Energy Economics

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Energy economics is a growing field in economics. The availability of new data sources and the interest of policy makers make this field an interesting topic for research. Moreover, many deep challenges in Iran are routed in energy policies. The country wastes about 20% of its GDP every year for energy subsidies, and at the same time lack any resources to spend for infrastructure, health and education. Additionally, about half of government income is funded by oil revenue in which it seems that the government has no strategic plan for its development. Recently, the dominance of petrochemical industry has changed the shape of manufacturing sectors and political lobbies.

This course is actually empirical energy economics and part of sequences will be presented in the near future. Advanced econometrics methods will be discussed in the course and homework are based on actual data and replication of recent papers in top journals. I advise you to take the course "Industrial Organization" and "Applied Econometrics. You have to referee two job market papers. The Two referee reports are due as indicated in the schedule . Two papers are:

1. Moravvej, Mohammad, "Risk, Diversification, and Competition in Trade Networks with evidence from US Natural Gas Market", 2020, University of Chicago, https://drive.google.com/file/d/1zccnNOUntv1ZRBbuIQFfj8XM6kOHjSp8/view
2. Karaduman, Ömer. Economics of Grid-Scale Energy Storage in Wholesale Electricity Markets. MIT CEEPR Working Paper 2021-005.

In addition, there will be four homework that you need to hand in them individually by strict deadline. You are also required to submit a research proposal under the topics of energy economics. I suggest you to pick a topic and reading all papers under the topic in the reading list. At the end of class I will ask one student to discuss the reading paper for the class. If you are absent you will miss the grade of the paper, if you are present in the class but not reading the paper beforehand, you will get half mark. The reading paper is marked with ❖. You need to answer these question when I call your name:

- What is the main question of the paper?
- What is the contribution of the paper?
- What method is used in the paper to answer the question?
- What data is employed to answer this question?
- What are findings of the paper?
- If you have any critique of the paper, you are welcome to highlight them at the end of you discussion.

There will be a research proposal that I will discuss during the classes: So, the grading is as follows:

Two referee reports (4 grades)
Four homework (4 grades)
Final (7 grades)
Research proposal (5 grades)

Syllabus:

Class 1: Hotelling model

- Devarajan, Shantayanan, and Anthony C. Fisher. "Hotelling's" economics of exhaustible resources": Fifty years later." Journal of Economic Literature 19.1 (1981): 65-73.
- Anderson, Soren T., Ryan Kellogg, and Stephen W. Salant. "Hotelling under pressure". Journal of Political Econom, 2018
- ❖ Miller, Merton H., and Charles W. Upton. "A test of the Hotelling valuation principle." Journal of Political Economy 93.1 (1985): 1-25.

Class 2: Ordering of extraction

- Chakravorty, U., J. Roumasset, and K. Tse. "Endogenous Substitution among Energy Resources and Global Warming", Journal of Political Economy, 105 (6), December, 1201-34.
- Chakravorty, Ujjayant, Michel Moreaux, and Mabel Tidball. "Ordering the extraction of polluting nonrenewable resources." The American Economic Review 98.3 (2008): 1128-1144.
- ❖ Covert, Thomas, Michael Greenstone, and Christopher R. Knittel. "Will we ever stop using fossil fuels?." Journal of Economic Perspectives 30.1 (2016): 117-38.

Class 3: Drilling economy

- Hendricks, Kenneth, and Robert H. Porter. "The timing and incidence of exploratory drilling on offshore wildcat tracts." The American Economic Review (1996): 388-407.
- Kellogg, Ryan, "The Effect of Uncertainty on Investment: Evidence from Texas Oil Drilling", American Economic Review 104 (June, 2014), 1698-1734.
- Kellogg, Ryan. "Learning by drilling: Interfirm learning and relationship persistence in the Texas oil patch." The Quarterly Journal of Economics (2011): qjr039.
- ❖ Covert, Thomas. "Experiential and social learning in firms: the case of hydraulic fracturing in the Bakken Shale." (2015).

Class -: Oil Transportation,

- ❖ Covert, Thomas R., and Ryan Kellogg. "Crude by rail, option value, and pipeline investment". No. w23855. National Bureau of Economic Research, 2017..
- ❖ McRae, Shaun. Crude Oil Price Differentials and Pipeline Infrastructure. No. w24170. National Bureau of Economic Research, 2017.

