The Role of Gold in Asset Allocation Analysis

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Abstract

This thesis starts with the investigation of gold's beta in the classic Capital Asset Pricing Model (CAPM). The classic CAPM is applied to estimate gold's beta. Then, a Markov-switching CAPM is developed to investigate whether gold is a safe haven. We find that gold is consistently a hedge; rather than having two distinct states, hedge or safe haven, it is always a hedge.

This thesis secondly analyses whether gold, government Treasury bills (T-bills), Overnight Index Swaps (OIS) or Interbank Offered Rates (IBOR) can be a risk-free asset in the classic CAPM and the Black (1972) zero-beta CAPM in the UK, the US, China, Japan, and India. The Wald test and the Likelihood Ratio Test (LRT) are used to assess whether a range of assets qualify as zero-beta assets for each company in FTSE 350 (UK), S&P 500 (US), SSE 180 (China), NIKKEI 225 (Japan) and SENSEX (India) in the zero-beta CAPM. We find that there is no universal proxy for the risk-free asset for all countries.

For the third empirical analysis in this thesis, we attempted to construct a risk-free portfolio using gold, T-bills, silver, platinum and palladium in the UK and US. The portfolio construction methods used are for portfolios in a one-time period, and portfolios in continuous time. The results show that a risk-free portfolio can be constructed with weights in real numbers. Then, we tested whether a zero-beta portfolio can be found based on the zero-beta CAPM using all the possible combinations. The results show that the risk-free portfolios are also tested as the zero-beta portfolio in the zero-beta CAPM in the UK. But the risk-free portfolios constructed are not found to be the zero-beta portfolios in the US. This also provides evidence to show that risk-free portfolios and zero-beta portfolios are not the same.

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Declaration

I declare that this thesis is a presentation of original work, and I am the sole author. This work has not previously been presented for an award at this, or any other, University. All sources are acknowledged as References.

Chapter 4 is published as “Is Gold a Sometime Safe Haven or an Always Hedge for equity investors? A Markov-Switching CAPM approach for US and UK stock indices” in International Review of Financial Analysis by He, O’Connor and Thijssen (2018).

Chapter 1: Introduction

1.1 Introduction

Modern Portfolio Theory (MPT) was developed by Markowitz (1952) and presented the first theoretical approach to show how to allocate funds in a portfolio while taking risk into account, showing mathematically how owning a portfolio with different assets is less risky than owning one asset. Markowitz's work showed how to optimally reduce the risk in the investment portfolio as well as how to optimise a portfolio risk return relationship.

In economics and finance, investors who are assumed to be particular risk-averse (Bernoulli, 1954) attempt to lower or avoid risk in their investments. Risk aversion in investors is shown in the behaviour of preferring a low expected payoff with more predictability rather than a possible higher unpredictable payoff. It is a common thing that someone would choose to deposit their money into a bank account with a lower but certain amount of return, rather than take the risk in the stock market where the expected return may be higher but comes with a chance of loss.

Following on from Markowitz (1952), diversification is the method that investors would use to secure a desirable return on the investment portfolio while reducing their total risk. One risky asset can be put in a portfolio with another risky asset, which can generate higher expected returns with less risk than holding individually if the correlation of the two assets is less than one.

In order to reduce the risk of an investment portfolio, researchers have been searching for and examining less risky assets, particularly assets called hedges or safe havens. A hedge is intended to offset the potential losses that incur in other investments in the portfolio, while a safe haven is an investment that can retain or even increase its value during a market crash. There are many types of financial instruments that could be a hedge or a safe haven, including stocks, insurance, options, government bonds and gold.

Investors could use the financial assets with these hedge or safe haven characteristics to manage downside risk in their investment portfolios. Investors expect to make gains from their investment. However, making an investment always has the risk of losses in a real-world investment. Such losses could be avoided by an investment with hedges or safe havens. Thus, it would be helpful for investors if researchers could discover and confirm which assets are a hedge or a safe haven. Adding hedges in an investment portfolio would help investors to compensate for potential losses in other investments. In other words, the risk of the investment portfolio will be reduced since the risk of loss would be reduced. This could, at least, reduce the overall loss in the investment. Adding assets that are a safe haven in the investment would help investors to retain or even increase the value of the investment during the market crash. Market crashes are times when market indices decrease dramatically in a short period. Past market crashes are shown in *Fig. 1-2* for the UK equity market. When the market crash happened, the overall market would be affected, which could result in losses in the investment. However, the asset that is not positively affected by the market crash could help investors get through the crash and retain the value of the investment. This is the reason why holding a safe haven is important during the market crash.

Gold is one of the most special assets that has been assessed and found to be a hedge or a safe haven. For years, gold has been considered an investment that can retain value. One reason is that gold is a physical commodity with limited supply, which is not the same as currency printed by the central banks. Another is that the price of gold is not influenced by the interest rate. The relationship between the gold price and the market is considered to be uncorrelated, which implies that gold is a hedge. The UK gold prices shown in *Fig.*

1-1 are from April 01 1968 to October 31st 2019. The gold price was steadily increasing but remained below £200 per troy ounce from 1968 to 1982. During 1983 and 2006, the gold price fluctuated and remained in the zone between £200 and £400 per troy ounce. Then the gold price increased dramatically, reaching a peak of £1200 per troy ounce in 2011 before dropping down to £800 per troy ounce and fluctuating around this mark for 3 years. In 2017, the gold price rose again above £1000 per troy ounce. After the price dropped in 2018, it increased above £1200 per troy ounce in 2019.

The market index of the Financial Times Stock Exchange (FTSE) 100 shown in *Fig. 1-2* is from December 30th 1983 to October 31st 2019. The three dramatic drops shown in *Fig. 1-2* are the UK market crashes in 2002, 2008 and 2016. The first UK market crash in 2002 occurred after the conflict in Iraq. The confidence of the investors was influenced by the crude oil price. The second UK market crash in 2008 occurred after the mortgage crisis in the US. Companies were lending money to people who had bad credit ratings, so that the loans could not be paid back. Eventually some banks (notably Lehman Brothers) collapsed, which caused the mortgage crisis in the US. The third market crash in 2016 occurred after the announcement of the Brexit referendum, as Brexit would cause more uncertainty in the market. It is interesting due to the fact that the gold price remained the same or rose while the market crashes occurred (*Fig. 1-2)*. Comparing *Fig. 1-1* with *Fig. 1-2*, the gold price steadily increased in 2002, rose dramatically in 2008 and rose again in 2016.

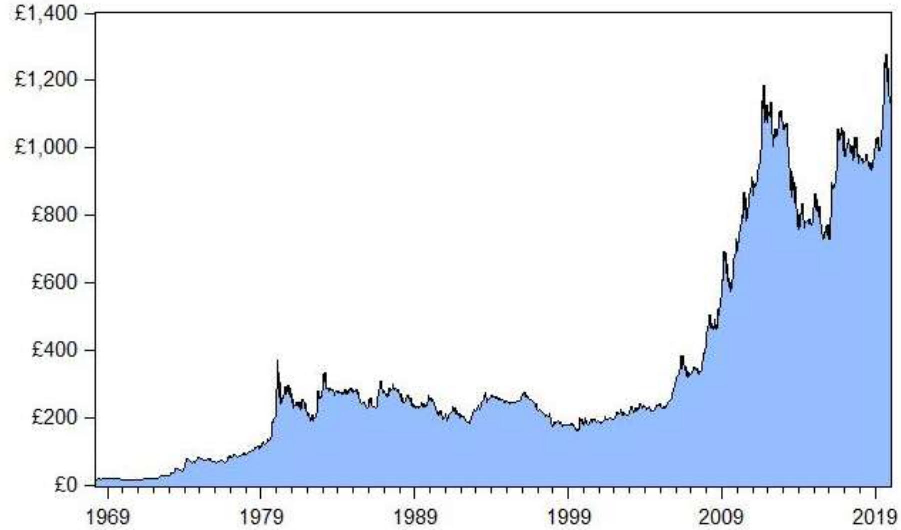

Fig. 1- 1 Gold price – UK (Daily)

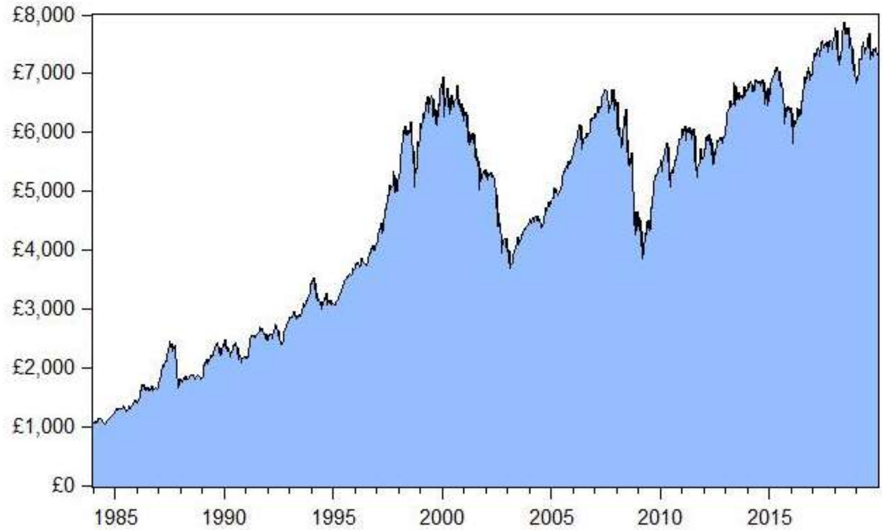

Fig. 1- 2 FTSE 100 price index (Daily)

This information shown in *Fig. 1-1* and *Fig. 1-2* motivates the first research objective in this thesis. The first objective is to test whether gold is a hedge or a safe haven by applying the Markov-switching Capital Asset Pricing Model (CAPM) to the UK and US stock markets inspired by O'Connor et al. (2015) and Baur and McDermott (2010). If gold is suggested as a hedge or a safe haven by the empirical results, investors will have a confirmed asset that could be added to the investment portfolio to avoid potential losses, and vice versa.

