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Oil shocks, stock market prices, and the U.S. dividend yield decomposition

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ABSTRACT

We estimate the effects of oil supply and demand shocks on the U.S. dividend yield components (dividend growth, real interest rate, subjective equity premium and mispricing), as they emerge from a decomposition based on the Campbell and Vuolteenaho (2004a) framework. A positive relationship between oil price increases and dividend yield emerges, the persistence of which depends on the news driving oil price increases. The linkages between oil price shocks and dividend yield's components show that a confluence of factors determines the ultimate impact of oil price increases on stock market valuations, revealing information about the oil price pass-through mechanism.

1. Introduction

The rising oil prices in the 70s and the international episodes of stagflation that ensued have motivated an enormous amount of research on the effects of oil prices on the macroeconomy (e.g., Brown & Yücel, 2002; Hamilton, 2003; Naifar & Al Dohaiman, 2013). This line of research remained buoyant even during the period of the "great moderation", which was characterized by relatively lower macroeconomic volatility (Sims & Zha, 2006), but, nevertheless, experienced several episodes of large movements in oil prices.[1] No consensus still exists, however, on a number of issues including the ultimate impact of oil price shocks on the macroeconomy, the direction of causality between them, and the channels through which these effects materialize (e.g., Barsky & Kilian, 2004; Hooker, 1996). This paper produces further evidence on the effects of oil price changes on asset markets. In particular, we focus on the effects of oil supply and demand shocks on the components of the U.S. dividend yield, namely, the dividend growth, real interest rate, subjective equity premium, and mispricing.

We explore the linkage between the U.S. stock market valuations and oil price changes by analyzing how oil price shocks are related to investors' expectations of firms' future cash flows and discount rates. Standard discounted-cash-flow models for stock price valuation suggest that stock price movements are determined by the changes in expectations of future cash flows and of the rates that will be used to discount them to the present (e.g., Campbell & Shiller, 1988). Exploring, therefore, how oil price shocks feed through to these expectations can allow pinning down the possible explanations for the effects of oil price fluctuations on the stock market.

Existing evidence on the impact of oil price changes on stock market prices provides mixed and inconclusive results. While a number of studies find that there does not exist an apparent significant link between oil prices and the stock market (Chen, Roll, &

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[1] For example, the spikes in oil prices in 1990–1991, 2000 and 2003 and the oil price decrease in 1986, (see, Barsky & Kilian, 2004).

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Ross, 1986; Huang, Masulis, & Stoll, 1996; Wei, 2003), other studies suggest that oil price increases adversely affect stock prices (Ciner, 2001; Jones & Kaul, 1996; Kling, 1985; Sadorsky, 1999). Moreover, there is evidence that oil price changes are significant predictors of stock market returns (Driesprong, Jacobsen, & Maat, 2008; Fan & Jahan-Parvar, 2012). Kilian and Park (2009) and Apergis and Miller (2009) find that in order to assess the implications of oil price increases one needs to know the underlying causes for the higher oil prices, and they examine the impact of Kilian's (2009) oil supply and demand shocks on stock market data. Kilian and Park (2009) find that oil price shocks explain more than 20% of the U.S. stock returns' volatility in the long run, while Apergis and Miller (2009), who use an adaptation of the same methodology, find that although oil price shocks exert the expected by theory effects on a sample of international stock markets, these effects are small in magnitude.

Another relevant line of research attempts to empirically identify the determinants of stocks' reaction to oil price shocks. Jones and Kaul (1996), exploring the link between oil price shocks and stocks' future returns and cash flows, find that the U.S. stocks' reaction to oil price shocks can be completely explained by the effects of oil price changes on firms' future real cash flows. Kilian and Park (2009), however, find that oil price shocks influence the historical evolution of both firms' expected future cash flows and expected future real stock returns. Although both studies establish a relationship of future excess returns and dividend growth with oil price shocks, they do not allow further inferences regarding the nature of these relationships. In this paper we study the timing, persistence, and economic significance of the effects of unexpected oil price increases on the future discount rate and cash flows of the U.S. stock market.

Specifically, we combine two empirical frameworks to analyze the effects of oil supply and demand shocks, as defined by Kilian (2009), on the U.S. dividend yield components, with the later being extracted from the methodology of Campbell and Vuolteenaho (2004a). The empirical methodology of Campbell and Vuolteenaho (2004a) allows the decomposition of the (log) dividend yield into four components attributable to the subjectively expected equity premium, the real interest rate, the mispricing, and the rationally forecasted excess dividend growth. In order to obtain quantitative estimates for the effects of oil price shocks on each one of the U.S. dividend yield's components separately, we employ the structural dynamic framework of Kilian and Park (2009). This model's specification takes into account the possibility that the relationship between oil prices and economic activity can be highly nonlinear (Hamilton, 1996; Lee, Ni, & Ratti, 1995; Mork, 1989), and that oil prices are driven by both oil supply and oil demand shocks (Kilian, 2008).

Identifying how the structural shocks impact on the dividend yield components reveals whether the effects of oil price shocks on the U.S. dividend yield can be explained by their effects on the subjective equity premium, the excess dividend growth, the real interest rate, and/or mispricing. The outcome from this empirical exercise, therefore, conveys information about the possible channels of transmission and may help to test existing presumptions regarding the transmission mechanism. The complexity of the mechanisms through which the oil price transmission materializes, along with the contradictory results from existing empirical analyses (e.g., Barsky & Kilian, 2001, 2004; Hamilton & Herrera, 2004), renders the identification of these channels an empirical task.

The organization of the paper is as follows. The next section reports the results from the (log) dividend yield decomposition of Campbell and Vuolteenaho (2004a). We extract the four components comprising the (log) U.S. dividend yield and we report their time series evolution along with some bias measures. Section 3 uses a dynamic structural framework, along the lines of Kilian and Park (2009), to investigate the effects of oil demand and supply shocks on the dividend yield components identified in the previous section. The section reports the cumulative impulse responses and the variance decomposition of the changes in the four components to the oil shocks and discusses the empirical results. Finally, Section 4 concludes.

2. The (log) dividend yield decomposition

A firm's stock price movements are a function of changing expectations of its future cash flows and of the discount rates that will be applied to these cash flows. Examining how oil price shocks are related to the changes in these expectations can unveil what drives the reaction of stock prices to changes in oil prices. To derive proxies for the expected values of future discount and dividend growth rates, we use Campbell and Vuolteenaho's (2004a) framework. This framework permits the decomposition of the logarithm of the dividend yield into components attributable to rational forecasts about future dividend growth and future discount rates, as well as to a component capturing the divergence between objective and subjective expectations about future dividend growth.

The empirical framework of Campbell and Vuolteenaho (2004a) is based on the loglinear dynamic framework of Campbell and Shiller (1988), which is captured by the following equation:

$$d_t - p_t \approx \frac{k}{\rho - 1} + E_t \sum_{j=0}^{\infty} \rho^j \left[e^r_{t+1+j} + i_{t+1+j} - \Delta d^e_{t+1+j} \right]. \quad (1)$$

Eq. (1) shows that the log dividend–price ratio (d–p), provided that it does not have an explosive behavior, can be approximated by the sum of the discounted conditional expectations of future excess returns (e^r), future real interest rates (i), future excess log dividend growth (Δd^e), and a constant term.[2] This loglinear approximation to the standard Gordon growth model allows for time-varying discount and dividend growth rates, and can be thought of as an accounting framework relating

[2] The parameters ρ and k take constant values and are defined similarly to Campbell and Vuolteenaho (2004a).

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