



## Impact of macroeconomic news on metal futures

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### ABSTRACT

This paper uses intra-day data for the period 2002 through 2008 to examine the intensity, direction, and speed of impact of US macroeconomic news announcements on the return, volatility and trading volume of three important commodities – gold, silver and copper futures. We find that the response of metal futures to economic news surprises is both swift and significant, with the 8:30 am set of announcements – in particular, nonfarm payrolls and durable goods orders – having the largest impact. Furthermore, announcements that reflect an unexpected improvement in the economy tend to have a negative impact on gold and silver prices; however, they tend to have a positive effect on copper prices. In comparison, realized volatility and volume for all three metals are positively influenced by economic news. Finally, there is evidence that several news announcements exert an asymmetric impact on market activity variables.

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### 1. Introduction

The relationship between information arrival and asset price movements is of central importance to price formation and price discovery in financial markets, and is a topic that has been extensively investigated in the literature. For instance, the mixture of distributions model relies on “news” to explain movements in asset returns (see Tauchen and Pitts, 1983). Among the various sources of information the role of public information is frequently examined because they are easily identifiable, and also carry implications for the canonical model of weakly efficient markets which posits that security prices reflect all available information. Chen et al. (1986) highlight the importance of macroeconomic factors such as industrial production and measures of unanticipated inflation on stock returns. In a related study, Flannery and Protopapadakis (2002) relate equity returns to macroeconomic variables. More recently, research attention has shifted to an examination of intra-day data that provides additional insights into the market microstructure behavior relating to trading and pricing variables. As a case in point, Adams et al. (2004) show that unanticipated inflationary news has distinguishable effects on intra-day equity returns, and that most of this information is incorporated within minutes of the news release.

This paper explores the price formation process and trading volume activity in the metals futures market around the release of new macroeconomic information. Four important questions are addressed. First, what is the impact of macroeconomic news on the return, realized volatility and volume of gold, silver and copper futures? Second, does the release of macroeconomic news affect the three metals in different ways? Third, how long does it take for the impact of macroeconomic news shocks to be fully absorbed by the market? Finally, does the metals market respond asymmetrically to the release of unexpected macroeconomic news?

The answers to these questions are important for several reasons. First, our analysis is based on high-frequency intra-day data, which allows us to detect patterns of market reaction that may not be easily discerned in lower frequency daily data. In this regard, it is important to point out that the empirical literature using daily data finds only mixed or relatively weak evidence of the link between macroeconomic announcements and commodity prices (see Roache and Rossi, 2010; Hess et al., 2008), thus lending support to the argument that, unlike other assets, commodity prices are predetermined with respect to US macroeconomic aggregates such as real output, consumption and investment variables (Kilian and Vega, 2010). Therefore, an investigation of how an important class of commodities, specifically metals, responds to macroeconomic news at intra-day frequencies provides a meaningful contrast with existing studies. Based on Andersen's (1996) argument that different types of news may have different stochastic arrival processes and therefore convey varying impacts on pricing behavior, we evaluate the impact of 19 different types of macroeconomic news. These announcements are sorted by the time of each news release, with the aim of identifying

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those announcement times that have the largest impact on the metals market. Furthermore, taking into account evidence from related asset markets such as equities (Koutmos and Booth, 1995), we also examine whether or not metal futures respond asymmetrically to economic news. We contend that a study of how metal futures prices react to positive versus negative economic surprises would be informative not only in terms of market efficiency and information processing, but may also provide an explanation as to why previous studies that do not account for potential asymmetries may have been unsuccessful in documenting a significant relationship between economic news and commodity prices.

Second, compared to financial assets, there is a relative paucity of studies that examine the role of information in the metal futures markets. This is especially noteworthy considering that in recent years there has been a steady increase in the amount of investor attention given to these markets. In general, the popularity of commodities, and in particular metals, stems from the belief that these assets act as a hedge against inflation, offer valuable diversification opportunities to investors, serve as a monetary medium during times of market uncertainty, and have a wide range of manufacturing and industrial applications. It is therefore not entirely surprising that these products are one of the most heavily traded in organized futures exchanges.

Finally, our study is comprehensive in scope in that it evaluates the responsiveness of several market activity variables including return, volatility and trading volume. We construct a realized volatility measure that accounts for intra-day price information within each particular time interval.

Therefore, to summarize, our sample period, research design, and empirical methods allow us to investigate more fully the high-frequency dynamics of three important commodities. The remainder of the paper is organized as follows. In the next two sections we provide a literature review and discuss theoretical considerations, respectively. Section 4 explains the data sources, summary statistics and cleaning procedures. Section 5 provides a brief description of the research design and empirical methods, and discusses the results. Section 6 concludes the paper.

