

# *On the asymmetric responses of real exchange rates to oil price changes: evidence from Indonesia*

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## **Overview**

Do fluctuations in crude oil prices play an important role in explaining a country's real exchange movements? This is an interesting question for two reasons. First, it is the most fundamental question for macroeconomic policy. If it is established that oil price hikes have a beneficial effect on countries' real incomes and hence lead to an appreciation in their currencies, for example, not many countries would choose expansionary monetary policy solely aimed at deliberate currency depreciation as a mean to economic growth. The answer to this question is also interesting because, although the subject has long been a hotly debated area of empirical research, the answer is not yet settled. Indeed, the effect of oil price changes on real exchange rate fluctuations varies depending on countries and is necessarily an empirical issue.

Since the seminal work by Krugman (1983a and 1983b), many scholars have sought to identify the potential effect of crude oil price fluctuations on the movements of real exchange rates in various countries. Important but perhaps less widely recognized in the literature, however, is the possibility that changes in crude oil prices could have asymmetric effects on real exchange rates. More specifically, no matter what country is selected for the study of the oil price-exchange rate nexus, the implicit assumption adopted in previous works is that oil prices have symmetric effects on the real exchange rate. In other words, it implies that if a 1% increase in crude oil prices leads to an appreciation (depreciation) in the currencies of the oil-exporting countries (oil-importing countries) by, say,  $x\%$ , then a 1% decrease in crude oil prices should depreciate (appreciate) them by the same magnitude, that is,  $x\%$ . Since market participants in the foreign exchange market are likely to react differently to increases and decreases in crude oil prices, however, such assumption does not always necessarily hold true in the real world. Furthermore, the empirical attention of the literature up until recently has been mostly paid to developed countries (e.g., G7, EU and OECD countries) with few studies considering the issue in developing countries.

The main contribution of this study is to empirically examine whether the effect of crude oil price changes on real exchange rates is asymmetric in the context of a developing country, specifically Indonesia. The oil sector has traditionally contributed significantly to the economy of Indonesia through total export revenues and foreign exchange reserves. In 2017, for example, the oil sector alone accounts for nearly 20% of Indonesia's overall exports, valued at approximately US\$28 billion. Hence, it would seem worthwhile to explore the oil price-exchange rate nexus in the case of Indonesia. To the best of our knowledge, Basnet and Upadhyaya (2015), Kisswani (2016), and Sultonov (2017) are the only three papers that have analyzed the oil price impacts on exchange rates for Indonesia. These studies, however, do not directly incorporate the asymmetry hypothesis in their analyses, thereby raising questions about the validity of the findings.

## **Methods**

A nonlinear autoregressive lag (ARDL) developed by Shin et al. (2014) is used. This approach has certain econometric advantages in comparison to standard cointegration method. First, this approach is applicable irrespective of whether the underlying regressors are purely I(0), purely I(1) or mutually cointegrated; hence, there is no need for pre unit-root testing. Second, an error-correction model (ECM) can be derived from the this approach through a simple linear transformation. The ECM captures the short-run dynamics while restricting the long-run equilibrium. This method thus estimates the short- and long-run parameters of the model simultaneously. For the analysis, monthly data are collected between August 1997 through June 2017. Note that August 1997 is chosen because at that time Indonesia ended the exchange rate intervention band and moved to freely floating exchange rate regime due to the 1997 Asian financial crisis. June 2017 is the last date for which complete data are available.

It is worth mentioning that in order to test whether oil price changes have either symmetric or asymmetric effects on the real exchange rate, we first separate crude oil price hikes from crude oil price plunges using the partial sum

concepts:  $op_{it}^+ = \sum_{j=1}^t \Delta \ln op_{ij}^+ = \sum_{j=1}^t \max(\Delta \ln op_{ij}, 0)$  and  $op_{it}^- = \sum_{j=1}^t \Delta \ln op_{ij}^- = \sum_{j=1}^t \min(\Delta \ln op_{ij}, 0)$ , where  $op_{it}^+$  measures

only increase in oil prices and  $op_{it}^-$  measures only decreases in oil prices. The Wald test then can be used for asymmetric hypothesis testing.

## Results

It is found that, in the long-run, a rise (decline) in oil prices causes the real exchange rate to decrease (increase), thereby appreciating (depreciating) the Indonesian rupiah. This is consistent with the movements of real exchange rates in oil-exporting countries. Further, the effect of falling crude oil prices on the Indonesian rupiah is found to be outweighed by the impact of rising oil prices, thereby seemingly supporting long-run asymmetric effects of oil price changes. Indeed, this long-run asymmetric effect is confirmed by the Wald test. Similarly, in the short-run, the different magnitudes of the coefficients coupled with different signs in oil price increase and decreases may seem to indicate short-run asymmetric effects. Unlike the long-run results, however, the Wald test provides little evidence of the short-run asymmetric effects.

It is important to note that the decline in Indonesia's oil production coupled with expanded domestic demand have turned Indonesia into a net importer for crude oil since 2003. As a result, Indonesia has suspended its membership of the Organization of Petroleum Exporting Countries (OPEC) since 2009. Therefore, it is very useful to investigate what happens to the Indonesian rupiah if we incorporate Indonesia's shift from net oil exporter to net importer into our modeling process. To do this, we add a dummy variable in our modeling process; it takes on the value unity from January 2003 onward, when Indonesia became a net oil importer. It is, however, found that the dummy variable is statistically insignificant, so there is no evidence that this change of status has been a substantial effect on the Indonesian rupiah since 2003.

## Conclusions

In this paper, we seek to contribute to the debate over the oil price-exchange rate nexus by asking: "Are the effects of crude oil price shocks on the real exchange rate symmetric or asymmetric in Indonesia?" After implementation of the nonlinear ARDL methodology of Shin et al. (2014), we find overwhelming evidence that oil price changes have asymmetric effects on the Indonesian rupiah in the long-run; that is, the movement in the Indonesian rupiah is more responsive to oil price hikes than to oil price plunges. However, the asymmetry of oil price changes is not observed in the short-run.

An important implication from our findings is that, when examining the oil price-exchange rate nexus for Indonesia, analysts need to incorporate the (long-run) asymmetry of oil price changes; otherwise, the empirical models are likely to be misspecified, thereby providing misleading results. Another important implication is that given the long-run relationship between oil prices and the Indonesian rupiah, any government policies implemented by overlooking the movement in the world oil market could lead to undesirable outcomes such as trade imbalances and welfare losses.

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