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Advancing the design of a dynamic petro-dollar currency basket

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ABSTRACT

This study offers Organization of Petroleum Exporting Countries (OPEC) member nations a crude oil pricing currency basket based on currency liquidity, in contrast with prior emphasis on OPEC trading patterns. Motivating the search for an alternative US dollar pricing of crude oil is the significant and inverse relationship ($r=-0.82$, $p<0.01$) between the US dollar major currencies index and crude oil price over the period January 1999–March 2009. A dynamically weighted petro-dollar currency basket is proposed based on the five currency claims (US dollar, Euro, British pound, Japanese yen and Swiss franc) and their varying proportions of foreign exchange reserves held by central banks. The major currencies US dollar index is compared against the proposed petro-dollar index to reveal an average US$8.1 billion annual gain in favor of the petro-dollar currency basket, offering OPEC members a revenue stream of diversified and highly liquid currencies to transition away from complete dependence on the US dollar crude oil pricing. The proposed petro-dollar crude oil pricing schema offers OPEC a crude oil price dynamically denominated in currencies reflecting the global use and importance of crude oil. This paper concludes with implementation issues facing a move toward the dynamically weighted petro-dollar crude oil pricing schema.

1. Introduction

Hitherto estimates of proven global crude oil reserves point to an abundant supply well into 2046 (IHS, 2004; Odell, 2004) complemented with sustained crude oil demand by the US, Japan and the EU (BP, 2004) and a rise in demand from China and India (Correlje and Van der Linde, 2006). Offsetting this promising picture is the continued US dollar's depreciation, which has contributed as a major factor driving up global crude oil prices (Zhang et al., 2008), a predicament likely to continue given a depreciated US dollar may be necessary to reduce the mushrooming US current account deficit (Ogawa and Kudo, 2007; Fratzscher, 2008). The twelve emerging market nations of the Organization of Petroleum Exporting Countries[1] (OPEC) have endured significant swings in the their economies as a result of export, import and international capital flows based on crude oil pricing in US dollars. The dominance of Saudi Arabia in the world oil market (Alhajji and Huettner, 2000) and the 2003 withdrawal of US military forces from Saudi Arabia offer a decisive economic opportunity to examine alternatives to crude oil pricing in US dollars. The purpose of this paper is to advance the design of a dynamically weighted petro-dollar currency basket offering OPEC nations a highly liquid currency hedge against a depreciating US dollar.

Section 2 provides some descriptive facts about the relationship between crude oil and US dollar pricing, OPEC's contribution to global crude oil demand, the relationship between crude oil pricing currency and economic benefit, currency risk exposure and shifts in crude oil markets. Section 3 uses data covering the period Q1 1999–Q1 2009 to discover long-term nature of the relationship between the US dollar index and crude oil prices, to design a dynamically currency weighted petro-dollar currency basket based on fluctuating central bank official foreign exchange reserve currencies and their weights, and reveal realizable gains from the use of the proposed petro-dollar versus the US dollar. Section 4 presents the results and a discussion of the analysis. Finally, some concluding remarks are provided in Section 5.

2. Descriptive Facts

2.1. Relationship of the US dollar and crude oil pricing

The invoicing currency for trade in crude oil is the US dollar, with studies reporting an empirical association[2] between US

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[1] Algeria, Angola, Ecuador, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, United Arab Emirates, and Venezuela (OPEC, 2009a, 2009b).

[2] Though beyond the scope of this study, the direction of causality between crude oil price and the US dollar have returned inconsistent results, from the US dollar exchange rate causing crude oil price change (Yousefi and Wirjanto, 2005; Krichene, 2005; Cheng, 2008) to crude oil price changes causing change in US dollar exchange rate (Bénassy-Quéré et al., 2005; Amano and van Norden, 1998).

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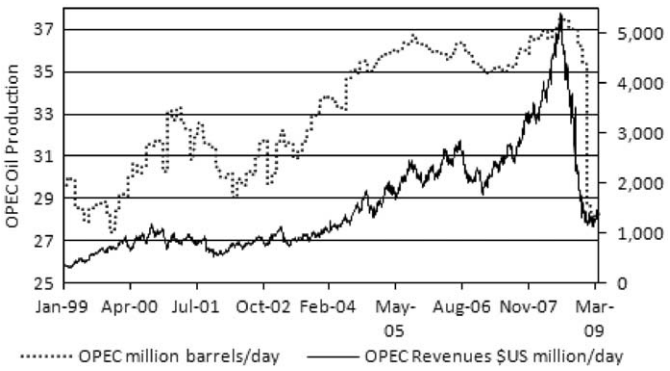

Fig. 1. OPEC oil production and revenues from January 1999 to March 2009. Sources: data for daily Brent spot oil prices (FOB) are from the US Energy Information Administration (2009a). Data for OPEC crude oil production (monthly output per day) are from the US Energy Information Administration (2009b).

dollar volatility and crude oil price volatility (Throop, 1993; Amano and van Norden, 1997; Zhou, 1995; Coudert et al., 2008). This relationship[3] is central to any proposed currency alternative to US dollar crude oil pricing when a long-term decline in the value of the US dollar may artificially raise the price of crude oil (Krichene, 2005; Cheng, 2008), such that according to Yousefi and Wirjanto (2005), the view that OPEC is able to specify a crude oil export price is questionable. Although dramatic short term crude oil price volatility (e.g., during 2008) may be influenced by various factors such as speculation, world demand, scarcity rent and geological limitations (Hamilton, 2008), Zhang et al. (2008) empirically demonstrate that over the long term, the influence of the US dollar exchange rate on crude oil prices is statistically significant.

