

THE EFFECTS OF REGULATIONS ON THE COMMERCIAL FERTILIZER INDUSTRY

CRAEA Research Grants Program

Gary W. Brester, Professor
Department of Agricultural Economics and Economics
Montana State University

November 15, 2016

1. Proposal Narrative

Abstract

Although the United States is a major nitrogen fertilizer manufacturer, it has increasingly relied on nitrogen fertilizer imports to fuel agricultural production. One reason for this trend is the exit of domestic nitrogen fertilizer production facilities during periods of high natural gas prices and low crop prices in the 1980s and 1990s. Despite increased natural gas production over the past decade, domestic fertilizer production has only marginally increased. The paucity of new plants is somewhat puzzling. Between 2006 and 2015, nitrogen fertilizer prices increased by 40% while natural gas prices decreased by 67%, signaling opportunities for market entry. The apparent lack of new capacity suggests that other barriers to entry might exist. One possible barrier could be regulatory costs. While regulatory policies related to natural gas and fertilizer production likely provide environmental benefits, there is little knowledge about potential indirect impacts on related industries, such as agriculture. This project will evaluate the impacts of regulations on the natural gas and fertilizer industries.

Statement of Specific Aims of the Project

Much of the agricultural economics literature and agricultural policy programs assess and create instruments to manage production and marketing risks associated with agricultural outputs. In contrast, analyses of agricultural input markets are much less common, even though producers often face similar, if not greater, input price uncertainty. For example, fertilizer expenditures represent between 20% and 45% of variable costs for many crops, but fertilizer purchases generally occur in spot markets. Thus, most agricultural producers have only limited opportunities to hedge price uncertainties. Furthermore, the United States is a net importer of nitrogen fertilizers, and the fertilizer supply chain faces substantial supply risks because of geopolitical, trade, and transportation factors.

The heavy reliance on fertilizer imports is partly due to the exit of domestic nitrogen fertilizer production facilities during multiple periods of high natural gas prices and low crop prices. Despite technological advances in natural gas discoveries (natural gas is the primary variable input for producing nitrogen fertilizer) over the past two decades, domestic fertilizer production has not increased. This is partly the result of the cost-reducing need to operate existing production facilities at full capacity and partly because very few new plants have been constructed in recent years.

The paucity of new plants is somewhat puzzling. Between 2006 and 2015, nitrogen fertilizer prices increased by 40% while natural gas prices decreased by 67%, signaling opportunities for market entry. It is the case, however, that some existing plants have expanded production capacities.

The apparent lack of new capacity suggests that other barriers might exist. One possibility could be costs imposed by regulations such as the Clean Air Act, New Source Performance Standards, Nonattainment New Source Review preconstruction program, and the Title V Operating permit program. While these regulatory policies likely provide environmental benefits, there is little knowledge about potential indirect impacts on related industries, such as agriculture.

This research will assess the regulatory environment of the natural gas and fertilizer industries and empirically investigate the extent to which this regulatory structure has affected the efficiency of information transmission in fertilizer markets. In addition, we will investigate the degree to which uncertainty has influenced our ability to predict fertilizer prices. This project will evaluate the extent to which agricultural production costs are affected by natural gas and fertilizer industry regulations.

Significance of the Project

U.S. fertilizer use has increased by almost 400% since 1960. Because the use of phosphate and potash fertilizers has been relatively flat, the increase in fertilizer use is almost completely attributable to nitrogen fertilizers. Ammonium nitrate was the most common form of nitrogen fertilizer until the 1980s when Urea became more prevalent. This change increased markedly following new regulations that resulted from the Oklahoma terrorist bombing (fueled by ammonium nitrate) in 1995.

In the early 1980's, the United States was a net exporter of nitrogen fertilizer. But as domestic fertilizer production declined in the 1990s, U.S. fertilizer imports increased substantially. Between 1999 and 2011, nitrogen fertilizer imports increased by 43% and the United States became the second largest importer of nitrogen fertilizer. Currently, the United States obtains more than 50% of its total nitrogen fertilizer needs from other countries. While many countries export nitrogen fertilizer, the largest are Russia, China, and Ukraine.

