Storage and Commodity Markets*

Distinguished Graduate Teaching award, American Agricultural Economics Association, 2000

Books Published

The Economic Function of Futures Markets, Cambridge University Press, 1986, 260 pp.

Storage and Commodity Markets, Cambridge University Press, 1991, 502 pp., with Brian D. Wright.

Manipulation on Trial: Economic Analysis and the Hunt Silver Case, Cambridge University Press, 1995, 244 pp. Translated into Japanese, sponsored by the Tokyo Grain Exchange and published by Jiji Press, 1996.

Monographs Published

"Deliveries on Chicago Board of Trade Wheat, Corn, and Soybean Futures Contracts, 1964/65–1988/89," *Food Research Institute Studie*s 22 (October 1991): 129–222, with Anne E. Peck. Translated into Chinese, with new preface and epilogue, sponsored by the China Zhengzhou Commodity Exchange, 1998.

Articles Published

"Tax-Transfer Policy and the Temporal Stability of Household Income," *Public Finance Quarterly* 6 (April 1978): 240–258, with Howard P. Tuckman and John M. Ortiz.

"Economics and Politics: Voting Behavior in Kansas During the Populist Decade," *Explorations in Economic History* 18 (July 1981): 233–256.

"The Origin of Futures Markets," *Agricultural History* 56 (January 1982): 306–316.

"The Economic Role of Commodity Storage," *Economic Journal* 92 (September 1982): 596–614, with Brian D. Wright.

"The Roles of Public and Private Storage in Managing Oil Import Disruptions," *Bell Journal of Economics* 13 (Autumn 1982): 341–353, with Brian D. Wright.

"The Welfare Effects of the Introduction of Storage," *Quarterly Journal of Economics* 98 (February 1984): 169–192, with Brian D. Wright.

"Fractional Reserve Banking in Grain," *Journal of Money, Credit, and Banking* 16 (November 1984, Part 1): 488–496.

"Anti–Hoarding Laws: A Stock Condemnation Reconsidered," *American Journal of Agricultural Economics* 66 (November 1984): 447–455, with Brian D. Wright.

"Futures Markets: A Consequence of Risk Aversion or Transactions Costs?", *Journal of Political Economy* 95 (October 1987): 1000–1023.

"Measurement of Consumer Gains from Market Stabilization," *American Journal of Agricultural Economics* 70 (August 1988): 617–628, with Brian D. Wright.

"The Incidence of Market–Stabilizing Price Support Schemes," *Economic Journal* 98 (December 1988): 1183–1198, with Brian D. Wright.

"A Theory of Negative Prices for Storage," *Journal of Futures Markets* 9 (February 1989): 1–13, with Brian D. Wright. Reprinted in the special Millennium Issue of the *Journal of Futures Markets* 20 (January 2000): 59–71.

"Prestiti di denaro e di titoli mediante contratti di riporto" [Lending of Money and Shares through the Riporti Market of the Milan Stock Exchange], *Rivista internazionale di Scienze sociali* 4 (October 1991): 593–615, with Emilio Barone.

"Deliveries on Commodity Futures Contracts," *Economic Record* 68 (Supplement, 1992): S63–74, with Anne E. Peck.

"Patterns in Recent Deliveries on the CBOT Wheat, Corn, and Soybean Contracts," *The Review of Futures Markets* 11 (1992): 204–215.

"CFC and Halon Banking," Chapter 7 in the *1994 Report of the Economic Options Committee*, United Nations Environmental Programme, with Stephen J. DeCanio.

"Convenience Yield without the Convenience: A Spatial–Temporal Interpretation of Storage under Backwardation," *Economic Journal* 107 (July 1997): 1009–1022, with Donna Brennan and Brian D. Wright.

"The Emergence of a Futures Market: Mungbeans on the China Zhengzhou Commodity Exchange," *Journal of Futures Markets* 18 (June 1998): 427–448, with Anne E. Peck, Albert Park, and Scott D. Rozelle.

"Processing Industry Capacity and the Welfare Effects of Sugar Policies," *American Journal of Agricultural Economics* 81 (May 1999): 424–441, with Brooke A. Isham.

"Evaluation of Price Policy in the Presence of Water Theft," *American Journal of Agricultural Economics* 81(November 1999): 928–941, with Isha Ray.