The Capital Asset Pricing Model (CAPM) is one of the most important models in finance. CAPM as it is commonly known was introduced in Sharpe (1964) and Lintner (1965). Coupled with the work on diversification in Markowitz (1952), CAPM is the first model to determine the return rate of an asset should be based on its exposure to systematic risk, in order to decide on adding an asset into a portfolio.

CAPM is used to describe the relationship between the expected return of assets and the market (systematic) risk in finance by the estimated beta coefficient. And the beta coefficient is the key point in CAPM. The practical value of CAPM is high, aside from the critiques and assumptions, as investors depend on the beta coefficient in their investment decisions. Beta (measuring an asset's exposure to systematic risk) describes how a stock's return responds to the market behaviour, which helps investors to understand how risky an investment is relative to the market. The magnitude of the beta coefficient helps investors to compare which stock is riskier. If two stocks both have positive (negative) beta in the stock market, the stock with a larger magnitude of beta is riskier. In other words, a change in the stock market will have much more impact on the expected return of the higher beta stock.

This is useful for investors in determining whether some stocks should be added into a portfolio, along with the risk. Adding stocks with less risk will, naturally, add less risk to the portfolio. In addition, if beta is positive, negative or zero, the expected return of the stock is positively affected, negatively affected or unaffected on average respectively. In real-world investment, investors would like to invest in stocks with a positive beta if they expect a rise in the market index. And if the expectation of the market index is for it to fall, investors would choose the stock with negative or zero beta. So, intuitively, the asset with negative or zero beta in CAPM will be a hedge and a candidate to be a safe haven.

As stated above, the beta coefficient in CAPM is the key to determining whether an asset is a hedge or a safe haven. However, there is not much research on gold utilising the CAPM. The application of CAPM is a straightforward method to estimate gold's beta. The Markov-switching CAPM is used to investigate whether gold is a safe haven. Markov-switching CAPM examines the gold's beta from a different angle compared to classic CAPM. In the Markov-switching CAPM, the gold's beta is examined by which probability regime it would be in at a given time.

As CAPM has been widely used in both finance theories and real-world investments, criticisms and explorations of the problems in CAPM have arisen (Fama and French, 2004). The problems with CAPM include: it is not sufficient to use the historical evidence in CAPM to predict the future return of assets; the beta-coefficient does not allow variation; there is no transaction cost or opportunity cost in CAPM. Problems in CAPM will be reviewed in Chapter 2, in Section 2.2.1: Development and Problem of CAPM. However, the CAPM is still one of the most important models used in both theory and practice. One of the foundations of CAPM is the assumption of the existence of a risk-free asset in the market. The relationship can be estimated between stock returns and market index returns using the risk-free asset. The fact is, in practice, the risk-free asset is difficult to find since an assumption of the model is that the variance of its return must be zero.

Government Treasury Bills (T-bills) have been considered as a proxy for risk-free assets for years. This is mainly due to the fact that they are backed by the government and their returns are guaranteed. In other words, there is no default risk in T-bills. As the assumption in CAPM states, the risk-free rate of return on a risk-free asset will remain constant (zero variance) over discounting periods and is uncorrelated with the market. However, the 3-month government Treasury bill monthly rate of return does not show as constant over time but fluctuates, as seen between 1984 and 2019 in Fig. 1-3. Even with this evidence, T-bills are still the option used by scholars and investors as the proxy for a risk-free asset.

However, the default risk of T-bills, which is assumed as zero, does not, theoretically, imply that T-bills are a good proxy for the risk-free asset. T-bills are selected as the proxy for the risk-free asset due to their certain characteristics. The main problem is due to the lack of a method to examine whether certain assets can be a proxy for the risk-free asset. Since we cannot obtain insights to find the risk-free asset using the zero-variance of the return on assets, another way must be found to examine the zero-beta asset as the proxy for the risk-free asset. This fact inspired us to use the zero-beta CAPM.

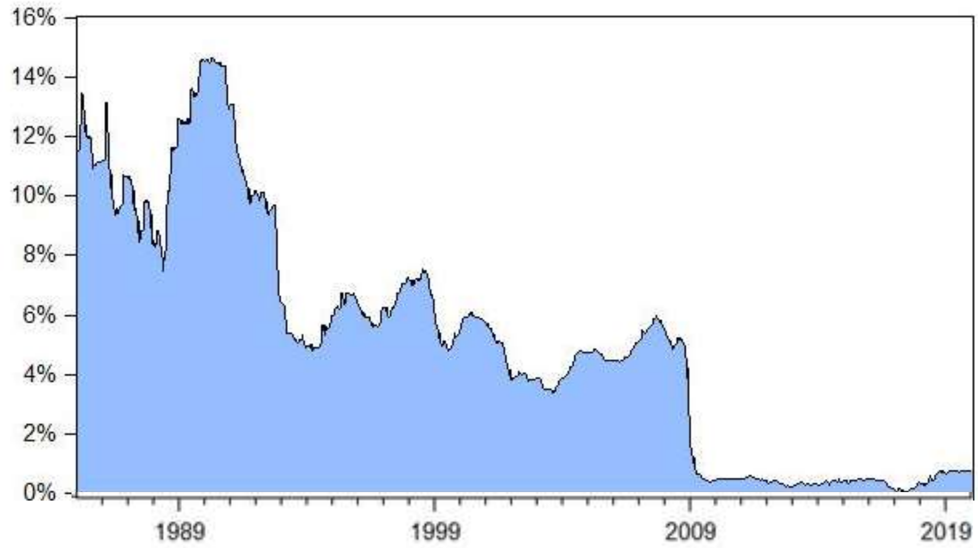

Fig. 1- 3 3-month T-bill rate of return – UK (Daily)

The model developed in Black (1972), known as the zero-beta CAPM, is neither widely used nor as popular as the classic CAPM. This may be due to the assumption that the rate of return in the risk-free asset is an unknown parameter (or cannot be found) in the model, which makes it really difficult for practical application. However, it is this strict and unique assumption in the zero-beta CAPM that is necessary in this research. The assumption in the zero-beta CAPM can facilitate the second objective in this thesis, as discussed in Chapter 5, which is to statistically rigorously test whether some assets can be a zero-beta asset in the zero-beta CAPM. This will examine whether certain assets can be the proxy for the risk-free asset.

According to the Wald test in the zero-beta CAPM in Section 5.2.2, the data of individual stock prices are needed in the test. We chose the stock price of every company in FTSE 350 (Financial Times Stock Exchange 350 index) in the UK, S&P 500 (Standard and Poor's 500) in the US, SSE 180 (Shanghai Stock Exchange) in China, NIKKEI (Nihon

Keizai Shimbun) in Japan, and SENSEX (Bombay Stock Exchange Sensitive Index) in India. As these indices represent the equity markets in each country, it would be a sufficient way to test each potential candidate asset against each individual company in the Wald test in the zero-beta CAPM in order to find a zero-beta asset as the proxy for the risk-free asset.

Gold must be examined in the zero-beta CAPM since gold is commonly considered to be uncorrelated with the market, which satisfies the condition of a zero-beta asset. The T-bill is one of the chosen assets that must be examined in the test since it is commonly used as the proxy for the risk-free asset. To broaden our analysis, we also choose Overnight Index Swaps (OIS) and Interbank Offered Rates (IBOR) in the Wald test in the zero-beta CAPM. We used SONIA (Sterling Overnight Index Average) for potential assets in the UK, SOFR (Secured Overnight Financing Rate) in the US, and TONA (Tokyo Overnight Average Rate) in Japan. Due to a lack of data of OIS in China and India, we chose IBOR in China and India instead.

Applying the test in the zero-beta CAPM can provide an empirical method to assess whether gold, T-bills, OIS or IBOR can be a zero-beta asset in order to be a proxy for the risk-free asset. If they are not, it would be a direct impact on the classic CAPM in the real-world investment since there would be a problem with the proxy for the risk-free asset. The expected excess returns on assets and market portfolios would not be the same, which would affect the estimated beta coefficient. In other words, the investment decision could be different if the beta coefficient is estimated by the different data. And it could be that the potential asset has not been discovered as the proper proxy for the risk-free asset. In this case, it is also worthwhile since we have provided the method to examine potential assets as the proxy for the risk-free asset.

The third objective is investigated in Chapter 6. It is inspired by the empirical results that show the difficulty in discovering an asset that qualifies as a proper proxy for the risk-free asset for all markets. If the risk-free asset is difficult to find, a risk-free portfolio could be the key to breaking through the status quo. Chapter 6 starts with finding a risk-free portfolio in both the UK and the US. T-bills, gold, and the white precious metals (silver, platinum and palladium) are the chosen assets to construct the portfolio. Silver, platinum and palladium were chosen because of the literature which has examined them and found them to be uncorrelated with the market; this is explained further in Section 2.3.2. Although Chapter 5 and Chapter 6 seem similar in scope, Chapter 6 aims to discover the proxy for a risk-free portfolio or a group of portfolios.

The first step is to examine whether the constructed portfolio satisfies the condition of zero variance for the proxy as the risk-free portfolio. If there is one portfolio that satisfies the condition, the proper proxy is confirmed for the risk-free portfolio. Therefore, T-bills would be replaced by the constructed risk-free portfolio. With the returns on the risk-free portfolio replacing T-bills, the calculation would not be the same in the expected excess return on assets and market portfolios, and the estimated beta would be different. The results will provide a different suggestion to investors about the riskiness of their investment as well as optimal portfolio allocation.

