Journal of Empirical Finance 38 (2016) 355–361

Contents lists available at ScienceDirect

Journal of Empirical Finance

journal homepage: www.elsevier.com/locate/jempfin

Commodity price volatility under regulatory changes and disaster☆

Akbar Marvasti [a,b,]*, Antonio Lamberte [c]

[a] U.S. Department of Commerce, Southeast Fisheries Science Center, NOAA,75 Virginia Beach Dr., Miami, FL 33149, United States
[b] Department of Economics, University of Miami, United States
[c] U.S. Department of Commerce, Southeast Regional Office, NOAA 263 13th Avenue South, St. Petersburg, FL 33701, United States

ARTICLE INFO

Article history:
Received 19 December 2015
Received in revised form 7 July 2016
Accepted 9 July 2016
Available online 21 July 2016

JEL classification:
C22
C52
Q22

Keywords:
Price volatility
GARCH
Time series
Regulatory change
Disaster

ABSTRACT

We find that the EGARCH model best describes the dynamics of U.S. Gulf of Mexico red snapper daily dockside prices and find their reaction to shocks to be asymmetric, though news has an impact on volatility level in a direction contrary to that of financial asset prices. We also find that volume contains useful information for predicting volatility. However, unlike financial asset prices, though consistent with fish commodities prices, red snapper price volatility diminishes when the volume is high. Also, the effect of expected changes on transaction volume is more dominant than that of unexpected changes. Explicitly accounting for oil spill closures and the Individual Fishing Quotas (IFQ) program in other species as variance shift parameters significantly reduces volatility and improves the market efficiency response to shocks.

1. Introduction

The fishing industry provides some important commodities and this paper studies the price and volume of red snapper and the effects of environmental factors, quotas and other government regulations on their price and supply. In particular, we examine price of red snapper, which is an important fish commodity commonly found in the Gulf of Mexico (GOM). The price and trading volume of red snapper reflect production uncertainty and patterns of volatility that have similarities with those in well-organized financial markets and are interestingly enough related but different to the usual assets considered in finance. However, previous work by Chambers and Bailey (1996) and Deaton and Laroque (1992) have presented theories of commodity prices that imply a positive correlation between price and volatility that is similar to other financial returns.

Studies examining fish commodity prices and market volatility are very limited. However, Bose (2004) finds persistent volatility in the prices of several fish species in Australia and a negative correlation between the variance of prices and trade volumes. While Oglend and Silkveland (2008)document evidence of increased volatility when prices for Norwegian salmon are high. The

☆ The authors are grateful for helpful guidance from Richard Baillie, one of the Journal editors. We are also thankful to Jessica Stephen and Andy Strelchek of NOAA for the data. The opinions expressed herein are those of authors and do not necessarily reflect the views of NOAA.
* Corresponding author at: U.S. Department of Commerce, Southeast Fisheries Science Center, NOAA,75 Virginia Beach Dr., Miami, FL 33149, United States.
E-mail address: Akbar.Marvasti@noaa.gov (A. Marvasti).

http://dx.doi.org/10.1016/j.jempfin.2016.07.008
0927-5398/© 2016 Published by Elsevier B.V.

authors also use trade volume as an exogenous variable in the variance equation and find a negative correlation between trade volume and price volatility, which they attribute to the availability of inventory.

In this paper, we examine the pricing and volatility of red snapper and how they are affected by some relevant exogenous variables. For this purpose, we apply the standard GARCH model and its extensions to the log of the daily price of red snapper. Our models are similar to those employed by Baillie and Myers (1991) for a variety of commodities; but we also include volume of trading and dummy variables to investigate the impact of various exogenous shocks. We also examine nonlinearity in the dynamic of red snapper prices and investigate the asymmetry in the effects of exogenous shocks to the red snapper fishing industry. In particular we assess the effects of oil spill shocks to the red snapper commodity. The rest of this paper is structured as follows: Section 2 provides institutional background and briefly describes the red snapper individual fishing quota (IFQ-RS) program. Section 3 discusses the stylized facts of price and other variables, as well as their dynamic properties. Section 4 presents various econometric models to which we apply variations of the GARCH model and discusses the empirical results. Section 5 summarizes the key findings and concludes.

