

Interlinkages Between Hedge funds, Equity, and Precious Metals:  
An Empirical Investigation of the Asia Pacific region

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## **Introduction**

### **1.1 Motivation of the study:**

During the era of 1990s, there have been continuous and significant changes in the global financial markets. The changes have simultaneously affected the emerging and developing markets alike, especially in terms of capital movement and more importantly eliminating and mitigating the restrictions. Other significant changes have also been influenced by the technology advancements by opening the doors of the global markets for individual and corporate investors to trade and invest. It actually allowed the businesses to invest and grow in the matter of twenty four hours in anywhere in the world. This market liberalization and technology advancements points the direction toward the market linkages, integration, events and shocks that take place in one financial market can immediately affect the other parts of the world through linked businesses. This phenomena can directly affect the investors who derive the profits by diversifying their portfolios internationally. The question now is, if this is the scenario and the international financial markets are interlinked than the diversification of the portfolio and the benefit of international trading should be eradicated in the long term. And the investments with long term horizons may not get benefits from it (Garrett & Spyrou, 1999). The phenomena of financial markets crisis spillover to other countries was first systematically studied by Morgenstern (Roose & Morgenstern, 1959). He studied the effects of 23 stock market crashes on foreign markets and referred it to the “statistical extremes” of the stock market movement. Thus this study will explore the level of integration and connection between the hedge funds, equity markets in Hong Kong, Australia, China, Singapore, Japan, South Korea, India and New Zealand against precious metals market such as Gold, Silver, Palladium, and Platinum).

A general perspective towards hedge funds is the advantage they have over other investment vehicles and the impression that they have the immunity to market crashes and shocks and that makes them attractive to the investors. Indeed, numerous empirical studies have found low correlations between hedge fund returns and market returns (Agarwal & Naik, 2004). Knowing the dependence that exists between hedge funds and asset markets is particularly important, as crashes in this industry might lead to potentially devastating effects in financial markets, given the leveraged positions hedge fund managers take. In particular, policymakers have implicated hedge funds as having had a role in several crises, the best known of which is the near-collapse of LTCM in 1998 (Ben-David, Franzoni, & Moussawi, 2012). A motivation of attempting this study is based on the investigation of contribution of tail dependence among assets, and especially in examining whether different financial markets have a different behavior during global financial crisis of 2007 – 2008. The period of 2007 – 2008 were used to investigate the behavior of markets as they represent the shocks that had an influence on most of the world economies.

### **1.2 Significance of research:**

This research approach differs in a number of aspects from previous studies in the existing literature. First, the data sample covers a longer and more up to date time period -1997 to 2008 - than existing studies in the area. Second, the research will focus on studying the interlinkages and volatility spillovers between hedge funds, equity and precious metals markets in a combined manner, a clear distinctive feature of this study. Third, the relationship between these financial markets will be analyzed, with a particular emphasis on the emerging markets in Asia Pacific region. This kind of analysis is very innovative and unique, as it will be

covering a broad area, where the empirical evidence on the relationship between these markets will be obtained and most importantly it will be analyzed and discussed.

### 1.3 Research Objectives

1. To investigate the growth of hedge funds and commodity market (Gold, Silver, Palladium, Platinum) in Asia-Pacific in comparison with the growth in stock markets capitalization in different sub periods of pre, during, and post 2007 - 2008 Global Financial Crisis (GFC).
2. To investigate whether hedge funds and commodity market (Gold, Silver, Palladium, Platinum) can be used as hedge assets against the stock market movements of Asia Pacific.
3. To investigate whether the hedging effects are consistent for commodity market and hedge funds during the pre, during and post financial crisis of 2007 - 2008 in Asia Pacific countries.
4. To investigate the flight-to-quality behavior of investor by controlling the performance of one investment avenue.

### 1.4 Research Questions

- i.a. Does commodity market (Gold, Silver, Palladium, Platinum), in Asia Pacific have higher growth rate in comparison with the growth of stock market capitalization in different sub periods of pre, during, and post 2007 - 2008 GFC?
- i.b. Does hedge funds in Asia Pacific have higher growth rate in comparison with the growth of stock market capitalization in different sub periods of pre, during, and post 2007 - 2008 GFC?
- ii. Is commodity market (Gold, Silver, Palladium, Platinum) a strong or a weak investment option against pre, during, and post 2007 - 2008 GFC of stock market?
- iii. Are hedge funds a strong or a weak investment option against pre, during, and post 2007 - 2008 GFC of stock market?
- iv.a. Is commodity market a weak option against stock market crashes after controlling for the extreme poor performance of hedge funds?
- iv.b. Are hedge funds a weak investment option against stock market crashes after controlling for the extreme poor performance of commodity market?