The second step is to apply the test in the zero-beta CAPM, as explained in Chapter 5, to examine whether the constructed portfolios with all different combinations are a zero-beta portfolio against each individual company in FTSE 350 and S&P 500 in the zero-beta CAPM for the UK and the US, no matter whether the constructed portfolio is a risk-free portfolio in the first step. If there is one portfolio found to be the zero-beta portfolio, this portfolio can be used as a proxy for the risk-free portfolio. So, it is also a way to find other potential proxies for the risk-free portfolio.

Chapter 2 provides the literature review of gold, T-bill, CAPM, zero-beta CAPM, risk-free asset, risk-free portfolio, zero-beta asset and other precious metals. Chapter 3 presents and discusses the data that are used in the empirical tests in this thesis. This thesis focuses on three objectives: testing the gold's beta in Markov-switching CAPM in Chapter 4; finding a real-world proxy for the risk-free asset in the zero-beta CAPM for the UK, US, China, Japan, and India in Chapter 5; discovering a risk-free portfolio with gold, T-bills, and other precious metals in Chapter 6. In Chapter 4, the quality of gold as a hedge or a safe haven is tested in the Markov-switching CAPM. Based on the results in Chapter 4, gold, T-bills, OIS and IBOR are separately tested for whether either of them can be the risk-free asset by the Wald test and the Likelihood Ratio Test (LRT) in the zero-beta CAPM for the UK, the US, China, Japan, and India in Chapter 5. Finally, Chapter 6 investigates whether the risk-free portfolio can be constructed by T-bill, gold and some other precious metals under zero-variance standards and the zero-beta CAPM. Chapter 7 provides further discussion and suggests future research.

1.2 Research Gap

This thesis attempts to fill in some gaps in the literature regarding the role of gold in modern financial markets and the existence of risk-free assets.

Chapter 4 aims to investigate gold's beta using the CAPM for the first time and Markov-switching CAPM. CAPM will be used as the method to determine whether gold is a hedge or a safe haven, while Markov-switching CAPM has not been applied in this context to date. It is a stricter way to apply Markov-switching CAPM without subjective settings than what previous research has done, with arbitrary sets in quantile regression (Baur and McDermott, 2010). Since there has not been any research testing gold, T-bills, OIS and IBOR as a zero-beta asset for the proxy for a risk-free asset by applying the zero-beta CAPM, Chapter 5 is the first empirical attempt to test a zero-beta asset in the zero-beta CAPM in the UK, the US, China, Japan, and India. Furthermore, Chapter 5 will attempt to provide the test method to determine whether an asset can be a zero-beta asset in the zero-beta CAPM in order to serve as the proxy for the risk-free asset. Chapter 6 aims to discover a risk-free portfolio using gold, T-bills, silver, platinum and palladium in the portfolios under the zero-variance standard and the zero-beta CAPM.

1.3 Chapter Summaries & Contribution

1.3.1 Chapter 4: Testing Gold as a Hedge or a Safe Haven in Markov-switching CAPM

The aim of Chapter 4 is to examine whether gold is a hedge or a safe haven to the UK and US stock markets. From the definitions of hedge and safe haven, we apply two sets of frameworks, the classic CAPM and Markov-switching CAPM, to test the role of gold in the UK and US stock markets. The results in the classic CAPM suggest that gold is a hedge for the UK and US stock markets. We use the Markov-switching CAPM to test whether gold is a safe haven to UK and US stock markets by setting two probability regimes. The method of assessment is to examine whether the gold's beta stays in the regime of the negative beta. We found that gold is always a hedge, but that neither state corresponds to what might be thought of as a separate safe haven characteristic.

The first contribution is to test gold's beta straightforwardly in CAPM. And the gold's beta is examined in the UK and US stock markets. Previous research mostly focused on the Arbitrage Pricing Theory (APT) model. This is due to research, discussed in Section 2.1.3, studying the relationship between gold and macroeconomics factors, e.g., inflation, exchange rate, etc., in the market.

The second contribution in this chapter is to provide the estimate of the gold as a hedge in CAPM by assessing gold's beta equal to zero, which is always assumed according to Baur and McDermott (2010), Blose (2010) and Reboredo (2013). This assumption is based on gold's unusually economically inert nature. For example, dividends act as a driver for equity prices, because they should drive these prices lower or higher. However, macroeconomic drivers do affect its price, such as inflation (O'Connor et al. 2015), but if you buy an ounce of gold it will remain an ounce of gold. It cannot default or go bankrupt as it has no offsetting liability.

Thirdly, though there has been a large amount of recent research on whether gold acts as a safe haven for a number of asset classes, all these studies choose an arbitrary quantitative cut-off point to define when a safe haven period should be present. Generally, it is defined as when an asset's returns are in the bottom 5% or 1% quartile of the sample. Authors then test the relationship between gold and the asset in that quantile; see for example Baur and Lucey (2010). However, using a Markov-switching model, rather than an arbitrary cut off point, we allow the data itself to determine whether two natural and separate "regimes" exist between gold and other asset prices. If two states do exist in the Markov-switching approach, then the next step is to see whether there is any relationship between one of the states and periods of extreme stock market movements.

1.3.2 Chapter 5: Is there a Real-world Proxy to the Risk-free Asset? Empirical tests of the Zero-beta CAPM model for the UK, US, China, Japan and India.

Chapter 5 aims to test whether gold, T-bills, OIS or IBOR can be a zero-beta asset in the zero-beta Capital Asset Pricing Model (CAPM) for the UK, the US, China, Japan and India. We start with the classic CAPM to test gold as a zero-beta asset by the estimated beta. However, the results of the statistical power of the CAPM regression show that CAPM is not consistently a sufficiently good method. Then, as we follow the hypothesis of the zero-beta asset in the zero-beta CAPM, the Wald test and the Likelihood Ratio Test (LRT) are applied in the zero-beta CAPM to investigate whether gold, T-bills, OIS or IBOR are a zero-beta asset. From the results of the Wald test in the zero-beta CAPM, we find gold can be a proxy for the risk-free asset in the UK and China, T-bills are still a proxy for the risk-free asset in Japan, IBOR is a proxy for the risk-free rate in China, and none of the OIS are qualified as a zero-beta asset in each country.

Firstly, this is the first empirical test for a zero-beta asset in the zero-beta CAPM. No such research has been done in the past. There is only research testing the zero-beta CAPM itself rather than connecting the null hypothesis with the T-bills or gold.

Secondly, another contribution is the evidence provided for the classic CAPM as not being a good method to describe whether some asset is a proxy for the risk-free asset. There are extremely low statistical values of R-squared and low power of test in classic CAPM. Low value in R-squared suggests poor description in the results, and the lower power of test causes type II errors in the model. Thus, the results in classic CAPM may cause problems when drawing conclusions.

Thirdly, a major contribution in Chapter 5 is that the method used is demonstrated to provide a strict and theoretical way to examine the zero-beta asset in the zero-beta CAPM for the proxy of the risk-free asset. The risk-free rate in CAPM originated from the assumption of the lack of correlation between the risk-free asset and the market. The problems of the poor explanatory power in the results can be avoided by using the Wald test and Likelihood Ratio Test (LRT) on the null hypothesis of potential zero-beta assets in the zero-beta CAPM (Kleibergen and Zhan, 2019).

Fourthly, we test gold, T-bills, OIS and IBOR against each of the individual companies in each of the indices using the Wald test and LRT for the UK, the US, China, Japan and India. This is the first study with such massive data to test zero-beta assets in the zero-beta CAPM. Also, this is the first study testing gold, T-bills, OIS and IBOR together for the UK, the US, China, Japan and India.

Fifthly, applying the Wald test and Likelihood Ratio Test (LRT) allows only the data to examine if T-bills or gold is a zero-beta asset, further as the proxy for the risk-free asset, rather than arbitrarily setting T-bills as the risk-free asset.

1.3.3 Chapter 6: Constructing the Risk-free Portfolio

Chapter 6 investigates whether the risk-free asset can be constructed by using gold, T-bills, and other precious metals (silver, platinum and palladium) in the UK and US. We start from the simple portfolio construction in one fixed time period to the continuous time portfolio model in the first step. The simple portfolio construction follows the rule that the weights of the assets equal 1. Brownian motion is applied in the portfolio construction in continuous time. The solutions in the quadratic equation of the portfolio in one fixed period show real roots in the constructed portfolios. And the solution for the portfolio in continuous time shows that it is impossible to have weights in real numbers R if, and only if, the relationship between the Wiener processes of two assets equals 1 or

-1. That is to say, there is a risk-free portfolio that can be constructed by assets with weights in real numbers. Thus, for all the portfolio combinations, we continue to the second step to test whether they can be the zero-beta portfolio in the zero-beta CAPM. All portfolios are constructed with combinations of gold, T-bills, silver, platinum and palladium, and are tested in the Wald test against every company in FTSE 350 and S&P 500 in the zero-beta CAPM for the UK and the US. The results suggest that some constructed portfolios satisfy the null hypothesis in the zero-beta CAPM, which means that the zero-beta portfolios can also be constructed using gold, T-bills, silver, platinum and palladium. Also, we find that risk-free portfolios constructed by gold, T-bills, silver, platinum and palladium in the first step do not all satisfy the requirements for the zero-beta portfolio in the zero-beta CAPM, except for risk-free portfolios constructed using gold & platinum and gold & palladium in the UK. It clearly shows that the risk-free portfolio and the zero-beta portfolio are not the same.

The first contribution of this chapter is that it is the first to investigate whether there is a certain portfolio that can be viewed as the risk-free portfolio under the zero-variance standard. Specifically, we attempt to construct a risk-free portfolio using gold, T-bills, silver, platinum or palladium in the UK and US, since they are accepted as the assets uncorrelated with the market.

For the second contribution, we have concluded that risk-free portfolios can be constructed with weights in real numbers using gold, T-bills, silver, platinum and palladium in both the UK and the US. Further, it would raise future discussions about whether risk-free portfolios can be constructed by any other assets under the zero-variance rule. And in the real world, it is possible to invest in assets to construct a risk-free portfolio for investors.

