

# Chapter 1

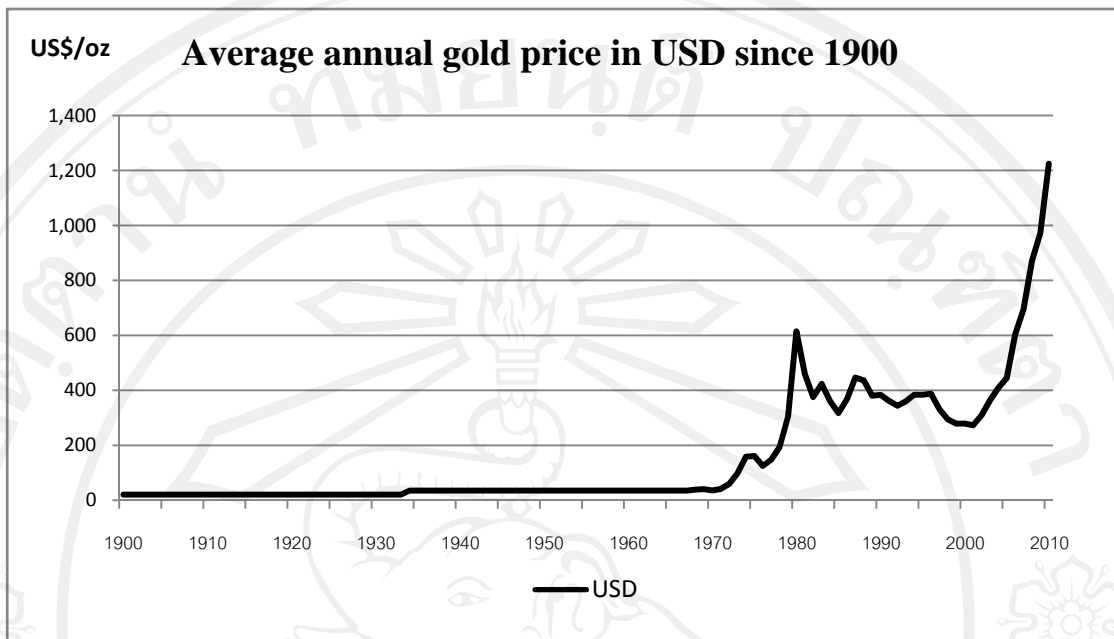
## Introduction

### 1.1 Background and Rationale

#### 1.1.1 Demand for gold versus gold prices in the United States

Gold is a major asset in terms of investment all over the world because it has served as one of the most stable monetary standards which have played a crucial role in the global economy. However, gold prices have been fluctuating since 1914. Historically, the United States has been determining the price of gold. One ounce of gold was fixed at an estimated price of \$20.67 US dollar for many decades until 1934. Subsequently the price of gold was raised to about \$35 US dollar per ounce. In 1968, a two-tiered pricing structure was established, and by 1975 the price of gold was allowed to fluctuate (L.S.Wynn, 2011). Presently, the price of gold has reached to about \$1,900 US dollar per ounce. Fluctuating gold prices has given rise to a growing speculation in gold.

