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The impact of oil price shocks on U.S. bond market returns

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ABSTRACT

This paper examines the effect of the demand and supply shocks driving the global crude oil market on aggregate U.S. bond index real returns. A positive oil market-specific demand shock is associated with significant decreases in aggregate bond index real returns for 8 months following the shock. A positive innovation in aggregate demand has a negative effect on real bond return that is statistically significant and becomes more adverse over 24 months. Structural shocks driving the global oil market jointly account for 27.1% of the variation in real bond returns at 24 month horizon. A spillover index from rolling SVAR models is used to identify the interdependence between the oil market and bond returns. The mean for this spillover index is 0.381 over 2001:01–2011:12 and 0.476 over September through December 2008 during the height of the global financial crisis.

1. Introduction

A considerable amount of research has focused on identifying the interaction between oil prices and stock markets. Early work gave conflicting results on the connection between oil price and stock returns. Chen et al. (1986) and Huang et al. (1996) do not find significant connections between oil price and oil price futures and U.S. stock returns, but Jones and Kaul (1996) find that oil price increases in the post war period have a significantly negative effect on aggregate stock returns. In recent years it has been noted that it is important to identify the source of oil price shocks when examining their impact on real stock returns. Kilian and Park (2009) show that U.S. real stock returns are adversely affected by positive oil market-specific demand shocks, but increases in global aggregate demand have a positive effect on real stock returns.

In this paper we examine the effect of the demand and supply shocks driving the global crude oil market on the U.S. real bond index returns. In contrast to work investigating the connection between oil prices and stock market returns, comparatively little attention has directly concentrated on the relationship between oil prices and bond market returns. Stock and bond markets are of comparable size in the functioning of the global financial system. U.S. stock market capitalization stands at about 21.4 trillion U.S. dollars in early 2012, at which time the value of the U.S. bond market is valued at close to $37 trillion U.S. dollars (Bloomberg). Outside the U.S., debt market capitalization exceeds equity market capitalization by a larger relative amount than in U.S. markets. Given the crucial position of the bond market in the financial system it is important to understand the connection between structural oil market shocks and real returns in the bond market.

We utilize a structural vector auto regression (SVAR) model to investigate how the demand and supply shocks driving the global crude oil market affect real bond returns. It is found that a positive oil market-specific demand shock is associated with significant decreases in a broad based U.S. bond index returns for 8 months after which time effects become insignificant and are eroded over the next 6 months. A positive innovation in global aggregate demand also has a negative effect on real bond return, but the effect is statistically significant over 24 months and becomes more adverse over time. The adverse effect is about 1% after 12 months. This result contrasts with the established result in the literature that a positive innovation in global aggregate demand is associated with increases in real stock returns.[1] The opposite response patterns of bond versus stock returns to global aggregate demand shocks show the importance of identifying the

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[1] Kilian and Park (2009) argue the positive relationship between stock returns and aggregate demand shocks has been driven primarily by the stimulating effects of strong global demand for industrial commodities during 1975–2006.

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source of oil price shocks when examining their transmission to the price of bonds that are a natural hedge against stocks.

Our aggregate analysis also indicates that, on average, in the long run, shocks to the global crude oil market play an important role affecting the U.S. bond market. The demand and supply shocks driving the global crude oil market jointly account for 30.6% of the long-run variation in real returns for a broad based U.S. bond index with average maturity of five years. The large statistically significant predictive ability of the structural oil price shocks for aggregate bond index real returns is found to hold across corporate and different fixed-term government bond indices. The structural oil price shocks jointly account for 28.2% of the long-run variation in real returns for a U.S. corporate bond index.

We find that shocks to oil market-specific demand explain 31.2% of the variation in the real 30-day Treasury-bill return in the long run. Shocks to oil market-specific demand explain 24.4%, 13.2%, 11.1% and 16.1% of the variation in the real returns for 1-year, 5-year, 10-year, and 30-year government bond indices in the long run. The dominant effects on the short-term Treasury-bill return are associated with the literature that addresses the connection between oil prices and monetary policy as reflected in the response in short-term interest rates (by Bernanke et al. (1997) and others). On the other hand, we find that the adverse effect on real bond returns of positive shocks to global aggregate demand is more marked the greater is bond maturity.

The key finding of Kilian (2009) that oil price shocks vary with different signs at different points in time implies that the oil- and bond market spillovers may be very different conditionally at any given point in time. We contribute to the literature by presenting the rolling sample analysis to investigate the dynamics of the effect of the structural oil price shocks on bond market returns over time. The summary spillover index of the connectedness of oil and bond markets is highly statistically significant. Rolling sample analysis indicates that the degree of spillover between the demand and supply shocks driving the global crude oil market and bond market return is especially high over the years 2008–2011, when economic activity slowed down significantly because of financial crisis and the post-crisis anemic recovery. The mean spillover index for the structural shocks in the global crude oil market and aggregate bond index real returns calculated from rolling SVAR models is 0.380 over 2001:01–2011:12 and 0.470 over September and October 2008. These results suggest that investors believe that bond holdings have value as a hedging instrument in recession, when decreased real oil prices and stock market fall are likely associated with increased real bond returns.