1.4 Dissemination of the research

As the thesis was being worked on, parts of the chapters have been published in journals and presented at conferences, as follows:

Chapter 4 is published as “Is Gold a Sometime Safe Haven or an Always Hedge for Equity Investors? A Markov-Switching CAPM Approach for US and UK Stock Indices” in International Review of Financial Analysis by He, O’Connor and Thijssen (2018). In addition, Chapter 4 was presented at INFINITI Conference 2018, Poznan Poland, June 2018 and at TYMS (The York Management School) Summer Conference, York, UK, June 2018. The results shown in Chapter 4 are further developed than in the publication.

Chapter 5 was presented at INFINITI Conference 2019, Glasgow UK, June 2019. I was invited by Professor Ana-Maria Fuertes from Cass Business School to present Chapter 5 at the 13th International Conference on Computational and Financial Econometrics (CFE 2019), Senate House, University of London, UK.

Chapter 5 is in the process of being prepared for submission to the Journal of Banking and Finance.

Chapter 6 is in preparation for presentation at INFINITI Conference 2021.

Chapter 2: Literature Review

This chapter will provide the literature reviews on gold, T-bills, precious metals (silver, platinum and palladium), Overnight Index Swaps (OIS), Interbank Offered Rates (IBOR), hedge, safe haven, the classic CAPM, Markov-switching CAPM, zero-beta CAPM, Wald test, Likelihood Ratio Test (LRT), and risk-free portfolio.

2.1 Literature Review for Chapter 4

2.1.1 Gold dominant market

This section contains a research review regarding the dominant market in the UK and the US gold market. The aim of this section is to help us to decide on the market for the data collection. If one gold market is constantly dominant, the major investigation will be based on that market, while we will do the investigation in both markets if neither is the constantly dominant gold market.

As explained in O'Connor et al. (2015), gold trading is offered in many gold markets throughout the world, including London Bullion Market Association (LBMA), New York gold market (COMEX, NYMEX), Shanghai Exchanges, Tokyo etc. Nevertheless, the discussion in O’Connor et al. (2015) has stated that the London gold market and the New York gold market are dominating markets. Their key point is to examine which gold market has the most significant contribution to the formation of the gold price. And the gold market in London and New York are mainly assessed as the dominant gold markets, with the Japan gold market and Shanghai gold market not affecting the gold price formation as much as the markets in London and New York (Xu and Fang, 2005; Lucey et al., 2014). It is important for this thesis to choose the data from both UK and US markets due to the fact that gold is traded globally.

Lucey et al. (2013) investigated gold prices in the London gold market and New York gold market. Their results suggest that there is no evidence to prove whether the London market or New York market is dominant. It turns out that the London gold market and New York gold market both significantly contributes to the gold price formation. However, the dominance switches between the two as there is no clear evidence to suggest one constant dominant gold market. Further research in Lucey et al. (2014) assesses the dominant role between the London gold market and New York gold market from another angle. They follow the methodology drawn from Diebold and Yilmaz (2009) to use the return and volatility spillovers to examine the contribution of four markets (London, New York, Shanghai and Tokyo) to the gold price formation. Their results show that both the London gold market and New York gold market are dominant according to the return and volatility. Wang et al. (2019) followed the idea of examining the contribution of both the London gold market and Shanghai gold market by using the GARCH (Generalized Autoregressive Conditional Heteroskedasticity) model. Although it investigated the contribution of the gold markets in another model, their conclusion does not shed light on the dominant role of the London gold market.

According to these studies, the data from both the UK and US gold markets are essential for the investigation of gold's role in the asset allocation in this thesis since both gold markets play an important role in gold trading. As there is no clear evidence to support a consistent dominant gold market between the London gold market and New York gold market, it is necessary to do the analysis in both markets in order to avoid deficiency in the data.

2.1.2 Gold trading

There are two ways to invest in gold. One is to invest in the physical gold through the OTC (Over-The-Counter) market, and the other is to invest in the gold ETFs (Exchange Traded Funds) on the exchange. The first and largest gold trading market is the London bullion market. The London bullion market is an international Over-The-Counter (OTC) market for trading gold and silver. The trading is conducted among the London Bullion Market Association (LBMA). The LBMA publishes the gold price fixing at 10:30 AM and 3:00 PM (local time) daily before gold trading. Gold is primarily traded via Over-The-Counter (OTC) transactions with a limited amount traded globally. Trading in the OTC market is the trade directly between market participants as opposed to the gold trading via gold ETFs. This provides the advantage of high flexibility and anonymity. However, transparency in the trade is lacking, and the credit rating of the participants is not exposed. Chai et al. (2015) use the two-scaled realized variance of the efficient market price as the measurement for the information flow to examine the information distribution of the OTC market over the world. Their results suggest that the London and New York OTC market provide more information flow that is related information to the gold price. And the Asia OTC market, particularly the Shanghai market, is increasingly offering information flow, which suggest that gold trading in the Shanghai market is becoming important. This also motivates us to include more markets, rather than just the UK and US markets, into the further analysis in Chapter 5.

Another way of investing in gold is in the form of securities, such as exchange-traded funds (ETFs) on the exchange. That is to say, gold ETFs are the securities that are backed by the physical gold. Investing in gold ETFs is to buy or sell the shares of rights to own the physical gold. The first gold ETFs were launched as the Gold Bullion Securities listed on the Australian Securities Exchange on 28th March 2003 (O'Connor et al., 2015). As explained in Emmrich and McGroarty (2013), gold ETFs offer another way to invest in gold. Unlike OTC, ETFs are traded on regulated platform, and provide a transparent price. The default risk of the counterparty is transferred to the platform and protected by the participant's collaterals. The introduction of gold ETFs does have some impact on the physical gold trading. Investors find it easier to invest in gold since investing in gold ETFs is convenient and causes less transaction costs. As explained in Cheng et al. (2018), their results suggest that gold ETFs can play a stronger role as a hedge or a safe haven than gold. They followed the model in Baur and McDermott (2010) using the data divided into the time before ETFs were introduced and after ETFs were introduced from 2000 to 2016. However, the time before the gold ETFs is too short since the first gold ETFs were launched in 2003 in Australia. In other words, the sample size is too small. Also, the correlation coefficient between pre-ETFs and post-ETFs is relatively close. Although there is no clear evidence to prove whether gold ETFs are a better hedge or safe haven than gold, investing in gold ETFs is still a popular trend for gold investment around the world (Prashanta and Suchitra, 2011).

2.1.3 Gold as a hedge

As mentioned in Chapter 1, the purpose of adding a hedge in a portfolio is to offset the potential loss that may be caused by other assets in the portfolio. This research aims to discover the potential assets, bonds or other financial instruments as a hedge in order to benefit investors. Bodie (1976), to our knowledge, is the earliest research to investigate hedges. The well-diversified portfolio of common stocks is used in the analysis of the effectiveness of hedge quality against inflation. Afterwards, a large amount of research was conducted to find a hedge against inflation. Particularly, gold was chosen in the assessment of a hedge against inflation due to the belief in gold as an asset that can retain its value. And Herbst (1983) is the first to compare the performance of hedging inflation between a well-diversified portfolio of common stocks and gold. His results suggest that gold is not as good as a well-diversified portfolio of common stocks as a hedge against the inflation. Although the conclusion does not support gold being a hedge against the inflation, the statement of viewing gold as a negative beta security will be useful in further research. This is beneficial for this thesis that a negative beta security can play a useful role in managing a portfolio. Further evidence can be found in Emmrich and McGroarty (2013). The data used in their analysis include prices of both physical gold bullion and gold ETFs from 1981 to 2011. They find that adding gold in a portfolio reduces the risk. Their results suggest that gold has been strongly suggested as an addition in investment portfolios since the financial crisis in 2007, and gold bullion is the best choice.

The research on gold as a hedge starts at the analysis of hedging inflation. It is based on the general belief that the acquisition of gold could hedge the losses incurred by the depreciation of one single currency (Brown, 1941). Chua and Woodward (1982) are the first paper to investigate the hedge quality of gold against inflation. They chose the data of gold prices and CPI (Consumer Price Index) from 1975 to 1980 in Canada, Germany, Japan, Switzerland, the UK and US. Their results suggest that gold is a hedge against the inflation only in the US. Although the test model is a simple linear regression to produce the correlation coefficient between gold returns and inflation rates, it gives the starting point for further research on gold as a hedge against the inflation. It is Baur and Lucey (2010) who first states the definition of a hedge as well as a safe haven in the analysis of gold on stocks and bonds. The definition of a hedge is an asset that is negatively or uncorrelated with another asset or portfolio on average.

In Beckmann and Czudaj (2013), the hedging ability of gold is examined in US Dollars, British Pounds, Euros and Japanese Yen from 1969 to 2011 in the data. It is quite reasonable to analyse the hedging ability of gold by a thorough comparison. The Euro was officially adopted as an accounting currency in 1999, however the data seems deficient for the Euro area since its sample is not as great as others in the UK, US and Japan. The new method used in their paper provides insights from another angle. The ability of hedging inflation in gold is tested in both long run and time-varying short terms by the Markov-switching vector error correction model (MS-VECM). According to the findings in Wang et al. (2011), the reason why the gold return can fully hedge against the inflation is due to the adjustment rigidity between gold prices and Consumer Price Index (CPI). Thus, Beckmann and Czudaj (2013) suggest that gold is partially able to hedge inflation in the long term since there is one (out of two) regime where gold prices are not affected by major shocks in the economy. Although this is the first research that applies time-varying framework to analyse gold as a hedge, they mention and conclude that gold is a partial hedge to a market portfolio applying the Johansen cointegration test and employing the data with gold prices, Consumer Price Index (CPI) and Producer Price Index (PPI) in four different areas. It is not adequate to make that conclusion by employing the Johansen cointegration test. In addition, their conclusion of partial hedge is based on a certain regime when time of shocks or economic turbulences happened. This conclusion is based on their analysis in a time-varying manner, which motivates the research on examining gold's beta from another perspective.

