Performance Analysis for some Asset Classes and Investment Theories

Abstract

We choose stock, bond, exchange rate, and gold as our main asset classes to exemplify the changes in Australian and global economy due to GFC. Among them, the Australian stock market has fluctuated a large proportion due to the market collapse in the US stock market. As for the bond market, we use the US treasury bond to symbolize the situation in the Australian bond market. It can be observed that the bond price has had a large drop in GFC. The bond yield represents the risk-free rate to some extent, and the government tried to stimulate the recessive economy and persuade people to consume more in this time. Then as for currency, compared to other foreign currencies, USD is a relatively stable currency in financial crisis. The other exchange rate like CNY, AUD, and HKD suffered from a significant decrease due to the change in the dominated market. Finally, Australian gold market was not largely impacted by GFC, the change on the gold price rely on the government policies.

In terms of investment theories, we use Modern Portfolio Selection Theory (MPT), Capital Asset Pricing Model (CAPM) and Behavioral Bias to discuss the performance of four asset classes above. After scientific analysis, we can conclude that MPT and CAPM are not-sensible-enough theories because both of them have strong assumptions in their nature. Behavioral finance by applying the concepts of behavioral biased is possible to provide a reasonable perspective in the large events in GFC.

1 Introduction

This essay describes the situation of financial investments during the Global Financial Crisis (GFC). It is known that the market has experienced a huge fluctuation and different asset classes showed different trends during this period. We make use of original data of specific specific assets and analyze the trends of them. After getting the results, we imply them with some well-known modern financial theories to discuss whether these theories are reasonable and explicable in these results. Each of the theories has held different features to GFC and has both advantages and disadvantages in discussing the situation with reality.

2 Performance analysis of changes in Asset Classes

2.1 Government bonds

We use US treasury as the benchmark for government bond. From Figure 1 we observe an obvious decrease in US short-term treasury yields (the blue line) between 2001 and 2004. This is the US government's response to the implosion of the high-tech recession in 2001 by actively reducing interest rates (Investment, 2014). Such action turned out to be effective and the economic system became healthy again until the start of GFC. A similar trend is observed for long-term treasury bonds but with less volatile, resulted from the relative stability of the capital market versus money market. From 2007 to 2009, historically lowest rates are observed, as a sign of recession in the world's No. 1 economy. Therefore, bond yields have also fallen in Australia (Figure 2) and other countries around the world. During the financial crisis, investors tend to buy large numbers of government bonds for safety over other assets. Meanwhile, the government would like to borrow huge amounts at a low rate to pay for bank bail-outs and encourage economic activities. After the colossal monetary and fiscal stimulus, the GFC ended in 2009, but the economy continued with floundering growth until today.

