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Energy and agricultural commodities revealed through hedging characteristics: Evidence from developing and mature markets☆

Simon Spencer*, Don Bredin, Thomas Conlon

University College Dublin, Ireland

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ABSTRACT

What can we learn about a physical commodity by studying its hedging characteristics? We use a hedging study to shed light on important properties of ethanol (a developing market) and corn (a mature market). Our three primary contributions are empirical, with implications for all storable commodities. We identify important differences between regularly cited data sets for spot ethanol prices and clearly explain these differences in terms of the data collection methodology. The data selection implications for hedge effectiveness are found to be substantial. Having provided clarity on the data, we find consistent evidence to support the *simple is better* hypothesis in relation to futures hedging models. Finally we caution against complacency, as our methodology reveals how extreme events can lead to biases which reduce the hedge effectiveness at the very times when effective hedges are most needed.

1. Introduction

The considerable increase in food price volatility between 2008 and 2012 sparked a flurry of studies examining the potential causes and the likely implications.[1] Griffin (2013) has argued that biofuels policy is largely to blame and should be reconsidered. Other recent studies have examined whether the price volatility is a result of technological or weather related supply shocks, or demand factors (including from the growth in biofuel demand), and the role of financialisation of commodities in general and agricultural commodities in particular (see Abbott, 2013; Baffes, 2013; Carter et al., 2015; Prokopczuk and Symeonidis, 2015; Serra and Zilberman, 2013; Serra, 2013; Tyner, 2013; Wright, 2011). Underpinning all these studies is a rarely questioned confidence in the validity of the data sets used. Rather than examine the causes of the price uncertainty, which is still a work in progress, our study focuses on issues faced by hedgers who are trying to mitigate this uncertainty. Data issues of concern to both researchers and hedgers are also revealed. Ethanol refiners are exposed to short-term price-risk separately on their corn and ethanol inventories and forward commitments. Corn is a mature market, while ethanol is a recently new and developing market. We identify differences in the issues faced by hedgers in these two markets and generalise our conclusions to other developing and mature markets. Understanding the hedging characteristics of corn and ethanol is of importance not only to corn farmers and ethanol users (mainly gasoline blenders),

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* Correspondence to: University College Dublin, Smurfit School, Carysfort Avenue, Blackrock, Co Dublin, Ireland.
E-mail addresses: simon.spencer@ucdconnect.ie (S. Spencer), don.bredin@ucd.ie (D. Bredin), conlon.thomas@ucd.ie (T. Conlon).

[1] For example the NBER organised a conference held August 15–16, 2012 on food price volatility, with research published in Chavas et al. (2014).

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but to all players involved in the refining industry. Given that the industry is heavily influenced by policy (Schnepf and Yacobucci, 2010), this understanding is also of critical importance to national and international policy formation.

This paper addresses issues affecting mature and developing markets by studying the hedging characteristics of the two most important commodities at the food-fuel intersection. Rather than examine the linkages between these commodities we rely on the evidence that the commodities are distinct[2] and draw from this that the two commodities must be separately hedged in the short term. The study examines the period between 2008 and 2014, including the summers of 2008 and 2013 when markets were particularly turbulent for different reasons.[3] Important differences between regularly cited data sets for spot ethanol prices are identified; we explain these differences in terms of data collection methodology and demonstrate the substantial effect of these differences on empirical results. Optimal futures hedge ratios and hedge effectiveness for the spot/futures pairs of corn and ethanol are investigated using a variety of models, hedge horizons and out-of-sample periods. All hedge strategies are tested for effectiveness using both a variance reduction metric and a value-at-risk reduction metric. Anomolous hedge performance in the latter part of our sample period is identified and evaluated, and this effect is explained in terms of weather-related inventory shocks and (to a lesser extent) biases in estimating optimal futures hedge ratios.

