



SHALE AND WALL STREET:

WAS THE DECLINE IN NATURAL GAS
PRICES ORCHESTRATED?

Deborah Rogers

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Executive summary

In 2011, shale mergers and acquisitions (M&A) accounted for \$46.5B in deals and became one of the largest profit centers for some Wall Street investment banks. This anomaly bears scrutiny since shale wells were considerably underperforming in dollar terms during this time. Analysts and investment bankers, nevertheless, emerged as some of the most vocal proponents of shale exploitation. By ensuring that production continued at a frenzied pace, in spite of poor well performance (in dollar terms), a glut in the market for natural gas resulted and prices were driven to new lows. In 2011, U.S. demand for natural gas was exceeded by supply by a factor of four.

It is highly unlikely that market-savvy bankers did not recognize that by overproducing natural gas a glut would occur with a concomitant severe price decline. This price decline, however, opened the door for significant transactional deals worth billions of dollars and thereby secured further large fees for the investment banks involved. In fact, shales became one of the largest profit centers within these banks in their energy M&A portfolios since 2010. **The recent natural gas market glut was largely effected through overproduction of natural gas in order to meet financial analyst's production targets and to provide cash flow to support operators' imprudent leverage positions.**

As prices plunged, Wall Street began executing deals to spin assets of troubled shale companies off to larger players in the industry. Such deals deteriorated only months later, resulting in massive write-downs in shale assets. In addition, the banks were instrumental in crafting convoluted financial products such as VPP's (volumetric production payments); and despite of the obvious lack of sophisticated knowledge by many of these investors about the intricacies and risks of shale production, these products were subsequently sold to investors such as pension funds. Further, leases were bundled and flipped on unproved shale fields in much the same way as mortgage-backed securities had been bundled and sold on questionable underlying mortgage assets prior to the economic downturn of 2007.

As documented in this report, emerging independent information on shale plays in the U.S. confirms the following:

- Wall Street promoted the shale gas drilling frenzy, which resulted in prices lower than the cost of production and thereby profited [enormously] from mergers & acquisitions and other transactional fees.
- U.S. shale gas and shale oil reserves have been overestimated by a minimum of 100% and by as much as 400-500% by operators according to actual well production data filed in various states.
- Shale oil wells are following the same steep decline rates and poor recovery efficiency observed in shale gas wells.

- The price of natural gas has been driven down largely due to severe overproduction in meeting financial analysts' targets of production growth for share appreciation coupled and exacerbated by imprudent leverage and thus a concomitant need to produce to meet debt service.
- Due to extreme levels of debt, stated proved undeveloped reserves (PUDs) may not have been in compliance with SEC rules at some shale companies because of the threat of collateral default for those operators.
- Industry is demonstrating reticence to engage in further shale investment, abandoning pipeline projects, IPOs and joint venture projects in spite of public rhetoric proclaiming shales to be a panacea for U.S. energy policy.
- Exportation is being pursued for the differential between the domestic and international prices in an effort to shore up ailing balance sheets invested in shale assets

It is imperative that shale be examined thoroughly and independently to assess the true value of shale assets, particularly since policy on both the state and national level is being implemented based on production projections that are overtly optimistic (and thereby unrealistic) and wells that are significantly underperforming original projections.

Introduction

Unconventional oil and gas from shales has been claimed to be a game changer, revolutionary, “a gift and national treasure”. Resource estimates for the U.S. have been giddily referred to as larger than “two Saudi Arabias” by Chesapeake Energy CEO Aubrey McClendon. It has even been said that shale oil and gas will provide energy independence for the U.S.

While such statements are expected from an industry which stands to gain monetarily, a careful, thorough and independent examination of shale production data and company filings demonstrate that shale promises have been vastly overstated, leading to troubling prognostications for the shale industry as a whole and for those regions exploited or planning to be exploited for this resource.

Shale development is not about long-term economic promise for a region. Such economic promise has failed to materialize beyond the first few years of a shale play's life in any region of the U.S. today that has relative shale maturity. Retail sales per capita and median household income in the core counties of the major plays are underperforming their respective state averages in direct opposition to spurious economic models commissioned by industry (see charts in Appendix).

Shale development is not about job creation. Optimistic job estimates by industry have relied heavily on unrealistic multipliers to claim vast numbers of indirect jobs.¹ Such job estimates in industry studies often include professions such as strippers and prostitutes in the overall job gains²—not the sort of jobs that most people think of when they hear optimistic numbers from the oil and gas industry. Moreover, direct industry jobs (for onshore and offshore oil and gas) have accounted for less than 1/20 of 1% of the overall U.S. labor market since 2003, according to the Bureau of Labor Statistics.³ This cannot be construed as game changing job creation.

Shale development is not about the long-term financial viability of shale wells. The wells have not performed up to expectations. Well decline curves are precipitously steep in shale gas and even steeper in shale oil based on historical production data filed by the operators in various states. Typical shale gas wells have an average field decline of 29-52%+ per annum while shale oil fields are declining at about 40%+ per annum.⁴ Industry admits that 80% of shale wells “can easily be uneconomic.”⁵ Massive write-downs have recently occurred which call into question the financial viability of shale assets and possibly even shale companies. In one case, assets were written off for more than 50% of the purchase price within a matter of months.⁶

Further troubling is the realization that shale assets classified as PUDs (proved undeveloped) may not have been properly reclassified by some operators per SEC rules because such reclassification would have resulted in collateral default. The fact that other industry players have been reluctant recently to bid on assets in the Utica shale of Ohio and have abandoned plans for a pipeline for the Bakken shale in North Dakota would seem to suggest a recognition within the industry of the questionable economics and short life span of shales.⁷

Shale development is not about vast reserves or “100 years of gas.” A recently published report reviewing production data of over 60,000 shale gas and oil wells observes that

U.S. shale gas has been on a plateau since December 2011, and that 80 percent of shale gas production comes from five plays, several of which are in decline.⁸ Further, according to a recent report by the Oil and Gas Journal, and industry publication, it is confirmed that the recovery efficiencies of shale plays are truly dismal. It is stated:

“The recovery efficiency for the five major [shale gas] plays averages 6.5% and ranges from 4.7% to 10% ...this contrasts significantly with recovery efficiencies of 75-80% for conventional gas fields.”⁹

Nor is shale development about technological advancements. Longer laterals have offered little in increased production, even in shale oil. Additional fracture stimulation stages also resulted in very little production gain according to studies conducted by the U.S. Geological Survey.¹⁰

Due to irresponsibly high debt levels, low cash, and the need to meet production targets for share appreciation, the price of both natural gas and natural gas liquids (NGLs) has been driven to new lows.¹¹ This complicates the shale picture enormously since margins are now non-existent. Exportation and its concomitant lucrative price spread is clearly seen by industry as offering the best hope for recovering losses.

The new business model of shales

Shale exportation provides a new frontier for shale development in the U.S. Operators are pushing lawmakers to open up vast tracts of land for exploration and development. This would clearly benefit the companies by giving them access at minimal cost and minimal future hassle.

Because of the favorable business climate, including exemption from all major federal environmental statutes and the willingness of some lawmakers to push for exportation, the U.S. has emerged as the preferred location for shale development by large multinational corporations.

