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Option-implied expectations in commodity markets and monetary policy ☆

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ABSTRACT

In this paper we estimate the dynamic interactions between option-implied variance and skewness in agricultural commodity markets and monetary policy. Using a structural vector autoregressive (SVAR) framework, we find that an expansionary (contractionary) monetary policy upwardly (downwardly) revises commodity markets' expectations about the price and volatility path of agricultural products. On the other hand, our empirical analysis reveals that monetary policy does not have a systematic and timely response to sudden changes in option implied expectations of commodity investors. In addition, we provide empirical evidence showing the robust forecasting power of agricultural option-implied information on monetary policy with R^2 values reaching almost 52%.

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1. Introduction

Empirical and theoretical studies have shown that monetary policy is an important determinant of commodity prices (Frankel and Hardouvelis, 1985; Frankel and Rose, 2010). Frankel (2013) argues that the lax monetary policy of the Fed during the recent period (2003–2013) was an important factor that contributed significantly to the rapid rise in almost all commodity prices. He provides a subtle economic interpretation of the factors that induce the negative statistical relationship between interest rates and commodity prices. Low interest rates increase the demand or decrease the supply of storable commodities because low interest rates decrease the incentive for extraction today versus tomorrow (real options effect), they decrease the cost of carrying inventories and lead to a portfolio rebalancing from bonds towards commodity markets.

The general consensus in the literature is that an expansionary (contractionary) monetary policy stance is usually associated with high (low) commodity prices. Anzuini et al. (2013) use a standard VAR analysis and examine the impact of US monetary policy shocks on commodity prices. They find that an expansionary monetary policy shock increases modestly commodities prices. Gubler and Hertweck (2013) provide empirical evidence that an expansionary monetary policy in US induces a persistent increase in commodity prices and Gilbert (2010) shows that "agricultural price booms" are better explained by macroeconomic and monetary factors instead of commodity-specific factors. Hammoudeh et al. (2015) find that a contractionary US monetary shock leads to a persistent rise in the volatile food prices. Gospodinov and Jamali (2013) use commodity futures data and find that US expansionary monetary policy surprises tend to increase commodity prices. However, they document that the sensitivity to monetary shocks varies significantly across different commodity

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groups. Gordon and Rouwenhorst (2006) show that commodities is the asset class which acts as the most efficient hedge against both the expected and the unexpected component of inflation, and Frankel and Hardouvelis (1985) find that when inflation expectations are upwardly revised, "investors to protect themselves will shift out of money and into commodities, thus driving up current commodity prices". In addition, many empirical studies in the relevant literature indicate that commodity prices are early warning signals of changes in monetary policy and of future inflationary pressures (Awokuse and Yang, 2003; Bhar and Hamori, 2008; Frankel, 2008; Cody and Mills, 1991; Garner, 1989; Gospodinov and Ng, 2013).

In this paper we take the current research one step further by linking US monetary policy not with commodity prices, but with the option-implied expectations about the future distribution of commodity prices. We focus on option implied variance and option implied skewness extracted from the maize, wheat and soybeans commodity derivative market. We choose these particular commodities for two reasons. First, maize, wheat and soybeans are homogenous agricultural products that usually have a quicker price response to monetary policy shocks compared to other commodity prices. For example, Robertson and Orden (1990) find that an unanticipated monetary policy shock has a stronger short-run impact on agricultural commodity prices compared to other commodities like energy and minerals.[1] Second, because maize, wheat and soybeans futures and options markets are one of the most liquid among agricultural commodities and that allows us to calculate option implied measures with great precision. We use implied variance as an ex-ante measure of investor's expectations about the future variance of agricultural commodity prices. However, investor's expectations extracted from the options market may embed both risk premia and objective expectations about future variance. To address this issue, in the empirical analysis we also decompose the implied variance into an objective expectation about future variance and a residual called Variance Risk Premium (VRP). Option implied skewness is used as an ex-ante measure which quantifies expectations about the future price path of commodity prices. For example, Han (2008) finds that in the S&P 500 equity option market implied skewness is highly positively correlated with market sentiment. In our empirical analysis we view a positively skewed implied distribution as a signal that reveals a bullish market and we consider a negatively skewed implied distribution as a signal that reveals a bearish commodity market.

