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Oil prices, stock returns, and exchange rates: Empirical evidence from China and the United States

Shuming Bai[a,*], Kai S. Koong[b]

[a] College of Business, University of Texas of the Permian Basin, 4901 East University Boulevard, Odessa, TX 79762, United States
[b] Andrew F. Brimmer College of Business and Information Science, Tuskegee University, 1200 West Montgomery Road, Tuskegee, AL 36088, United States

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ABSTRACT

Employing the diagonal BEKK model as well as the dynamic impulse response functions, this study investigates the time-varying trilateral relationships among real oil prices, exchange rate changes, and stock market returns in China and the U.S. from February 1991 to December 2015. We highlight several key observations: (i) oil prices respond positively and significantly to aggregate demand shocks; (ii) positive oil supply shocks adversely and significantly affect the Chinese stock market; (iii) oil price shocks persistently and significantly impact the trade-weighted US dollar index negatively; (iv) the US and China stock markets correlate positively just as the dollar index and the exchange rate does; (v) a significant parallel inverse relation exists between the US stock market and the dollar and between the China stock market and the exchange rate; and (vi) the Chinese stock market is more volatile and responsive to aggregate demand and oil price shocks than the US stock market in recent years.

1. Introduction

The recent two-cycle rise and fall ofcrude oil price over the past fifteen years combined with its wide-spread importance has generated a great deal of interest in the determinants of the crude oil prices (Hamilton, 2009; Kilian & Murphy, 2014) and the relationship among oil price shocks and financial markets (see, for example, Kilian & Park, 2009; Park & Ratti, 2008). Crude oil price is determined not only by its supply (production and inventory) and demand (consumption), but also by other important geopolitical, economic, and financial factors such as geopolitical events, economic activity and growth, correlations with other commodities, stocks, and currency markets. For example, there is extensive research on the bilateral relationship between oil prices and stock returns and between oil prices and foreign exchange rates, particularly in the advanced economies. However, the trilateral relationship among oil prices, stock returns, and exchange rates is scarcely examined especially in a comparative framework between large developed and developing economies. The objective of this paper is to employ a two stage analysis (the dynamic impulse response function and the dynamic conditional correlation DIAGONAL BEKK-GARCH model) to investigate the trilateral relationship in China and the United States, the largest developing and developed economies in the world. To our knowledge, this is the first paper to address the issue in such a framework.

For the past seventeen years, crude oil prices, measured by the West Texas Intermediate, rose and fell two times: from an average of $12 per barrel in January 1999, it slowly rose to peak at $134 in June 2008 and then to dip to $39 in February 2009 (same time for

* Corresponding author.
E-mail address: bai_s@utpb.edu (S. Bai).

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the U.S. stocks' bottom) and rose again to $106 in June 2014 to drop again to $37 by the end of 2015. The Chinese stock market seemed to have two sharp rises and falls around similar periods as those for the crude oil, but with greater volatility and with opposite direction for the 2014–2015 period. After some big ups and downs during its debut years from 1992 to 1994, the Shanghai Composite index experienced a slow and varied rise to $268 in May 2001 and then an extended shallow fall to $128 in May 2005. From there it rose sharply to top at $798 in October 2007 (before oil peak but same time as the U.S. market hike) to plummet to 253 points in October 2008 (ahead of oil dip). It then increased again with extensive oscillation to steep rise to 744 points in May 2015 and dropped again to 480 points in September 2015 (same time for the U.S. market lows). For the U.S. stock market, it had two distinctive turning points, one at the dot com bubble in May 2000 (1518 points) and the other before the global financial crisis in October 2007 (1549), same time as the Chinese stock peak). Compared with the Chinese stocks, the U.S. stock market grew higher and longer and with clearer pattern and more momentum. From 1279 points in January 1999, the S&P 500 rose to 1518 in August 2000 to drop to 815 in September 2002. It rose again to peak at 1549 in October 2007 (as the Chinese stocks did) to fast plunge to its nadir of 735 in February 2009 (same time oil bottomed) and then to rise extraordinarily high reaching 2044 points by the end of 2015 (see Fig. 1).

