



Communication

The impact of water depth on safety and environmental performance in offshore oil and gas production

Lucija Muehlenbachs^{a,*}, Mark A. Cohen^{a,b}, Todd Gerarden^c

^a Resources for the Future, 1616 P Street NW, Washington, DC 20036, USA

^b Vanderbilt University, 401—21st Avenue South, Nashville, TN 37205, USA

^c Harvard Kennedy School, 79 John F. Kennedy Street, Cambridge, MA 02138, USA

HIGHLIGHTS

- ▶ Analysis of performance indicators for oil production platforms in Gulf of Mexico.
- ▶ In recent years there have been dramatic increases in the water depths at which offshore oil and gas is extracted.
- ▶ Self-reported incidents (e.g. blowouts, injuries, spills) increase with water depth.

ARTICLE INFO

Article history:

Received 19 March 2012

Accepted 26 December 2012

Available online 17 January 2013

Keywords:

Offshore oil and gas

Oil spills

Safety

ABSTRACT

This paper reports on an empirical analysis of company-reported incidents on oil and gas production platforms in the Gulf of Mexico between 1996 and 2010. During these years, there was a dramatic increase in the water depths at which offshore oil and gas is extracted. Controlling for platform characteristics such as age, quantity of oil and gas produced, and number of producing wells, we find that incidents (such as blowouts, injuries, and oil spills) are positively correlated with deeper water. Controlling for these and other characteristics, for an average platform, each 100 feet of added depth increases the probability of a company-reported incident by 8.5%. While further research into the causal connections between water depth and platform risks is warranted, this study highlights the potential value of increased monitoring of deeper water platforms.

© 2012 Elsevier Ltd. All rights reserved.

1. Introduction

In the aftermath of the *Deepwater Horizon* oil spill on April 20, 2010, government, industry, and the public sought explanations for the largest offshore oil spill in the history of the petroleum industry. The United States Government quickly took steps intended to reduce the likelihood of a future oil spill of this magnitude by restructuring its regulatory institutions as well as imposing new technology requirements on industry.

To achieve the goal of increased safety through regulatory modifications, it is imperative that policymakers and regulators incorporate knowledge of the risk factors contributing to incidents in offshore oil and gas production. To inform regulatory policies, this paper provides an empirical analysis of industry activity on offshore production platforms on the Gulf of Mexico Outer Continental Shelf over the period 1996–2010. Motivated by

the *Deepwater Horizon* oil spill, this work analyzes company-reported incidents and focuses on the variation in outcomes across different water depths.

In the past, high-volume oil spills have been largely associated with crude oil transport. Accordingly, the risk analysis literature focuses on accidents associated with transport (Epple and Visscher, 1984; Stewart and Leschine, 1986; Cohen, 1986, 1987; Viladrich-Grau and Groves, 1997; Homan and Steiner, 2008). However, the literature on offshore oil exploration and production remains relatively underdeveloped. As a result, published findings from empirical analysis of offshore oil and gas activity are sometimes inconsistent and even contradictory.¹ Furthermore, the literature to date has used data on incidents that occurred prior to 2000. However, since 2000 there have been dramatic increases in the maximum water depth at which wells can be drilled offshore. For example, in 2000 the deepest water at which a well was drilled was less than 4000 feet, but in 2010 this

* Corresponding author. Tel.: +1 202 328 5010; fax: +1 202 939 3460.

E-mail addresses: muehlenbachs@rff.org (L. Muehlenbachs), mark.cohen@owen.vanderbilt.edu (M.A. Cohen), gerarden@fas.harvard.edu (T. Gerarden).

¹ For example, Shultz (1999) finds water depth decreases the likelihood of incidents but Jablonowski (2007) does not; Iledare et al. (1997) find age increases the likelihood of reported incidents, but Shultz (1999) does not.

was 8000 feet (see Fig. 2). Currently the U.S. Department of the Interior classifies “deep water” as deeper than 1000 feet and a new classification of “ultra-deep,” for deeper than 5000 feet, has been introduced.² Yet, for example, Jablonowski (2007) analyzes data through 1998 and thus considers production in water deeper than 400 feet as “deep water.” To our knowledge, no empirical analysis of incidents during oil exploration and development has been conducted at water depths beyond 4000 feet. This paper expands the existing literature on predictors of offshore oil production incidents with a focus on identifying and analyzing factors relevant to future regulatory decisions in a world of increasingly deep water oil exploration.

We find that platforms in deeper water tend to be younger, more complex, produce more, and are more likely to be active. We also find that deep water platforms have a much higher probability of an incident (such as a spill, accident, or injury) reported. We also show that the depth of oil and gas production has made tremendous leaps over the years. Using recent observations of incidents, we find that self-reported incidents increase with water depth contrary to Jablonowski (2007) and Shultz (1999).