Class 4: Dutch disease

- Matsen, Egil, and Ragnar Torvik. "Optimal dutch disease." Journal of Development Economics 78.2 (2005): 494-515.
- Allcott, Hunt, and Daniel Keniston. "Dutch disease or agglomeration? The local economic effects of natural resource booms in modern America." The Review of Economic Studies 85.2 (2017): 695-731.

- ❖ Caselli, Francesco, and Guy Michaels. "Do oil windfalls improve living standards? Evidence from Brazil." American Economic Journal: Applied Economics 5.1 (2013): 208-38.

Class 5: OPEC

- Asker, John, Allan Collard-Wexler, and Jan De Loecker. "(Mis) Allocation, Market Power and Global Oil Extraction." (2018).
- Smith, J. L. "Inscrutable OPEC? Behavioral tests of the cartel hypothesis." Energy Journal 26.1 (2005): 51-82.
- ❖ Lippi, Francesco, and Andrea Nobili. "Oil and the macroeconomy: a quantitative structural analysis." Journal of the European Economic Association 10.5 (2012): 1059-1083

Class 6: Oil price

- Baumeister, Christiane, and Lutz Kilian. "Forty years of oil price fluctuations: Why the price of oil may still surprise us." The Journal of Economic Perspectives 30.1 (2016): 139-160.
- Kilian, Lutz. "Not All Oil Price Shocks Are Alike: Disentangling Demand and Supply Shocks in the Crude Oil Market." American Economic Review 99.3 (2009): 1053-69
- Baumeister, Christiane, and Lutz Kilian. Forecasting the real price of oil in a changing world: A forecast combination approach. Centre for Economic Policy Research, 2013
- ❖ Baumeister, Christiane, and Gert Peersman. "Time-varying effects of oil supply shocks on the US economy." American Economic Journal: Macroeconomics 5.4 (2013): 1-28.

Class 7: Oil upstream contract

- Hampson, Philip, John Parsons, and Charles Blitzer. "A case study in the design of an optimal production sharing rule for a petroleum exploration venture." Journal of financial economics 30.1 (1991): 45-67.
- Feng, Zhuo, Shui-Bo Zhang, and Ying Gao. "On oil investment and production: A comparison of production sharing contracts and buyback contracts." Energy Economics 42 (2014): 395-402.
- ❖ Ghandi, Abbas, and C-Y. Cynthia Lin. "Do Iran's buy-back service contracts lead to optimal production? The case of Soroosh and Nowrooz." Energy Policy 42 (2012): 181-190

Class 8: Expropriation,

- Stroebel, Johannes, and Arthur Van Benthem. "Resource extraction contracts under threat of expropriation: Theory and evidence." Review of Economics and Statistics 95.5 (2013): 1622-1639
- ❖ Guriev, Sergei, Anton Kolotilin, and Konstantin Sonin. "Determinants of nationalization in the oil sector: A theory and evidence from panel data." Journal of Law, Economics, and Organization 27.2 (2011): 301-323.

Class 9: Lease auctions, 1397/7/16. Due homework 1

- Hendricks, Kenneth, Joris Pinkse, and Robert H. Porter. "Empirical implications of equilibrium bidding in first-price, symmetric, common value auctions." The Review of Economic Studies 70.1 (2003): 115-145.
- Robert Porter, "Recent Developments in the Empirical Analysis of Auction Markets", Minnesota Applied Micro Workshop, 2007
- ❖ Hendricks, Kenneth & Porter, Robert H (1988). "An Empirical Study of an Auction with Asymmetric Information," American Economic Review, American Economic Association, vol. 78(5), pages 865-83, December

Class 10: Natural Gas Demand and subsidy

- Auffhammer, Maximilian, and Edward Rubin. Natural Gas Price Elasticities and Optimal Cost Recovery Under Consumer Heterogeneity: Evidence from 300 million natural gas bills. No. w24295. National Bureau of Economic Research, 2018.
- Hahn, Robert W., and Robert D. Metcalfe. "Efficiency and Equity Impacts of Energy Subsidies." *American Economic Review* 111.5 (2021): 1658-88.

Class 11: Natural Gas Supply

- Davis, Lucas W., and Lutz Kilian. "The allocative cost of price ceilings in the US residential market for natural gas." Journal of Political Economy 119.2 (2011): 212-241.
- ❖ Borenstein, Severin, and Lucas W. Davis. "The Equity and Efficiency of Two-Part Tariffs in US Natural Gas Markets." Journal of Law and Economics 55 (2012).