### 1.5 Research methodology

According to the definition by (Baur & Lucey, 2010), if an investor is using asset as strong hedging strategy against the stock market, it must have a strong often significant negative co-movement against the stock market to serve the purpose. This is probably the most common measures of hedging. On the other hand if we find that the hedge assets and the underlying assets are correlated, we might easily find the co movement

of those two assets by means of linear relationship of these two variables. This is actually similar to the most common concept of delta hedge. In the empirical investigation, the general co-movement and linear relationship can be investigated through the Kendal's coefficient, linear regression or by Pearson's correlation.

To understand the co-movements among these three assets (hedge funds, equity, and precious metals), we need to estimate a multivariate distribution with these three random variables. The econometric method used to estimate the multivariate distributions will be discussed below, and the explicit form of the tail dependences, which are used to test the extreme conditions' co-movements, will be derived later in the study. These newly developed econometric techniques allow us to further understand the hedging and diversification roles of alternative investments.

## 1.6 Structure of the thesis:

The first approach of this study to analyze the interlinkages among different asset markets (hedge funds, equity and precious metals) with the special attention to the countries in Asia Pacific region. Thus, the study will focus on analyzing eight Asian markets, namely Hong Kong, Australia, China, Singapore, Japan, South Korea, India and New Zealand, for the period 1997 to 2017. The second approach is to deal with the hedge funds and equity markets' behavior with the focus on these market relationships during the Asian crisis (July 1997 to December 1998). Finally the analysis of precious metals volatility spillover effect will be presented against hedge funds and equity markets. The rest of this subsection is a brief discussion of each of the markets and regions included in this thesis.

## **Literature Review**

The interlinkages situation between different markets such as stock market, hedge funds, commodity markets such as, precious metals, has captured a lot of attention of academics and researchers throughout the world. This thesis covers these interlinkages among different markets and investment avenues in terms of stability and safe investments when the stock market movement is unstable and in financial distress situations.

This chapter is structured as follows: first of all the analysis of hedge funds and precious metals is outlined, where the most prominent findings are organized by the time period and the region of research. Therefore the literature review will comprised on the previous researched that has been done on the Asia pacific regions and the countries that are most active in hedge funds investments and will also explore the standing of precious metals among countries in Asia Pacific region.

In the second part, the detailed structure of the previous researched specific to precious metals will be formulated. Due to the lack of previous researches, the findings will be organized based on the time period. Finally the thesis will discuss and provide a potential future research outline and the major contributions to the literature by this thesis specific to this academic field of research.

### 2.1. Introduction:

In the past two decades, the growth of financial markets has been significantly increased in terms of the scope, its value and the total volume. Along with this massive growth, the financial markets has seen catastrophic market conditions as well, such as the Dotcom bubble, the subprime crisis, European crisis and

Global financial crisis, have emphasized and reminded the investors about the significance of financial risk management. Traditionally, researchers and the scholars in the field of asset pricing and other areas of finance tend to take risk as systematic based on the diversified investment portfolio and the fact that the assets has generally a co- movements with the market conditions. Thus, the most practical approach would be to hedge the investment portfolio by investing in derivatives with the co-movement with hedge, such as delta and gamma hedging, has been widely used to mitigate the risk and to control the market risk.

## 2.2.Hedge funds industry

Hedge funds of Asia Pacific region has been one of the fastest growing and developing sectors in universe of global hedge funds over the last decade, in terms of both number of funds and assets under management (AUM). Since the Asia-focused hedge funds have rapid inflows, the sustainability concern of risk-adjusted performance (alpha) of hedge funds has become more and more relevant. Global financial crisis had a significant impact on the hedge fund industry. It affected virtually every market and almost every type of asset class. Risk weighted performance evaluation on Asia-focused hedge funds in comparison to associated equity market during the depression have not been in research to a large extent. One possible reason could be the lack of available data for this period. Therefore, we are aiming to investigate and evaluate the risk weighted performance of hedge funds based on the countries which are considered as the top leaders of financial markets in Asia Pacific region in comparison to associated equity markets using a data sample that encompasses the profound crisis of 2007-2009.

## 2.3.Asia-Pacific Hedge Fund Industry:

Stock markets around the world have been significantly affected by the Global Financial Crisis that also increased the price volatility. Studies suggested that the market volatility had greater impact by the bad news spread as compare to the good news impact of the same magnitude (Black, 1976). Since 2000, the Asia-Pacific hedge fund industry has experienced the fastest growth within the industry of global hedge funds in terms of both the established number of funds and assets under management (AUM), estimated by EurekaHedge. The database of EurekaHedge also estimates the growth of the Asia-pacific hedge fund industry from approximately US\$30 billion in 2000 to US\$125 billion as of December 2010 in terms of (AUM) assets under management. This actually implies the compounded annual growth of almost 15% as compared to the assets under management of global hedge funds which comprises of roughly 14% during the same period. This also implies the contribution of the Asia-pacific in the global asset allocation framework.