Bampinas and Panagiotidis (2015) examine the hedge ability of gold and silver against inflation in the UK and US. According to their results from the cointegration analysis, gold is suggested as a strong hedge against the inflation, but silver is not a hedge. In their paper, they use the data of gold prices, silver prices and CPI in a very long-time span from

1791 to 2010. A similar test method and dataset are used in Aye et al. (2016). The cointegration analysis between gold and inflation is modified with the Markov-switching as an interrupted cointegration equation to examine the structural change in the gold market at a certain time. The results suggest that gold may act as a hedge against inflation but not constantly. They explain that these results may be due to external factors that could affect the gold market. However, gold can still be a hedge since the definition in Baur and Lucey (2010) emphasizes the period as ‘on average’, even though gold may be not constantly a hedge against inflation. Their application of the Markov-switching approach is important for this thesis in the examination of gold’s role in asset allocation as the approach would be appropriate to apply in the investigation at a certain time.

A large amount of research has been testing gold as a hedge against not only inflation but exchange rates as well. Capie et al. (2005) provide the results that suggest that gold is a hedge to exchange rates, including both sterling-dollar and yen-dollar exchange rates, in both short-term and long-term runs, but the role of gold as a hedge against the exchange rates of dollar may significantly depend on unpredictable political events. Some authors have also concluded gold as a hedge against exchange rates. Reboredo and Rivera-Castro (2014) examine the role of gold as a hedge against exchange rates from another angle. They look at this problem from the currency investors’ perspective. They compare the risk of the portfolio composed of gold and currencies to the portfolio of full currencies. The results show the positive dependence between the gold price and the currency depreciation from 2000 to 2013, which suggests that gold is a hedge against exchange rates. Another method to examine gold as a hedge against exchange rates is explained in Beckmann et al. (2015). They analyse the volatility spillover effect between gold prices and exchange rates. The negative relationship in their results suggests that gold is a hedge against exchange rates. One interesting fact is that there has not been any literature, to my knowledge, that provides the evidence to prove that gold is not a hedge against exchange rates.

Only a few studies analyse gold as a hedge to the stock market. Most of the research that focuses on the role of gold against stock markets aims to investigate whether gold is a safe haven to the stock market together with examining gold as a hedge to the stock market. The model in Baur and Lucey (2010) allows for the positive and negative shocks in the simple regression between returns on gold prices, stock prices, and bond prices. The results suggest that gold is a hedge to stock markets. However, the data of stock prices and bond prices are from MSCI stock and bond indices without any statement of the reason for choosing these indices instead of others, e.g., S&P 500, Dow Jones, or whether they are a good proxy for the market. However, another contrary conclusion has been drawn by Iqbal (2017). He conducts a thorough analysis of the role of gold as a hedge and a safe haven to stock markets, inflation and exchange rates. The method follows the quantile regression in Baur and Lucey (2010) with daily and monthly data in India, Pakistan and the US from 1990 to 2013. According to his results, gold is not suggested as a hedge to the stock market in India. This may be due to the arbitrary setting of quantile returns in the quantile regression, which could cause a loss of objectivity in the analysis.

2.1.4 Gold as a safe haven

Unlike the research on gold as a hedge, most of the research on gold as a safe haven focuses on the stock market rather than exchange rates. The history of analysis on gold as a safe haven is not as long as the research on gold as a hedge. The research on gold as a safe haven has been increasing due to the uncertainty and instability of the economy and assumptions and beliefs about gold as a safe haven since 2010. And most importantly, the increasing amount of research on gold as a safe haven is due to Baur and Lucey (2010) who firstly proposed a definition of a safe haven and then provided a method to test it. According to Baur and Lucey (2010), the definition of a safe haven is one asset that is uncorrelated or negatively correlated with other assets or portfolios during a market stress period. Using a GARCH (Generalized Autoregressive Conditional Heteroskedasticity) model, Baur and Lucey (2010) assess whether the relationship between gold returns and other asset returns is different in the lowest quantiles of returns (1%, 2.5% and 5%). They find, for example, that the relationship between gold and US equities is -0.0475 (statistically significant) i.e., an almost zero correlation between gold and US equities, which is indicative of a hedge based on their definition above. In the three countries examined for stocks and bonds, their average relationships all indicate that gold offers significant diversification benefits when added to a portfolio due to the low, or negative, correlation with a diversified portfolio. In looking at the safe haven aspect, they find that the relationship between gold and stock returns for the US at the extreme end of the distribution (the 1% quartile) is -0.0183 (statistically significant) which does fit the definition of a safe haven, as given above. But this is a less negative relationship than the average described above. For the UK, the figure for the 1% quartile is a lot lower at -0.29 (versus 0.18 on average) and the German estimate in the 1% quartile is -0.0727 versus 0.04 on average. Looking at the definition of a safe haven above, this means that while for the US your portfolio does benefit from gold in times of severe market falls, it does not act differently at these times. It remains a hedge rather than becoming a safe haven. For the UK, it has a negative relationship in crisis periods, but also on average. So, again, gold seems to remain an excellent hedge at all times rather than there being a significant shift in the relationship, at times of large share price falls, into a safe haven.

As explained in Baur and McDermott (2010), gold may be viewed as a hedge and safe haven asset. Due to their results of the regression models at daily, weekly and monthly frequency, conducted on an international basis, gold is suggested as a safe haven. In addition, gold is concluded to be a strong safe haven for most developed markets with more refined definition of a hedge and a safe haven than those in Baur and Lucey (2010). However, the evidence mostly depends on the market crash in 1987 while Asian and other less developed markets had less response.

Joy (2011) also investigates whether gold acts as a hedge or a safe haven against the exchange rate. The weekly data are used for 16 dollar-paired exchange rates in 25 years in dynamic conditional correlations. Gold is concluded as a poor safe haven in Joy (2011) as the results shows less negativity between gold and dollar-paired exchange rates in lower quantiles. Joy concludes that there have been different conclusions in the research of gold's role as a safe haven due to the application of different empirical methods. According to the quantile correlation used in the analysis, the conclusions state that there is no clear evidence to suggest that gold is a consistent safe haven during times of market stress. The same conclusion can be found in Ciner et al. (2013), though it is not for the same case. Similarly to Baur and Lucey (2010), Ciner et al. (2013) used the same empirical method (the quantile regression) to investigate whether gold is a safe haven in the UK and US from 1990 to 2010. Though their results suggest that gold is not a safe haven to the UK stock market constantly, they emphasize that gold is suggested as a safe haven for paper currencies. This is due to the results that constantly show gold as a safe haven during the time when the exchange rate drops significantly in both the UK and US. As mentioned earlier, the definition of a safe haven mentioned earlier is that it behaves when the stock market crash. The time when exchange rates drop significantly may not be the time period of the market crash. This is an application of the definition of the safe haven into the foreign currency market. Since a significant drop of the market index means a stock market crash, the time when the exchange rate drops significantly implies the foreign currency market crash. The interesting part in Ciner et al. (2013) is examining whether crude oil can be a safe haven to exchange rates and stock market compared with gold. A similar conclusion is drawn that crude oil is not a safe haven to the stock market constantly. The reason why this is worth mentioning is due to the fact that more and more commodities and currencies have been used into the investigation of a safe haven.

Chen and Wang (2017) use the Dynamic Conditional Correlation (DCC) GARCH model to examine gold as a safe haven in the stock market between 2002 and 2017 in China. During the time span of the dataset, there are five bear markets. Gold is examined during each bear markets. The results suggest that gold is not constantly a safe haven to the stock markets in China. It is true that the Shanghai gold market does not have a very long history. However, the conclusion that gold is not a constant safe haven to the stock market in China cannot be ascribed to the imperfect capital market and irrational investors.

Hood and Malik (2013) examine the role of gold, other precious metals (silver and platinum) and VIX (Volatility Index) as a safe haven to the US stock market from 1995 to 2010. Their regression model follows the model (quantile regression) proposed in Baur and Lucey (2010). Gold does not show constant negative correlation to the US stock market during the period of high volatility and low volatility, while VIX has a negative correlation with the US stock market all the time. Their results suggest that VIX is a better hedge and a better safe haven to the US stock market compared with gold. Lucey and Li (2015) examined gold's role as a safe haven in a time-varying manner, extending it to include three other precious metals, silver, platinum and palladium. Their results suggest that gold may not act as a safe haven at times when silver, platinum and palladium can. Some of these specific periods, referred to as quarters in their results, are relatively close, e.g., Q2 2000, Q3 2001, and Q4 2001. It may provide a certain time period for a further test of whether gold can act as a safe haven in that period. Beckmann et al. (2015) examined gold as a safe haven by applying the exponential transition function in the APT model with gold return and stock returns. Two defined regimes, "normal time" regime and "extreme time" (market stress) regime, are applied for the estimation of the coefficients of variables. However, the results do not show any clear signs of the time of the market stress. The results are not clear enough to conclude that gold can be a safe haven during the time of market stress. Ranaldo and Soderlind (2010) used a factor model to investigate the linear or non-linear link between currencies and equity markets. Banaldo and Soderlind attempted to find some currencies with the attributes of a safe haven in the market. In their research, the currency as a safe haven is defined as the currency which will appreciate when the market risk and illiquidity increase. However, Ranaldo and Soderlind (2010) find no confirmed currencies that satisfy the definition of a safe haven. Or the definition of the currency as a safe haven might not be appropriated.

2.1.5 Gold vs. Bitcoin as a safe haven

With the increasing quantity of research on precious metals and other commodities, Bitcoin is one emerging currency to be examined as a safe haven. Bitcoin is a cryptocurrency. It is a decentralized digital currency that does not need a central bank and is sent on the user-to-user network. With the emergence of Bitcoin in the market, investors would like to gather more information in order to decide whether it is good to add Bitcoin to the portfolio.