Class 12: Electricity Competition

- Borenstein, Severin, James B. Bushnell, and Frank A. Wolak. "Measuring market inefficiencies in California's restructured wholesale electricity market." American Economic Review (2002): 1376-1405.
- Mercadal, Ignacia. "Dynamic competition and arbitrage in electricity markets: The role of financial players." (2018). NBER Working paper
- ❖ Wolfram, Catherine D. "Measuring duopoly power in the British electricity spot market." American Economic Review (1999): 805-826

Class 13: Electricity Regulation

- Lim, Claire SH, and Ali Yurukoglu. "Dynamic natural monopoly regulation: Time inconsistency, moral hazard, and political environments." Journal of Political Economy 126.1 (2018): 263-312.
- ❖ Kang, Karam, and Bernardo S. Silveira. "Understanding disparities in punishment: Regulator preferences and expertise." *Journal of Political Economy* 129.10 (2021): 2947-2992.

Class 14: De-Regulation, Due referee report 1

- Fabrizio, Kira R., Nancy L. Rose, and Catherine D. Wolfram. "Do markets reduce costs? Assessing the impact of regulatory restructuring on US electric generation efficiency." American Economic Review 97.4 (2007): 1250-1277.
- Cicala, Steve. "When Does Regulation Distort Costs? Lessons From Fuel Procurement in U.S. Electricity Generation." American Economic Review,(2015) 411-44.
- Han, Jin Soo, et al. "When Does Regulation Distort Costs? Lessons from Fuel Procurement in US Electricity Generation: Comment." *American Economic Review* 111.4 (2021): 1356-72.
- ❖ Mansur, Erin T. "Measuring welfare in restructured electricity markets." The Review of Economics and Statistics 90.2 (2008): 369-386.

Class 15: Electricity market and strategic bidding, Due homework 2

- Hortaçsu, Ali, and Steve Puller. "Understanding strategic models of bidding in deregulated electricity markets: a case study of ERCOT." The RAND Journal of Economics 39 (2008): 86-114.
- Reguant, Mar. "Complementary bidding mechanisms and startup costs in electricity markets." The Review of Economic Studies 81.4 (2014): 1708-1742.
- ❖ Puller, Steven L. "Pricing and firm conduct in California's deregulated electricity market." The Review of Economics and Statistics 89.1 (2007): 75-87

Class 16: Electricity supply

- Bushnell, Jim, Erin Mansur, and Celeste Saravia. 2006. "Vertical Arrangements, Market Structure and Competition: An analysis of Restructured U.S. Electricity Markets." American Economic Review. Vol 98, No. 1. March 2008
- ❖ Chan, Hei Sing Ron, Maureen L. Cropper, and Kabir Malik. "Why Are Power Plants in India Less Efficient than Power Plants in the United States?." The American Economic Review 104.5 (2014): 586-590.

Class 17: Electricity demand,

- Reiss, Peter C., and Matthew W. White. "Household electricity demand, revisited." The Review of Economic Studies 72.3 (2005): 853-883
- Ito, Koichiro. "Do consumers respond to marginal or average price? Evidence from nonlinear electricity pricing." American Economic Review 104.2 (2014): 537-63.
- ❖ Davis, Steven J., et al. "Electricity Unit Value Prices and Purchase Quantities: US Manufacturing Plants, 1963–2000." Review of Economics and Statistics 95.4 (2013): 1150-1165.

Class 18: Electricity Real Time Pricing

- Borenstein, Severin. "The long-run efficiency of real-time electricity pricing." *The Energy Journal* 26.3 (2005).
- Allcott, Hunt. "Rethinking real-time electricity pricing." *Resource and energy economics* 33.4 (2011): 820-842.

- Jessoe, Katrina, and David Rapson. "Knowledge is (less) power: Experimental evidence from residential energy use." American Economic Review 104.4 (2014): 1417-38
- ❖ Fowlie, Meredith, et al. Default effects and follow-on behavior: evidence from an electricity pricing program. No. w23553. National Bureau of Economic Research, 2017.

Class 19: Renewable Energy- Solar

- De Groote, Olivier, and Frank Verboven. "Subsidies and time discounting in new technology adoption: Evidence from solar photovoltaic systems." *American Economic Review* 109.6 (2019): 2137-72.
- Borenstein, Severin. "The private and public economics of renewable electricity generation." Journal of Economic Perspectives 26.1 (2012): 67-92
- ❖ Fell, Harrison, and Daniel T. Kaffine. "The fall of coal: Joint impacts of fuel prices and renewables on generation and emissions." American Economic Journal: Economic Policy 10.2 (2018): 90-116.