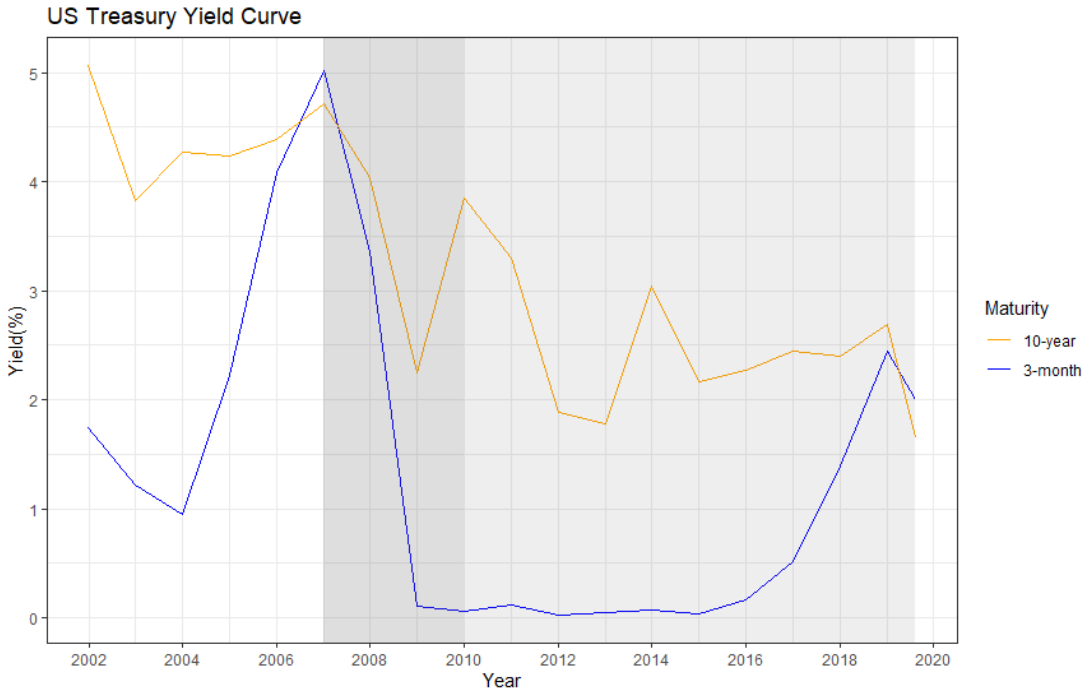

Figure 1: 3-month (blue solid line) and 10-year (yellow solid line) US Treasury yield curve

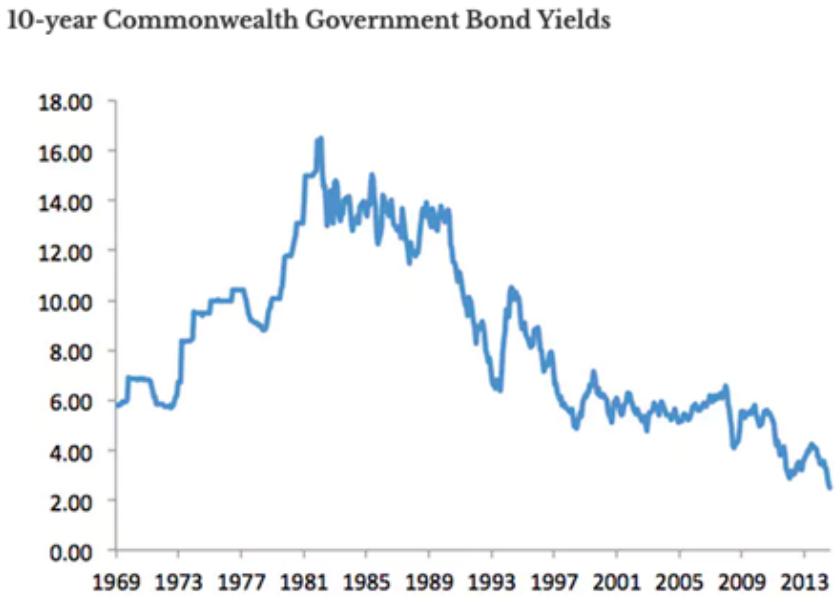

Figure 2: The 10-year Commonwealth Government Bond issued by Australia government: The horizontal axis indicates the year, and the vertical axis is the corresponding bond yield in percentage

2.2 Foreign exchange rate

As figure 3 shows that, Australian currency underwent a robust appreciation against the US dollar (USD) in the last decade, except for the intense depreciation from June to October 2008. The rise in exchange rates mainly resulted from the prosperity of Australian mining industry (P Garton, 2019), while such fall against the USD was observed in most countries that were not at the center of the crisis during this time (MK, 2012). More surprisingly, all depreciated currencies were quickly and strongly reversed within one year. One possible explanation is that the global economic crisis introduced excessive uncertainty and arose risk aversion among investors. Hence US dollars, generally regarded as the most liquid haven currency, became more attractive and expected to retain or increase value during hard times. As the risk aversion receded along 2009 the exchange movement would reverse, because devaluation generated great interest rate differential to make carry trades profitable, and thus exerts upward pressure for depreciated currency.