The paper represents a number of contributions. The recent evolution of the ethanol market has given rise to many sources of spot data. The paper is the first known study to highlight the considerable variation in ethanol spot price data and is a useful reference for those studies planning to adopt ethanol spot market data. The data variation appears minimal to the naked eye, but is shown to have considerable implications on hedge effectiveness results. Following analysis of the data, we recommend a suitable measure of ethanol spot prices. The second contribution is to compare the use of sophisticated system-based modelling techniques with univariate regression when estimating futures hedge ratios for corn and ethanol. By applying the Vector Auto-regression (VAR) model and the Vector Error Correction (VECM) model dynamically to both the corn and ethanol data sets, we are able to compare the results directly with naïve and simple regression generated hedges on a rolling window basis. Finally, by presenting the rolling-window analysis graphically, we are the first to identify and explain (in terms of weather-related shocks and estimation biases) a dramatic fall in hedge performance of both commodities around the 2013 harvest.

Our results indicate that spot exposures to both corn and ethanol are readily hedgeable with the matching futures. However, the hedgeability of ethanol is very sensitive to the choice of spot data, and this sensitivity decreases with increasing hedge horizon. As a result we detail what data is available, how it is constructed and the implications for hedging. It is found that futures hedge ratios generated by simple linear regression are just as effective as futures hedge ratios generated by more complex (and theoretically motivated) models, and more effective than naïve hedges (with a futures hedge ratio of 1.00). Our finding of the superiority of simple models is consistent with recent studies including Alexander and Barbosa, 2005; Alexander et al., 2013, and Carbonez et al., 2011). The turbulence of 2013 is seen to have had a dramatic impact on the hedging characteristics of both corn and ethanol. We demonstrate that a brief period of extreme backwardation in 2013 was responsible for diminishing the out-of-sample hedge effectiveness of strategies using futures hedge ratios estimated from earlier in-sample data. The same period was responsible for biasing the in-sample estimation of futures hedge ratios for strategies tested out-of-sample in subsequent periods. This result is consistent for both corn and ethanol, and has implications for all empirical studies examining these commodities over this period.

As highlighted earlier in the introduction, a number of studies have been motivated by recent food price volatility. Our analysis of the ethanol data issues will be of particular importance to researchers, as we highlight the potential pitfalls associated with adopting spot ethanol price data. Our comparison of simple and system-based hedging models will be of particular interest to traders, hedgers and ethanol processors, indicating as it does that effective hedging need not involve the most complicated (or theoretically motivated) mathematical models. The recent decline in hedge performance, and its explanation, is of particular importance not only to traders and hedgers but also to policy makers. Policy regimes have implications for corn inventory holdings (see for example Carter et al., 2015). We show how reduced inventory holding can impact on the ability of the refining industry, and others exposed to corn or ethanol, to manage their risks. Policy makers need to be aware of the effect of ethanol production on the corn market, and should take note of the inventory-related shock of 2013. The remainder of this paper is organised as follows: Section 2 reviews a selection of literature relevant to our key contributions. Section 3 covers the methods and models employed. Section 4 analyses the data and presents and discusses empirical results. Section 5 concludes.

2. Literature review

The Renewable Fuel Standard (RFS) introduced in the US via the Energy Policy Act (2005) has created a statutory demand for ethanol. A previous subsidy regime is shown by Duke and Kammen (1999) to have had negligible net benefit. Schnepf and Yacobucci (2010) provide a detailed account of the RFS and its implications. Using a structural VAR, Carter et al. (2015) find that corn prices were 30% higher between 2006 and 2010 as a result of the RFS, while Griffin (2013) describes the RFS as a folly which should be rescinded. The linkage between ethanol and corn is, however, more complex. The role of policy regimes in the interplay between ethanol processing margins, input costs (food and energy products) and output values (ethanol and distillers' dried grains (DDGs)) is examined by Abbott (2013). Abbott (2013) finds that the processing margin (crush spread) absorbs fluctuations in input and output values under some policy regimes, while under others the margin is less flexible and simply transmits price volatility between food

[2] See for example Vacha et al. (2013) and Abbott (2013).

[3] The start of the sample is determined by the introduction of version 2 of the renewable fuel standard (RFS), the Energy Independence (2007). The RFS indicates a minimum volume of biofuels that should be used in the national transportation fuel supply, see Schnepf and Yacobucci (2010).