"Commodity Futures and Options," *Handbook of Agricultural Economics*, Vol. 1B, B. Gardner and G. Rausser, eds., 2001, North–Holland, Chapter 13, 745–816.

"E–Commerce and the Lessons from 19th–Century Exchanges," *American Journal of Agricultural Economics* 83 (December 2001): 1250–1257.

"Locational Asymmetry and the Potential for Cooperation on a Canal," *Journal of Development Economics* 67 (February 2002): 129–155, with Isha Ray.

"Soil Fertility Management on Small Farms in Africa: Evidence from Nakuru District, Kenya," *Food Policy*, 27 (April 2002): 159–170, with S.W. Omamo, G.A. Obare, and N.N. Ndiwa.

"The Influence of Markets and Policy on Spatial Patterns of Non-Timber Forest Product Extraction," *Land Economics* 78 (May 2002): 260–271, with Elizabeth J.Z. Robinson and Heidi J. Albers.

"Smallholder Production Structure and Rural Roads in Africa: The Case of Nakuru District, Kenya," *Agricultural Economics*, 28 (May 2003): 245–254, with G.A. Obare and S.W. Omamo.

"Walrasian Tâtonnement Auctions on the Tokyo Grain Exchange," *Review of Financial Studies* 20 (July 2007): 1183–1218, with James Eaves.

"The Supply of Storage for Natural Gas in California," *Energy Journal* 28 (July 2007): 31–50, with Rocio Uria.

"Volatility Dynamics of NYMEX Natural Gas Futures Prices," *Journal of Futures Markets,* 28 (May 2008): 438–463, with Hiroaki Suenaga and Aaron Smith.

"Spatial and Temporal Modeling of Community Non-Timber Forest Extraction," *Journal of Environmental Economics and Management* 56 (November 2008): 234–245, with Elizabeth J.Z. Robinson and Heidi J. Albers.

"Valuing Risk: Options in California Water Markets," *American Journal of Agricultural Economics* 90 (December 2008): 1336–1342, with Kristiana Hansen and Richard Howitt.

"Using Census Aggregates to Proxy for Household Characteristics: An Application to Vehicle Ownership," *Transportation* 36 (March 2009): 223–241, with Michael Adjemian.

"Are Intraday Volume and Volatility U-shaped after Accounting for Public Information?" *American Journal of Agricultural Economics*, 92 (February 2010): 212–227, with James Eaves.

"Estimating Spatial Interdependence in Automobile Type Choice with Survey Data," *Transportation Research Part A* 44 (November 2010): 661–675, with Michael Adjemian and C.-Y. Cynthia Lin.

"Sizing Reserves within a Landscape: The Roles of Villagers' Reactions and the Ecological–Socioeconomic Setting." *Land Economics* 87 (May 2011): 233–249, with Elizabeth J.Z. Robinson and Heidi J. Albers.

"Implications of Simultaneity in a Physical Damage Function," *Journal of Environmental Economics and Management* 62 (September 2011): 278–289, with Kelly M. Cobourn, Hannah J. Burrack, Rachael E. Goodhue, and Frank G. Zalom.

"Spotted Wing Drosophila Infestation of California Strawberries and Raspberries: Economic Analysis of Potential Revenue Losses and Control Costs." *Pest Management Science* 67 (November 2011): 1396–1402, with Rachael E. Goodhue, Mark Bolda, Derek Farnsworth, and Frank G. Zalom.

"Managing a Pest with Harvest Timing: Implications for Crop Quality and Price," *European Review of Agricultural Economics* 40 (December 2013): 761–784, with Kelly M. Cobourn and Rachael E. Goodhue.

"Cars on Crutches: How much Abatement do Smog Check Repairs Actually Provide?," *Journal of Environmental Economics and Management* 67 (May 2014): 371–395, with Pierre Mérel, Aaron Smith, and Emily Wimberger.

"Heterogeneity among Motorists in Traffic-congested Area in Southern California," *Transportation Research Part A: Policy and Practice* 70 (2014): 281-293, with Jennifer J.F Lee and Peter K. Kwok.