Kristoufek (2015) investigates the main drivers of the Bitcoin price. Particularly, he examined whether Bitcoin is a safe haven compared with gold since Bitcoin once was labelled as a safe haven. The interconnection between the market indices and Bitcoin only shows once, while it shows multiple times in the case of gold. He concludes that gold remains a safe haven while Bitcoin is not, which is neither clear nor adequate. As previous research explained in Section 2.1.4, there is evidence that shows Bitcoin has been a safe haven once. From this, Bitcoin could be considered as a weak safe haven compared to gold, which is a stronger safe haven.

Bouoiyour and Selmi (2015) use the Bitcoin price in the regression model to investigate various objectives, such as investors' attractiveness, monetary velocity, output volume, gold price, Shanghai market index etc., in ARDL (Autoregressive Distributed Lag) Bounds testing method. They conclude that there is no clear sign Bitcoin is a safe haven due to evidence from trade transactions. However, this conclusion is not based on the definition proposed in Baur and Lucey (2010). Thus, their results cannot be used as evidence to prove that Bitcoin is not a safe haven.

Shahzad et al. (2019) examine whether Bitcoin can be a better safe haven to the stock market than gold and commodities from 2010 to 2018. The model is tested by using five Morgan Stanley Capital International (MSCI) stock indices, including the world, developed, emerging markets, China and the US. Bitcoin, gold and commodities are each shown to be a weak safe haven to different stock markets. Urquhart and Zhang (2019) employ the non-temporal threshold regression test to investigate whether Bitcoin is a safe haven to the currencies during extreme market turmoil. The correlation between Bitcoin price and currency prices are shown in their results. Their results suggest that Bitcoin is a safe haven to Canadian Dollars, Swiss Francs, and British Pounds. Further, Shahzad et al. (2020) compare the characteristics of gold and Bitcoin for the G7 stock market in order to investigate which serves better as a safe haven. Their model still follows the quantile regression proposed in Baur and Lucey (2010) with certain thresholds at 10%, 5%, and 1%. Their results show evidence that Bitcoin is a safe haven to G7 stock markets. However, gold is a much stronger safe haven compared to Bitcoin. This is not surprising since the gold market is much more efficient and regulated.

Smales (2019) stated that Bitcoin should not currently be considered as a safe haven, even though the criteria are met. He explained this according to the high volatility and lower liquidity to gold, which may seem insufficient to draw that negative conclusion. His starting point of this research, in my opinion, should aim to remind investors to be rational in their investment while considering adding Bitcoin. However, that is not evidence to hinder Bitcoin being considered a safe haven according to the criteria. Bitcoin is merely a weaker safe haven than gold.

2.1.6 CAPM and APT

One objective in Chapter 4 is to examine the gold's beta in the stock markets according to the research topic. The choice of model is important in this thesis. As the CAPM is one of the most important models in finance and is the most widely used model in practice, it is fundamental to use CAPM to investigate the gold's beta in the stock markets. Building on the modern portfolio theory (Markowitz, 1952), CAPM was developed by Sharpe (1964) and Lintner (1965a, b). CAPM is a model to price a security or portfolio and is widely used in both theory and practice. CAPM has the form shown in equation 2.1.1.

$$E(R_i - R_f) = \beta_i E(R_M - R_f) \tag{2.1.1}$$

where R_i denotes the raw return of asset i, R_f denotes the raw return of the risk-free asset, R_M denotes the raw return of the market portfolio, β_i is the coefficient of the asset i.

CAPM is a single factor model, which is used to examine the risk (β_i) of asset i by the excess return of asset i and the excess return of the market portfolio. The core of CAPM is the assumption of the risk-free return. As shown in equation 2.1.1, any asset can be assessed in the market via CAPM, which results in the wide use of CAPM in practice and in theory. Since we aim to investigate whether gold is a hedge or a safe haven to the stock market by assessing the estimate of gold's beta in this thesis, it is more appropriate to use CAPM in the stock markets rather than other models (e.g., the multi-factor model and Arbitrage Pricing Theory (APT) model), to be the candidate in the application of the examination of gold's beta. Since CAPM is introduced as the single-period and discrete-time pricing model, CAPM will facilitate the assessment of the relationship between gold and market portfolios. Multi-factor model is not the model to be chosen for the investigation of the relationship between gold and the stock market, which is the one-factor model. And it is not the driving factor that this research aims to discover.

The following part in this section will describe the differences between CAPM and APT and explain the reason why CAPM is a better fit to investigate the role of gold in this thesis than the APT model.

Arbitrage Pricing Theory (APT) was introduced by Ross (1976). Unlike CAPM shown in equation 2.1.1, the APT model is a multi-factor model, in which Chen et al. (1986) identified macroeconomic factors (e.g., inflation, Gross National Product (GNP)), which are significant to explain the portfolio returns. The APT model is shown in equation 2.1.2.

$$E(r_i) = \alpha_i + \lambda_{i1} f_1 + \lambda_{i2} f_2 + \cdots + \lambda_{in} f_n + E(\epsilon_i) \tag{2.1.2}$$

$$E(\epsilon_i) = 0$$

where $E(r_i)$ is the expected (logarithmic) return on a well-diversified portfolio, α_i is a constant for asset i, f_n is the factors, λ_{in} is the sensitivity of the asset i to factor n, ϵ_i is the idiosyncratic random shock of asset i with a mean of zero. The return in CAPM is calculated as the raw return of the asset or portfolio, while logarithmic return is applied in the APT model.

According to Ross (1976), one difference between the CAPM and the APT model is that the CAPM is an equilibrium model, but the APT model is not. However, Ehrhardt (1987) concluded that the APT is an equilibrium model by derivation from a multi-factor equilibrium model. Ehrhardt (1987) clearly stated the difference among the CAPM, the multi-factor model and the APT model. As he mentioned, these three frameworks are based upon different assumptions and have different implications. Ehrhardt (1987) applied the conditions in CAPM to the multi-factor model, then derived the APT model by the assumption of the homogeneous expectations as the condition for the market equilibrium. Although the APT model can be derived that way, the APT is still not an equilibrium model according to the arbitrage that exists in the market. And CAPM cannot be simply derived to the APT model since CAPM is the equilibrium model.

Another difference of APT from the CAPM is that the APT investigates the relationship between the expected returns of a well-diversified portfolio and the factors (Ross, 1976). The aim of this research is to investigate the role of gold in the asset allocation models. That is to say, it tests whether gold is a hedge or a safe haven to the stock market. Given the definition of a hedge or a safe haven in Baur and Lucey (2010), it is the return of the stock market portfolio that is used as the explanatory variable in the regression model rather than some potential driving factors. Also, using gold in the APT model is not appropriate since gold is an asset not a well-diversified portfolio. Thus, the CAPM is the chosen model for the investigation of gold's beta in this thesis.

2.1.7 Gold in CAPM

The application of the CAPM to gold is rare. It is agreed by most researchers that gold's beta is either close to zero or statistically insignificant most of the time. Chua et al. (1990) aimed to estimate gold's beta in the regression model by employing the monthly data of gold bullion prices in the Toronto Stock Exchange (TSE) gold stock index, S&P gold index and S&P 500 index from September 1971 to December 1988. Although they mentioned the application of the CAPM, the variables in the model are the logarithmic returns, which are not the variables in the CAPM (Sharpe, 1964, Lintner, 1965a,b). As the variables in CAPM are raw returns, the estimated results cannot correctly explain the relationship between gold and the stock market by using logarithmic returns in Chua et al. (1990). Moreover, the rule to determine the time span of the subperiods is merely based on the highest mean and highest variance in gold or the S&P 500 index. Although the results suggest that gold's betas are insignificantly different from zero in two subperiods in S&P 500, the difference between two estimated betas (0.03 and 0.22) is relatively large. Although their rule of dividing periods may seem arbitrary, the estimated results can be one piece of evidence that the gold's beta is time-varying, which supports the application of the Markov-switching approach in CAPM in the following Section 2.1.8. Dee et al. (2013) stated that they used the CAPM by employing gold prices, stock prices and CPI in China. However, the original CAPM is changed into the Arbitrage Pricing Theory (APT) model (Ross, 1976) as the inflation is added as a factor by Dee et al. This is one example of the misuse of CAPM and the APT model, and the misunderstanding of the assumption and condition in CAPM and the APT model. It is the APT model, as they stated, used to estimate the gold's beta not the CAPM. However, adding additional factors into CAPM does not simply change the model into the APT model.

McCown and Zimmerman (2006) used the CAPM to examine gold's beta coefficient in the US stock market with annual, quarterly and monthly data. However, the returns on gold and the market portfolio are not clearly explained as the raw return or the logarithmic return. If the returns used are the logarithmic return, they cannot be used in the CAPM since only the raw returns can be used in the CAPM. In addition, adding more factors into the CAPM does not make the new model the APT model.

According to the literature above, CAPM has been misused and misunderstood in the estimation of gold's beta. And technically, there has not been one study that correctly applies the CAPM to estimate gold's beta. This gap will be filled by this research. And the result of gold's beta will be estimated and discussed in CAPM to investigate the role of gold as a hedge.

