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Economics of Innovation in the Energy Sector
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A wealth of energy innovation research has focused on the role of input prices in inducing firm innovation.[1] However, a few recent works have pointed to the role of other microeconomic drivers of innovation.[2] Namely, firms' innovation efforts should be sensitive to their shares of inputs, which is related to input price shocks through firms' elasticities of substitution. Understanding the net effect of input price shocks and firms' substitution to alternative inputs on innovation outcomes is important for policy: input price changes alone may not lead to innovation if firms can substitute inputs, but this substitution itself could lead to a new technological trajectory. For this paper, I propose an empirical study of the role of input prices vs. input shares in an industry with a high elasticity of substitution (in which an "input share effect" may dominate): electricity. Additionally, the US natural gas boom has provided an exogenous input price shock to the industry, translating into an input share change for many firms that now produce more from natural gas.[3] For this paper, I plan to estimate how this shock impacted electricity firms' technology choices through a number of outcomes: the efficiency (heat rate) of natural gas units, replacement of existing units, and adoption of advanced unit types for new units. I plan to match these plant-level outcomes with data on firm investments to create a full picture of firm innovation choices. Note that results will have natural implications for climate policy.

[1] For example:

Aghion, P., Dechezleprêtre, A., Hemous, D., Martin, R., Van Reenen, J., 2016. Carbon taxes, path dependency, and directed technical change: Evidence from the auto industry. Journal of Political Economy 124, 1–51.

Newell, R.G., Jaffe, A.B., Stavins, R.N., 1999. The induced innovation hypothesis and energy-saving technological change. The Quarterly Journal of Economics 114, 941–975.

Noailly, J., Smeets, R., 2015. Directing technical change from fossil-fuel to renewable energy innovation: An application using firm-level patent data. Journal of Environmental Economics and Management 72, 15–37.

Popp, D., 2002. Induced innovation and energy prices. The American Economic Review 92, 160–180.

[2]Acemoglu, D., 2003. Factor prices and technical change: from induced innovations to recent debates. Knowledge, Information and Expectations in Modern Macroeconomics 464–491.

Hanlon, W.W., 2015. Necessity Is the Mother of Invention: Input Supplies and Directed Technical Change. Econometrica 83, 67–100. https://doi.org/10.3982/ECTA10811

[3]Linn, J., McCormack, K., 2019. The roles of energy markets and environmental regulation in reducing coal-fired plant profits and electricity sector emissions. The RAND Journal of Economics 50, 733–767. https://doi.org/10.1111/1756-2171.12294

Coglianese, J., Gerarden, T.D., Stock, J.H., 2020. The effects of fuel prices, environmental regulations, and other factors on US Coal Production, 2008-2016. The Energy Journal 41.