It is also interesting to note that in countries such as Poland, once touted as the shale gas savior of Europe, industry has begun to abandon plans to exploit the resource due to higher costs and poor well production.¹² According to Deputy Environment Minister Piotr Wozniak, supplies have so far produced only “humble” results.

Fewer financial and environmental hurdles obviously lead to higher potential for margins and thereby profits. Given the slim margins in shale production at best, it makes good business sense to exploit the U.S. Unfortunately, adequate safeguards are not in place for those communities where such exploitation will take place.

In short, the lower the overall cost to extract shale hydrocarbons, the greater the profit spread particularly when the gas is exported. If export terminals were available today in the U.S., industry could extract, pipe, refine and ship shale gas to Asia for approximately \$9/mcf. They would currently get paid as much as \$18/mcf. Obviously, this is a highly lucrative spread.

In October of 2011, the Department of Energy granted the first shale gas export permit to Cheniere Energy. At that time, another 7 permits were pending which collectively committed approximately 20% of U.S. shale gas for export. One year later, in November of 2012, the number of permits had grown to 18 and the percentage of shale gas committed for export has grown significantly, accounting for approximately 60% of current U.S. consumption.¹³

It is interesting to note that while once the oil and gas industry exploited other regions of the globe to effect energy security for the U.S., it is now exploiting the U.S. to provide energy security to other regions, primarily Asia. These economies will pay the highest price and thereby offer the most profitability to the individual corporations.

It is, therefore, imperative to take a dispassionate view of this industry. Platform rhetoric about energy independence is nonsense as most within the industry realize. Further, oil and gas companies are not in business to steward the environment, save the family farm or pull depressed areas out of economic decline. If these things should by chance happen, they are merely peripheral to the primary mission of the companies and certainly were never considered in corporate exploration and production plans. Further, given shales' steep declines and thus limited lives, such benefits will be short-lived as well. It would be the height of naïveté to assume that such companies have altruistic intent towards a region or its residents. They do not. Oil and gas companies are in business to extract hydrocarbons as cheaply and efficiently as possible and get them to the customer that will pay the highest price. If they can shave dollars off already thin margins by refusing to use pollution control devices then that is precisely what they will do if it is not mandated, regardless of whether this will increase costs for a region due to pollution or negatively impact other industries. Even though pollution and degradation involve real costs, they are not borne by the industry that perpetrates them in today's economic accounting. This is especially true of the oil and gas industry as they are exempt from federal environmental protection statutes.

If shale developers can export their product to Asia where they will be paid multiples of what they can expect domestically, then that is where the gas will go. Additionally, the oil and gas industry is not in business to provide chemical, plastic and fertilizer manufacturers in the U.S. with low cost feed stock to the obvious detriment of their own bottom lines. Again, this would never be a part of their business model. Nor should it.

The energy context

For the past 100 years fossil fuels have held the primary position as the drivers of the U.S. and western economies. Nevertheless, fossil fuels are finite. New deposits of hydrocarbons have proven harder and harder to replace. Indeed, for more than a decade the largest oil and gas producers (the "Majors" as they are collectively called) have not been able to materially expand their reserve replacement ratios.¹⁴ In fact, approximately one quarter of their reserve growth has come from acquisitions rather than the drill bit, such as ExxonMobil's acquisition of XTO Energy. This constitutes consolidation rather than organic growth.

To give another example, in 2010 Chevron replaced less than one fourth of the oil and gas it had sold the prior year.¹⁵ This is highly problematic for the future share price of these companies and explains the exuberant share repurchase programs which they have engaged in recently, buying back shares in excess of as much \$5 billion a quarter in the case of ExxonMobil.¹⁶

This is, of course, highly problematic for the future health of global economies. It is also problematic for the share prices of the individual fossil fuel companies.

Further, there are various grades and types of hydrocarbons, some much more efficient as fuels than others. Additionally, some hydrocarbons simply require such an expenditure of energy to extract and produce that their use becomes questionable. This measure is referred to EROI (energy returned on investment) and is often seen as a ratio. For instance, it is estimated that in the early days of the U.S. oil industry, the EROI for oil was 100:1 (that is, 100 units of energy recovered for every one unit of energy invested)¹⁷ but this has since declined to an EROI of under 20:1.¹⁸ Because unconventional hydrocarbons like tar sands and shales are by definition more challenging (i.e., more energy-intensive) to produce, they generally have very low EROIs: likely well under 5:1.¹⁹

Additionally, although industry boldly exclaims each new hydrocarbon discovery with hyperbole, there is a general consensus that we are on the downward slope of hydrocarbon abundance. In April 2011, the chief economist of the International Energy Agency (IEA) Fatih Birol stated: “We think that the crude oil production has already peaked, in 2006.”²⁰

Street economics: The roots of the crisis

In an environment of declining crude reserves and a now-necessary reliance on low-EROI unconventional hydrocarbons, the oil and gas industry launched a public relations campaign with shale gas and oil of disproportionate scale to the actual performance of the wells. From a business perspective, of course, this made perfect sense.

The financial markets are intricately married to large multinational corporations. Without such markets, companies would be small and local rather than the transnational behemoths of today. Therefore, the growth of companies and the growth of economies relies heavily on the global capital markets.

In order for a publicly traded oil and gas company to grow extensively, it must manage not only its core business but also the relationship it enjoys with its investment bankers. Thus, publicly traded oil and gas companies have essentially two sets of economics. There is what may be called field economics, which addresses the basic day to day operations of the company and what is actually occurring out in the field with regard to well costs, production history, etc.; the other set is Wall Street or “Street” economics. This entails keeping a company attractive to financial analysts and investors so that the share price moves up and access to the capital markets is assured.

“Street” economics has more to do with the frenzy we have seen in shales than does actual well performance in the field.

With the help of Wall Street analysts acting as primary proponents for shale gas and oil, the markets were frothed into a frenzy. Boom cycles have the inherent characteristic of optimism. If left unchecked, such optimism can metamorphose into a mania such as we saw several years ago in the lead up to the mortgage crisis.

The Dallas Federal Reserve Bank noted in their 2011 Annual Report on “too big to fail” financial institutions:

“Credit default swaps fed the mania for easy money by opening a casino of sorts, where investors placed bets on—and a few financial institutions sold protection on—companies’ creditworthiness... Greed led innovative legal minds to push the boundary of financial integrity with off-balance-sheet entities and other accounting expedients. Practices that weren't necessarily illegal were certainly misleading—at least that's the conclusion of many post crisis investigations.”²¹

Such similarities can now be seen with shale operators.

In this case, Wall Street once again led the mania by enlisting its army of sell-side analysts to promote shale production. In August of 2011, Neal Anderson of Wood Mackenzie had this to say about the investment community and shale exploration:

“It seems the equity analyst community has played a key role in helping to fuel the shale gas M&A market, acting as chief cheerleaders for shale gas plays.”²²

A shale company's worthiness was extolled through analyst “buy” recommendations. Investors placed their bets and speculation drove natural gas prices in 2008 to artificially high levels far beyond historical prices. Investors leaped in with reckless and emotional abandon because of the exuberance. The price of natural gas hit a high of \$13.50/mcf in 2008, more than twice the historical average of \$5-6/mcf. Further, and even more troubling, operators and investors began to refer to such artificially high prices as though they were the new norm. In fact, drilling decisions were made based on an erroneous assumption that prices would never move back to historical levels.