The method is different when testing the role of gold as a safe haven. The single-period and discrete-time CAPM cannot be simply used in the test according to the definition of a safe haven since it requires both the estimate of gold's beta and the time period of the market stress rather than only the estimates in one whole time period. It requires a time-varying model to estimate whether gold's beta is negative, positive or zero during times of market stress. The estimation of gold's beta in CAPM is done by Ordinary Least Square (OLS) test as the common method (Jensen et al., 1972, Fama and Macbeth, 1973) in the UK and the US market. In classic CAPM, the assumption is that beta is assumed to be constant. However, as mentioned in Capie et al. (2005), it is highly likely to cause misleading results, which is gold as a hedge against the exchange rate in dollars. Since the data covers the entire periods of the available gold price, there may exist substantial regime changes during the data period. Their statement of this regime change is not supported by any evidence from former research or any statistical results. Even earlier, Jensen et al. (1972) divided their entire data period into four sub-periods to test the stationarity of the risk coefficient beta and the intercept alpha. This supports the investigation of the non-stationarity of gold beta to the stock market Based on the evidence in empirical investigations (Ferson and Harvey, 1991, Ferson and Korajczyk, 1995), the beta is suggested to have statistically significant variation over time. Therefore, both models have considered that the beta is nonstationary. The data consistency of the systematic risk measure, the beta, in CAPM is tested respectively by using the weekly data in the Taiwan Stock Exchange and the risk-free rate proxy with 3-month Treasury bill. The results suggest that the beta is nonstationary. However, the observations (125 observations) are small in size, and additionally the econometric method used in the analysis is the Ordinary Least Squares (OLS). The evidence of variation in the gold’s beta inspired us to apply the Markov-switching approach to estimate the beta in the time-varying manner to test whether gold is a safe haven during the market stress time.

2.1.8 Markov-switching model

The application of the Markov-switching model is to estimate the changes over time in the time series with respect to the mean value, the volatility, etc. It is called the regime shift or the regime switch, that the changes in value exist from switching between one state and another state. The Markov-switching model was first introduced in Hamilton (1989) for the analysis of the nonstationary time series and the business cycle. The growth rates of the real GNP are tested for the shifts, and the business cycle is suggested to be characterized by two states in the Markov-switching model. One motivation to apply the Markov-switching approach is that there has not been any research that has tested the regime shifts in gold's beta in the stock markets. Markov-switching approach is a better way to test whether gold is a safe haven by ruling out the arbitrary part in the test. The only application of the Markov-switching model in the research of gold to our knowledge is Lucey and O'Connor (2013). The two different regimes are used to describe whether there is a bubble in the gold spot price. Prukumpai (2015) did the rolling regression to test the time variance before applying the regime-switching model into the examination of the time-varying industrial portfolio betas in Thailand's stock market.

As explained in Huang (2001), the assumption to apply the regime-switching beta model is that a certain beta has revealed significant variation over time. In Huang's model, the CAPM is modified by allowing the regime switching in the intercept, the beta and the error term. Two regimes are characterized: high risk (larger value in beta) and low risk (smaller value in beta) under the assumption that the betas exhibit a time-varying status in Huang's research. In Huang's research, the consistency assumption is tested in CAPM with the application of the Markov-switching model. Although the results show the inconsistency with CAPM in the low-risk regime and consistency in the high-risk regime, it is worthwhile testing gold's beta with a similar method. It motivates us to apply the Markov-switching approach into the classic CAPM in order to examine the regimes that gold's beta stays in during certain market stress in this thesis. Our method is to examine whether there are regimes of gold's beta and which regime gold's beta stays in during the time of market stress. Gold can be assessed as a safe haven to the stock market if gold's beta stays in the regime of the negative or zero beta during the market stress time, and vice versa.

2.2 Literature Review for Chapter 5

2.2.1 Development and Problem of CAPM

The Capital Asset Pricing Model (CAPM) is one of the most important models in finance. The most cited publications are Sharpe (1964) and Lintner (1965a, b) as the foundation of CAPM. However, French (2003) states that some unpublished manuscripts from Jack Treynor should be given credits for the development of CAPM. Unfortunately, the contribution of Treynor's work has been ignored due to his unpublished research. French (2003) does comparisons among Treynor during 1962 and Sharpe (1964) and Lintner (1965a, b). He finds that their models are generally similar in assumptions and characteristics. One of the similarities is that their models all rely on the foundation of the portfolio theory of Markowitz (1952). Markowitz (1952) makes assumptions of investor's preferences and introduces the mean-variance model based on the expected returns and the standard deviation of the various portfolios. It is a portfolio optimization model that helps to select the most efficient portfolios on the efficient frontier in the efficient set. As Markowitz (1952) examines the risky asset with the nonlinear efficient set, Sharpe (1964) and Lintner (1965a, b) assume that there is a risk-free asset. This assumption in CAPM greatly facilitates the pricing of securities and assets, and the examination of the relationship between assets and stock markets. This contribution has a large impact on the usefulness of CAPM in theory and practice. However, there are several problems in CAPM.

Criticism has existed about CAPM as a "dead" model for decades as researchers have been arguing the incapability of interpreting the returns via CAPM. One important criticism is due to the results in Fama and French (1992), which finds that beta does not explain the expected return. And Fama and French (1996) continue to argue that CAPM is a "dead" model from the positive conclusion about CAPM in Kothari et al. (1995). They argue about the survivor bias, the relation between the average return and the book-to-market equity (BE/ME). Fama and French (1996) consider the reason why CAPM does not work is due to the bad proxies for the market or the payoffs in empirical asset pricing. However, the problem might be the sample selection in empirical tests not the model itself. Yoshino and Santos (2009) adopt the three-factor model in Fama and French (1992) using the panel cointegration FMOLS (full modified OLS) estimator in the Brazilian stock market to test whether CAPM is "dead". Their results suggest that the intercept is not zero in the empirical tests and there are other explanatory variables for the stock premium. The same negative conclusion about CAPM can be found in Lai and Stohs (2015), based on whether beta is sufficient to explain the expected return. Although Isakov (1999) stated that beta is still a good way to explain the expected return, the sample in his research is selected for the period from 1983 to 1991 and in certain stock market in Switzerland. This is neither sufficient nor efficient for concluding whether CAPM works.

It seems that most research has not focused on another "weak spot" in CAPM. As they focused on beta, this research focuses on the risk-free rate in CAPM. Sharpe (1964) and Lintner (1965a, b) introduced the risk-free rate as the rate of return on the risk-free asset, its variance being zero and equivalent to the interest rate. To conduct the empirical test in CAPM, a risk-free asset must be selected in the real world. In other words, an asset can be a risk-free asset if the variance of its return is zero. It is commonly accepted that it is impossible to find one asset that perfectly satisfies this condition. Treasury bills (T-bills) are selected as the proxy for the risk-free asset since the government will never default. This is the zero-default-risk asset not the assumed risk-free asset in CAPM. However, some researchers and investors are using it as the risk-free asset. Some knows that T-bills are not risk-free, but it may not be a big issue for practical purposes. No one has ever questioned whether T-bills can be used as the risk-free asset in CAPM, and no one has ever tried to explore potential risk-free assets or portfolios. This thesis will try to answer this question and solve the problems.

2.2.2 Risk-free asset and zero-beta asset

The risk-free asset and the zero-beta asset are not the same thing. The risk-free asset is based on the measurement of the zero variance of its return, while the zero-beta asset is based on the uncorrelated relationship between the asset and the market. As the standards are not the same, they are not the same. It can also be shown in the derivation of the risk-free rate according to Cochrane (2009: 116).

The risk-free rate is the rate of return in the asset/portfolio that has zero risk. The risk-free rate has a mean-variance presentation of:

$$R^f = R^* + R^f R^{e*} \tag{2.2.1}$$

where R^* is the return of the portfolio on the mean-variance frontier, R^{e*} is the excess return on the mean-variance frontier.

Each of the following returns (the Constant-mimicking portfolio return, Minimum variance return and Zero-beta return) has one property of the risk-free rate in the market where there is no risk-free rate. That is to say, each of these returns is mean-variance efficient. Assuming there is one risk-free rate, the returns that have the quality of zero-beta return R^{α}, minimum variance returns $R^{min.var.}$ and constant return $\hat{R}$ are expected to reduce to the risk-free rate.

Constant-mimicking: $$\hat{R} = R^* + \frac{E(R^{*2})}{E(R^*)} R^{e*} \tag{2.2.2}$$

Minimum variance: $$R^{min.var.} = R^* + \frac{E(R^*)}{1-E(R^{e*})} R^{e*} \tag{2.2.3}$$

Zero-beta: $$R^{\alpha} = R^* + \frac{var(R^*)}{E(R^*)E(R^{e*})} R^{e*} \tag{2.2.4}$$

Assuming that there is one risk-free rate, equations 2.2.2, 2.2.3 and 2.2.4 are all the same. The following equation must hold:

$$R^f = \frac{E(R^{*2})}{E(R^*)} = \frac{E(R^*)}{1 - E(R^{e*})} = \frac{var(R^*)}{E(R^*)E(R^{e*})} \tag{2.2.5}$$

Deriving from the expectation of equation 2.2.2 and equation 2.2.5, we have:

$$\frac{E(R^{*2})}{E(R^*)} = E(R^*) + R^f E(R^{e*}) \tag{2.2.6}$$

After rearrangement in equation 2.2.6, the risk-free rate is:

$$R^f = \frac{E(R^{*2}) - E(R^*)^2}{E(R^*)E(R^{e*})} = \frac{var(R^*)}{E(R^*)E(R^{e*})} \tag{2.2.7}$$

Given equation 2.2.4 and 2.2.7, it can be seen that the risk-free rate and the zero-beta rate are not the same thing. As the zero-beta return is the mean-variance efficient return that is uncorrelated with another mean-variance efficient return, it may seem reasonable to consider the zero-beta return as the proxy for the risk-free return. Although the risk-free asset cannot be easily found, testing potential assets as the zero-beta asset in the zero-beta CAPM would be another way to find the proxy for the risk-free asset.

2.2.3 Zero-beta CAPM

The assumption of the risk-free rate in CAPM indicates that one asset is the risk-free asset if the variance of its return is zero. It is the assumption that has been used for years and may have not been tested in the real world. It could be the fact that the testing method is lacking, or the existence of the risk-free asset is commonly accepted. However, this is not a reason to accept this assumption without any questions. Lintner (1969) has derived the specification of the market's composite parameters and probability assessment with and without a risk-free asset. He stated that the market's assessment of expected prices will be directly altered by the differences in risk assessments when there is no risk-free asset. In other words, the expected prices will be estimated differently without a risk-free asset in CAPM.