The Chinese stocks shared some similar turning points as the U.S S&P 500 when both peaked in October 2007 before plummeted during the global financial crisis. Both stock markets seemed to have served as leading indicators and signaled the upcoming crash for the crude market. The stock markets pulled oil prices down as the demand from the largest economies, especially China, had been softened enough to weaken the crude prices. This represented the global demand-driven (weak demand) impact on crude oil prices.

On the exchange rate side, the U.S. dollar index, the numeraire for many commodities as measured by the U.S. dollar value relative to that of its most significant trading partners, jumped from 95 in January 1999 reaching 113 in February 2002 to be bottomed at 70 in March 2008, and climbed up again to 94 by the end of 2015 to return to square one of 1999. The U.S. dollar to Chinese yuan (renminbi) exchange rate (USD-CNY) movement behaved differently as renminbi implemented fixed exchange rate regime: from the nominal exchange rate of RMB 5.7 per dollar prior 1994 to 8.7 per dollar in 1994 when China adopted a new managed-float regime by devaluating dramatically the exchange rate. The USD-CNY exchange rate stayed around 8.27 yuan per USD until June 2005, when China administered a new managed float and switched the peg from the U.S. dollar to a basket of currencies. Under the dollar-pegging system, China achieved remarkable current account surpluses as well as capital account surpluses in all the years except for 1998, leading the real exchange rate to appreciate steadily (Huang & Wang, 2004). Since July 2005, the renminbi was allowed to fluctuate within certain bands on a daily basis. The renminbi has been appreciating against the U.S. dollar reaching a peak of 6.05 yuan per USD in January 2014 and then to 6.45 yuan per dollar by the end of 2015, a 22 percent appreciation over the 15 year period (see Figs. 2 and 3).

Understanding the interdependent relationship among the three largest financial markets (energy, stock, and currency) in these two largest economies is important because the information can help guide financial and investment decisions particularly in the emerging economies like China as it is assuming greater role and eminence in the global financial and political arena, especially in both oil and foreign exchange markets. In addition, China's fast and energy-intensive growth propelled by consistent trading surplus with a fixed USD-CNY exchange rate before July 2005 created a great demand for energy and could contribute to the oil price rise to certain extent.

In the global energy arena, China has quickly risen to the top ranks in global energy demand over the past few years due to its large-size population and fast-growing economy. According to the U.S. Energy Information Administration (2015), China has become the global second-largest oil consumer behind the United States in recent years. China also grew to surpass the United States at the end of 2013 as the world's largest net importer of petroleum and other liquids. These changes, along with a remarkable double digit growth rate of gross domestic product for the past three decades (Bloomberg, 2010), has earned China a greater influence in the world especially in the areas of dominance of international trade, large hoard of foreign exchange reserves, sizable ownership of the United States government debt, and its substantial demand for energy products including crude oil. China's growth has impact on commodity prices.

Effective October 1, 2016, the Chinese renminbi has been approved by the International Monetary Fund (IMF, April 6, 2016) to be included as a fifth currency in the Special Drawing Rights (SDR) basket, a global supplementary reserve asset. This will allow the

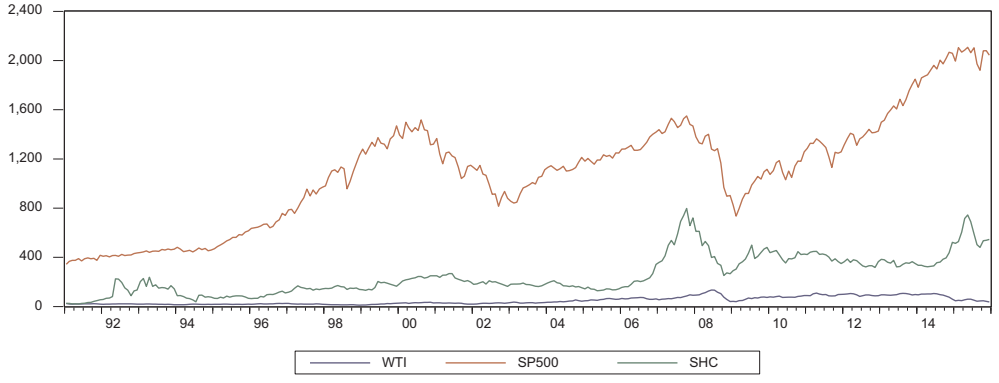

Fig. 1. Time-series plots of oil prices and stock prices (original data), 1991:01-2015:12.