High hopes, no transparency

All overtly exuberant market cycles have one common characteristic: they are overwhelmingly emotional rather than rational in their decision-making processes. This always poses a danger. In hindsight, the mortgage bubble was predicated on years of financial exuberance. A general outlook of “this party can go on forever” had taken hold. New technologies emerged which allowed for much more sophisticated financially engineered products. Creativity abounded on Wall Street. Products were deliberately engineered to reduce the lenders’ risk. Or so it was thought.

Banks no longer held on to mortgages. Instead it became lucrative to make loans, package the mortgages, have a ratings agency pronounce it a safe investment and then flip them to investors, thereby collecting large fees. This is not unlike the land grab which shale operators engaged in

by leasing millions of acres of land, drilling a handful of wells and pronouncing the field “proved up” and thereby a “safe” investment, and then flipping such parcels to the highest bidder. This exercise quickly drove prices up.

Before the mortgage crisis, once the extent of the appetite was realized for credit default swaps, representatives of the capital markets worldwide embraced the new products. The fees generated were immense. It was similar with shale. Land was bid up to ridiculous prices with signing bonuses reaching nearly \$30,000/acre and leases on unproven fields being flipped for as much as \$25,000/acre, multiples of original investment.²³ There seemed an unending appetite.

In another example of parallels: credit default swaps were not traded on any exchange, so transparency became a paramount issue. It proved very difficult to accurately measure the underlying fundamentals with such a lack of transparency. It was the same with shales. Due to the new technology of hydrofracture stimulation, shale results could not be verified for a number of years. There simply was not enough historical production data available to make a reasonable assessment. It wasn't until Q3 of 2009 that enough production history on shale wells in the Barnett had been filed with the Texas Railroad Commission that well performance could be checked.²⁴ What emerged was significantly different from the operators' original rosy projections. Of further interest is the fact that once numbers could begin to be verified in a play, operators sold assets quickly. This has followed in each play in the U.S. as it matured. The dismal performance numbers were recognized as a potential drag on company share prices. A good example would be the operators in the Barnett play in Texas. The primary players were Chesapeake Energy (significant portion of assets sold or jv'ed), Range Resources (all Barnett assets sold), Encana, (all Barnett assets sold) and Quicksilver Resources (company attempting to monetize all Barnett assets via MLP or asset sale since 2011. In that time frame, stock has plunged from about \$15/share to \$2.50/ share).

The issue of well performance disclosure has continued to mask problems in shale production. States such as Pennsylvania and Ohio do not release well performance data on a timely basis, which makes it very difficult to get a true picture of actual well history.

Purposeful complexity, willful ignorance

Many highly complex financial products were at the very heart of the mortgage crisis. Interestingly, they have also found a place in shale production.

For instance, in May 2011, Barclays Capital came up with an innovative structure through a volumetric production payment (VPP) which allowed a broader base of investors into a shale deal with Chesapeake Energy. According to Risk, March, 2012:

“The main challenges in putting together the Chesapeake VPP deal were getting the structure right and guiding the rating agencies and institutional investors—who did not necessarily have deep familiarity with the energy business—through the complexities of natural gas production.”²⁵

Once again, investors are encouraged into investments in an off-balance sheet transaction which is inherently complex and which they admittedly do not have familiarity with. Further, by Barclay's own admission the ratings agencies needed to be “guided” to fully understand the complexities of the deal.

During the lead up to the mortgage crisis, financial products were actually reverse-engineered to pass the ratings agencies requirements. In addition, lenders sought out clients who were not qualified to assume mortgages.

It is also interesting to note that before the mortgage crisis, Congress encouraged the government agencies of Fannie Mae and Freddie Mac into becoming the largest buyers of mortgage securities, a move that in hindsight was ill-conceived.²⁶

Recently some members of Congress have begun advocating the perceived benefits of shale gas and shale oil exportation. It is a controversial position, however, and one which is not necessarily shared by all industry insiders more well-versed in resource potential than Congressional representatives.

In August, 2012, the *New York Times* reported:

“Last week, more than 40 members of Congress urged President Obama to move forward with approval, citing the benefits of free trade and the prospect of creating more jobs as demand for exports leads to growth in gas production.”²⁷

And yet, in February, 2012, Lee Raymond, former CEO ExxonMobil stated:

“Even if you get past the politics, you have to test whether or not the resource base is sufficient [for exportation]...It’s going to be a little while before people are really confident that there is going to be a sufficient amount of gas for 30 years...I’m frankly not sure that we have enough experience with shale gas to make the kind of judgment you’d have to make.”²⁸

In addition, John Hofmeister, the former chief of U.S. operations for Shell, stated in September 2012, “Unless something seriously changes in the next five years, we’ll be standing in gas lines because there won’t be enough oil to go around.”²⁹

The drilling treadmill

Mr. Hofmeister said he believes forecasts also understate the “decline” rate of shale fields. The hydrocarbons tend to flow robustly in the first months of drilling, then decline before plateauing at lower levels. Wells have also not been as long-lived as originally forecast.

Mr. Hofmeister concluded that to sustain growth, companies will need to drill many wells at a rate “beyond the capacity of the industry as currently defined...Those who ballyhoo oil shale and say that this will take care of us—no, it won’t.”

Mr. Hofmeister is referring to a phenomenon known as the “drilling treadmill” or “exploration treadmill.” Shale extraction requires continuous and prolific drilling programs covering vast acreage in order to maintain a production plateau. Once drilling begins, it must be maintained or production declines rapidly. In other words, shales are heavily reliant on perpetual expansion. This is highly problematic for a fuel which is to be considered a bridge to alternative energies.

According to Dave Hughes, author of a forthcoming report on U.S. shale plays for the Post Carbon Institute:

“The sweet spots have now been identified, and [initial productivities] are rising as drilling is focused on these areas. It is only a matter of time, however, until available locations in these areas become saturated and the Marcellus moves into middle age... Due to their high decline rates [tight oil] plays require high levels of capital input for drilling and infrastructure development to maintain production levels.”³⁰

Hence the drilling treadmill: as production grows, more wells and capital are needed simply to offset the inherent steep declines of shale wells.

Each shale play has essentially followed the same pattern. Operators move into a region and begin a prolific drilling program. Economically, it provides a boost in the short term. The sweet spots are drilled out first as this provides the best possibilities for good wells in addition to good public relations material. In the beginning of a play, individual well productivity appears to climb rapidly. But to extrapolate from this that shale will necessarily provide long term economic stability for a region is highly problematic and unlikely. The older the play, the more difficult it becomes to maintain the production plateau. And the more costly.