"A New Way to Utilize Remote-Sensing Data: Automated Road Travel Survey," *Transportation Research Record: Journal of the Transportation Research Board* (in press), with Jennifer J.F Lee.

Book Reviews and Commentary

Risky Agricultural Markets: Price Forecasting and the Need for Intervention Policies by Pasquale Scandizzo, Peter Hazell, and Jock Anderson, *American Journal of Agricultural Economics* 67 (November 1985): 896–897.

Futures Markets: Vol. 1, *Their Economic Role*, Vol. 2, *Regulatory Issues*, edited by Anne E. Peck, *Journal of Economic Literature* 25 (September 1987): 1342–1343.

"Is Risk Aversion a Theoretical Diversion?" by Michael Hartzmark, *The Review of Futures Markets* 7 (1988): 27–29.

"Expected Soybean Futures Price Distributions: Option–Based Assessments," by Bruce Sherrick, *The Review of Futures Markets* 9 (1990): 410–412.

Grain Futures Contracts: An Economic Appraisal, by S. Craig Pirrong, David Haddock, and Roger Kormendi, *Journal of Finance* 50 (March 1995): 390–392.

"Lessons from CFCs: The Need for Markets," *in Market Tools for Green Goals*, edited by Peter Alonzi and Richard F. Kosobud, Chicago Board of Trade, 1997, 109–119.

"The Persuasive Analysis of Roger Gray," *Research Symposium Proceedings*, Spring 1998, 1–19, Chicago Board of Trade.

"Hedging Multiple Price Uncertainty in International Grain Trade," by Michael S. Haigh and Matthew T. Holt, *Research Symposium Proceedings*, Spring 1999, 245–248, Chicago Board of Trade.

Editorial Boards

The Review of Futures Markets (1990-2000, from July 2005)

The Journal of Futures Markets (1996-2005)

American Journal of Agricultural Economics (2002-2006, 2008–2011)

Grants

Chicago Board of Trade Foundation grant for study of futures markets, 1978

National Science Foundation grant for study of price bands and price supports, 1983–84, with Brian D. Wright

National Grain and Feed Association grant for study of Chicago Board of Trade grain contracts, 1990–91, with Anne E. Peck

Tokyo Grain Exchange grant for the study of futures deliveries and expirations, 1999

California Energy Commission grant for the study of natural gas storage, 2006

USDA PREISM grant for the study of the olive fruit fly in California, 2007, with Rachael Goodhue and Frank Zalom

Principal Advisor for Completed Dissertations

Karen Parker, "The Role of Expectations in the Foreign Exchange Market: The Mexican Case," 1991.

E. Leigh Bivings, "Price Seasonality and Trade Liberalization: A Dynamic Spatial Model of the Mexican Feedgrains Sector," 1992, recipient of the American Agricultural Economics Association's award for Outstanding Dissertation.

Brooke Isham, "The Economics of Sugar Refining," 1992.

Timothy Richards, "The Effect of Supply Management on Productivity Growth: The Case of Alberta Dairy," 1993, honorable mention for the American Agricultural Economics Association's award for Outstanding Dissertation.

Manuela Ferro, "Labor Mobility, Optimal Inertia, and Land Price Dynamics," 1994.

Bob Baulch, "Spatial Price Equilibrium and Food Market Integration," 1994, recipient of the American Agricultural Economics Association's award for Outstanding Dissertation.

S. Were Omamo, "Smallholder Agriculture under Market Reform: The Case of Southern Siaya District, Kenya," 1995, recipient of the American Agricultural Economics Association's award for Outstanding Dissertation.

Calixto Mateos Hanel, "Operation of an Exchange-Rate Band Based on Mexico's Experience," 1996, second-place recipient of the Premio Banamex de Economía.

Elizabeth Robinson, "Evolution of Property Rights with Incomplete Enforcement," 1997, honorable mention for the American Agricultural Economics Association's award for Outstanding Dissertation.

Mauricio Mora, "Exchange for Physicals in Commodity Futures Markets," 2000.

James Eaves, "Searching for Walras: An Analysis of the Tokyo Grain Exchange Auctions," 2001.

Kris Waumans, "Manipulation in Commodity Markets: A Dynamic Programming Approach," 2001.

Dongqing Liu, "Market–Making Behavior on the Dalian Futures Exchange," 2002.

