Crude oil shocks and stock markets: A panel threshold cointegration approach

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This paper proposes a panel threshold cointegration approach to investigate the relationship between crude oil shocks and stock markets for the OECD and non-OECD panel from January 1995 to December 2009. Nonlinear cointegration is confirmed for the oil–stock nexus in the panel. Because threshold cointegration is found, the threshold vector error correction models can be run to investigate the presence of asymmetric dynamic adjustment. The Granger causality tests demonstrate the existence of bidirectional long-run Granger causality between crude oil shocks and stock markets for these OECD and non-OECD countries. However, the short-run Granger causality between them is bidirectional under positive changes in the deviation and unidirectional under negative ones. Moreover, the speed of adjustment toward equilibrium is faster under negative changes in the deviation than that under positive ones in these OECD and non-OECD countries.

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1. Introduction

Hamilton (1983) indicates that crude oil price shocks were a factor in the US recession after World War II. Since then, the identification of connections between crude oil prices and the macroeconomy has been a major concern in theory and practice. A large amount of literature tries to shed light on the effects of crude oil price shocks on economic activities, such as aggregate demand, inflation, employment and real economic growth (Bachmeier, 2008; Cunado and Perez de Garcia, 2005; Hamilton, 2003). The aforementioned studies have yielded mixed results. However, in the empirical literature, only a relatively small number of works have looked into the effects of crude oil prices on the stock markets. Studies by Jones and Kaul (1996) and Sadorsky (1999) report a significant negative impact of crude oil shocks on stock returns, a result that is further supported by Papapetrou (2001). According to the latter paper, an oil price shock has a negative effect on stock returns for the first 4 months. In this line of research, however, Chen et al. (1986) and Huang et al. (1996) do not reach the same conclusions. All of these results show that there is no consensus on the relationship between crude oil shocks and stock markets; therefore, more research may be necessary on this subject.

Much of the literature thus far has focused on the connection between crude oil price changes and stock prices. Specifically, almost all publications stress the influence of crude oil shocks on stock markets combined with other economic determinants. The new literature can be categorized into four types: first, the relationship between crude oil shocks and stock markets seems to be significantly evident and negative. This observation tends to be in line with Jones and Kaul (1996) and Sadorsky (1999) (Ciner, 2001; Kilian and Park, 2007, among others). In particular, Hammoudeh and Li (2005) suggest that on a daily basis, there is a negative bidirectional dynamic relationship between crude oil price growth and the world capital market. Ghouri (2006) also reveals that there is a very strong negative relation between West Texas Intermediate Cushing (WTI) and US monthly stock positions. Miller and Ratti (2009) analyze the long-run relationship between the world price of crude oil and international stock markets, utilizing a cointegration vector error correction model (VECM) with additional regressors. Aloui and Jammazi (2009) and Chen (2010), who use Markov-switching models, obtain similar results. Moreover, Basher and Sadorsky (2006) provide strong evidence of the impact of oil price risk on emerging stock market returns. Hammoudeh and Choi (2007) and Nannda and Hammoudeh (2007) further document that oil plays an important role in emerging stock markets. They find that stock prices increase as the crude oil price decreases and decrease as the crude oil price increases. Second, the relationship between crude oil shocks and stock markets seems to be significantly evident and positive (Arouri and Rault, 2011; Chen et al., 2014...
time series for single countries. More recently, there have been some studies that deal with the interactions between energy and economic activities based on panel data. To the best of our knowledge, no work has analyzed the oil–stock nexus by applying a panel approach at the international level. This paper aims to provide the first empirical study that tests a panel of 14 OECD and non-OECD countries in terms of long-run equilibrium and the Granger-causal relationship between crude oil shocks and stock markets. Furthermore, using threshold cointegration in panel framework, we are able to better estimate the asymmetric adjustment.

This study makes several unique contributions. First, the estimates adopting a large group of panel data are more robust than those based on time series models because the former account for the long run relationship and Granger-causal relationship between crude oil shocks and stock markets with more reliable identification. Second, we consider a multivariate framework with additional regressors. Except for crude oil prices and stock market prices, we also incorporate interest rates and industrial production. Following Fama’s (1981) hypothesis, measures of economic activity and inflation have played a role in the analysis of stock market activity. It is thus important to consider interest rates and industrial production in the context of international economies. The effect of crude oil prices on stock markets is better captured by considering these necessary variables. Thirdly, we take into account the possibility that the long-run relationship between crude oil shocks and stock markets may involve threshold effects. Thus, the panel threshold cointegration tests are conducted to examine the possible asymmetric effects on the oil–stock nexus, which accommodate asymmetric adjustment in the long run.

The rest of this paper proceeds as follows. Section 2 introduces the econometric methodology employed in this study. Section 3 presents the data and preliminary investigation. Section 4 reports the empirical results, and the final section presents our conclusions.

2. Econometric methodology

To evaluate the potential linkages between crude oil prices and stock market prices, we employ panel cointegration techniques. Unlike the existing studies in the single nonstationary time-series literature, recently developed panel methods have produced new strands of panel cointegrating regression analysis. In a panel context, the number of observations available is greatly increased when testing the long-run relationship, and as a result, more informative data can be obtained. Thus, the panel-based tests can gain statistical power substantially and overcome the low power problem of asymmetric adjustment in the tests’ univariate counterparts.

In this paper, the test for long-run equilibrium between crude oil prices and stock markets in a panel framework is conducted based on panel cointegration tests. Before proceeding to the panel-based cointegration tests, the panel-based unit root tests are performed. Panel-based cointegration tests are then conducted to examine the long-run relationship between the variables in question. In addition, it is possible that there are threshold effects in a potential cointegrating relationship between crude oil prices and stock markets, which indicates asymmetric adjustment in the oil–stock nexus. Thus, panel threshold cointegration tests are used to detect the asymmetry. Given that the variables are cointegrated, a panel VECM can be adopted to check whether a linear combination of nonstationary variables exists, which then suggests that a long-run equilibrium relation holds between the variables. However, if the variables are threshold

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2 These particular covariates should be included in levels, and we choose the real economic variables but not the nominal ones.

3 Since our interest in this study is merely discovering whether there exists asymmetric cointegration relationship, the identification of the number of cointegration relationships is beyond the scope of this study.
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