Encana's statement from their press release of the sale of all their assets in the Barnett Shale of North Texas illustrates this point quite well:

“We’re going to focus our energies on our higher growth properties that are at earlier stages of development and have more opportunity for growth...The Barnett is not the best place for Encana to put its money.. It’s a mature area and the sweet spots have been drilled out.”³¹

Each shale play in the U.S. has demonstrated such sweet spots and steep declines. In spite of industry promises of long-term stability, shale plays are known within the industry as statistical plays. Dr. John Lee, the architect of the SEC's rule change for oil and gas and a well-respected petroleum engineer stated:

“It is sometimes said...that 20% of [shale] wells carry a project; the other 80% can easily be uneconomic.”³²

This adds further problems for shale developers because with so many uneconomic wells it becomes that much harder to keep production flat. Furthermore, all new wells being drilled will follow this 80/20 estimation.

For illustrative purposes, industry would need to drill 561 new wells per year just to offset declines at present using the latest type curve for the Marcellus. Because the Marcellus is a relatively new play, currently there are 1244 new wells being added each year. Thus production is still in the growth phase. As production grows, so does the number of new wells needed to offset declines.³³

This business model is not sustainable. Once the sweet spots are drilled out, operators begin to sell assets because the costs of trying to maintain a flat production profile are enormous. This corroborates Mr. Hofmeister's statements above.

The cost of maintaining a flat production profile is staggering. For instance, according to Dave Hughes, the cost of a Marcellus well is about \$4.5 million, which translates to \$2.5 billion each year to offset declines (excluding leasing and infrastructure costs). This is lower than the Haynesville at \$7 billion (to maintain a flat production profile) and the Barnett at \$5.3 billion.³⁴

Financial co-dependency

In the lead up to the financial crisis, Wall Street bundled mortgages of different quality, packaged them and sold them off to investors. Through reverse-engineering to meet the ratings agency's stipulations, they managed to get approximately 80% of these loans classified as investment grade. These were inherently complex financial products. Due to the tremendous appetite for the securities, it then became expedient to originate mortgages. The more mortgages of any quality available, the more that could be packaged and sold to hungry investors. One study found that 68% of all residential mortgages had been originated by a mortgage broker prior to the crisis.³⁵

In much the same manner, the shale operators moved into areas and began leasing acreage. Companies vied with one another to bundle vast acreage. Each play followed the same game plan: operators would originate leases and then bundle them.

Aubrey McClendon, CEO of Chesapeake Energy, stated unequivocally in a financial analyst call in 2008:

“I can assure you that buying leases for x and selling them for 5x or 10x is a lot more profitable than trying to produce gas at \$5 or \$6 mcf.”³⁶

This sort of promotion was not peculiar to Chesapeake Energy. In January, 2012, Bloomberg reported:

“Surging prices for oil and natural gas shales, in at least one case rising 10-fold in five weeks, are raising concern of a bubble as valuations of drilling acreage approach the peak set before the collapse of Lehman Brothers Holdings Inc.”³⁷

Bundling leases was highly profitable business in much the same manner as bundling mortgages. Operators and sell-side analysts, although not necessarily in admitted collusion, would froth the markets with heady forecasts. Operators would then drill a few wells and declare

the field as “proved up”. There was, however, uncertainty as to whether the fields truly were “proved up”.

In January, 2012, Bloomberg noted:

“Chinese, French and Japanese energy explorers committed more than \$8 billion in the past two weeks to shale-rock formations from Pennsylvania to Texas after 2011 set records for international average crude prices and U.S. gas demand. As competition among buyers intensifies, overseas investors are paying top dollar for fields where too few wells have been drilled to assess potential production...”³⁸

Moreover, production targets added further financial strain to ailing balance sheets.³⁹ They also added much more gas to already burgeoning supply capacity. This in turn drove prices lower still. In January, 2012, prices plunged under \$3/mcf. Break even costs for shale wells were averaging about \$4-6/mcf, so operators were facing significant shortfalls.⁴⁰

And yet, the banks who were generating large fees off shale company transactions were still rating these same companies as “buys” to the average investor.

To give an example, Chesapeake Energy announced the sale of assets and a notes offering last February. Bank of America/Merrill Lynch, Morgan Stanley, Deutsche Bank, Goldman Sachs, Jeffries and Royal Bank of Scotland were the banks involved in the deals.

In the days and weeks leading up to the announcements, these same banks issued recommendations on Chesapeake Energy.⁴¹ They were as follows:

Bank of America/Merrill Lynch	Buy
Jeffries and Co.	Buy
Morgan Stanley	Overweight
Goldman Sachs	Hold
Deutsche Bank	Neutral
Royal Bank of Scotland	N/A

At the same time of this announcement, other analysts at institutions which did not stand to gain fees from these transactions had an opposite view of the prospects for Chesapeake Energy.

On February 15, 2012, an analyst in *Deal Pipeline* stated, “Chesapeake is in serious trouble...Its Enron style of media hype, off-balance sheet accounting and excessive leverage has finally caught up with them. The end appears to be close.”⁴²

Zacks Equity Research placed Chesapeake Energy on bankruptcy watch with an Altman Z score of .84. Anything below 1.80 is considered to be at high risk for bankruptcy.⁴³

Over the next two months, numerous problems came to light regarding Chesapeake. Reuters broke a story disclosing \$1.1B in undisclosed notes.⁴⁴ Then it was uncovered that Chesapeake CEO Aubrey McClendon was running a \$200 million hedge fund from Chesapeake corporate offices in Oklahoma City trading in the very commodities which Chesapeake produced.⁴⁵ Both the Department of Justice and the SEC opened investigations.⁴⁶ In Q2-3 2012, the company wrote off over \$2B in shale assets and have been forced to sell over \$10B in assets just to stay afloat with more asset sales pending and expected.⁴⁷ The share price plunged over 40% in a matter of weeks.

Ralph Eads of Jefferies, one of Chesapeake Energy's primary investment banks, was quoted in the *New York Times*, October, 2012, admitting to talking up prices and perhaps even alluding to hoodwinking the Majors who bought shale assets:

“Typically we represent sellers, so I want to persuade buyers that gas prices are going to be as high as possible...the buyers are big boys—they are giant companies with thousands of economists who know way more than I know. Caveat emptor.”⁴⁸

According to KPMG, shale gas accounted for \$46.5 billion in deals in the U.S. alone in 2011.⁴⁹ The mergers and acquisitions market for shale assets exploded in the prior two years directly in sync with the downward descent of natural gas prices (see chart, below). In much the same way as mortgage backed securities bolstered the banks' profits before the downturn, energy M&A had now become the new profit center within these banks.

Value of Mergers & Acquisitions Compared to Natural Gas Prices, 2008-2011



Data: IHS Herold; Energy Information Administration.

The demise of the NGL market

As the drilling treadmill became more apparent, operators attempted to divert attention away from the plummeting natural gas price by focusing intently on liquids-rich production, announcing concentration on wet gas areas of shale plays. This was an obvious ploy to salvage the appearance of profitability and continue to meet the production targets so necessary for share price appreciation. In effect, however, this focus wreaked havoc on the natural gas liquids (NGL) market in the same way it had eroded natural gas prices.