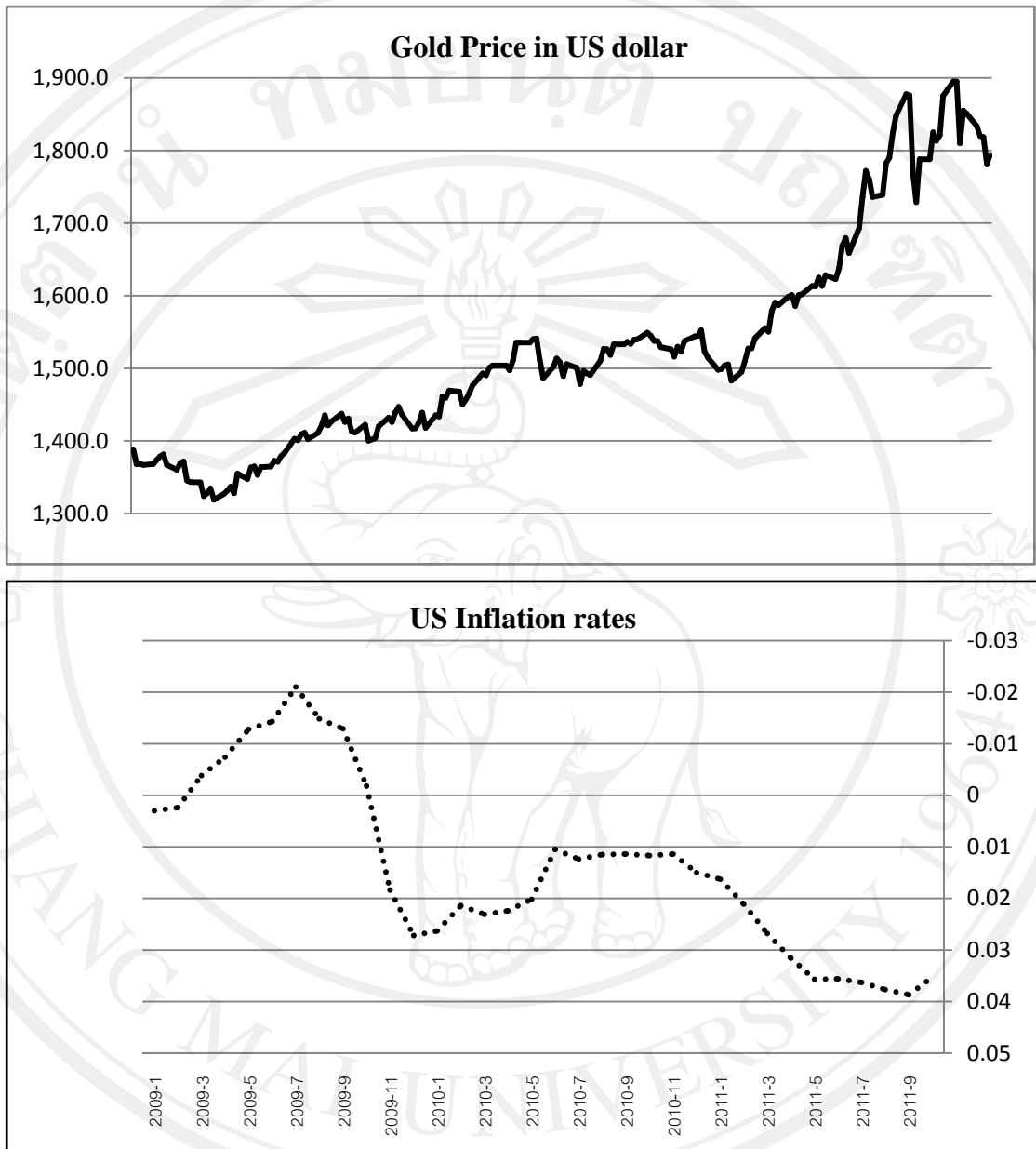
The following chart shows annual average gold prices from 1914 to 2009. However, due to geo-political events between 1970 and 1990, a dramatic rise and fall in gold prices were caused by certain events such as Russian invasion of Afghanistan in Dec 1979, Iran hostage crisis and, a host of strong and unconventional policy actions and market events (the Fed under Volcker increased fed funds rate from 13% to 20% for a short period in Q1 1980, and Hunt's brothers silver market cornering failed due to their inability to meet a margin call during falling silver prices in March 1980, exacerbating the fall in precious metals). All of which events resulted in the roller coaster gold prices in 1980. (True North's Instablog, 2010)



Source: Reuters DataStream, World Gold Council

Figure 1.1 Average Annual Gold Prices in US dollar from 1900 to 2010

Comparing gold prices to US real rate, the basic fundamentals in this inverse relationship are that when US monetary policy is looser, real rates fall and therefore demand for gold rises. Figure 2 shows that US real rates are in relation to gold prices, hence gold prices have an inverse relationship to US real rates. However if the US does embark on further monetary easing, or market expectations of easing increase, then US real interest rates could fall still further, implying an even higher gold price (Bob Kirtley, 2011).

