NARDeP
National Agricultural & Rural Development Policy Center
A Regional Rural Development Centers Initiative

POLICY BRIEF
BRIEF 25/JUNE 2014

SHALE GAS DRILLING AND FARM REAL ESTATE VALUES

By Jeremy Weber and Claudia Hitaj (Economic Research Service United States Department of Agriculture)

SUMMARY

A wave of drilling has occurred in areas with shale formations rich in oil and gas. By increasing the value of subsurface rights or by creating environmental side-effects, leasing and drilling affect self-reported farm real estate values and farm wealth. In parts of Texas and Pennsylvania, farm real estate appreciated when land was leased prior to drilling, with greater appreciation in Pennsylvania where farmers are more likely to own the rights to the subsurface. There, appreciation added $130,000 in wealth for the average farm. When drilling actually occurred, farms in and outside of shale areas appreciated at a similar rate.

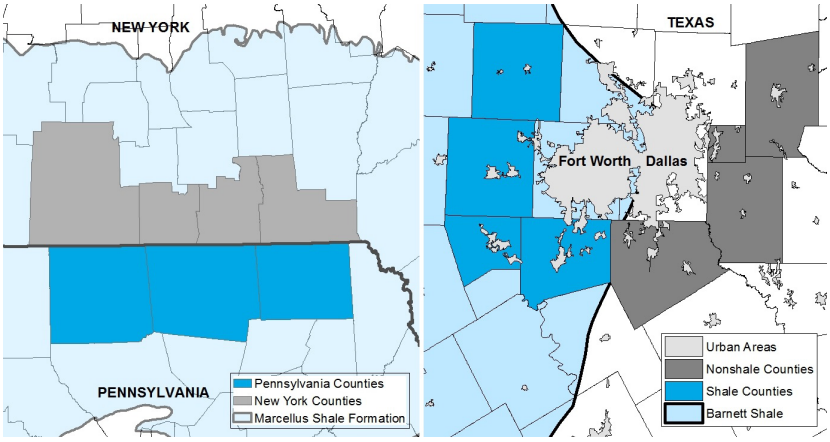

Figure 1. Study Counties.

INTRODUCTION

Technological developments propelled a wave of oil and gas drilling in areas of the U.S with gas or oil trapped in shale formations. The local implications of development are broad, ranging from effects on employment to housing values to infant health (Hill, 2012; Gopalakrishnan and Klaiber, 2013; Olmstead et al., 2013; Weber, 2012, 2013). By increasing the value of subsurface rights attached to the land or by creating unsightly infrastructure and negative environmental side-effects, drilling may also have considerable consequences for farm real estate values.

Farm real estate values matter for several reasons. First, large changes in values cause changes in household wealth because farm households hold much of their wealth in real estate. As the aftermath of the 2008 housing bust showed, changes in asset values influence household decisions to spend or invest. Second, little information exists on split estates – land where the subsurface rights have been split from the surface rights – and changes in farm real estate values can help reveal the prevalence of such estates. Compared to surface owners, subsurface owners of split estates are arguably more likely to live far from the property where they own rights. More split estates therefore mean that less royalty income will be received and spent locally. Third, changes in farm real estate values can help indicate how drilling affects the suitability of land for the uses that give it value, such as recreation or raising livestock.

Every five years the Census of Agriculture attempts to collect information on all places meeting the USDA definition of a farm, which is any place that would normally have $1,000 in sales of agricultural products in a year. The broad definition of a farm means that the Census collects information on much of the land in many counties. We look at self-reported per acre farm real estate values across the 1997, 2002, 2007, and 2012 Censuses of Agriculture for several counties on either side of the Pennsylvania-New York border and for counties in and outside of the Barnett Shale in the Dallas-Fort Worth region of Texas (see Figure 1).

Although the New York border counties are in the Marcellus Shale, Pennsylvania accounts for more of the Shale's total area and the industry first focused its resources there. By 2007, the

PA Department of Environmental Protection had already issued 280 permits for unconventional wells (PA DEP, 2014). In contrast, by the fall of 2008, the NY Department of Environmental Conservation had received less than a dozen permit applications for high volume fracking of horizontal wells, and had approved none of them (NY DEC, 2008). Afterwards regulatory hurdles in New York continued to prevent use of the same technologies used to intensively drill the Pennsylvania side. In the case of the Barnett Shale, the sharp eastern edge of the Shale provides a clear demarcation of areas that did and did not experience drilling based on their geology.

Because the leasing of land occurs before permitting or drilling, real estate markets likely respond to shale gas development a year or more before drilling occurs. Much leasing in the northeastern Pennsylvania counties of Tioga, Bradford, and Susquehanna of the Marcellus Shale occurred in the 2005-2008 period. Drilling then picked up in 2008, 2009, and 2010, with the number of unconventional wells drilled in the three counties increasing from 78 to 369 and finally 772. In adjacent counties in New York, there was very modest drilling throughout the mid-2000s, and this persisted in the years when drilling boomed in the neighboring Pennsylvania counties. Thus, although both the Pennsylvania and New York counties experienced modest drilling in the mid-2000s, the subsequent drilling boom on the Pennsylvania side suggests that leasing activity would have been substantially more intense there.