Analysts did, in fact, recognize the possibility of a glut in NGLs. This would, of course, have placed additional psychological and financial pressure on operators to consider selling assets or seeking joint venture partners, even mergers, which the banks could then effect. About the NGL market, Bank of America/Merrill Lynch stated:

“Perhaps more importantly, we also find that the weak fundamentals in the NGL market hold some interesting repercussions for natural gas. Although returns on NGL production are currently protecting natural gas producers from low natural gas prices, eventually the glut in the NGL market could catch up with them. Lower NGL prices could then quickly translate into a slowdown in liquid drilling programs if margins contract or turn negative even. In other words, while drilling for NGLs is currently producing a chunk of natural gas at zero cost, the surpluses in the NGL market could come to haunt producers.”⁵⁰

That is precisely what happened. In an obvious effort to appease their bankers and shareholders, operators had overproduced yet again and driven prices of NGL's to new lows.

In May, 2012 Reuters reported:

“U.S. natural gas drillers, stung by decade-low gas prices, have flooded into so-called liquids-rich plays, but the surge in natural gas liquids (NGLs) output that was meant to salvage profitability is leading to a new glut.”⁵¹

By July, 2012 Reuters reported:

“U.S. oil and gas companies that have depended on natural gas liquids to lift profits may now have to rein in spending or sell some assets after the industry drilled its way into a glut of natural gas liquids.”⁵²

And the sale of assets began.

An interesting example of NGL overproduction is Range Resources, who heavily touted their emphasis on liquids-rich production. In their earnings call Q4 2011, it was stated:

“The first is the super-rich Marcellus...Given the high price of oil versus the current low price of gas, this super-rich play enhances the value of our Marcellus economics.”⁵³

Range management went on to say:

“The higher volumes are not only the result of drilling in the higher BTU area, but are also the result of drilling longer laterals and completing them with more frac stages. We’ve also experimented with reduced cluster spacing, decreasing the frac interval from 300 feet to 150 to 200 feet; all of this looks very promising. Once we extract ethane beginning late next year, this will further enhance the economics.”⁵⁴

Note that the additional BTUs gained from liquids “are also the result of drilling longer laterals and completing them with more frac stages.” This translates into higher costs to extract liquids for which the market was already becoming glutted. Improving the economics in this way has proven to be wishful thinking as Range announced disappointing margins for the last five quarters with a loss of \$53.8 million in 3Q 2012.⁵⁵

Oil and gas companies with material exposure to NGLs include Range Resources, Quicksilver Resources Inc., Forest Oil Corp and Pioneer Natural Resources.

Foreign entities buy up U.S. shale

Beginning in 2009, the number of M&A deals within the shale market began to explode. Initially, many transactions involved foreign investors such as Chinese, Korean, French and Norwegian companies looking to purchase U.S. shale assets. The banks effected these transactions for large fees.

CNOOC, a Chinese oil and gas company, paid \$1.1 billion for 33.3% of Chesapeake Energy’s Eagle Ford acreage and agreed to fund another \$1.1 billion of the drilling costs. It is estimated that Chesapeake cleared approximately \$10,237 per acre, a significant multiple of original cost.⁵⁶ Anadarko, too, has entered into a joint venture with the Korea National Oil Corporation, which agreed to pay \$1.55 billion for a 33% share of Anadarko Petroleum’s acreage in the Maverick Basin in Texas.⁵⁷

In addition, BHP Billiton, a large Australian mining multinational agreed to acquire Petrohawk Energy Corp, for approximately \$15.2 billion paying a considerable premium of approximately 65% to Petrohawk’s prior day close.⁵⁸ In addition, BHP paid Chesapeake Energy approximately \$4.75 billion for its Fayetteville shale assets only to write down in excess of 50% of their value a mere 18 months later.⁵⁹ Many other deals were consummated during this time.

By Q2-Q3 2012, shale asset write-downs began in earnest.

Massive write-downs of shale assets

In the lead up to the mortgage crisis, there were hints of things to come in the form of asset write downs. Unfortunately, very few were heeded. In February 2007 HSBS booked a loss on

mortgage assets of \$10.5B.⁶⁰ In Q3, UBS announced a loss of \$690m.⁶¹ In January of 2008, Citigroup announced a loss for the prior quarter of \$9.8B.⁶² Other write-downs occurred, in addition to Chapter 11 filings for some companies.

Similar hints have been emerging with regard to shale. In May 2012, *Forbes* reported the following:

“Chesapeake Energy shares closed down 14% today on wording in an SEC filing that the company might have to write down the value of its assets because of record low gas prices and might have trouble meeting its obligations under bond covenants...Although such write-downs don’t affect the company’s cash balance, they do erode the value of the assets carried on the company’s balance sheet. This asset value directly impacts the amount of debt leverage the company can maintain.”⁶³

In Q3 2012, as predicted, further deterioration occurred for Chesapeake. The company took an additional and considerably larger impairment charge of \$2.02B on its shale assets.⁶⁴

Further, in July, 2012, ITG Investment Research, at the request of several large institutional investors, engaged in a study which ultimately questioned Chesapeake Energy’s (CHK) claims of booked reserves. ITG gathered its well data from public sources such as production history filed with the Texas Railroad Commission. They concluded that a significant portion of Chesapeake reserves in the Barnett “have no positive value, heralding a potential writedown in our opinion.”⁶⁵

Through July and August 2012 the bad news kept pouring in. According to Reuters:

“Encana said it had recorded a US\$1.7 billion non-cash after-tax impairment charge resulting primarily from the decline in 12-month average trailing natural gas prices.”⁶⁶

“Natural gas-focused producer Quicksilver Resources Inc. posted a second-quarter loss on a big impairment charge as weak prices for natural gas and natural gas liquids lower the value of the company’s assets...Quicksilver said its results were hurt by a \$992 million non-cash impairment of oil and gas properties due to lower prices.”⁶⁷

According to the *Financial Times* of London:

“British Petroleum (BP) said Tuesday it is taking an impairment charge of US\$2.11 billion, primarily relating to its U.S. shale gas assets.”⁶⁸

“BHP Billiton (BHP) blamed a glut of gas supply in the US for a US\$2.84B impairment charge against the value of its Fayetteville gas assets, which it acquired for US\$4.75B 18 months ago.”⁶⁹

According to Bloomberg:

“BG Group, the U.K.’s third-largest oil and gas producer, wrote down \$1.3 billion on its U.S. shale fields...”⁷⁰

Further impairments are expected in the coming quarters.

Although companies claim that such charges are not reflective of the fair value of the assets, this is highly questionable given the significant reserve downgrades which the USGS has assigned to all shale plays in the U.S. The fact that some of these companies would have found themselves in collateral default had they accurately reflected their reserves on the books is also extremely troubling.

In view of these significant impairments, deal-making appears to have reached saturation point as of Q3 2012.

According to PriceWaterhouseCoopers, companies with acreage in the Marcellus had enjoyed approximately \$32 billion in merger and acquisition deals since the beginning of 2010. The third quarter of 2012, however, was the first in that period with no deals at all. Activity fell to zero.⁷¹

Given the poor performance of prior shale deals, it appears that investors are becoming more cautious. According to Reuters:

“...one investment banker said that there is currently ‘a little bit of “JV fatigue” ’ in the energy industry, noting that some companies might be wary of linking up with the precariously positioned Chesapeake... ‘I think that's very true as it relates to Chesapeake, which has a bit of an asterisk beside their name at this point. I think people have found their experience with Chesapeake has been unrewarding...’ ”⁷²

And yet, Chesapeake has been continuously touted by industry and its investment banks to have some of the very best shale acreage in the business.