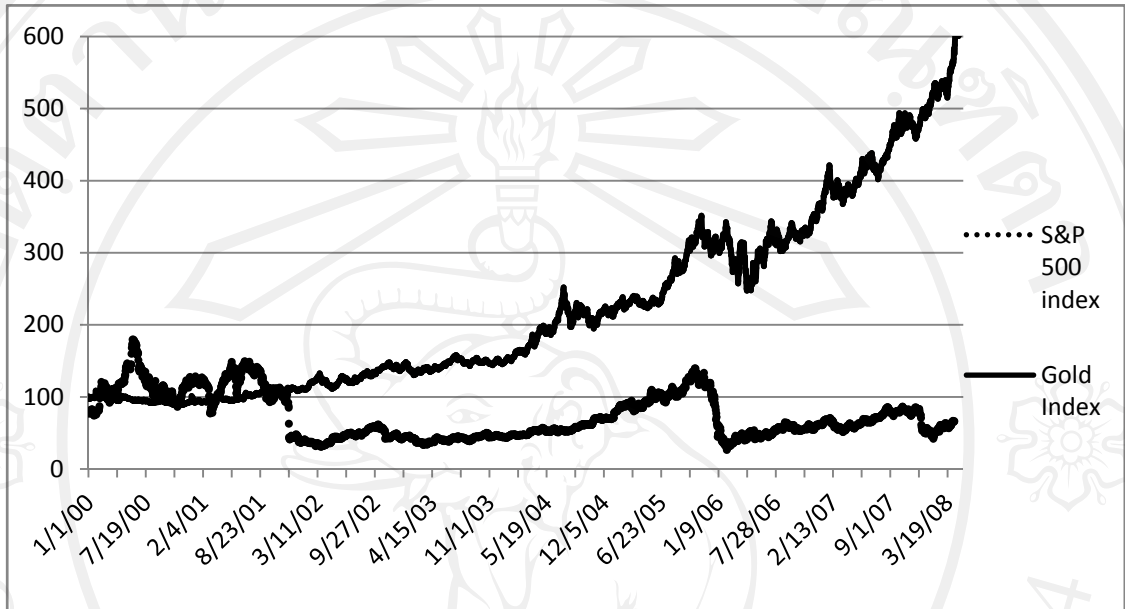


Source: Falling Inflation, the Most Bullish Sign for Gold, 2011

Figure 1.2 Inverse Relationship between 10 Year US Real Rates and Gold Price in 2011

Moreover, figure 1.3 shows how gold index and S&P500 index fluctuated in the last decade. The index of gold prices in US dollar is more likely to increase than the index of S&P 500 from 2001 to 2011, using a base index as of January, 1 2001. It

can be concluded that the rate of return on gold price is higher than the rate of return in S&P 500.



Source: World Gold Council

Figure 1.3 Gold and S&P 500 in US (1 Jun 2001=100)

According to Table 1.1, the performance on various assets in US; Gold (US\$/oz), DJ UBS Comdty Index (Dow Jones-UBS Commodity Indexes), Brent crude oil (US\$/bbl), BarCap US Tsy Agg (The Barclays Capital Aggregate Bond Index), BarCap US High Yield (The Barclays Capital U.S. High Yield), S&P 500, the total return indices of gold is more interesting than other assets, it gives a -2.3% of 1-month investing, a 4.8% of 3-month investing, a 6.8% of 6-month investing, a 20.8% of 1-year investing, a 62.1% of 3-year investing, 150.2%, a 17.5% of 3-year CAGR (compounded annual growth rate) investing and a 20.1% of 5-year CAGR investing, respectively. Comparing to the total return indices of S&P 500, it gives only one more return at 30.7% of 1-year investing, others are less than gold return.

Table 1.1 Performance on Various Assets in US

|         | Gold<br>(US\$/oz) | Dow<br>Jones-UBS<br>Commodity<br>Indexes | Brent<br>crude oil<br>(US\$/bbl) | The Barclays<br>Capital<br>Aggregate Bo<br>nd Index | The Barcla<br>ys Capital<br>U.S. High<br>Yield | S&P 500 |
|---------|-------------------|--|----------------------------------|---|--|---------|
| 1-month | -2.3%             | -5.0%                                    | -4.3%                            | -0.3%   | -1.0%  | -1.7%   |
| 3-month | 4.8%              | -6.7%                                    | -4.8%                            | 2.4%  | 1.1%   | 0.1%    |
| 6-month | 6.8%              | -0.9%                                    | 20.8%                            | 2.6%  | 5.1%   | 6.0%    |
| 1-year  | 20.8%             | 25.9%                                    | 51.2%                            | 2.2%  | 15.6%  | 30.7%   |
| 3-year  | 62.1%             | -31.5%                                   | -19.8%                           | 16.1%   | 43.1%  | 10.3%   |
| 5-year  | 150.2%            | 1.3%                                     | 53.2%                            | 35.6%   | 56.7%  | 15.4%   |
| 3y*CAGR | 17.5%             | -11.9%                                   | -7.1%                            | 5.1%  | 12.7%  | 3.3%    |
| 5y CAGR | 20.1%             | 0.3%                                     | 8.9%                             | 6.3%  | 9.4%   | 2.9%    |

\*CAGR = compounded annual growth rate (i.e., the geometric average rate of return over the corresponding period).