2.2. OPEC's global oil supply and income

According to the US Energy Information Administration (2009a), OPEC's annual average proportion of the global oil supply from 1997 to 2008 has ranged from a low of 30.265 million barrels in 2002 (39.31% of global supply) to a high of 36.761 million barrels in 2008 (43.01% of global supply). Over the 12-year period, OPEC has contributed an average of 41.6% of the world's oil supply—highlighting the importance of OPEC to the world's economy, and secondly, that any petro-dollar currency basket formulation must reflect a global orientation to include the world's most liquid currencies given the scope and magnitude of crude oil supply.

Fig. 1 reports estimated[4] daily OPEC oil production and revenues from January 1999 to March 2009. This 10-year series reports oil production (M=30.8, range 26.42–34.15 million barrels/day) and oil revenue (M=US$1.4 billion, range US$292.9 million–US$4.9 billion/day). To offer a sharper comparison between these two time series, the standard deviation for each series was computed (to isolate differences in magnitude, each series was divided by its mean before computing the standard deviation), which for oil production is 0.09 million barrels/day and for revenues is US$0.66 million/day. Clearly, OPEC's angst is toward the higher relative volatility of the US dollar, by a factor of 7.33. This notable finding is matched with the decline in daily oil revenues in February 2009 down to US$1.1 billion, a level not witnessed since April 2005. A drop in both market demand and price per barrel of crude oil has placed financial strain on OPEC member nations, who may have expected oil prices to remain at mid-2008 levels over the long run. In most cases, the financial strain is the result of shaky financial policies during the boom, exemplified by overspending in Iran, Venezuela and other member nations as a result of the resource curse (Gelb, 1988; Karl, 1997; Auty, 2001) such that an abundance of crude oil attracts a false sense of security leading to carelessness about human, physical and social capital (Gylfason, 2001). For example Nigeria's oil wealth per capita from independence in 1960 to 2000 has not changed (World Bank, 2000).

2.3. Crude oil pricing effects on OPEC economies

According to Noreng (2008), the crude oil market's choice of currency is relevant in the valuation of oil versus goods and services traded regionally and internationally. This relationship results in oil prices influencing each OPEC member's GDP over the short- (Mork et al., 1994; Jimenez-Rodriguez and Sanchez, 2005) and long term (Hooker, 2002; Lardic and Mignon, 2006). Lescaroux and Mignon (2008) report that oil prices and GDP are positively cointegrated for Iraq, Qatar and the United Arab Emirates (two-way for Iran and Saudi Arabia), while oil prices and CPI are positively related for the United Arab Emirates (two-way for Kuwait). These findings motivate OPEC's interest to seek member nation economic success by investigating alternatives to the pricing of crude oil in US dollars.

Exchange rate volatility in global trade creates uncertainty in pricing imports and exports (Rose, 2000), impacting profitability (Baum et al., 2001) and discourages or delays production and employment investment decisions (Belke and Gros, 2002). A solution against exchange rate volatility is a diversified risk currency basket, which serves as an instrument of stabilization (Horne and Martin, 1989) and as a monetary policy mechanism (Bird and Rajan, 2002) that may also serve a particular country's or organization's self-interest (Hochreiter et al., 2003). Detractors of the currency basket approach point to the instability of individual currencies such that a change in value of one currency changes the value of the basket in terms of the other currencies (Thakur, 1994); however, such a position may hold favor for select highly volatile currencies one may not wish to include in a currency basket. In the same vein, a basket such as the Special Drawing Rights (SDRs) suffers from non-constant purchasing power over time (Coats, 1989) and has been dismissed as a viable option for OPEC members (Amuzenager, 1978).

2.4. Extant currency risk exposure

The gradual erosion in value of the US dollar and a shift in import trade emphasis from non-US dollar denominated trading areas of Europe and Asia has damaged OPEC's purchasing power (Verleger, 2003). Work by Guillermo and Mishkin (2003) suggests that when export and import prices shift due to movements in supply or demand, then exchange rate flexibility is in order. US dollar weakness, OPEC trade shifts and US seigniorage (issuing currency at will to cover its economic woes) have caused a US$5.3 billion drop in OPEC's US dollar holding from 67% to 65%, and a US$2.8 billion increase in Euros from 20% to 22% (Blas et al., 2006), together with remarks by OPEC's secretary general of a likely switch to Euro crude oil pricing by 2018 (Williams, 2008). As attractive a switch to a substitute single currency such as the Euro

[3] According to Yousefi and Wirjanto (2005), studies up to 2005 (e.g., Cremer and Salehi-Isfahan, 1991; Adelman, 1993) modeling the oil market and OPEC have not included exchange rates in crude oil price formation.

[4] The OPEC reference basket of a weighted average of eleven types of crude of oil (OPEC, 2007) makes for a cumbersome analysis, and therefore the Brent daily spot crude oil price is used as a reasonable approximation of the eleven types of crude oil given most transactions in crude oil outside the US refer to Brent prices as is the case in the Dubai market (Horsnell and Mabro, 1993).