Companies start pulling out

In spite of all the hype surrounding shale production, it is interesting to note the recent behavior of other industry players with regard to shale assets.

In October, 2011, Norse Energy announced it was putting its 130,000 acres in New York State's portion of the Marcellus up for bid. Over a year later, in December, 2012, Norse Energy had not been able to sell the assets. This, coupled with high levels of debt, forced Norse to declare bankruptcy under Chapter 11.⁷³

Although there is a moratorium at present in New York State with regard to hydrofracking, it is generally assumed that fracking will be allowed at some point in the state. The fact that no other

energy company was interested in picking up these assets, however, indicates a distinct lack of confidence in the assets overall.

Other companies have also begun letting their leases expire in New York with no intention to renew. For instance, Anschutz Exploration recently announced that they would not seek to renew leases. According to the *Denver Business Journal* in December 2012:

“Anschutz Exploration isn't alone. Other companies are letting their oil and gas leases on property in the state lapse because a drilling moratorium, coupled with the threat of tougher regulations, has made New York less attractive for gas operations.”⁷⁴

As stated at the beginning of this report, industry relies heavily on fewer business hurdles to effect their drilling programs. Margins are simply too thin in shales and the well performance too poor to justify investment in wells with added regulatory and environmental costs.

It is also interesting to note that in the Utica shale, which Chesapeake Energy CEO Aubrey McClendon boasted in the early days was “the biggest thing to hit Ohio since the plow,” operators have experienced difficulties getting joint venture partners for drilling. According to Bloomberg, September 2012:

“PDC Energy Corp. didn’t receive a high enough bid from would-be joint-venture partners for an interest in its Utica holdings and will develop the acreage on its own...”⁷⁵

Information is emerging that the Utica wells are not performing up to expectations. Financial analysts, upon examining the initial well results released by the State of Ohio, characterized them as “underwhelming”. According to Reuters:

“Even Chesapeake has muted its trumpet...In an SEC filing this May, the company said it was planning to drill a significant number of wells in Utica's ‘oil window’ over the rest of this year, referring to an area that is expected to hold mostly oil. Three months later it said it ‘continues to focus on developing the wet gas and dry gas windows,’ with no mention of oil. Chesapeake declined to comment on the change in description.”⁷⁶

In the Bakken shale of North Dakota, which is primarily an oil shale play, plans to build a pipeline to carry the oil to a large storage facility in Cushing, Oklahoma were recently abandoned. According to Energy and Capital, November 2012:

“Oneok Inc. (NYSE: OKE) experienced a recent setback after its subsidiary, Oneok Partners LP (NYSE: OKS), failed to secure enough oil producers to justify developing a \$1.8 billion Bakken pipeline.”⁷⁷

This is of particular interest. Pipeline projects are expensive and require that a steady and consistent stream of gas or oil can be counted on for a long period of time in order to recoup initial capital outlay. Once initial capital is recouped, however, they tend to be cash cows. Given the steep decline curves for shale oil that are now readily apparent, it appears that operators

recognize that the Bakken will not be a long-term play. As such, they are not prepared to invest the needed capital upfront for a pipeline: again, a distinct lack of confidence in the long term viability of shales.

Costs versus benefits

In the 2012 Summary of Revised Regulatory Impact Statement, the New York State Department of Environmental Conservation (DEC) made the following remark regarding high volume hydraulic fracturing (HVHF):

“The Department considered the denial of permits for HVHF, but while this alternative would fully protect the environment from any environmental impacts associated with HVHF, it would eliminate the economic benefits.”⁷⁸

The purported economic benefits of shale gas and oil have been consistently and egregiously overstated by industry in every shale play to date. While there is some initial economic boost, it has proved short-lived and will almost certainly never cover the peripheral costs of production such as long-term environmental degradation, air quality impacts, aquifer depletion and potential contamination, road repairs and health costs just to name a few. The fact that DEC appears unaware of this is troubling and would seem to suggest that DEC has not done proper due diligence.

Examples abound of industry rhetoric which has not lived up to initial promises. For instance, in 2007 Chesapeake Energy, the largest leaseholder in New York State, issued the following statement in a press release regarding their wells at Dallas-Fort Worth Airport (DFW):

“Assuming an estimated average recovery of approximately 2.5–3.0 billion cubic feet of natural gas equivalent (bcfe) gross reserves per well, the company believes that up to one trillion cubic feet of natural gas equivalent (tcfe) reserves can be produced from under the airport at an all-in finding and development cost of approximately \$2.00 per thousand cubic feet of natural gas equivalent (mcf).”⁷⁹

Firstly, based on actual production history in the Barnett shale, Chesapeake wells average 1.5 Bcf, not 2.5–3.0.⁸⁰ Secondly, while Chesapeake claimed that finding and development (F&D) costs were in the range of \$2/mcf, independent sources put F&D costs for the Barnett at approximately \$4/mcf.⁸¹

Not only were the wells in significant decline by year-end 2011—a mere four years after the above-mentioned giddy statements of the press release—Chesapeake also found itself settling a lawsuit with DFW Airport with regard to significant underpayment of royalties.⁸²

Further, additional peripheral costs are being borne by taxpayers in states where drilling is prevalent. For instance, according to the *Fort Worth Star Telegram*, July, 2012:

“...the Texas Department of Transportation (TXDOT) told industry representatives and elected officials on Monday that repairing roads damaged by drilling activity would ‘conservatively’ cost \$1 billion for farm-to-market roads and another \$1 billion for local roads.”⁸³

Another article dated 25 December, 2012, from the Associated Press (AP) stated:

“The first operating loss in about five years at a north-central Pennsylvania hospital is a sign of the influx of natural gas field workers without health insurance, the facility’s CEO said...Jersey Shore Hospital president and CEO Carey Plummer told the *Sun-Gazette* of Williamsport that many subcontractors attracted to the area’s Marcellus Shale drilling boom do not cover employees.”⁸⁴

It is unlikely that such costs will be borne by the oil and gas industry given the poor performance of the wells and industry’s frenzy to sell leases and joint venture shale properties. This will continue to prove problematic for states where shale development has occurred.

Moreover such costs must be factored into the overarching economic equations. Shale development is a highly industrial activity with all that entails. The Texas Commission on Environmental Quality submitted a report to U.S. EPA in December 2011, confirming that drilling activities were contributing 42% more volatile organic compounds than all on-road mobile sources in the Dallas-Ft. Worth region, a significant obstacle to ozone attainment goals.⁸⁵ Again, a cost to be borne by the taxpayers rather than the industry that created it.

Every region in the U.S. which has shale development provides a cautionary tale. Economic stability has proved elusive. Environmental degradation and peripheral costs, however, have proved very real indeed.