Source: Barclays Capital, World Gold Council; calculations based on total return indices unless not applicable.

As a result, table 1.2 indicates that the percentage change of demand for investment is at the highest, as estimated 36% in 12-month ending September 2011 to 12-month ending September 2010. This rise may be the result of the percentage increase of total bar and coin demand in 2008 to 2009, which is a proportion of 74%. However, gold demand for jewelry is at the highest at a \$79,399 US dollar in 2010. Therefore, gold demand for jewelry, Technology and investment throughout in 2010 was on the rise, excepting Exchange Traded Funds and similar products.

Table 1.2 Gold Demand<sup>1</sup> (US million)

|  | 2009    | 2010    | Percentage Change of the third quarter between a year of 2010 and 2011 | Percentage Change between a year of 2010 and 2011 <sup>2</sup> |
|--|---------|---------|--|--|
| <b>Jewelry</b>                         | 56,695  | 79,399  | 24   | 31   |
| <b>Technology</b>                      | 12,811  | 18,363  | 39   | 30   |
| Electronics                            | 8,595   | 12,867  | 40   | 32   |
| Other industrial                       | 2,568   | 3,579   | 40   | 31   |
| Dentistry                              | 1,648   | 1,916   | 26   | 15   |
| <b>Investment</b>                      | 43,555  | 59,730  | 84   | 36   |
| Total bar and coin demand              | 24,264  | 45,254  | 79   | 74   |
| Physical bar demand                    | 15,104  | 33,409  | 84   | 91   |
| Official coin                          | 7,319   | 8,367   | 87   | 33   |
| Medals/imitation coin                  | 1,841   | 3,477   | 14   | 42   |
| ETFs and similar products <sup>3</sup> | 19,291  | 14,476  | 119  | -66  |
| <b>Gold demand</b>                     | 113,061 | 157,492 | 48   | 32   |

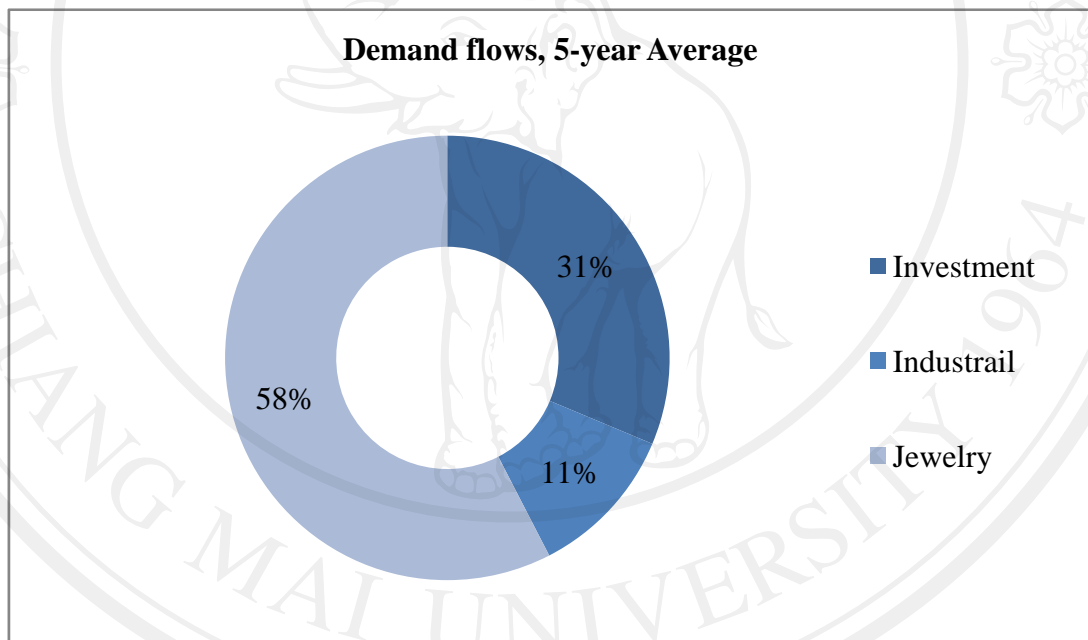
<sup>1</sup>: Gold demand excluding central banks

<sup>2</sup>: Percentage change, 12 months ended Sep 2010 vs 12 months ended Sep 2011.

