



World gold prices and stock returns in China: Insights for hedging and diversification strategies



Mohamed El Hedi Arouri^a, Amine Lahiani^b, Duc Khuong Nguyen^{c,*}

^a CRCGM, University of Auvergne, Clermont-Ferrand, France

^b University of Orléans, Orléans, France

^c IPAG Business School, Paris, France

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ABSTRACT

This article uses the VAR–GARCH framework of Ling and McAleer (2003) to explore both return and volatility spillovers between world gold prices and stock market in China over the period from March 22, 2004 through March 31, 2011. It further analyzes the optimal weights and hedge ratios for dedicated gold–stock portfolio holdings and show how empirical results can be used to build effective diversification and hedging strategies. Several competing multivariate volatility models which are commonly-used in the finance literature (CCC–GARCH, DCC–GARCH, diagonal BEKK–GARCH, scalar BEKK–GARCH, and full-BEKK–GARCH) are also considered for comparison purpose. Our results show evidence of significant return and volatility cross effects between gold prices and stock prices in China, as well as the superiority of the VAR–GARCH model over the other multivariate GARCH specifications. In particular, past gold returns play a crucial role in explaining the dynamics of conditional return and volatility of Chinese stock market and should thus be accounted for when forecasting future stock returns. Our portfolio analysis suggests that adding gold to a portfolio of Chinese stocks improves its risk-adjusted return and helps to effectively hedge against stock risk exposure over time. Finally, when considering the period of the recent global financial crisis, we find that the gold asset serves as a safe haven for stocks in the Chinese stock markets.

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1. Introduction

The purpose of the present study is threefold. Our first objective is to examine the dynamic return and volatility transmission using a bivariate Vector Autoregressive–Generalized Autoregressive Conditional Heteroscedasticity (VAR–GARCH) model for gold and stock markets in China. The empirical model is particularly advantageous in that it allows simultaneous shock transmission in the conditional returns and volatilities. We then use the model's results to compute and analyze the optimal weights and hedge ratios for gold–stock portfolio holdings. We finally assess the diversification and hedging effectiveness of gold in China based on different competing multivariate GARCH-based models.

The literature on gold and other precious metal markets has recently regained particular attention from finance researchers and practitioners. Such a tendency can straightforwardly be explained by the investors' willingness to produce a hedge to diversify away the increasing risk in the stock markets through investing in other asset classes. Indeed, the high volatility and widespread contagion caused by successive

financial turbulences and crises over the last decades have prompted investors to consider alternative investment instruments as a part of diversified portfolios of stocks. Not only oil asset but also major precious metals including gold emerged as natural desirable asset classes eligible for portfolio diversification because they offer different volatilities and returns of lower correlations with stocks, at both sector and market levels (Arouri and Nguyen, 2010; Daskalaki and Skiadopoulos, 2011). It is now common that when risk aversion mounts due, for example, to increasing instability and uncertainty in stock markets or to long swings in the price of oil, most investors are directed towards the metal markets and gold in particular, being viewed as the refugee or safe haven asset in time of crises.

It is thus not surprising that the existing literature on the gold asset is part of the one examining the price dynamics, stochastic properties and roles of the commodity markets in portfolio management. A number of studies have questioned the responses of precious metal prices to changes in international institutional and macroeconomic factors (e.g., Batten et al., 2010; Christie-David et al., 2000; Ciner, 2001; Heemskerk, 2001; Kaufmann and Winters, 1989). Sjaastad and Scacciavillani (1996) find, for example, that fluctuations of floating exchange rates of major currencies, following the breakdown of the Bretton Woods currency arrangements, have led to price instability in the world gold market over the period from January 1982 to December

* Corresponding author at: IPAG Business School, 184 Boulevard Saint-Germain 75006, France. Tel.: +33 1 53 63 36 00; fax: +33 1 45 44 40 46.

E-mail addresses: mohamed.arouri@udamail.fr (M. El Hedi Arouri), amine.lahiani@univ-orleans.fr (A. Lahiani), duc.nguyen@ipag.fr (D.K. Nguyen).

1990. For their part, [Batten et al. \(2010\)](#) document the sensitivity of precious metal volatility to macroeconomic factors, but with different degrees. The overall results suggest that precious metals are too distinct to be considered a single asset class. In particular, gold volatility can be empirically explained by monetary variables. Gold also seems to be highly sensitive to exchange rate and inflation, which implies that it can offer the best hedge during inflationary pressures and exchange rate fluctuations and an optimal portfolio of precious metals that minimizes risk should be dominated by gold ([Hammoudeh et al., 2011](#)).

More recent studies have rather looked at the issues of gold price volatility modeling and information transmission between precious metals and other commodities in order to draw the implications of the estimated results for portfolio diversification and hedging strategies involving precious metals.¹ For example, [Hammoudeh and Yuan \(2008\)](#) make use of various GARCH-based models to examine the properties of conditional volatility for three important metals (gold, silver, and copper) while controlling for shocks from world oil prices (WTI) and three-month US Treasury bill interest rate. Using daily three-month futures prices of the three metals, they find that conditional volatility of gold and silver is more persistent, but less sensitive to leverage effects than that of copper. This finding leads to suggest, on the one hand, the importance of accurate volatility modeling especially when gold and silver are used as underlying assets in financial derivative contracts, and on the other hand the valuable contribution of these two metals in down markets and crisis times. [Hammoudeh et al. \(2010\)](#) document, from a multivariate Vector Autoregressive Moving Average–Generalized Autoregressive Conditional Heteroscedasticity (VARMA–GARCH) model, weak volatility spillovers across precious metals, but strong sensitivity of metal volatility to exchange rate variability. They further point out the role of gold as a hedge against exchange rate risk when optimal weights and hedge ratios are computed.