Conclusion

As documented in this report, emerging independent information on shale plays in the U.S. confirms the following:

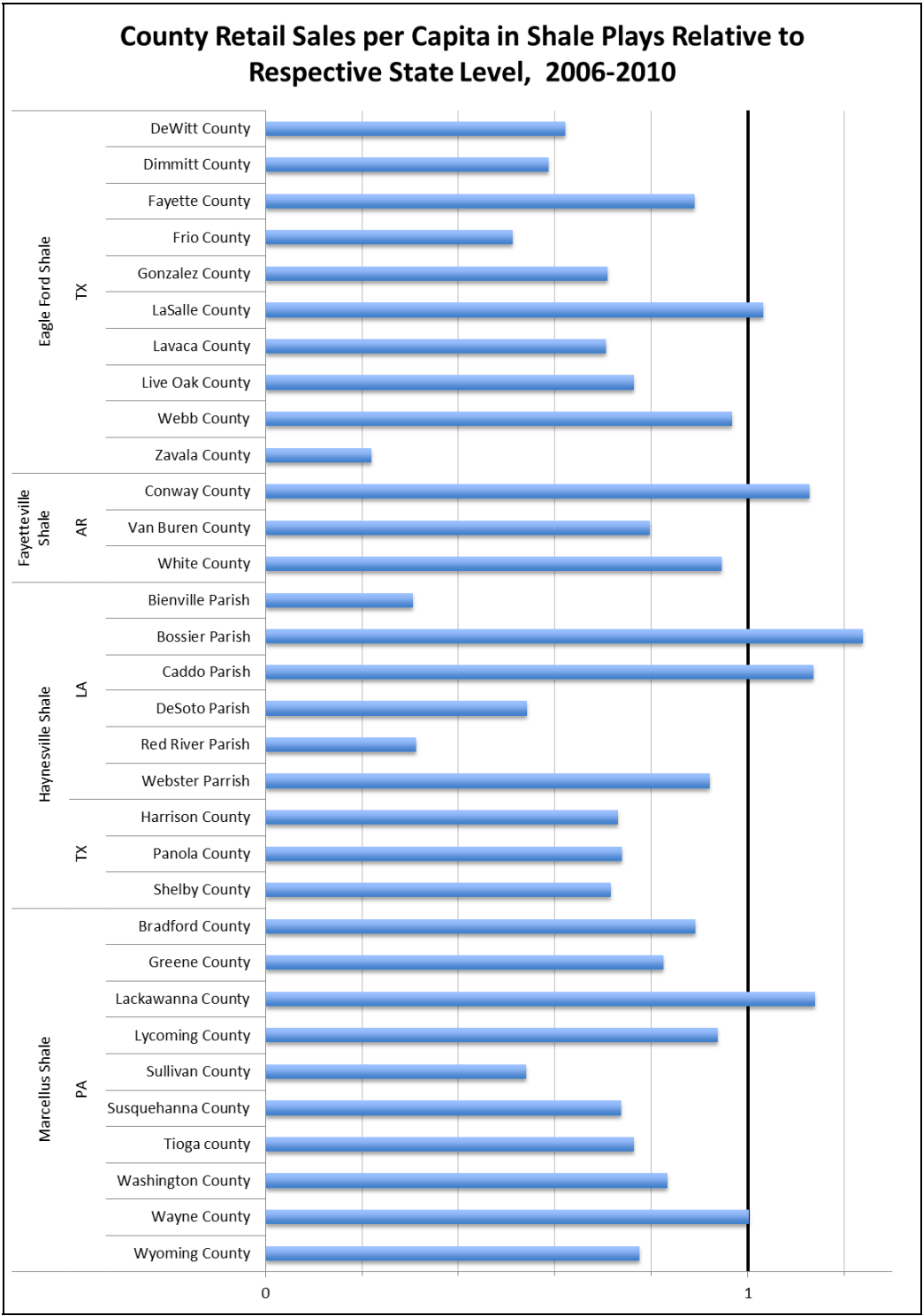
- Wall Street promoted the shale gas drilling frenzy, which resulted in prices lower than the cost of production and thereby profited [enormously] from mergers & acquisitions and other transactional fees.
- U.S. shale gas and shale oil reserves have been overestimated by a minimum of 100% and by as much as 400-500% by operators according to actual well production data filed in various states.
- Shale oil wells are following the same steep decline rates and poor recovery efficiency observed in shale gas wells.
- The price of natural gas has been driven down largely due to severe overproduction in meeting financial analysts’ targets of production growth for share appreciation coupled

and exacerbated by imprudent leverage and thus a concomitant need to produce to meet debt service.

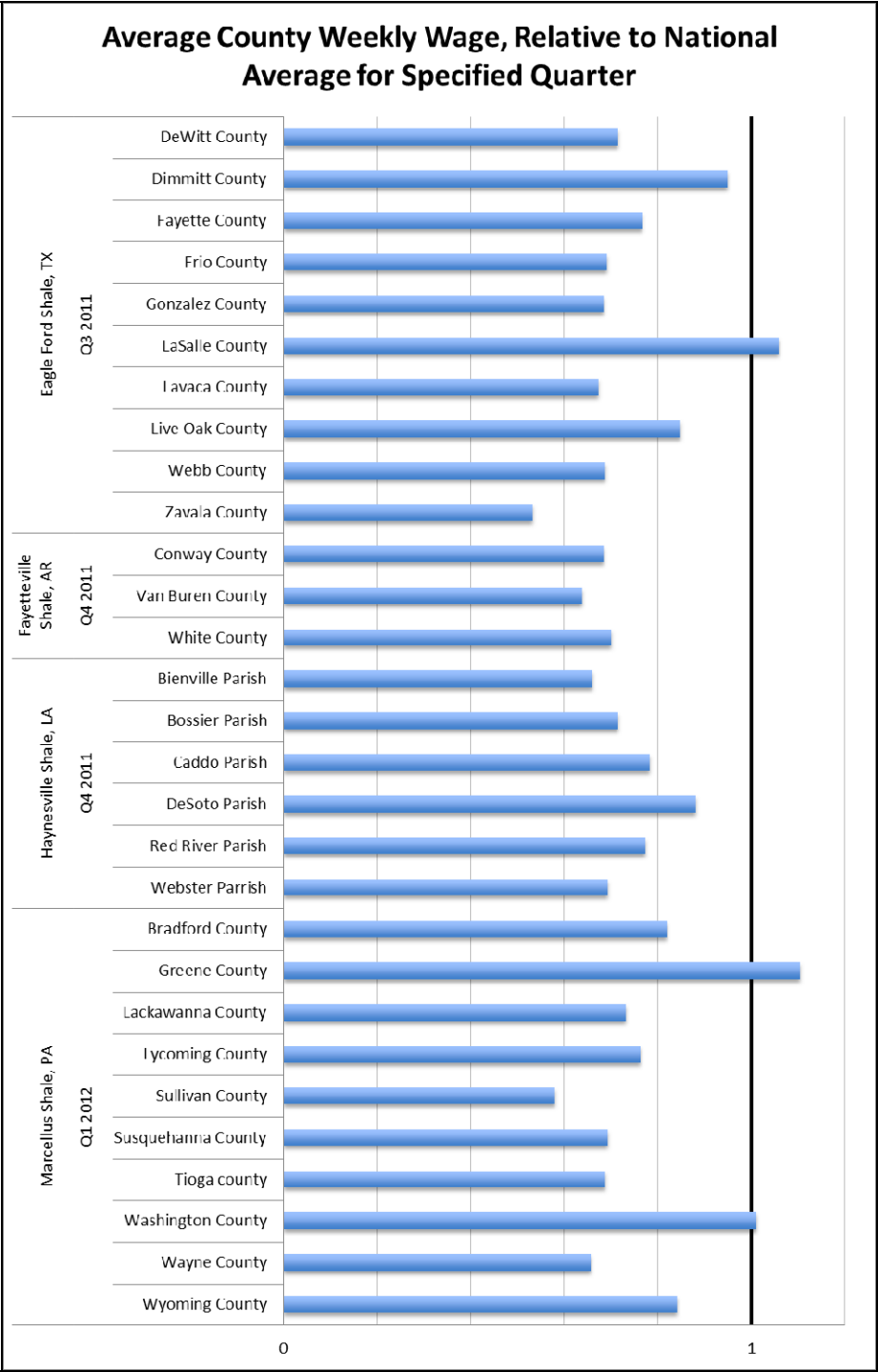
- Due to extreme levels of debt, stated proved undeveloped reserves (PUDs) may not have been in compliance with SEC rules at some shale companies because of the threat of collateral default for those operators.
- Industry is demonstrating reticence to engage in further shale investment, abandoning pipeline projects, IPOs and joint venture projects in spite of public rhetoric proclaiming shales to be a panacea for U.S. energy policy.
- Exportation is being pursued for the arbitrage between the domestic and international prices in an effort to shore up ailing balance sheets invested in shale assets

