



Testing for common features in North American energy markets

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Abstract

Using recent advances in the field of applied econometrics, we explore the strength of shared trends and shared cycles between North American natural gas and crude oil markets. In doing so, we use daily data from January 1991 to April 2001 on spot U.S. Henry Hub natural gas and WTI crude oil prices. The results show that there has been ‘decoupling’ of the prices of these two sources of energy as a result of oil and gas deregulation in the United States. We also investigate the interconnectedness of North American natural gas markets and find that North American natural gas prices are largely defined by the U.S. Henry Hub price trends.

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1. Introduction

In recent years, the North American energy industry has undergone major structural changes that have significantly affected the environment in which producers, transmission companies, utilities and industrial customers operate and make decisions. For example, major policy changes are the U.S. Natural Gas Policy Act of 1978, Natural Gas Decontrol Act of 1989, and FERC Orders 486 and 636. In Canada, deregulation in the mid-1980s has also broken the explicit link between the delivered prices of natural gas and crude oil (that was in place prior to 1985), and has fundamentally changed the environment in which the Canadian oil and gas industry operates. Moreover, the Free Trade Agreement (FTA) signed in 1988 by the United States and Canada, and its successor, the North American Free Trade Agreement (NAFTA) signed in 1993 by the United States, Canada, and Mexico,

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have underpinned the process of deregulation and attempted to increase the efficiency of the North American energy industry.

The main objective of this paper is to assess the strength of shared dynamics between North American energy markets in the period after deregulation. In doing so, we provide a first look at shared trends and shared cycles between the West Texas Intermediate (WTI) crude oil and Henry Hub natural gas markets, drawing on recent developments on cointegration theory. We are interested in whether the link between these two markets weakened in the deregulated period, as competition and market forces played a greater role in determining prices. Moreover, we explore the interconnectedness of North American energy markets by investigating the strength of shared features between the U.S. Henry Hub and AECO Alberta natural gas prices. We are interested in whether Canadian export prices to the United States are simply linear transformations of the U.S. Henry Hub price.

Shared stochastic trends between different energy markets have been investigated in a number of recent studies—see, for example, Serletis (1994), Serletis and Herbert (1999), and Plourde and Watkins (2000). These studies, however, typically require the researcher to take a stance on a common order of integration for the individual price series. As a result, most of the literature ignores a recent important contribution to this topic by Ng and Perron (1997) who show that we should be wary of estimation and inference in nearly unbalanced nearly cointegrated systems. In this paper, we use the recent Pesaran et al. (2001) bounds testing approach to the investigation of long-run relationships. This is a particularly relevant methodology as it does not require that we take a stand on the time series properties of the data. Therefore, we are able to test for the existence of a long-run relationship without having to assume that the series are integrated of order zero (or $I(0)$) in the terminology of Engle and Granger, 1987) or $I(1)$.

Our principal concern, however, is with the dynamics of North American natural gas and crude oil markets. The distinctive feature of our contribution is that we test for shared cycles (and when appropriate for codependent cycles) using the recently developed testing procedures by Engle and Kozicki (1993) and Vahid and Engle (1993). Our main objective is to determine the strength of the dynamic relationship between natural gas and crude oil markets, judged according to whether they respond in a similar manner to cycle generating innovations. The Engle and Kozicki (1993) and Vahid and Engle (1993) approach provides a stronger and more informative test of cyclical comovements than the previously used (by Serletis and Kemp, 1998) Hodrick–Prescott (HP) contemporaneous and cross-correlation analysis.

The paper is organized along the following lines. Section 2 reviews some basic theoretical results and relates them to the sharing of trends and cycles. Section 3 discusses the data and tests for common trends, cycles, and (where appropriate) codependent cycles in U.S. natural gas and crude oil markets. Section 4 investigates the interconnectedness of North American energy markets, and the last section briefly summarizes and concludes.

2. Common trends and common cycles

Consider two variables y_t and x_t for which there may be possible long-run and/or short-run relationships. Following Stock and Watson (1988), we can decompose each variable

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