The paper is organized as follows. A brief literature review is provided in Section 2. Section 3 presents the methodology and the structural VAR model. Section 4 describes data sources. Section 5 discusses empirical results about the dynamics of oil price shocks and real bond returns. The robustness of results is discussed in Section 6. Section 7 concludes.

2. Literature review

Hamilton (2008) notes that the main channel by which energy price shocks influence aggregate economic activity is through effects on consumer and business spending on other goods and services. Bernanke (2006) argues that energy prices affect aggregate activity primarily through effects on consumer spending. This is consistent with work by Lee and Ni (2002) showing that oil price shocks primarily influence activity at industry level through demand side effects.

In recent years it has been noted that it is important to identify the source of oil price shocks when examining their impact on real economic activities and consumer prices. Kilian (2009) shows that positive oil market-specific demand shocks lower real GDP growth and raise CPI inflation, whereas oil price increases associated with increases in global aggregate demand have a negative effect on GDP growth with a delay. Oil supply disruptions are found to cause a temporary decline in real GDP and have little effect on the price level. Hamilton (2009) distinguishes oil price shocks due to demand and supply side influences. Global demand for oil in recent decades has been driven by rapid growth in major developing economies. Supply side influence is captured by changes in world oil production. It is thus recognized as crucial to identify the source of the oil price change in examining the effects of movement in oil price on real variables.

The importance of identifying the source of the oil price change in examining the effect of oil prices on stock returns has been confirmed in the literature. Filis et al. (2011), Basher et al. (2012) and Abhyankar et al. (2013) find that positive oil price shocks due to aggregate (oil market-specific) demand factors increase (decrease) stock returns. Degiannakis et al. (2014) find that aggregate demand driven oil price changes reduce stock market return volatility and that the other shocks are not significant. Apergis and Miller (2009) report that structural shocks have influence on stock returns, but that the magnitude of the effect is small. Wang et al. (2013) and Park and Ratti (2008) note that it is also important to distinguish between the effect of oil price shocks on the stock markets of oil importing and exporting countries.

Unlike studies on the effect of oil prices on real activity and stock markets, little work has been done on the effect of oil prices on bond markets. An issue connected to the relationship of structural oil market shocks with real bond market returns, the connection between oil prices and monetary policy as reflected in the response in short-term interest rates, has been addressed in the literature (by Bernanke et al. (1997) and others). Kilian and Lewis (2011) argue that there is little evidence of systematic policy responses to oil price shocks because oil price changes have different causes.

3. Methodology

Oil price shocks cause unanticipated changes in discretionary income and in precautionary saving and can thus influence returns in the bond market through influencing the demand for bonds by investors. Kilian and Park (2009) argue that an upturn in the global business cycle simultaneously promotes recovery in the U.S. economy and pushes up the real price of oil (which tends to offset the rise in U.S. economic activity). Kilian and Park (2009) find positive innovations to global aggregate demand have a positive effect on U.S. real stock returns despite oil prices being higher than expected. In response to a positive innovation to global aggregate demand, the stimulating effect on oil prices and on stocks is likely associated with falling net real aggregate demand for bonds and declining aggregate bond index real returns.

U.S. real stock returns are found to be adversely affected by the positive oil market-specific demand shocks (by Kilian and Park (2009) and others). This effect is found by controlling for global aggregate demand and is associated with increases in the real price of oil based on a precautionary concern for the stability of future oil supplies. The effect of an increase in real price due to a positive innovation in oil market-specific demand for oil may cause uncertain investors to move out of both stocks and bonds. Thus, it is hypothesized that aggregate bond index real returns decline with a positive oil market-specific demand shock. The likely divergent (similar) responses of real bond return and real stock return to shocks to global aggregate (oil market-specific) demand highlights the significance of isolating the source of oil price changes when predicting effects on financial markets.

A structural VAR model is used to separate the three structural oil price shocks – shocks to world oil supply, shocks to global aggregate demand for all commodities and oil market-specific demand shocks – and to assess their relationship with real bond returns. The structural representation of the VAR model of order p is

$$A_0 y_t = c_0 + \sum_{i=1}^{p} A_i y_{t-i} + \varepsilon_t, \tag{1}$$

where $y_t = (\Delta prod_t, rea_t, rpo_t, ret_t)$ is a 4×1 vector of endogenous variables, A_0 denotes the 4×4 contemporaneous coefficient matrix, c_0