<sup>3</sup>: Gold Exchange Traded Funds and similar products including: Gold Bullion Securities (London), Gold Bullion Securities (Australia), SPDR Gold Shares (formerly streetTRACKS Gold Shares), NewGold Gold Debentures, iShares Comex Gold Trust, ZKB Gold ETF, GOLDIST, ETF Securities Physical Gold, ETF Securities (Tokyo), ETF Securities (NYSE), XETRA-GOLD, Julius Baer Physical Gold, Central Gold ETF, Credit Suisse Xetra and Dubai Gold Securities.

Source: LBMA, Thomson Reuters GFMS, World Gold Council

In addition, figure 1.4 shows demand flows in 5-year average of gold during 2005 to 2010. Jewelry takes accounts for over two-thirds of gold demand, which is around \$55 billion US dollar, making it one of the world's largest categories of consumer goods. Second, a portion of investment demand is transacted in the over-the-counter market, therefore not easily measurable. However, there's no doubt that investment demand in gold has increased considerably in recent years, because the last five years to the end of 2009 saw an increase in value terms of around 119%. Last, Industrial, medical and dental technology accounts for around 12% of gold demand.

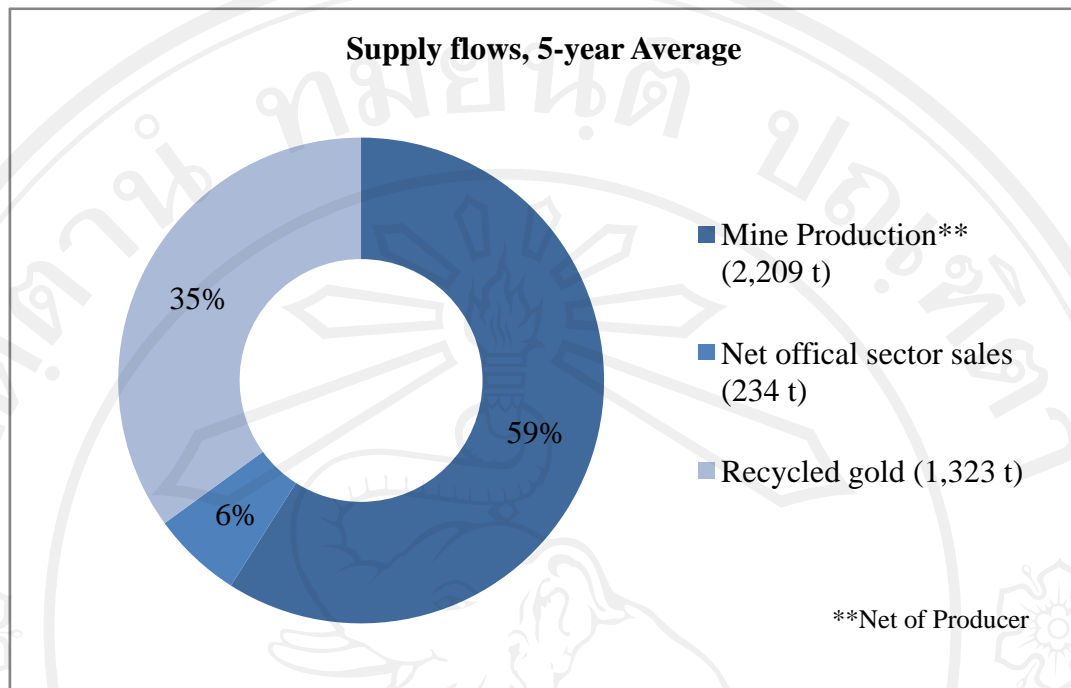


Source: World Gold Council

Figure 1.4 Demand Flows, 5-year Average during 2005 to 2010

Moreover, figure 1.5 shows a proportion of gold flows. Mine production takes an account for 59% of total because there are several hundred gold mines operating worldwide ranging in scale from minor to enormous. Second, Recycle gold takes an account for 35% and 6% for net official sector sales.





Source: World Gold Council

Figure 1.5 Supply Flows, 5-year Average

### 1.1.2 Value at Risk (VaR) Estimator and Extreme Value Theory (EVT)

As was mentioned above, gold prices have significantly increasing all the time. However, gold prices have experienced both positive and negative side depending on the different events. To the most beneficial investment in gold, this study has investigated an evaluation of Value at Risk of gold price return at a given period.