Our estimation strategy does not demonstrate that there is a causal link between water depth and incident or violations but we do show that there are statistically significant relationships between the variables. In particular, we find that reported incidents are positively related to water depth. In addition, we find that production volumes, age, complexity, distance to shore, prior violations as well as the number of platforms managed by the operator are all related to self-reported incidents, suggesting that enforcement agencies might consider these factors in designing targeted inspection programs.

2. Background information on offshore platforms and production

This section provides background information on offshore platforms and production in the Gulf of Mexico. Publicly available data were obtained from the Bureau of Ocean Energy Management, Regulation and Enforcement (“BOEMRE”) (*Offshore Energy and Minerals Management, Gulf of Mexico OCS Region, Field Operations*, BOEMRE, 2009)³ and include water depth, age, and measures of size and complexity of platform operations in addition to the volume of production by lease operator.

2.1. Platform characteristics

As of 2010, there were 3020 unique platform “complexes” remaining in the Gulf of Mexico.⁴ A platform complex may include more than one structure, and is kept in the government data set until the entire complex is abandoned or removed. The data set contains information such as the distance to shore, water depth, lease number, location (area and block), whether personnel are on board 24 h per day, whether a platform has a heliport, and the number of beds in the living quarters. There is also an indicator of whether the platform is considered a “major complex” (defined as a platform that has at least one structure with at

least six well completions or two pieces of production equipment). In the analysis here, following BOEMRE’s terminology, platforms in water depths less than 1000 feet are considered to be in shallow water; those between 1000 and 4999 feet are considered deepwater; and 5000 feet or more, ultra-deep water. Table 2 shows that platform characteristics vary by water depth: unlike platforms in shallow waters, all platforms producing from waters between 1000 and 5000 feet are major complexes and are manned 24 h a day. Platforms currently in deeper water are also younger: platforms are on average 3.2 years old in waters deeper than 5000 feet, 10.03 years old in waters between 1000 and 5000 feet, and 22.69 years old in water less than 1000 feet (Table 1).

2.2. Annual production

Annual platform-level production and the number of wells producing in each year were calculated from monthly well-level production data for all wells in the Gulf of Mexico from 1996 to 2010.⁵ These data include monthly gas volume, monthly oil volume, and days on production. Using information on the date that each well was drilled, we calculated the total number of wells at a platform, the average length of time to drill the wells at a platform, the average depth of the wells, and the number of wells drilled in the year of the observation. In 2009, the average platform produced 387 million barrels of oil—ranging from zero to 68,302 million barrels. The average shallow water platform produced 86 million barrels, while the average deep water platform produced 7682 million barrels and the average ultra-deep water platform produced over 20,000 million barrels in 2009 (Table 1).

2.3. Lease owners and designated lease operators

A single lease can have many owners with different percentages of ownership (working interests). A lease may also be divided into different aliquots, or portions, and each aliquot may have multiple working interests. Data on the lease ownership and the designated operator of a lease were obtained for each year from 1996 to 2010.⁶ Ownership of a lease is on average divided among slightly more than two companies, and ranges from sole ownership to 27 companies. Table 2 shows that the average working interest in a lease is lower the deeper the water. At any point in time, however, there is only one designated operator of the aliquot. The average working interest of the lease operator ranges from 0% to 100% and, again, is lower at greater depth (Table 2). According to these data, there are 25,461 leases assigned in the Gulf of Mexico; however, only 2757 of these leases are associated with platforms (see *N* in Table 2).

2.4. Platform operators

A platform operator is typically the responsible party in the event of an oil spill. However, in some instances a platform ties in production from a subsea lease that is miles away and could be leased to a different operator. Under U.S. government regulations, all three parties (the surface platform operator, the subsea lessee, and the pipeline right-of-way holder) are required to show oil spill financial responsibility. The platform operator, as defined by BOEMRE, is either the lease holder or the party designated (and

² Throughout this paper we use the term “deeper” as a comparative term that simply means “increase in water depth” while the terms shallow, deep, and ultra-deep are defined as less than 1000 feet, 1000–5000 feet, and greater than 5000 feet, respectively.

³ BOEMRE was formerly known as the Minerals Management Service (MMS). On October 1, 2011, BOEMRE was reorganized and its enforcement arm became the Bureau of Safety and Environmental Enforcement (BSEE).

⁴ Platform Masters database and Platform Structures database, <http://www.data.boem.gov/homepg/data_center/platform/platform.asp>.

⁵ Monthly Production Data was obtained from: <http://www.data.boem.gov/homepg/pubinfo/freeasci/product/freeprod_ogora.asp>. In addition, borehole data was obtained to match production data with platform characteristics: <http://www.data.boem.gov/homepg/data_center/well/well.asp>.

⁶ Lease Ownership & Operator Data, <http://www.data.boem.gov/homepg/data_center/leasing/leasing.asp>.

Download English Version:

<https://daneshyari.com/en/article/7405670>

Download Persian Version:

<https://daneshyari.com/article/7405670>

[Daneshyari.com](https://daneshyari.com)