2.3 Stock

The fluctuations of stock indexes (Hang Seng Index, Nikkei 225, S&P 500 Index, ASX 200 and SSE Composite Index) are typical indicators to describe the whole story of GFC in the globe. In general, the trend of Australia stock market (ASX200) has followed by the dominated US market (S&P 500). First, from 2001 to 2006 most stock indexes have slightly increased before GFC. After ASX200 hitting record high in 2007 at 6870.1, stock indexes are observed a forewarning of a weak recession due to the influence of slowdown in the housing market the US stock market. In September 2008, the bankruptcy of Lehman Brothers and sequent "Black Friday" caused partially frozen stock market in the US. The Dow fell 777.68 on September 20, which is the most in any single day in history (reference link). Under such emergent variation, stock indexes in other countries have been impacted by the drastic drop in US stock market, for example, simultaneously stock return in Australian market dropped 41.29% at the

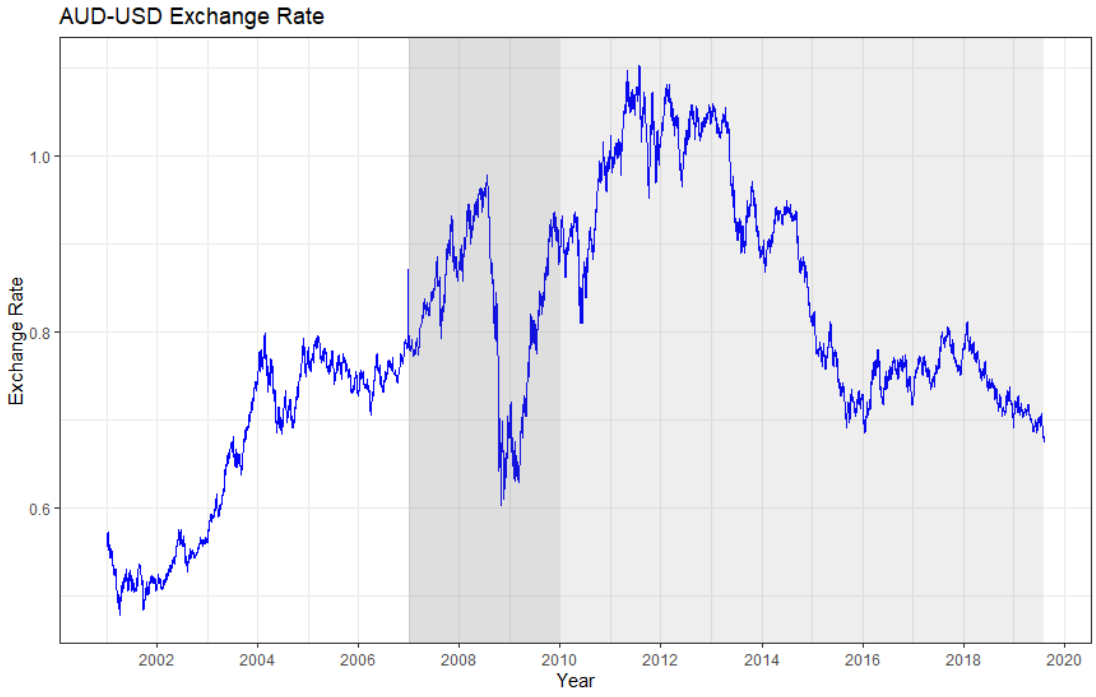

