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Is there a homogeneous causality pattern between oil prices and currencies of oil importers and exporters?☆

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ABSTRACT

Although the link between oil prices and dollar exchange rates has been frequently analyzed, a clear distinction between prices and nominal exchange rate dynamics and a clarification of the issue of causality has not been provided. In addition, previous studies have mostly neglected nonlinearities which for example may stem from exogenous oil price shocks. Using monthly data for various oil-exporting and oil-importing countries, this study contributes to the clarification of those issues. We discriminate between long-run and time-varying short-run dynamics, using a Markov-switching vector error correction model. In terms of causality, the results differ between the economies under observation but suggest that the most important causality runs from exchange rates to oil prices, with a depreciation of the dollar triggering an increase in oil prices. On the other hand, changes in nominal oil prices are responsible for ambiguous real exchange rate effects mostly through the price differential and partly also through a direct influence on the nominal exchange rate. Overall, the fact that the adjustment pattern frequently differs between regimes underlines the fact that the relationships are subject to changes over time, suggesting that nonlinearities are an important issue when analyzing oil prices and exchange rates.

1. Introduction

Since oil prices and exchange rates against the dollar both experienced long swings after the breakdown of Bretton Woods, the link between both quantities has attracted considerable interest from both policymakers and researchers.[2] In a nutshell, empirical research has provided evidence for two directions of causalities: A popular finding is that real exchange rates and real oil prices are cointegrated over the recent floating period. In this vein, shocks to real oil prices have been identified as a possible explanation for the non-stationarity of real exchange rates (Chaudhuri and Daniel, 1998). In terms of dollar exchange rates, other studies have provided evidence for a real appreciation of the dollar in the case of an increase in real oil prices and, in addition, for an increase in the nominal price of oil as a result of a depreciation of the dollar (Yousefi and Wirjanto, 2004).

However, although different relationships between oil prices and exchange rates have been identified, some important issues remain to be solved. Firstly, the question of causalities between oil prices and exchange rates has not been broadly examined in an unrestrictive fashion. This is due to the fact that many studies which provide evidence for one direction of causality have focused either on particular bilateral exchange rates or on effective exchange rate dynamics. A second caveat of previous studies stems from the possibility of nonlinearities in the relationship

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[2] For instance, Lammerding et al. (2013) recently provided evidence for the existence of speculative bubbles in oil price dynamics.

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between exchange rates and oil prices. Since different degrees of volatility and co-movements between oil prices and exchange rates vis-à-vis the dollar can be identified, it seems important to allow for structural changes when analyzing the corresponding long-run relationships (Breitenfellner and Crespo Cuaresma, 2008; Reboredo, 2012). Nonlinearities may also stem from major oil prices shocks triggered by exogenous factors.[3] Finally, surprisingly little attention has been paid to the dissection of nominal price and exchange rate effects when examining causalities between oil prices and exchange rates. For example, many studies, such as the recent work provided by Chen and Chen (2007) which conducts panel cointegration methods, have directly analyzed the relationship between real exchange rates and the real oil price. However, as known from the literature on purchasing power parity, such an approach applies symmetry restrictions with regard to prices and nominal exchange rates without putting the underlying dynamics under closer scrutiny (Sarno and Valente, 2006). Moreover, due to a diverging degree of importance of a commodity such as oil for oil-exporting and oil-importing countries it makes much more sense analyzing the causality pattern for each economy separately instead of applying a panel approach which produces results based on an average of all individual economies.

Adopting a multivariate Markov-switching vector error correction model (MS-VECM) framework, this paper contributes to the literature to tackle those caveats. Firstly, our approach is unrestricted in the sense that it allows an analysis of the issue of causality between oil prices and exchange rate dynamics while distinguishing between short- and long-run dynamics. Secondly, we allow for time-varying causality patterns in terms of an error correction mechanism regarding deviations from a long-run equilibrium. This is a huge improvement compared with studies which rely on a linear specification. Finally, our framework also enables us to dissect the contribution of prices and nominal exchange rate dynamics to real exchange rate movements while investigating the causality on oil prices. In addition, our analysis, which is based on an evaluation of twelve different exchange rates against the US dollar, also allows us to answer the question of whether a general pattern for oil-exporting or oil-importing countries can be observed or if the relative contribution of an oil price or exchange rate shock depends on the level of oil importance to the production sector of the national economy and the net position of the economy in the oil market. In a broader context, using a structural vector autoregression (SVAR) the study of Wang et al. (2013) recently showed that the impact on stock markets to oil price shocks highly depends on whether the country is a net importer or exporter in the world oil market.