Class 20: Renewable Energy- Wind

- Novan, Kevin. "Valuing the wind: renewable energy policies and air pollution avoided." American Economic Journal: Economic Policy 7.3 (2015): 291-326.
- Cullen, Joseph. "Measuring the environmental benefits of wind-generated electricity." American Economic Journal: Economic Policy 5.4 (2013): 107-33.
- ❖ Fell, Harrison, and Daniel T. Kaffine. "The fall of coal: Joint impacts of fuel prices and renewables on generation and emissions." American Economic Journal: Economic Policy 10.2 (2018): 90-116.

Class 21: Solar Electricity and intermittency, Due Referee Report 2

- Gowrisankaran, Gautam, Stanley S. Reynolds, and Mario Samano. "Intermittency and the value of renewable energy." Journal of Political Economy 124.4 (2016): 1187-1234.
- Lee, Kenneth, Edward Miguel, and Catherine Wolfram. "Appliance ownership and aspirations among electric grid and home solar households in rural Kenya." American Economic Review 106.5 (2016): 89-94.
- ❖ Borenstein, Severin. "Private net benefits of residential solar PV: the role of electricity tariffs, tax incentives, and rebates." Journal of the Association of Environmental and Resource Economists 4.S1 (2017): S85-S122.
- ❖ Borenstein, Severin. "The market value and cost of solar photovoltaic electricity production." (2008).

Class 22: Targeted Subsidy

- Davis, Lucas W. "The economic cost of global fuel subsidies." American Economic Review 104.5 (2014): 581-85.
- McRae, Shaun. "Infrastructure Quality and the Subsidy Trap." The American Economic Review 105.1 (2014): 35-66.

- ❖ Ito, Koichiro. "Asymmetric incentives in subsidies: Evidence from a large-scale electricity rebate program." American Economic Journal: Economic Policy 7.3 (2015): 209-37

Class --: Energy Subsidy Reform,

- Lin, Boqiang, and Zhujun Jiang. "Estimates of energy subsidies in China and impact of energy subsidy reform." Energy Economics 33.2 (2011): 273-283.
- Solaymani, Saeed, and Fatimah Kari. "Impacts of energy subsidy reform on the Malaysian economy and transportation sector." Energy Policy 70 (2014): 115-125.
- ❖ Lau, Lawrence J., Yingyi Qian, and Gerard Roland. "Reform without losers: an interpretation of China's dual-track approach to transition." Journal of Political Economy 108.1 (2000): 120-143.
- ❖ Araghi, Mansor Khalili, and Sajjad Barkhordari. "An evaluation of the welfare effects of reducing energy subsides in Iran." Energy Policy 47 (2012): 398-404.

Class 23: Gasoline supply

- Houde, Jean-François. "Spatial differentiation and vertical mergers in retail markets for gasoline." The American Economic Review (2012): 2147-2182
- Hastings, Justine S. "Vertical Relationships and Competition in Retail Gasoline Markets: Empirical Evidence from Contract Changes in Southern California." The American Economic Review 94.1.
- ❖ Davis, Lucas W., Shaun McRae, and Enrique Seira Bejarano. An Economic Perspective on Mexico's Nascent Deregulation of Retail Petroleum Markets. No. w24547. National Bureau of Economic Research, 2018.

Class 24: Gasoline demand

- Levin, Laurence, Matthew S. Lewis, and Frank A. Wolak. High frequency evidence on the demand for gasoline. Working paper, Ohio State University, 2009
- Rahmati, Tavakoli, Vesal, "What One Hundred Million Transactions Tell Us about Gasoline Elasticity of Demand", 2018
- ❖ Gillingham, Kenneth. "Selection on anticipated driving and the consumer response to changing gasoline prices." Workin Paper, Yale University, School of Forestry & Environmental Studies (2012)

Class 25: Gasoline policy, Due homework 3

- Bento, Antonio M., et al. "Distributional and efficiency impacts of increased US gasoline taxes." The American Economic Review (2009): 667-699.
- ❖ Anderson, Michael L., and Maximilian Auffhammer. "Pounds that kill: the external costs of vehicle weight." The Review of Economic Studies 81.2 (2014): 535-571

Class 26: Gasoline price

- Anderson, Soren T., et al. "Forecasting gasoline prices using consumer surveys." The American Economic Review 101.3 (2011): 110-114.
- Allcott, Hunt. "Consumers' perceptions and misperceptions of energy costs." The American Economic Review 101.3 (2011): 98-104.