It is imperative that shale be examined thoroughly and independently to assess the true value of shale assets, particularly since policy on both the state and national level is being implemented based on production projections that are overtly optimistic (and thereby unrealistic) and wells that are significantly underperforming original projections.

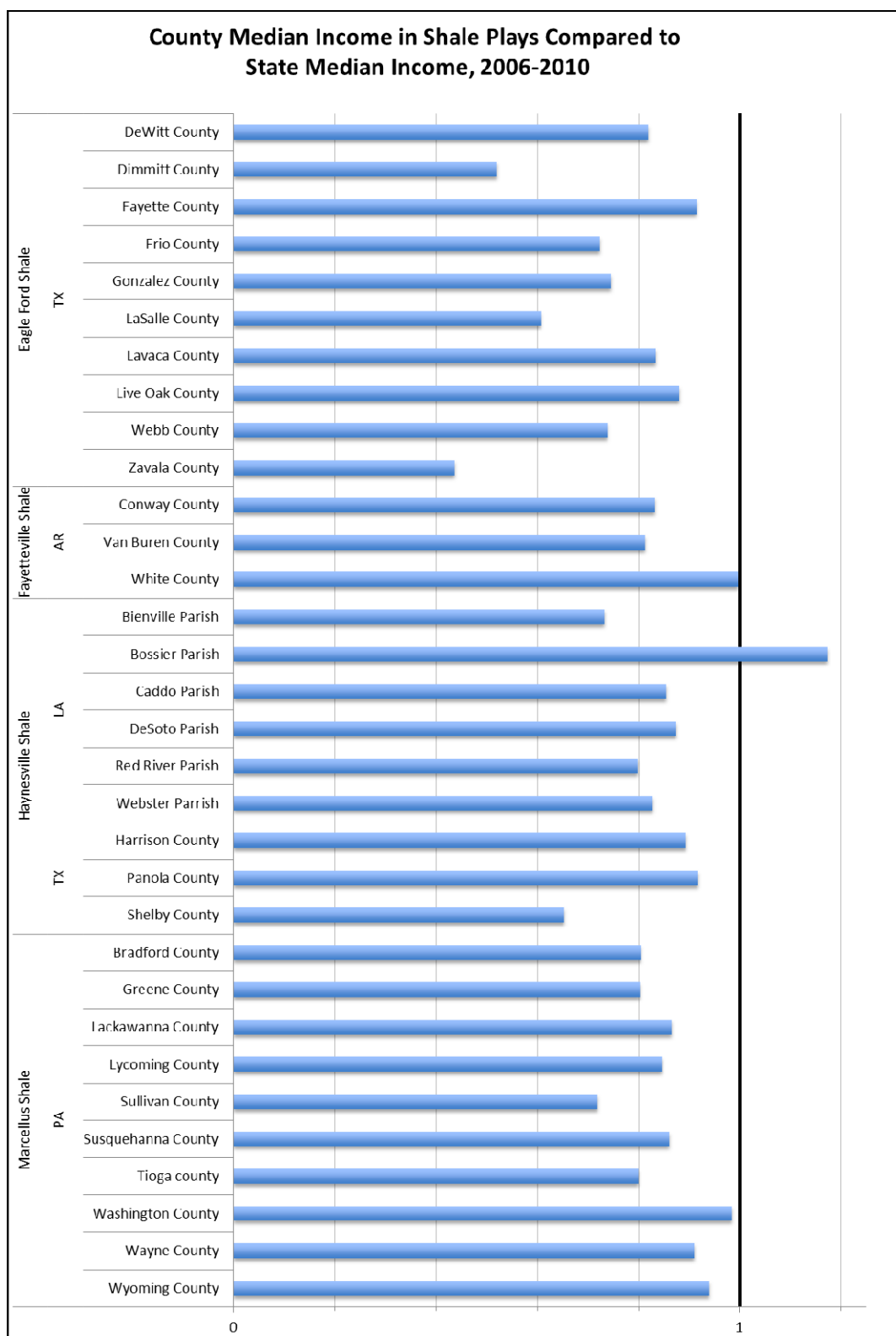
Appendix



Data: U.S. Bureau of Labor Statistics, 2012.



Data: U.S. Bureau of Labor Statistics, 2012.



Note: Median household income (MHI), normalized by state.
 Data: U.S. Bureau of Labor Statistics, 2012.

About the Author

Deborah Rogers began her financial career in London working in investment banking. Upon her return to the U.S., she worked as a financial consultant for several major Wall Street firms, including Merrill Lynch and Smith Barney. Ms. Rogers was appointed as a primary member to the U.S. Extractive Industries Transparency Initiative (USEITI), an advisory committee within the Department of Interior, in 2013 for a three year term. She also served on the Advisory Council for the Federal Reserve Bank of Dallas from 2008-2011. She was appointed in 2011 by the Texas Commission on Environmental Quality (TCEQ) to a task force reviewing placement of air monitors in the Barnett Shale region in light of air quality concerns brought about by the natural gas operations in North Texas. She is a Member of the Board of Earthworks/OGAP (Oil and Gas Accountability Project). She is also the founder of Energy Policy Forum, a consultancy and educational forum dedicated to policy and financial issues regarding shale gas and renewable energy. Ms. Rogers lectures on shale gas economics throughout the U.S. and abroad and has appeared on MSNBC and NPR. She has also been featured in articles discussing the financial anomalies of shale gas in the *New York Times* (June 2011), *Rolling Stone* (March 2012) and the *Village Voice* (September 2012).

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