Figure 3: The Australian dollar to US dollar exchange rate as a function of time

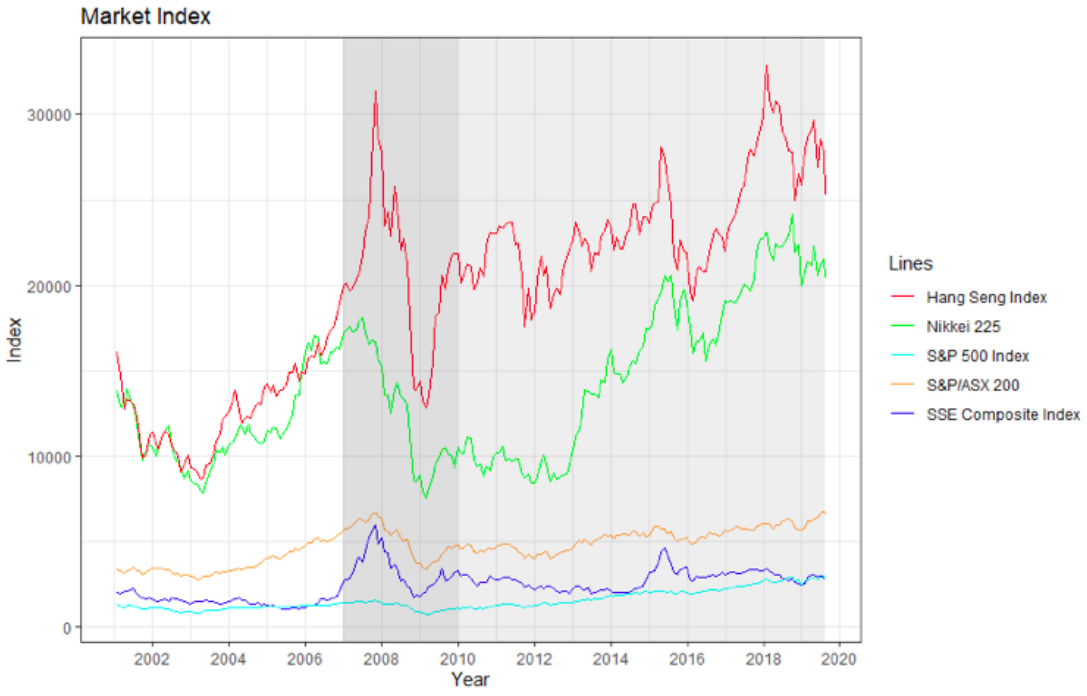

Figure 4: The Global stock market indices

end of 2008. Soon afterward, on January 2019, the US government tried to tackle the recession throughout Obama's economic stimulus plan, which regained the confidence from investors and stopped the market panic. The world economy gradually woke up and rebounded after GFC, for example, US shares made it back to their 2007 high in 2013. Similarly, the ASX200 hit 6,870.1 in July 2019 – almost 20 points more than its previous high point of 6,852, set on 1 November 2007.

2.4 Gold

According to two trend charts (Figure 5), the history index of the gold price to Australian dollar illustrated a prosperous gold market in the past nearly two decades. Unlike the stock market, XAU-USD exchange rate had just minor influence on XAU-AUS exchange rate. Since 2001, the development of Australian gold price can be divided

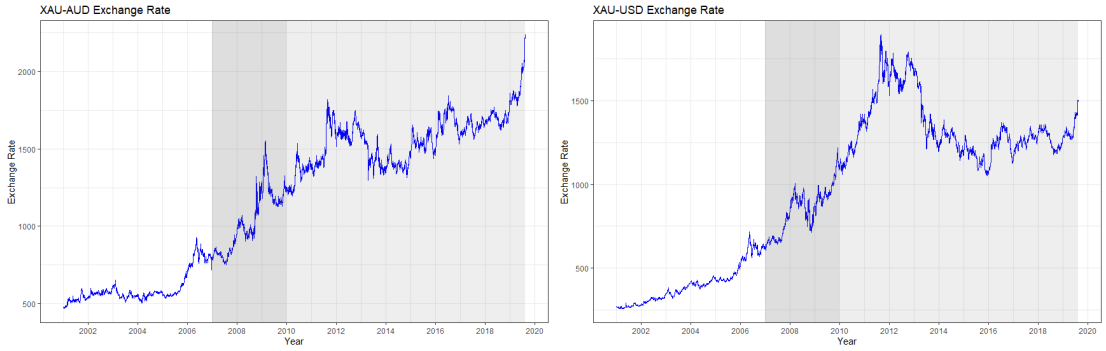

Figure 5: XAU: The ISO 4217 standard code for one troy ounce of gold, considered as a currency.