2. Red snapper IFQ system and other regulatory controls

As one of the most important fishery species in the GOM, red snapper stocks have been subjected to quota management since 1990 with the establishment of a total allowable catch (TAC), allocating 51% of the quota to the commercial sector and the remaining 49% to the recreational sector. The commercial red snapper quota was reduced in 1991 over concerns of overfishing. This quota reduction brought about some fishery closures and also market gluts as fishermen attempted to harvest as much as they could before the quota was reached and the fishery closed; see Waters (2001). Subsequent management measures, including an endorsement system in 1993 that was later converted to a two-tier license limitation system in 1998, a 10-day open season each month, and a quota increase in 1996, alleviated the derby fishing problem. Nonetheless, dockside prices remained low until January 1, 2007, when the IFQ-RS program was implemented, replacing the two-tier license limitation program. This program effectively expanded the commercial harvest season length from approximately 85 days a year to year-round. Since then, prices appear to have stabilized at higher levels, consistent with the general expectation from the IFQ-RS program, and the derby fishing problem has been essentially eliminated.[1]

Independent of the IFQ program, the commercial TAC has continued to change based on the status of the stock, fluctuating between 2.297 million pounds (gutted weight) in 2007 to 3.713 million pounds in 2012 (Fig. 1). For example, the TAC was reduced by 23% to address continuing overfishing in 2008 and was maintained at that level until the end of 2009. However, the typical short-term market gluts associated with the fishing derby did not recur. Although red snapper prices rose during this period in reaction to the reduced quota, the price reaction was not as severe as in the early 1990s.

The industry has recently gone through two other notable regulatory changes. In January 2010, the IFQ-RS program was complemented by an IFQ program for the grouper-tilefish species (IFQ-GT), many of which are harvested with red snapper. The IFQ-GT program appears to have contributed to a geographic expansion of red snapper landings by allowing the trading of share allocations between these two programs and may possibly have affected price volatility for red snapper. This geographic expansion has been aided by the rebuilding of red snapper stocks in West Florida, as well as a generally increasing population. The IFQ-GT is thus believed to have led to an increase in both the diversity of the catch composition in the GOM and the number of vessels harvesting red snapper (NOAA, 2013).

Another notable event for the industry was the April 20, 2010 *Deepwater Horizon* oil spill, which was one of the largest in U.S. history. The extent of the potential damage to the fishery was a serious environmental disaster causing the government to close various areas of the GOM to fishing between May 2 and December 30, 2010. This paper estimates the average percentage of the GOM area that was closed for each day of that period due to the *Deepwater Horizon* oil spill (Fig. 2). The peak closure was reached on June 3, 2010, when approximately 36% of the GOM was closed to fishing. Evidence in this paper indicates that the volatility of red snapper prices is directly affected by the oil spill over the regular market volatility.

3. Data and properties of the time series

Our analysis is based on daily red snapper prices during the period of January 3, 2007 through September 30, 2015, which are obtained from the National Oceanographic and Atmospheric Administration (NOAA).[2] Since 2007, the commercial red snapper fishing season has been open throughout the year; although the actual landings under the IFQ-RS program started on January 3, 2007. The IFQ-RS monitoring system electronically records all daily commercial red snapper landings and the corresponding (ex-vessel) price per pound. Under the red snapper IFQ program, commercial vessels may land at any time; but fish may not be offloaded between 6 P.M. and 6 A.M. A landing transaction is then completed by the IFQ dealer recording the date, location of transaction, weight and actual ex-vessel value of fish landed. The number of dealers purchasing red snapper throughout the

[1] Initially, the IFQ shares were issued based on the number of red snapper landings reported under each participant's license during a specific time period. IFQ shares for Class 1 license holders were based on landings in the best ten consecutive years in 1990–2004. For historical captain's license holders, the IFQ shares were based on seven years of landings in 1998–2004. For Class 2 license holders, the IFQ shares were based on landings in the best five years in 1998–2004. A total of 546 entities, natural or juridical persons, qualified for the initial IFQ shares, in which 0.0001% was the lowest share issued and 6.0203% the highest. The number of shareholders has dropped since the beginning of the program, from 554 to 407 in 2012.

[2] Daily prices have only been available since the institution of the IFQ-RS program in 2007.