According to Preqin Research, investors from all over the world and Asia accounts for just over 12% of all active institutional investor today as compared to the approximately 5% in 2002 (Research, 2009). Possibly the most significant investment groups in this region are sovereign wealth funds, with pool of massive investment capital readily available for hedge funds investment. For instance, the Government of Singapore Investment Corporation (GIC) has an investment of US\$9 billion in the hedge funds and almost US \$70 billion investment in alternative assets classes as a whole (Research, 2009). Nevertheless, the industry of Asia-Pacific hedge funds was not immune to the financial crisis of 2007-2009, as many of the hedge fund from Asia-Pacific has experienced large number of redemptions in the midst of the financial crisis. Subsequently many of those funds were forced to be consolidated or closed. At the same time the region had also experienced a sharp reduction in flow of investment capital. However, the report published by EurekaHedge says, that the rebound of the hedge fund industry in second half of 2009 attracted more capital and posted excellent returns.

Country	No. of Active Institutional Investors	Avg Current Allocation to Hedge Funds (As a % of AUM)	No. of Hedge Fund Managers	Hedge Fund AUM (\$bn)
Hong Kong	92	13.9	368	63.2
Australia	185	7.5	124	29.6
China	27	9.7	80	18.9
Singapore	64	14.1	181	17.6
Japan	118	13.0	56	9.9
South Korea	44	3.7	28	5.6
India	17	5.3	40	1.2
New Zealand	19	8.1	9	-

(Research, 2009)

This study will take Preqin Special Report: Hedge Funds in Asia-Pacific (Research, 2009) also as base to take sample of Asia focused hedge funds that are most active in hedge fund industry and analyze their activity as whole along with the leading countries in this region.

#### 2.4. Precious metals:

Precious metals such as gold and silver have combined history of almost 6000 years except platinum which is relatively recent and has a discovered back in 16th century when Ecuador has been discovered and after 100 years palladium. Precious metals are strongly associated with cultures and beliefs. Principally these metals comprised of two basic purposes medium of an exchange and a commodity such as jewelry, electronic dentistry, automotive and various other industry applications including nanotechnology sector.

March 1973, when major currency began to float against each other. This exchange system of currency floatation has been introduced to European banks and that affected the convertibility of the Dollar to gold and resulted a system collapse(Wang, Lee, & Thi, 2011). With the situation described above, the investors started to become more risk averse and seek flight-to-quality investment assets in order to mitigate their losses and protect their portfolio.

US pilot survival kit contained neither paper currency, nor any US Dollar but only gold. Therefore, the fact that even in finance distress situation and unusual circumstances, the gold apparently plays a role as a hedging asset and thus a safer investment option. The question arise here is to investigate the same characteristics for other precious metals as well.

## Data

Asian Equity Markets Data In this subsection, the main analysis has the purpose of investigating volatility spill overs between stock returns and exchange rate changes for five Asian markets, namely Hong Kong, Australia, China, Singapore, Japan, South Korea, India and New Zealand, for the period 1997 to 2017. The time period has been selected in order to be consistent with the analysis that will be done in the rest of the emerging economies, and also bearing in mind the fact that the Asian crisis deserves particular investigation.

### 3.1. Precious Metals Markets and the Asian Crisis Data

This section analyses precious markets interlinkages during the Asian crisis, focusing the investigation on the period 1997 to 2017. Again, for consistency motives it has been judged appropriate to analyze the whole sample and also to attempt the analysis of three subsamples. Thus, the first subsample spans over the years 1997-2000, the period of Asian crisis and dot com bubble. The second subsample will cover the 2007-2008 period when the crisis hit the markets, and finally, the last sample period covers the years till 2017.

### 3.2. Hedge Fund Sample:

We obtain data on hedge fund returns and characteristics from the Lipper/TASS database for the period 1997–2017. The sample includes both “live” funds that are in operation and “graveyard” funds that no longer report to TASS for reasons such as liquidation, fund merger, and closure to new investments. We include graveyard funds that are available in the post-1994 period.

TASS classifies hedge funds into ten style categories: convertible arbitrage, dedicated short bias, emerging markets, equity market neutral, event driven, fixed income arbitrage, global macro, long-short equity, managed futures, and multi-strategy. In terms of the number of funds, long-short equity is the largest strategy category, consisting of 2,342 distinct hedge funds, whereas dedicated short bias is the smallest strategy category, including only 45 distinct hedge funds. In our initial analysis, we group all hedge funds based on their exposures to tail risk. Later, we repeat the analysis for hedge funds within each investment style category.