into three stages. In the first period from 2001 and 2007, the global gold market was in the growing stage. The explosion of the new market like Middle Asia and India significantly triggered the increasing demand of gold in the global market and stimulated the gold price so that both Australia and US gold market presented a steadily increasing trend. Then during GFC, although US gold price dropped at around 30% in October 2018 due to the implication of subprime mortgage crisis, Australian gold price climbed up to $1324.08851 on 2009 after experiencing minor decrease on 2008 due to US market. After GFC, the global gold prices surged up and hit the record respectively in September 2011 until the emergence of Cypriot financial crisis in 2012, because Cyprus had to undersell the gold to replay the liability, which suddenly decreased 4% global price market to bridge financing gaps. Afterward, many governments in the world including Australia tried to control the gold price by releasing sale restriction so that the gold price declined due to policy effect. Recently, Australian gold market rebounded to a normal state and showed a rising inclination in the past five years.

3 Performance of investment theories

The global financial crisis has caused many questions about the validity of prevalent investment theories. In this section, we mainly discuss Modern Portfolio Selection

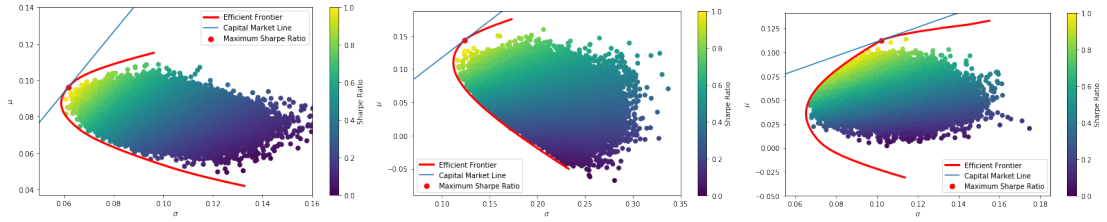

Figure 6: Left: before GFC; Middle: during GFC; Right: after GFC. All available historical data of risky assets has been taken into consideration. The data points (σ, μ) are generated from different assets allocation by uniformly random sampling. The colour map of the data points indicates the corresponding Sharpe ratio. There are 100,000 such samples in total. We derived the efficient frontier by minimizing σ, a scalar function of allocation, using the numerical algorithm of Sequential Least Squares Programming (SLSQP).

Theory (MPT), the Capital Asset Pricing Model, and the Behavioural Bias Theory.

3.1 Modern Portfolio Selection Theory (MPT).

MPT is a theory pioneered by Harry Markowitz in 1952 on how risk-averse investors can build an optimizing portfolio by finding minimum risk given a required expected return. To discuss how MPT interacts with the GFC, we construct a portfolio consisting of n assets from four asset classes in section 1, with weight vector $\vec{x}$ where each of its element x_i indicates the weight of corresponding asset, and hence the expected return can be given by

$$\mu = \sum_i x_i \mu_i, \tag{1}$$

where μ_i is the expected return of the i^{th} asset. Similarly, the expected standard deviation of the given portfolio with given weights is

$$\sigma = \sqrt{\sum_i x_i^2 \, \text{Var}(\mu_i) + 2 \sum_i \sum_j x_i x_j \, \text{Cov}(\mu_i \mu_j)}. \tag{2}$$

From the three plots, we observe the distribution changes of allocation points for

periods before, during and after the GFC. In figure 6 (left) the expected return of most portfolio allocations are between 6% and 11%, while the risks lie between 6% and 16%. In 6 (middle) the period's expected return moves downwards and largely to the right, indicating a loss in return as well as much higher volatility of all possible combinations of assets. The distribution even moves further away from the efficient frontier, and a greater proportion of dark color points (Sharpe ratio closer to 0) reveals unsatisfying risk-adjusted return. The distribution in figure 6 (right) moves backward, which demonstrates the movements in figure 6 (middle) is mainly because of the crisis. The change of efficient frontier for the three periods has the same pattern as distribution of allocation points, that the risk of optimized portfolio sharply goes up during the crisis and then back down after 2009. It is mainly because increased correlations across a wide range of assets are observed during the GFC compared to pre- and post-crisis periods.