Hiroaki Suenaga, "Spot-Forward Price Relationships in Restructured Electricity Markets," 2005.

Rocio Uria, “Spatial and Temporal Arbitrage in the California Natural Gas Network,” 2006.

Jennifer Thompson, “Misunderstood Markets: The Case of California Gasoline,” 2008.

Michael Adjemian, “Estimating Spatial Interdependence in Automobile Choice with Multilevel Data,” 2009.

Emily Wimberger, “From Detection Through Repair: Vehicle Emissions Testing in the San Joaquin Valley,” 2011

David Corderi, “The Economics of Water Infrastructure Investment in the Dong Nai River Delta,” 2011.

Co-Principal Advisor for Completed Dissertations

Beatriz Avalos, “Modeling Nitrogen Fertilizer Management in Wheat in Mexico’s Yaqui Valley,” 1997.

Cesar Revoredo, “Storage and Commodity Price Behavior,” 2001.

Kristianna Hansen, “Three Essays on Western Water Markets,” 2008, recipient of the American Agricultural Economics Association’s award for Outstanding Dissertation.

Kelly Couburn, “Incentives for Individual and Cooperative Management of a Mobile Pest: An Application to the Olive Fruit Fly in California,” 2009, recipient of the American Agricultural Economics Association’s award for Outstanding Dissertation.

Jennifer Lee, “Heterogeneity among Motorists in Traffic-Congested Areas in Southern California,” 2012.

Derek Farnsworth, “Perspectives on California Berry Production: Labor Availability, Pest Management, and Trade Restrictions,” 2014.

Preliminary Cost Proposal

	TASK									
	1	2	3	4	5	6	7	8	9	**Total**
Salaries and Wages	$125,619	$32,347.50	$21,565	$21,565	$10,782.50	$10,782.50	$10,782.50	$21,565	$32,589	$287,598
Fringe Benefits	$6458	$1742	$1161.33	$1161.33	$580.67	$580.67	$580.67	$1161.33	$6193	$19,619
Materials & Supplies	$4000	$250	$166.67	$166.67	$83.33	$83.33	$83.33	$166.67	$1000	$6000
Domestic Travel	$600	$150	$100	$100	$50	$50	$50	$100	$600	$1800
Student Assistance/Support	$72,980	$20,070	$13,380	$13,380	$6690	$6690	$6690	$13,380	$0	$153,260
Indirect Costs	$13,668	$3449	$2299.33	$2299.33	$1149.67	$1149.67	$1149.67	$2299.33	$4039	$31,503
Total Project Costs	$223,325	$58,008.50	$38,672.33	$38,672.33	$19,336.17	$19,336.17	$19,336.17	$38,672.33	$44,421	**$499,780**

Budget Justification

Senior Personnel: Funds are requested for 8.33% of Dr. Lin's time and 8.33% of Dr. William's time throughout the project. They are the principal investigators and will coordinate the overall project and manage personnel and the budget. They will oversee the development and estimation of the structural econometric model, and the analysis of the results. They will also lead the dissemination of the results through meetings and presentations.

Other Personnel: Funds are requested to support four resident graduate students to provide research assistance in all phases of the project. The graduate students will each be hired at a 46.9% appointment for 3 quarters during the academic year and at a 50% appointment during 3 summer months for each summer during the first two years of the project.

Fringe Benefits: A benefit rate for the PIs follows the newly required composite rate of 17.0% with a slight increase in subsequent years. A benefit rate of 1.3% has been applied to the graduate students' salaries.

Equipment: No equipment has been requested.

Materials and Supplies: Funds are requested each year for supplies that will cover computer software and data acquisition costs for running the econometric models ($1000 per year). Additionally, funds are requested in year 1 for one computer to be used to run the computationally intensive econometric models ($3,000).

Publication Costs/Documentation/Dissemination: No funding for publication costs has been requested.

Travel:
Domestic travel: To provide funds for the PIs and graduate students to attend domestic conferences/meetings, and to disseminate the research results, amounts of $600 per year have been budgeted for each year to cover costs of airfare, lodging, per diem, and local taxi/airport shuttle service.

Foreign travel: None.

Indirect Costs: 10% of the modified total direct cost (MTDC).