## **Methodology**

### 4.1 MEST copula model

The copula model function is a method to couple and joint the one dimensional marginal distribution functions to their multivariate distribution functions. Due to the reason of separability of the dependence structures and the marginal distribution, a copula based model estimator use few parameters to accommodate the rich dependence structures. In addition, such model estimator facilitates the modeling of tail dependence to capture the stylized properties of the tails (Liu, Chang, Wu, & Chui, 2016). This section outlines the MEST copula model that is used to capture the dependence between the variables used in this study. This is the two stage study process. Firstly each return series will be fit into the GARCH Generalized Autoregressive conditional heteroscedasticity model and then calculate the implied standardized residuals. The cumulative distribution functions of these standardized residuals will then be used in second stage copula density estimator which is the feature of the MEST copula model.

According to (Sklar, 1996) a multivariate distribution function can be decomposed into marginal distributions and a copula function that incorporates all marginal distributions. For a continuous  $p$ -dimensional random vector  $\mathbf{X} = (X_1, \dots, X_p)$  with marginal density function  $f_1(x_1), \dots, f_p(x_p)$  and marginal distribution  $\{F_1(x_1), \dots, F_p(x_p)\}$ , that is a unique copula function that actually accommodate

$$f(x_1, \dots, x_p; a_1, \dots, a_p, \theta)$$



$$\prod_{i=1}^p f(x_i; a_i) c(F(x_1; a_1), \dots, F(x_p; a_p); \theta) \quad (1)$$

Where  $c(\cdot)$  is the copula density function. Practically the parameter for dependence  $\theta$  is usually estimated by the maximum likelihood method. Due to the nature of the financial data i.e., non *i.i.d.* series, the filtration of data becomes necessary to get *i.i.d.* series data which is the requirement for the maximum likelihood method estimation. To filter the data, the commonly used method is to use univariate GARCH type model to each marginal series. The standardized residuals will be denoted by the  $\hat{u}_i = i - 1, \dots, p$ . Their empirical cumulative distributions and their corresponding ranks will be used in the sub-sequent copula estimation method. Below, we shall propose a MEST copula model that will be used in our investigation of the dependence among the returns of assets.

#### 4.2 Estimation of the marginal distribution:

In order to estimate the dependence structures through MEST copula model the first step is to find out the individual marginal distribution. Due to the existence of the autocorrelation and autoregressive conditional heteroscedasticity among asset returns (Patton, 2004),(Patton, 2006; Reboredo & Rivera-Castro, 2014), a data filtration is necessary to get *i.i.d.* marginal series. In this study an AR ( $P$ )-GJR(1,1) model using the quasi-maximum likelihood estimation (Glosten, Jagannathan, & Runkle, 1993) has been used.

#### 4.3 Estimation procedure

To investigate the interlinkages between the hedge funds, equity and precious metals, one of the most important procedure is to measure the dependence structure among these three assets (hedge funds, equity and precious metals). This study is using the proposed MEST copula model to capture the fat-tailed properties and the possible skewness and to allow the flexibility towards the joint distribution of the hedge, equity and precious metals returns in the region of Asia Pacific. To investigate the variable parameters in the proposed MEST copula model, this study applies the canonical maximum likelihood method proposed by (Genest & Ghoudi, 1995).

The procedure is in the following order:

1. Model selection and estimation of parameters of marginal models for each return
2. Non-parametric transformation of filtered residuals
3. Estimation of parameters of the MEST copula.

### **Expected Contributions**

In the recent past, where commodities prices have first trended sharply upwards and have subsequently suffered an adjustment due to the current economic circumstances, it is plausible to think that after the world economy recovers, the upward trend in these markets will come back and will tend to persist for the coming years. This assumption is based on the fact that the demand for precious metals has been and will continue to be deeply affected by the needs of emerging economies located in Asia Pacific region (Hong Kong, Australia, China, Singapore, Japan, South Korea, India and New Zealand).

The correlation and integration among financial markets is very important for portfolio managers in the composition of their portfolios. Associating this statement with this research it is possible to explain markets

connections as follows: if the results show that hedge funds, equity markets and precious metals are not interlinked, implying that the markets are not moving together in the long-term, investors can build their investment portfolios wisely, trying to exploit the differences between countries.

Finally in terms of this study objective, the interlinkages needs to be identified and the extent of the dependency in order to utilize the full potential of the diversified portfolio. In global economies and after all the changes in the global financial markets such as the introduction of the euro in the financial markets in 1999, - with the objective of eliminating transaction costs, facilitating capital flows and therefore allowing for an easy movement of capital between equity markets – it would not be unreasonable to think that the global equity markets should become more interlinked, a fact that, if that happens than it would have direct effects on the investor's portfolios and decision making. For this reason, this study tried to provide the evidence of slow integration, and not homogeneity of the situation around the world, and there should be still opportunities for the investors to create profitable portfolios.

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