While understanding the dynamic interactions between gold price changes and stock markets is a crucial element for portfolio designs, risk management and asset pricing, these interactions have only been examined very recently by, to the best of our knowledge, two studies. [Baur and Lucey \(2010\)](#) show that gold serves as a safe haven for stocks in the US, the UK, and Germany especially after extreme negative shocks affecting stock markets. Gold is also a hedge for stocks in the US and the UK. [Baur and McDermott \(2010\)](#) test whether gold represents a safe haven against stocks of major emerging and developing countries, and show that over the period 1979 to 2009 gold is both a hedge and a safe haven for major European stock markets and the US but not for Australia, Canada, Japan and large emerging markets such as the BRIC (Brazil, Russia, India, and China) countries. Furthermore, gold is found as a strong safe haven for most developed markets during severe episodes of the recent financial crisis.

Our study extends the existing literature into return and volatility spillover between gold and stock markets, portfolio designs in the presence of both gold and stocks, and choice of appropriate models for modeling gold–stock interactions. Specifically, we provide a thorough analysis of how shocks and volatility are transmitted from world gold market to Chinese stock market and from Chinese stock market to world gold market. This research is of particular interest for several reasons. First, none of the previous studies has considered the volatility spillover between gold and stock markets while a better understanding of the transmission mechanisms between them helps building accurate stock valuation models and accurate forecasts of the volatility of both markets. Empirical results from volatility spillover analysis also permit to address several important issues such as hedging strategies, optimal portfolio allocation, and derivative management with respect to the uncertainties associated with gold price fluctuations. Note that the works of [Baur and Lucey \(2010\)](#) and [Baur and McDermott](#)

(2010) only provide grounds for understanding the gold–stock return relationships.

Second, the linkages between world gold prices (represented by the prices of the 3-month gold futures contract traded in the Commodity Exchange in New York – COMEX) and Chinese stock market (represented by the MSCI China index) have never been examined despite the increasing role of China in the world economy. According to the IMF statistics, China showed, over the last decade, a very high economic growth rate ranging from 8.3% (2001) and 14.2% (2007). This strong economic performance made China the second largest economy in 2010 with respect to the total GDP measured at purchasing power parity. In the meantime, the study of [Lai and Tseng \(2010\)](#) suggests that the Chinese stock market is not only a safe haven but also a hedge for global investors' portfolios, in particular during times of financial turbulence. Additionally, we note the continuing surge in China's gold demand in recent years. The World Gold Council's report on May 17, 2012 pointed out that China's investment demand for physical gold is more than doubled from 40.7 tons a year ago to 90.9 tons in the first quarter of 2012. Soaring international market prices, high uncertainties in stock and property markets, and rising inflation expectations are undoubtedly candidate factors that have led to the robust growth of the domestic gold investment market in China. Like anywhere in the world, gold may thus be seen as a good alternative investment and the best hedge to inflation. It is worth noting that the 3-month gold future prices at COMEX are global benchmark prices for gold trading. These prices would have a significant impact on Chinese stock markets since gold is now an integrated part of portfolio diversification and the fastest world growth for commodities including gold comes from China. To the extent that the strong total marginal demand of gold from China is linked to the global benchmark at the COMEX, there would thus be a strong empirical and direct linkage between the variables we consider.

Finally, our empirical analysis relies on the multivariate specification of the vector autoregressive – generalized autoregressive conditional heteroscedasticity model (VAR–GARCH) developed by [Ling and McAleer \(2003\)](#). This model offers the possibility to explore the conditional volatility dynamics of the return series as well as the conditional cross effects and volatility spillover between them. It also provides meaningful estimates of the model's parameters with fewer computational complications than other multivariate GARCH specifications, such as the [Engle and Kroner \(1995\)](#)'s full BEKK–GARCH model. Moreover, the findings can be used to analyze the diversification and hedging effectiveness across gold asset and stock market, while taking the return and volatility transmission into account. Some papers have recently taken the VAR–GARCH approach to investigate the volatility spillover and hedging strategies between Gulf Arab equity sectors ([Hammoudeh et al., 2009](#)), between precious metals and exchange rates ([Hammoudeh et al., 2010](#)), between crude oil spot and future returns of the Brent and WTI oil price benchmarks ([Chang et al., 2011](#)), and between oil and stock markets ([Aroui et al., 2011](#)). These studies commonly suggest the suitability of the VAR–GARCH model for capturing the dynamic linkages between different asset markets as well as building optimal portfolios.

Overall, we find evidence of significant volatility cross effects between world gold price and stock market in China over the period 2004–2011. In particular, the past shocks to gold returns are found to play a crucial role in explaining the time-varying patterns of conditional volatility of Chinese stock returns and should thus be accounted for when making volatility forecasts of future stock returns. On the other hand, our portfolio analysis suggests that adding the gold asset to a well-diversified portfolio of Chinese stocks improves its risk-adjusted performance and that stock risk exposures can be effectively hedged using gold. Moreover, we show that the VAR–GARCH model performs better than five alternative multivariate GARCH volatility models (Constant Conditional Correlation or CCC-, Dynamic Conditional Correlation or DCC-, and scalar, diagonal and full BEKK–GARCH) in

¹ See [Aroui et al. \(2012\)](#) for a detailed discussion of this literature.

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