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Volatility persistence in metal returns: A FIGARCH approach

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ABSTRACT

This study examines the returns and the long-memory properties of the return volatilities of four metals – copper, gold, platinum, and silver. Daily returns for the January 4, 1999 to March 10, 2009 period are used. Three key issues are addressed: (1) whether the volatility processes exhibit long-run temporal dependence; (2) whether the returns and conditional volatility of returns are affected by the uncertainty brought about by the financial crisis in September 2008; and (3) whether the implied volatility in the equity market, as measured by VIX, plays a significant role in determining metal risk and return. The results show that VIX is important in the determination of metal returns and return volatility. The findings suggest that metal and equity returns are influenced by a common risk factor and failure to explicitly model this factor will yield less than optimal portfolio diversification. Events during the post-September 1, 2008 period contributed to increased return volatility for several of the metals. The interaction effect of VIX and a financial crisis dummy variable is also found to be significant. The results strongly suggest that VIX should be considered in any future modeling of metal returns and return volatility. FIGARCH (1,*d*,1) appropriately describes the volatility processes as all long-memory parameters are statistically significant.

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1. Introduction

The recent movements in metal prices provide a unique opportunity to revisit the issue of volatility persistence in metal returns. After maintaining a monotonic increase from the late 1990s to approximately 2005, metal prices experienced sharp increases in 2006 and 2007, which were followed by steep declines in 2008. This common price behavior is illustrated in Fig. 1, which graphs the co-movements in the prices of four metals, copper (COP), gold (GOL), platinum (PLA), and silver (SIL), and their volatilities for the January 4, 1999 through March 10, 2009 period.[3] The Commodity Futures Modernization Act of 2000 has made investment in commodities more attractive for certain groups of investors. For example, as a result of the Act, both hedge funds and exchange traded funds have been more active in the commodity derivatives markets. In fact, hedge fund activity in the commodity futures markets increased three-fold between 2004 and 2007, while the sharp increase in energy and base metals prices since 2002 has gone hand in hand with growing derivatives market activities (see, e.g., Domanski & Heath, 2007). Subsequent to the stock market crash in 2001, commodities in general have assumed increasingly greater roles in pension funds, endowments, and mutual funds as more 'buy and hold' investors appear to view commodities not just as a way to diversify but as a source of returns (see, e.g., Tang & Xiong, 2010).[4] As financial investor interest in commodities has increased, it is only natural to explore whether equity market returns and its associated implied volatility play a significant role in the return and volatility dynamics of commodities.

In this study, the volatility patterns of four important metals – copper, gold, platinum, and silver – are examined using the fractionally integrated GARCH (FIGARCH) methodology. Three key issues are addressed: (1) whether the volatility processes exhibit long-run temporal dependence; (2) whether the financial crisis of September 2008 had any effect on metal returns and their conditional volatility dynamics; and (3) whether the implied volatility in the equity market, as measured by VIX, plays a significant role in determining metal returns and volatilities.[5] An understanding of the characteristics of the returns and return volatilities of these commodities is important for a number of reasons. The financialization of commodities has increased commodity price exposure to financial shocks.[6] However, the exposure of commodities to a set of state variables, such as inflation, exchange rates, interest rates, and industrial production, may differ substantially from the exposure experienced by other widely held asset classes such as equities and bonds. As a result, much of commodity-specific risk may be diversified away and systematic shocks may increasingly dominate commodity returns. This, in turn, would increase the correlation with other asset classes and generate greater time-varying volatility. These developments, along with the financial crisis of 2008, raise the issues of whether the importance of the idiosyncratic risk factors driving commodity returns and the nature of the conditional volatility of returns have changed over time and form the basis for the motivation of this study.

Although it is difficult to affix a precise date as to the start of the financial market problems, the collapse of Lehman Brothers on September 15, 2008 is widely believed to have ushered in an

[3] The prices for copper (PCOP), gold (PGOL), platinum (PPLA), and silver (PSIL) presented in Fig. 1 are expressed in U.S. dollars per unit/weight and are those reported on the NYMEX. Daily returns for copper (RCOP), gold (RGOL), platinum (RPLA), and silver (RSIL) are used in this study and are calculated as the log difference in price, $\log(P_t/P_{t-1})$, where P_t is the daily closing spot price. These variables are obtained from www.Globalfinancialdata.com. Given that the paper focuses on VIX and conditional volatility, Fig. 1 also contains these two series.

[4] The California Public Employees' Retirement System, the largest U.S. pension fund with $240 billion under management, announced in February 2008 that it may increase its commodity investment 16-fold to $7.2 billion through 2010 as raw material prices surge to record highs (www.bloomberg.com). Similarly, a British local government pension fund with assets of eight billion GBP is planning to double its commodity allocation to two percent (uk.reuters.com).

[5] VIX is the ticker symbol for the Chicago Board Options Exchange Volatility Index, which is a measure of the implied volatility of S&P500 index options. A high value of VIX is associated with greater volatility while a low value is consistent with greater stability in the market.

[6] Financial activity in commodity futures markets is large compared to the size of the physical production of such commodities. In 2005, the volume of exchange traded derivatives for gold, copper, and aluminum was approximately 30 times larger than physical production (Domanski & Heath, 2007).