## 2. Literature review

A survey of the literature in the metals commodities markets reveals three major research streams: (a) characterization of the distributional properties of metal prices (Khalifa et al., 2011); (b) identification of dynamic relationships between futures and spot prices of various metals (Kocagil, 1997); and (c) examination of metals as a hedge against inflation, currency rate risk, and market uncertainty (Baur and Lucey, 2010). Our study on how metal futures market responds to macroeconomic news adds a new dimension to the literature and carries implications for market efficiency, risk premia, and the pricing and trade behavior of gold, copper and silver.

Although there is a vast amount of literature that documents the effects of macroeconomic news on stocks (e.g., Boyd et al., 2005), bonds (e.g., Simpson and Ramchander, 2004; Nowak et al., 2011) and currencies (e.g., Simpson et al., 2005; Chen and Gau, 2010), the corresponding literature on the reaction of metal prices to economic announcements is relatively scarce. Some notable exceptions exist. Using daily data, in a broader examination of 12 different commodities including gold, silver and copper, Roache and Rossi (2010) find that daily prices are relatively insensitive to macroeconomic news. Hess et al. (2008) provide a state-dependent interpretation of macroeconomic news by showing that daily commodity prices are responsive only during recessionary periods, but not during periods of economic growth.

To our knowledge there are only two studies that use intra-day data to examine gold and/or silver prices. Christie-David et al.

(2000) use intra-day 15-min transaction prices between 1992 and 1995 to show that the impact of economic surprises on the return variance of gold and silver futures prices is less pronounced compared to interest rate futures. Cai et al. (2001) provide a detailed characterization of return volatility in gold futures using 5-min returns between 1994 and 1997. They find that the impact of macroeconomic announcements is much smaller on gold compared to the impact on Treasury bond or currency markets, and only four announcements – jobs report, inflation, GDP and personal income – carry statistically significant effects on gold volatility.

Our study differs from both Christie-David et al. (2000) and Cai et al. (2001) in several regards. First, we use a longer and more recent time frame (2002 through 2008) for the analysis, a period during which metal prices experienced a dramatic increase in price and trading activity. For instance, the futures price of gold increased more than threefold during this period (from about \$278 per troy ounce in 2002 to about \$1003 in 2008). There was also a corresponding rise in aggregate trading volume from about 6.8 million contracts in 2001 to more than 38 million in 2008.<sup>1</sup> Second, our study is more comprehensive in scope since we consider the impact of economic news on three important market activity variables – i.e., returns, volatility and trading volume. Third, we differentiate our work from prior studies by constructing a realized volatility measure that has been shown to provide consistent estimates of integrated volatility in the underlying price process (see Barndorff-Nielsen and Shephard, 2002).<sup>2</sup> A final point of distinction is that our study allows for the possibility of return, realized volatility and volume measures to respond asymmetrically to macroeconomic news announcements, and examines the persistence of economic shocks in the metals futures market.

## 3. Theoretical considerations

Physical commodities are different from most financial assets in that they are continuously produced and consumed. The fact that they can be stored implies that production need not be consumed at once. Therefore, mismatches between production and consumption levels can lead to either accumulation or depletion of inventory resulting in price changes. The theory of storage (see Brennan, 1958) highlights the role of the interest costs of storing the commodity as an important determinant of commodity price changes. In this framework, an unexpected increase in interest rates reduces the demand for inventories (since it raises storage costs) and puts downward pressure on commodity prices.

Unfortunately, given that aggregate inventories are usually not observable and inventory estimates are subject to potential misrepresentation, one may have to explain observed price changes in the context of information arrival. It is in this context that an examination of macroeconomic news, which reveals new information about future economic conditions, becomes pertinent in explaining commodity price movements. However, it must be noted that although news releases are expected to affect commodity prices by altering market beliefs about future economic conditions, the direction of the impact is indeterminate *a priori*. For instance, announcements that cause market participants to revise

<sup>1</sup> The price movement in the copper market is even more dramatic. Its price was about \$0.66 per pound at the beginning of 2002 and reached a peak in July 2008 when it closed at about \$4.04 per pound; only to drop precipitously to about \$1.26 at the end of 2008. The aggregated volume in copper futures increased from 2.8 million contracts in 2001 to 4.56 million contracts in 2008. Silver also seem to have followed a similar meteoric rise. It was about \$4.53 per troy ounce at the beginning of 2002 and closed at its peak at \$20.92 in March 2008. The aggregate volume of silver futures increased from 2.58 million in 2001 to 8.8 million in 2008.

<sup>2</sup> Note that, however, the presence of microstructure noise may bias realized volatility estimates. We account for such potential bias using alternative estimators, as discussed in the 'research design' section of the study.

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