The remainder of this paper is organized as follows. The following section provides a brief description of theoretical considerations and summarizes previous empirical findings providing evidence for two ways of causality. Section 3 describes our data and provides a description of and motivation for our empirical framework. Our results are presented and analyzed in Section 4. Section 5 concludes.

2. Theoretical considerations and review of the literature

2.1. Causalities running from oil prices to exchange rates

Various theoretical relationships between oil prices and exchange rates have been established in the literature, with causalities going in both directions. Two transmission channels of oil prices to exchange rates can be roughly distinguished: the 'terms of trade channel' and the 'wealth effect channel'. The 'terms of trade channel' focuses on real exchange rates and was originally introduced by Amano and Van Norden (1998a,b). Their basic approach may be illustrated as a simple two-economy model consisting of two sectors which produce tradable and nontradable goods, respectively:

$$p_t = \alpha p_t^T + (1-\alpha)p_t^N, \tag{1}$$

$$p_t^* = \alpha^* p_t^{T^*} + (1-\alpha^*)p_t^{N^*}, \tag{2}$$

where p_t^T and p_t^N correspond to the logarithm of prices for tradable and nontradable goods, respectively. p_t indicates the logarithmic general price level and the foreign economy is always denoted by an asterisk. The weights α and α^* give the corresponding expenditure shares on tradable goods (Chen and Chen, 2007). Oil enters both production functions as an input factor while the price of nontradable goods is determined solely by labor costs.

In the original model, the real exchange rate is expressed in internal terms as the ratio between prices of tradable and nontradable goods in a small open economy with a relative increase in the price of tradable goods corresponding to a real depreciation of the domestic currency. Assuming that the tradable output price is fixed internationally, one can see that the price for nontradable goods determines the reaction of the real exchange rate (Bénassy-Quéré et al., 2007). If the nontradable sector is more dependent on oil than the tradable sector, the price of nontradable goods increases to a greater extent and the domestic currency experiences a real appreciation once the oil price increases. Expressed the other way around, a rise in oil prices results in a real depreciation in economies with large oil dependence in the tradable sector (Chen and Chen, 2007).[4] This channel of transmission operates for oil-exporting economies, whereas movements in oil prices, by definition, dominate the terms of trade of industrialized economies (Backus and Crucini, 2000; Buetzer et al., 2012).

Turning to the more popular definition of the real exchange rate, in external terms the logarithm of the real exchange rate q_t may be expressed as follows:

$$q_t = s_t + p_t^* - p_t, \tag{3}$$

where s_t corresponds to the logarithm of the nominal exchange rate. Substituting the price levels based on Eqs. (1) and (2) in Eq. (3) gives

$$q_t = \left(s_t + p_t^{T^*} - p_t^T\right) + (1-\alpha)\left(p_t^T - p_t^N\right) - (1-\alpha^*)\left(p_t^{T^*} - p_t^{N^*}\right). \tag{4}$$

According to Eq. (4), the dynamics stemming from an increase in oil prices become more complicated. Strictly speaking, a country with a greater increase in inflation experiences a real appreciation, a mechanism which mirrors the Balassa–Samuelson effect (Buetzer et al., 2012). Under the assumption that the price of a tradable good is internationally fixed, and that $a = a^*$, the reaction of the real exchange rate is then again determined by the relative oil-dependence of the tradable and nontradable sectors (Chen and Chen, 2007).

The 'terms of trade channel' therefore works mainly through relative prices and may leave the nominal exchange rate unchanged. In Eq. (4), purchasing power parity (PPP) is assumed to hold only for the price of tradable goods, with a relative rise in the price differential of tradable goods being matched by a proportional depreciation of the nominal exchange rate. However, the literature on the validity of PPP is not only extensive but controversial (see Sarno and Taylor (2003) for an overview). Considering recent empirical results, which have delivered evidence in favor of a nonlinear PPP adjustment of nominal and real exchange rates based on exponential smooth transition regression (ESTR) models (Kilian and Taylor, 2003; Taylor et al., 2001; Wu and Hu, 2009), a reasonable view would be that the price differential between two countries is important for the long-run path of the nominal exchange

[3] The common view is that major oil price shocks are triggered by exogenous factors. However, according to Kilian (2008), this view is supported by the data for the 1980/81 and 1990/91 oil price shocks, but not necessarily for shocks occurring afterwards.

[4] See Schnabl and Baur (2002) for an analysis of the importance of export prices to the yen–dollar exchange rate.