Development of the Barnett Shale began earlier, with much leasing probably occurring in the early 2000s (see Figure 2). The number of well permits peaked in 2007 and 2008 at more than 1,600 permits approved each year (and subsequently drilled) in the four shale counties of interest. In contrast, the comparison counties, which were almost entirely outside of the shale, had less than 30 permits approved in 2008.

We calculate the median percent change in per acre farm real estate values for farms in the two groups of counties in the two regions for the three periods (1997-2002, 2002-2007, 2007-2012). The median percent change is the value at which half of the farms appreciated more and half appreciated less. For the change from 1997 to 2002, for example, we only consider farms observed in both the 1997 and 2002 Censuses of Agriculture, which allows us to compare the same farm over time. The same is true of the appreciation estimated for the other five-year periods.

Prior to Marcellus Shale development (1997 to 2002), farms on the New York side experienced slightly better appreciation than those in Pennsylvania. A stark change occurred in the following period, 2002 to 2007, when farms on the Pennsylvania side appreciated 28 percentage points more than farms on the New York side. The abrupt change from the prior trend suggests that greater interest in leasing the subsurface rights in Pennsylvania translated into higher farm real estate values. In a period when drilling expanded, 2007-2012, farm real estate in the Pennsylvania counties appreciated at a similar rate as those in the adjacent New York counties.

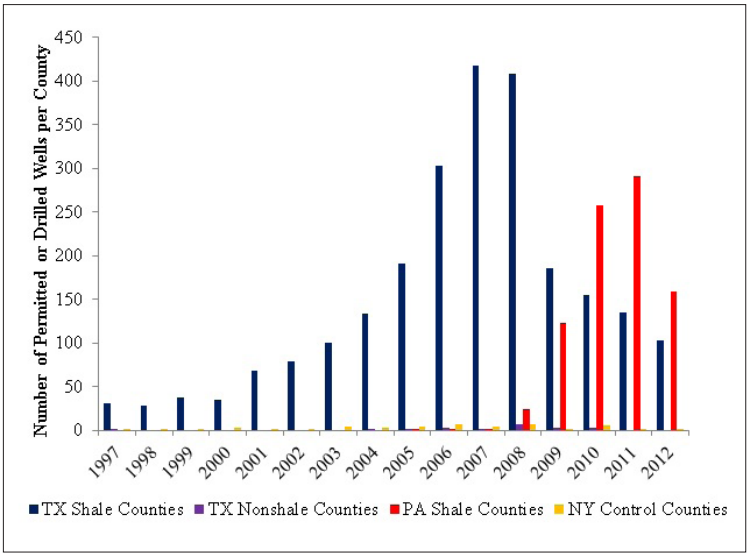

Figure 2. Shale Gas Development, 1997-2012.
Source: Pennsylvania Department of Environmental Protection; New York Department of Environmental Conservation; Railroad Commission of Texas.
Note: Only unconventional wells are considered, which are those wells drilled in unconventional formations (the Barnett Shale in Texas and the (mostly) Marcellus Shale in Pennsylvania). For Pennsylvania and New York, the year corresponds to the year when the well was drilled. For Texas, the year corresponds to when the well permit was approved, excluding permits that were never drilled. The TX Shale and Nonshale Counties and the PA Shale and NY Control Counties correspond to the counties in the map in Figure 1.

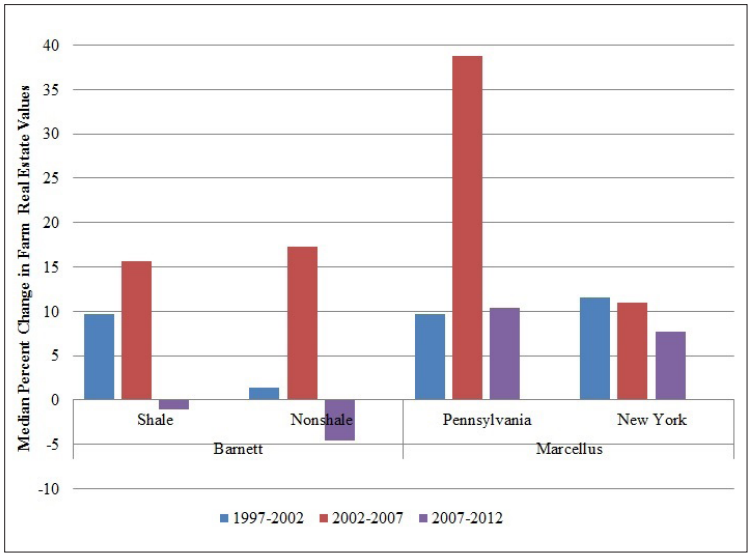

Figure 3. Median Farm Real Estate Appreciation, 1997-2002, 2002-2007, 2007-2012.

"Because the leasing of land occurs before permitting or drilling, real estate markets likely respond to shale gas development a year or more before drilling occurs."