One of the powerful instruments in financial market is Value at Risk estimator (VaR). Value at Risk has been established as a standard tool among financial institutions to depict the downside risk of a market portfolio. It measures the maximum loss of the portfolio value that will occur over a given at some period at some specific confidence level due to risky market factors<sup>1</sup>. Moreover, Value at Risk is a statistical measure the maximal possible losses which can be incurred in investment activities and losses that surpass the value of the Value at Risk happen

<sup>1</sup> Martin Odening and Jan Hinrichs, 2003 Quoted in Jorion, P., 1997.



only with a certain probability<sup>2</sup>

The question for Value at Risk is that what is the most we can lose on gold investment. Value at Risk tries to provide an answer, at least within a reasonable bound. This approach is a statistical measure the maximal possible losses which can be incurred in investment activities and losses that surpass the value of the Value at Risk happen only with a certain probability (Linsmeier et al., 2000). It estimates the future distribution of returns. This could result in the holding of excessive amounts of cash to cover losses. Value at Risk statistic has three components namely: a time period, confidence level and a loss amount (or loss percentage), for examples the question:

- What is the most I can expect to lose in dollars over the next month with a 95% or 99% level of confidence?
- What is the maximum percentage I can expect to lose over the next year with 95% or 99% confidence?

With many different approaches and models, namely, The Historical Simulation, The Variance-Covariance Method, Monte Carlo Simulation, Martin Odening and Jan Hinrichs<sup>3</sup>, investigate by using Extreme Value Theory to estimate Value at Risk, stated that this article examines problems that may occur when conventional Value at Risk estimators are used to quantify market risks in an agricultural context. For example, standard Value at risk methods, such as variance-covariance method or historical simulation, can fail when the return distribution is fat tailed. This problem is aggravated when long-term Value at risk forecasts is desired. Extreme Value Theory is proposed to overcome these problems. Gençay and Selçuk (2004) investigated an Extreme Value Theory to generate Value at Risk estimates and study the tail forecasts of daily returns for stress testing. Neftci (2000) found that the extreme distribution theory fit well for the extreme events in

<sup>2</sup> Vladimir Djakovic, Goran Andjelic, and Jelena Borock, 2010:340 Quoted in Linsmeier TJ, Pearson ND, 2000.

<sup>3</sup> Martin Odening, Jan Hinrichs, 2003. "Using extreme value theory to estimate value-at-risk." *Agricultural Finance Review* 63: 55 – 73

financial markets. Bali (2003) determined the type of asymptotic distribution for the extreme changes in U.S. Treasury yields. In his paper, the thin-tailed Gumbel and exponential distribution are worse than the fat-tailed Fréchet and Pareto distributions.

Based on those applications of Extreme Value Theory, which is the appropriate model that matches the purpose of this study best. This paper focuses on risk evaluation of gold price return and the tail distribution of extreme events in gold price returns in US dollars.

### **1.2 Objective of the study**

One of the popular models for evaluated Value at Risk is Extreme Value Theory. Therefore, this study aims at investigating the value at risk of the daily gold price return by Extreme Value Theory. Moreover, this study will discuss how to calculate Value at risk using Block Maxima model (BM) and Peak Over Thresholds (POT). According to these investigations the objectives are as follows;

- To evaluate and analyze Value at Risk of the daily gold price return by Extreme Value Theory
- How much does the maximum loss involved in gold investing at a given period

### **1.3 Scope of the Study**

This study attempts to analyze Value at Risk of the daily gold price return by Extreme Value Theory. It focuses on the 2 method evaluation in Extreme Value Theory; block maxima method modeled by the Generalized Extreme Value (GEV) distribution and peak over threshold models considering large values over some high threshold, which can be simulated by the Generalized Pareto Distribution (GPD). This study uses daily gold price in US dollar over the period of January 1, 1985 through August 31, 2011. The source of gold prices is from World Gold Council. The sample size of the study is 3,181 observations of daily loss gold price return.

By evaluating Value at Risk of the daily gold price return, this study will discuss the maximum loss of gold investing at a given period.

#### **1.4 Outline of the Chapters**

The thesis is organized in 5 Chapters. The general introduction explained in Chapter 1 and Chapter 2 reviews the related literature and theoretical background. The methodology explained in Chapter 3. Chapter 4 includes the empirical results and the recommendations. Conclusion is explained in Chapter 5.