- Gicheva, Dora, Justine Hastings, and Sofia Villas-Boas. "Investigating Income Effects in Scanner Data: Do Gasoline Prices Affect Grocery Purchases?." The American Economic Review 100.2 (2010): 480-484.
- ❖ Borenstein, Severin, A. Colin Cameron, and Richard Gilbert. "Do Gasoline Prices Respond Asymmetrically to Crude Oil Price Changes?." The Quarterly Journal of Economics 112.1 (1997): 305-339.

Class 27: Efficiency

- Davis, Lucas W., Alan Fuchs, and Paul Gertler. "Cash for coolers: evaluating a large-scale appliance replacement program in Mexico." American Economic Journal: Economic Policy 6.4 (2014): 207-238
- Allcott, Hunt, Christopher Knittel, and Dmitry Taubinsky. "Tagging and targeting of energy efficiency subsidies." The American Economic Review 105.5 (2015): 187-191.
- ❖ Gillingham, Kenneth, Richard G. Newell and Karen Palmer. 2009. Energy Efficiency Economics and Policy. Annual Review of Resource Economics

Class 28: Emission and market

- Banzhaf, Spencer H., and Randall P. Walsh. "Do people vote with their feet? An empirical test of Tiebout's mechanism." The American Economic Review 98.3 (2008): 843-863.
- Fowlie, M., Holland, S. P., and Mansur, E. T., 2012. "What Do Emissions Markets Deliver and to Whom? Evidence from Southern California's NOx Trading Program." American Economic Review, 102(2): 965–93
- ❖ Fowlie, M. (2010). "Emissions Trading, Electricity Restructuring, and Investment in Pollution Abatement." The American Economic Review, 100:837–869.

Class 29: R&R and Innovation in Energy Industry

- Newell, R., Jaffe, A., Stavins, R. (1999). "The induced innovation hypothesis and energy-saving technological change". The Quarterly Journal of Economics 114 (3), 41-975.
- Popp, D. (2002). "Induced innovation and energy prices". American Economic Review 92 (1), 160-180.
- ❖ Popp, David, Richard Newell and Adam Jaffe, 2010. "Energy, the environment, and technological change," in Hall, Bronwyn H. and Nathan Rosenberg, eds., Handbook of the Economics of Innovation, North Holland,
- ❖ Rose, N., Joskow, P. (1990). "The diffusion of new technologies: Evidence from the electric utility industry". Rand Journal of Economics 21, 354-373.

Class 30: Nuclear Energy, Due Homework 4

- Lucas Davis "Prospects for Nuclear Power" Journal of Economic Perspectives, Volume 26, Number 1, Winter 2012—Pages 49–66
- Lucas Davis and Catherine Hausman, "Market Impacts of a Nuclear Power Plant Closure", AEJ: Applied Economics, 2016

- Hausman, Catherine. "Corporate incentives and nuclear safety." American Economic Journal: Economic Policy 6.3 (2014): 178-206.
- ❖ Davis, Lucas W. and Catherine D. Wolfram. 2012. "Deregulation, Consolidation and Efficiency: Evidence from U.S. Nuclear Power," American Economic Journal: Applied Economics, 2012, 4(4), 194-225

Class --: Energy Finance, Valuations, Real Options

- Paddock, James L., Daniel R. Siegel, and James L. Smith. "Option valuation of claims on real assets: The case of offshore petroleum leases." The Quarterly Journal of Economics 103.3 (1988): 479-508.
- Kellogg, Ryan. The effect of uncertainty on investment: Evidence from Texas oil drilling. No. w16541. National Bureau of Economic Research, 2010.
- ❖ Moel, Alberto, and Peter Tufano. "When are real options exercised? An empirical study of mine closings." Review of Financial Studies 15.1 (2002): 35-64.

Class --: Energy in the developing world

- Allcott, Hunt, Allan Collard-Wexler, and Stephen D. O'Connell (2014). "How Do Electricity Shortages Affect Productivity? Evidence from India." Working Paper
- Ryan, Nicholas (2014). ""The Competitive Effects of Transmission Infrastructure in the Indian Electricity Market" (Job Market Paper)
- Fuchs, Alan, Paul Gertler, Orie Shelef, and Catherine Wolfram (2013) "The Demand for Energy-Using Assets among the World's Rising Middle Classes"
- Malik, Kabir, Maureen Cropper, Alexander Limonov, Anoop Singh (2013) "Estimating the Impact of
- ❖ Restructuring on Electricity Generation Efficiency: The Case of the Indian Thermal Power Sector", NBER WP 17383.

Research proposal due date is 1400/11/15