Our work is motivated by empirical studies that identify the structural linkages between the monetary policy stance and the perception and pricing of risk by financial market participants. Bekaert et al. (2013) and David and Veronesi (2014) identify the "risk taking channel" of monetary policy in equity markets by showing that monetary policy shocks have a significant impact on the equity market uncertainty (as measured by VIX). In this paper, we test if the "risk taking channel" exists in commodity markets and to this end we examine the effects of monetary policy shocks on commodity market uncertainty (as measured by implied variance). In the empirical analysis we use a structural vector autoregressive (SVAR) framework to test the dynamic interactions between expectations about future variance and skewness in agricultural commodity markets and monetary policy. The stance of monetary policy is proxied by the Fed funds rate or other alternative measures, like the real interest rate, the short-term US-Treasury Bill and the state of inflation expectations. To the best of our knowledge, this is the first study to examine the dynamic interactions between commodity option-implied variance and skewness and monetary policy.

Bernanke and Kuttner (2005) and Bekaert et al. (2013) find that in the equity market a lax monetary policy decreases option implied variance and variance risk premia in the short to medium run (after about 6 months).[2] In our empirical analysis we find that the exact opposite result holds in the agricultural market. An expansionary (contractionary) monetary policy increases (decreases) implied variance and variance risk premium and makes the implied distribution more positively (negatively) skewed in the short to medium run (after 4–7 months). In other words, we empirically verify that expectations in commodity markets have an opposite reaction to monetary shocks compared with those in the equity market.

The underlying economics behind these contrasts are hidden in the different price/volatility correlation observed in the equity and commodity market. An expansionary monetary policy (low interest rates) leads to a price increase both in the equity and commodity markets. However, it has an exact opposite effect on the volatility of equity and commodity prices. In the equity market, good news about prices (a rising stock-market) reduces volatility in the market due to the 'leverage effect' (Christie, 1982). In the commodity markets the price-volatility correlation is usually positive because rising prices result to increasing market turbulence and uncertainty about these prices. The mechanics which link prices and the respective volatility in commodity markets have their roots in the 'Theory of Storage" (Kaldor, 1939; Brennan, 1958; Telser, 1958).

We additionally find that the degree of 'bullishness' (option-implied skewness) of agricultural markets is more sensitive to monetary shocks compared to implied variance. A possible explanation of this result is that the increased sensitivity of the risk neutral skewness stems from the persistent negative impact of interest rates on commodity prices (see, for example, Frankel, 2008; Frankel and Rose, 2010). Since interest rate changes have a negative long lasting impact on commodity prices, it is reasonable to assume that commodity option writers instantly assign greater probability to commodity price increases (decreases) after observing a negative (positive) interest rate shock. As a result, the implied distribution would become more positively (negatively) skewed after a negative (positive) interest rate shock. We additionally examine the dynamic interac-

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[1] Other empirical studies which focus on commodity markets employ a cross section of around 12 agricultural commodities (see, for example, Daskalaki et al., 2014; Fernandez-Perez et al., 2017). Although in this paper we focus on the impact of monetary policy shocks on agricultural commodities, it is certainly an interesting topic for future research to examine how other type of commodities react to policy shocks.

[2] David and Veronesi (2014) estimate a bivariate VAR model with the 3-month US Treasury Bill and the put/call ratio (the ratio of out-of-the-money put and call option prices) of the S&P 500 option contract. The put/call ratio has a similar economic interpretation compared to our risk neutral skewness since it quantifies investors' fears about stock-market declines. They find that the responses of the put/call ratio to shocks on the US-Treasury bill rate are insignificant.

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