This increased reliance on imports has raised concerns about both short- and long-term supply chain logistics and increased supply risks. For example, fertilizer imports are generally shipped from the Gulf of Mexico on Mississippi river barges to distribution facilities upstream. High- and low-water flows on the Mississippi and Missouri rivers, planned and unplanned river transportation repairs, and uncertain barge availability can cause fertilizer shipments to be reduced, delayed, or off-loaded at unplanned locations and then transported by truck or rail to their end-use destinations. These unanticipated changes in deliveries increase supply chain costs, generate delays, and stress transportation infrastructures. The lengthy and somewhat unpredictable delivery systems associated with fertilizer imports from countries such as Russia can also reduce the efficiency and effectiveness of the domestic fertilizer distribution system. Further, most

distributors place fertilizer orders between 40 and 65 days in advance of delivery, which requires them to make potentially inaccurate predictions about local demand conditions well before they sell products to agricultural producers.

The market for fertilizer is national in scope. Between 2003 and 2007, national (and Montana) fertilizer prices doubled. Prices doubled again between 2007 and 2009, before returning to 2007 levels in 2010. Since 2010, prices increased more than 50% before declining recently. To some extent, these prices have mirrored changes in fuel and petroleum prices as the primary input used to produce nitrogen fertilizer (natural gas) is a product of oil production. However, changes in natural gas drilling technologies could potentially break the oil/fertilizer price relationship. Increases in fertilizer production could have national and global implications if the United States becomes a net fertilizer exporter. Such a change would impact transportation infrastructures and national fertilizer prices. Hence, the impacts on Montana, Northwest, and Great Plains agricultural producers and fertilizer suppliers may be substantial.

Innovation

It is well-known that the best procedure for forecasting future commodity prices occurs when one uses commodity futures markets to obtain a forecast of a national price, and then adjusts that forecast by the expected local basis. This approach, however, is only relevant for those commodities for which futures markets exist. While there is a futures market for natural gas, there is not a contract traded for any type of fertilizer. Because of delivery lags between imported fertilizer at harbor facilities, and eventual purchase at interior locations, we will investigate whether or not an effective fertilizer price forecast model can be developed using FOB Gulf prices with adjustments made by basis predictions.

Approach (Design and Methods)

Relatively little research exists regarding the history and evolution of regulation in the U.S. natural gas and fertilizer industries. Even less is known about how regulations may have affected the fertilizer processing sector. We will examine the fertilizer processing industry and document both qualitative and quantitative information related to these impacts. This project will develop an organized, detailed, industry and regulatory overview to provide important insights about potential externalities that these regulations may create for the agricultural sector.

A review of existing literature, academic and industry economic analyses, and other information sources will be conducted. Industry representatives will be involved in this process. This qualitative assessment will then be augmented with quantitative approaches to develop a better understanding of U.S. fertilizer prices. Net import prices are determined by world markets with basis adjustments from port facilities. Quantitative approaches (e.g., difference-in-difference, VAR, error correction models, etc.) will be used to evaluate the impacts of market shocks on fertilizer price levels, basis, and price volatility at Gulf of Mexico, Northern Plains, Central Plains, and Northwest regions using

time series data. A fertilizer price model will be developed for the Northern Great Plains based on Gulf prices.

Trade models will also be developed to evaluate the impacts of the United States potentially becoming a net fertilizer exporter if abundant natural gas in the Northern Plains provide an impetus for building or expanding nitrogen fertilizer plants. This would change the basis in the northern Great Plains because the region would become the beginning point of the fertilizer supply channel rather than its end.

Gary Brester will collaborate with Anton Bekkerman to investigate the impacts of regulation on natural gas and fertilizer prices and basis behavior.

2. Human Subjects

Human subjects will not be used at any time throughout this research project.

3. Itemized Budget

Requested funds total \$____. Of this amount ____, will be used as summer salary compensation for Dr. Brester. This total amount includes all benefits payable by the principal investigator. In addition, \$____of travel funds are requested to offset expenses related to the presentation of a Selected Paper at the 2017 Western Agricultural Economics Association Annual Meeting in July, 2017.

Item	Amount Requested
Summer Funding (including benefits): Dr. Gary Brester	
Travel	
Total Requested Funds	

4. Project Timeline

The *goal* of the project is to evaluate the impact of regulations on the U.S. fertilizer industry. The *objective* is to develop trade and price basis models that help evaluate the potential effects of expansions in nitrogen fertilizer capacity, price variability, and trade. The research will result in several *accomplishments* including at least one white paper published by CRAEA, a seminar in the DAEE, a selected paper presentation at the 2017 WAEA and/or AAEE Annual Meeting, and a journal article submission. These accomplishments will be obtained within one year of the award date.