Because of the earlier start of oil and gas development, the 1997-2002 period in Barnett Shale is analogous to the 2002-2007 period in the Pennsylvania-New York comparison. There, farm real estate also appreciated more in shale counties than in nonshale counties but to a lesser degree (8 percentage points). Over the subsequent five years, 2002-2007, when large-scale drilling actually occurred, farm real estate in both areas appreciated at similar rates. And as drilling in the Barnett slowed, 2007-2012, farms in the shale had slightly better appreciation than farms outside of it.

The greater appreciation found in the Pennsylvania counties suggests that farms there are more likely to own the rights to the subsurface than are farms in the Barnett Shale. This interpretation is supported by data on property taxes paid by farms in the Barnett. In Texas – but not in Pennsylvania – the owners of oil and gas rights pay property taxes on the value of their rights once a well associated with the rights begins to produce. In further analysis we see no clear increase in property taxes paid by farms in the Barnett Shale relative to those outside of it as drilling and production increased (Weber and Hitaj, 2014).

In 2002 the total value of farm real estate in the three border counties in Pennsylvania was about 1.67 billion dollars. The 28 percentage points in greater appreciation for Pennsylvania farms implies the creation of about $466 million in total wealth for farmers in the three counties, about $130,000 per farm. This represents an average effect, with some farmers experiencing smaller (or no gains) and others experiencing larger gains. This wealth increase may help farmers upgrade equipment and technology to improve the profitability of their operations. To the extent that many natural-gas rich properties are sold without the oil and gas rights, shale development should not make it substantially more costly for beginning farmers to buy land.

The large increase in farm real estate values in Pennsylvania most likely did not translate into increased property taxes for local schools and governments. Much farm real estate in the State is valued at its agricultural use value, which drilling should not have affected. In 2002 the Pennsylvania Supreme Court ruled that oil and gas cannot be taxed as property under the State's assessment laws (Pepe, 2009). If the observed appreciation in farm real estate values fully reflects the value of oil and gas rights, then it would not have contributed to property tax revenues in the State.

REFERENCES

Gopalakrishnan, S., and H. A. Klaiber. 2013. Amer. J. of Agri. Economics. 96(1):43-66.

Hill, E. L. 2013. Working Paper No. 2012-12.

Muehlenbachs, L., et al., 2013. Resources for the Future Discussion Paper 13-39.

New York Department of Environmental Conservation (NY DEC), 2008. Commissioner's Testimony at NYS Assembly Hearing on Oil and Gas Drilling October 15, 2008. Available at: http://www.dec.ny.gov/energy/47910.html (accessed on February 26, 2014).

Olmstead et al., 2013. PNAS. 110(13): 4962-4967.

Pennsylvania Department of Environmental Protection (PA DEP), 2014. http://www.portal.state.pa.us/portal/server.pt/community/oil_and_gas_reports/20297

Pepe, R. P. 2009. Oil & Gas/Real Estate Alert. April 17.

Weber, J.G. 2012. Energy Economics. 34: 1580-1588.

Weber, J.G. 2013. Resource and Energy Economics, forthcoming.

Weber, J.G. and C. Hitaj. 2014. Available at http://ageconsearch.umn.edu//handle/170596.

The views expressed are those of the authors and should not be attributed to the USDA or the Economic Research Service.

The National Agricultural & Rural Development Policy Center (NARDeP) is organized by the Regional Rural Development Centers to provide information about the increasingly contentious and complex agricultural and rural development U.S. policy issues.

The Center is funded by the USDA National Institute of Food and Agriculture (NIFA) under a competitive grant (Number 2012-70002-19385), and engages land-grant universities as well as national organizations, agencies, and experts to develop and deliver timely policy-relevant information around signature areas identified by our Advisory Boards.

Current signature areas are:

- Energy and the Environment
- Food Systems Development
- Self-Employment and Entrepreneurship

In addition, the Center supports research that cuts across policy issues related to the farm and agricultural sectors; the environment; rural families; households and economies; and consumers, food, and nutrition.

NARDeP's continuing objectives are to:

- Provide timely and cutting-edge research on current and emerging public policy priorities and regulations in a quantitative format
- Contribute to the development of theoretical and research methods
- Create and disseminate new datasets from secondary and our other sources to policymakers, analysts, and other interested individuals
- Serve as a clearinghouse for technology diffusion and educational resources and to disseminate impartial information web-based training and other publications
- Help to train the next generation of policy analysts

Visit us on the web nardep.info

The POLICY BRIEFS are published by the National Agricultural & Rural Development Policy Center (NARDeP) after a blind peer review process. NARDeP was formed by the Regional Rural Development Centers in response to the increasingly contentious and complex agricultural and rural development policy issues facing the U.S. NARDeP is funded by USDA National Institute of Food and Agriculture (NIFA) under a competitive grant (Number 2012-70002-19385), and works with the land-grant college and university system and other national organizations, agencies, and experts to develop and deliver timely policy-relevant information. NARDeP is an affirmative action/equal opportunity employer. For information about NARDeP, visit the website: nardep.info.

RRDC
Regional Rural Development Centers