However, a notable flaw of MPT is that, all analysis relating to the efficient frontier built is based on the mean-variance assumption and that all investors are rational and risk-averse in investing. These are not practical in reality. Evidence can be observed from plots, that allocation points seldom lie on the efficient frontier, the optimized line, and they will go even further during a crisis. Some of the explanation can be found in section 3.3 the behavior bias theory. Therefore such impractical characteristics usually prevent us from analyzing real-life investment performance completely following MPT without any other tools.

3.2 Capital Asset Pricing Model (CAPM)

CAPM can be regarded as a simplified model of portfolio theory since MPT considers the way to diversify portfolio given any pattern of risk correlations, while CAPM is a one-factor model assuming that all securities are correlated with "the market". The model for the portfolio-wide expected return in CAPM is defined by

$$E = \alpha + \beta \times (\text{market risk premium}) + \text{idiosyncratic term} \tag{3}$$

where the idiosyncratic term is diversifiable and assumed to be uncorrelated with the market performance. The main point in such a model is that the variance of the portfolio's idiosyncratic term is less than the weighted sum of all components' idiosyncratic variances. Therefore, we can conclude from CAPM that the greater the degree of diversification, the less the risk of the portfolio as a whole.

When looking at the feature of securities during the crisis, we could observe that the underlying factor exhibits a large movement because of the market turmoil. Even if we assume the alpha and beta of idiosyncratic terms of individual securities remain constant throughout the GFC, almost all asset classes and securities will move in the same direction. Thus, in this case, the systematic risk exerts much more influences on unsystematic risks compared to normal periods.

The limitation of CAPM is mostly the same as that of MPT, which is also based on a set of unrealistic assumptions. Besides, CAPM is a one-factor model assuming the idiosyncratic part of one security is not correlated with that of another. In reality, the systematic terms of a different combination of securities are themselves related. Several paper works after the introduction of CAPM provided convincing evidence, for instance, the existence of industry factors presented by King(1966), and the multi-factor model was derived to overcome such problem.

3.3 Behavioral Bias Theory

Behavioral bias also plays an important role in corporate finance, especially during GFC. From its basic nature, behavioral finance is the study that illustrates the psychology of the investors and financial analysts and the reason why they buy and sell investments, which can have a significant impact on the market expectation. It is common sense that people also make a decision based on their previous experience. However, too much reliance on experience may lead to forecasting or memory bias. From the trend of the stock market between 2001 and 2007, many investors including specialized analyst from large financial institutions held the optimistic opinion that stock market was impossible to recess in short time due to the increase of mortgage and demand.

They overestimated the precision of their beliefs and forecasts, and also overestimate their abilities to buying more stocks and sell more CDO and ABS to investors. With the times in 2006 and 2007, both buyer and seller immerse in the sweet dream and were overconfident on the stock market. The things had completely changed after a declaration of bankruptcy by Lehman Brothers on September 15th, 2008. The most Wall Street traders were called in to close the transaction with Lehman Brothers. People suddenly realized that there was something wrong with this market bubble. Terrified investor in panic undersold the stocks in a short time to save their money, the market experienced a large drop in this week. On Wednesday, September 17, money market funds lost $144 billion. Simultaneously, the price of house market dropped at the same time. People who bought home mortgage may have anchoring effect due to their worthless house so that they stopped to pay the installment and more and more houses are charged by the bank. The bad circle occurred, even with investors who had the ability not to make default due to representatives. In this representative, people tended to act as if a small sample like Lehman Brother was a representative of the large financial institutions in the global financial market.

Fortunately, many governments in the world took the positive measures to tackle the influence of GFC. The economy gradually recovered after 2010. Investors started to make investments and be confident on market economy. Using the prospect theory in behavior finance, people tried to hold higher utility with the given level of wealth. With the time by, the current economy from the stock market perspective has turned back the level before GFC.

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