Black (1972) is the first research to try to replace the risk-free asset in CAPM for another asset that became known as the zero-beta asset. But he did not question the existence of the risk-free asset in the real world. His model is considered as a more general model with the assumption that investors may take long or short positions of risky assets with no risk-free asset allowed. One interesting thing is that he stated his assumption is not realistic due to the restrictions on short selling not the risk-free asset. This implies that he did not question the existence of the risk-free asset. And what he was doing was to derive the equilibrium when the risk-free asset would not be accessed.

The zero-beta CAPM was introduced by Black (1972). His idea was to construct a model with the absence of the risk-free asset. The zero-beta asset is defined as one asset that has minimum variance and is uncorrelated to the market. In addition, the residuals in the zero-beta CAPM are approximately mutually independent in Black (1972).

As the zero-beta model originated from the classic CAPM, the zero-beta CAPM contains the zero-beta asset (Black 1972). The derivation of the zero-beta CAPM will start from CAPM with the zero-beta asset instead of the risk-free asset which is assumed as missing.

$$E\left[R_{i,t}\right] = E\left[R_{0,t}\right] + \beta_i\left[E\left[R_{m,t}\right] - E\left[R_{0,t}\right]\right] \tag{2.2.8}$$

where $E\left[R_{i,t}\right]$ denotes the expectation of the raw return of the asset i in a stock market at time period t, $E\left[R_{0,t}\right]$ denotes the expectation of the return of zero-beta asset at time period t, $E\left[R_{m,t}\right]$ denotes the expectation of the return of the market portfolio at time t, β_i denotes the coefficient for asset i.

Thus, the equation (2.2.8) can be written as:

$$E[R_{i,t}] = (1 - \beta_i)E[R_{0,t}] + \beta_i E[R_{m,t}] \tag{2.2.9}$$

Black (1972) only mentioned the characteristics of the zero-beta asset, which has a covariance with risky asset proportional to $(1 - \beta_i)$, but lacks the introduction of a proper method for testing. To test whether an asset is a zero-beta asset is to examine the statistical insignificance of the coefficient of $E[R_{0,t}]$, and the covariance between $R_{i,t}$ and $R_{0,t}$ needs to be computed to examine whether the covariance between zero-beta asset and the risky asset is proportional to $(1 - \beta_i)$. However, there is still no certain method to test the zero-beta asset in the zero-beta CAPM. It would be one reason why the zero-beta CAPM is not as popular as the classic CAPM.

Since the zero-beta CAPM was developed, many researchers have worked on testing the model itself. Faff (1991) follows the multivariate approach developed in Gibbons (1982) to test the time-varying beta in the zero-beta CAPM by the employment of Australian equities. This is evidence of the application of the zero-beta CAPM in the literature. However, the variables in their model are not the same as those in this thesis. We only apply the original zero-beta CAPM without adding additional variables. And the tests in the zero-beta CAPM are not the same. It is inspired by Chou (2000). Chou (2000) applied the Wald test and the Likelihood Ratio Test (LRT) in the zero-beta CAPM and performed tests in the Generalized Method of Moments (GMM) model to test the zero-beta CAPM in the absence of the risk-free asset. All Chou's tests provide means to examine validity of the zero-beta CAPM. None of them applied the Wald test and the Likelihood Ratio Test (LRT) to see whether any assets satisfy the requirement to be the zero-beta asset in the zero-beta CAPM, let alone testing government Treasury bills (T-bills) as a zero-beta asset. The measurement of the risk-free asset has been introduced as the zero variance in returns by Markowitz (1952). T-bills are still commonly accepted as the risk-free asset, even though the variance is not zero. And most investors and researchers may consider that setting T-bills as the proxy for the risk-free asset might not have much influence on the results in practice. However, it cannot be an excuse for us to neglect testing whether T-bills are a proper proxy for the risk-free asset since no research has done such testing. So, it would be another way to test whether T-bills or any other assets can be the zero-beta asset (proxy for the risk-free asset) in the zero-beta CAPM. This research will fill this gap to test whether some candidates (gold, OIS and IBOR) of the risk-free asset and the zero-beta asset can be the proxy for the risk-free asset.

The test method will be the application of the Wald test and the LRT in the zero-beta CAPM. The Wald test is named after Abraham Wald, a Hungarian mathematician (Morgenstern, 1951). In statistics, the constraints on parameters are assessed by the weighted distance between the hypothesized value and the estimates under the null hypothesis in the Wald test (Fahrmeir et al., 2013). Other classical methods of hypothesis testing are the Likelihood Ratio Test (LRT) and the Lagrange Multiplier. The LRT assesses two statistical models by the ratio of their likelihoods, specifically one computed by maximization and the other one with the constraint. Unlike LRT, the Wald test only requires the estimation of one unrestricted model. The process is based on testing if a set of estimated parameters is equal to some value in the null hypothesis in the Wald test.

Like the development of econometrics for the CAPM hypothesis in Gibbons (1982), the Wald test and the Likelihood Ratio Test (LRT) are employed to test the zero-beta asset in the zero-beta CAPM. Also, there are alternative tests explained in Shanken (1985). The test in Shanken (1985) is the cross-sectional regression test (CSRT) along with the Lagrange multiplier test (LMT) and Likelihood Ratio Test (LRT). Chou (2000) develops an analytical Wald test with the generalized method of moments in the test of the zero-beta CAPM. The Wald test and the LRT are the methods often applied in the zero-beta CAPM research. The reason for applying the Wald test in this thesis is that the data of expected returns of the zero-beta asset, which in this research is assumed to be gold and T-bills, can be obtained and estimated.

Although the Wald test and the LRT are asymptotically equivalent, which will be explained in detail in Section 5.2.3, the results in the Wald test and LRT may lead to different conclusions. It would be necessary to use both methods in the thesis. This is the reason why Chapter 5 will apply the Wald test in the zero-beta CAPM to examine whether T-bills or gold are a zero-beta asset, and will use LRT as the robustness test, since the LRT is asymptotically equivalent to the Wald test.

2.2.4 Government T-bills as the proxy for risk-free asset

According to the assumption in classic CAPM, the asset uncorrelated with the market is the risk-free asset in classic CAPM. However, the original assumption is to use the asset that has a zero variance in its returns as the variance is the measurement of the risk. That is to say, the return of the risk-free asset must have zero variance.

Government T-bills have commonly been used as the risk-free asset for decades. The reason is based on the fact that the government Treasury bills are backed by the government, and the rate of return is approximately similar to the interest rate. That is, the government will never default on the Treasury bills, and investors will always get a certain amount of return from T-bills. However, T-bills are not strictly risk-free. According to Markowitz (1952), the risk is measured by the variance of the return. Viewing T-bills as the risk-free asset cannot be based on zero beta coefficient to the market or no default risk. And evidence has shown that the variance of the return of the T-bills is not zero.

In addition, researchers have found a potential for defaulting with T-bills evidence that T-bills may not be a risk-free asset. Nippani et al. (2001) analysed the sustained effect of a chain of events in the US on the potential default risk by the comparison of yield spreads between 1995 and 1996. Their results have clearly provided evidence that a potential default of T-bills would occur. In addition, the impact of the events suggests that three-month T-bills are more likely and more substantially influenced than the six-month T-bills. Furthermore, Nippani and Smith (2010) used the spread between 10-year USD LIBOR (London Inter-Bank Offered Rate) and the 10-year US T-bills as a measure of the default risk. Using some major events, the statistical significance was tested on the change in the spread. The results suggest the potential of defaulting on T-bills for an even longer term. However, the potential of the default risk in T-bills is not the proper way to assess T-bills as a risk-free asset. A better way is to test T-bills or other asset in the zero-beta CAPM under the assumption of the risk-free asset in classic CAPM. Although their empirical method is not based on the origin of the risk-free asset (the zero-beta asset in the zero-beta CAPM), the evidence of the potential default in T-bills is enough to question whether T-bills are a risk-free asset. In this case, we will proceed with testing whether T-bills are a zero-beta asset in the zero-beta CAPM in order to serve as a proxy for the risk-free asset.

2.2.5 Hypothesis of gold as the zero-beta asset

In this thesis, gold will also be tested as the zero-beta asset in the zero-beta CAPM, while T-bills will also be tested. It is due to its characteristics that researchers and investors all consider gold as an asset uncorrelated to the stock markets. This provide support for gold being a zero-beta asset.

As previous research stated in Section 2.1.3, gold is commonly considered as a hedge as the gold returns are uncorrelated with the return of market portfolio, interest rates, exchange rates, and inflation rates. In other words, the lack of correlation between gold and the market implies that gold is viewed as the zero-beta asset. McCown and Zimmerman (2006) used CAPM to examine gold's beta coefficient in the US stock market with annual, quarterly, and monthly data. However, adding more variables in the CAPM does not change the CAPM into the Arbitrage Pricing Model, and it is no longer CAPM. Additionally, since gold is not a well-diversified portfolio, the results in their model cannot provide the proper evidence to conclude that gold's beta is zero. However, the results in He et al. (2018) showed that the gold's beta coefficient is zero between the gold and the market in CAPM. It is mostly due to the result that the beta coefficient is extremely close to zero or has statistical insignificance.

In addition, McCown and Zimmerman (2006) concluded that gold has approximately the same mean return as the Treasury bill, which implies that gold can provide a return which equals the risk-free rate. However, the power of test is not conducted in the CAPM regression in their research. It is not, therefore rigorous, for them to conclude that gold's beta is zero due to the potential of the type II error. If there is a type II error, the false null hypothesis is more likely not to be rejected.

Blose (2010) ran the tests for whether gold spot prices can be affected by CPI under the assumption that gold is assumed as the zero-beta asset. Blose's assumption of gold as the zero-beta asset was based on prior research not fully mentioned by Blose's. Furthermore, it is not strictly proper to state that gold's return is the same as the risk-free rate due to the fact that gold does not yield a return. Although the gold return can only be viewed as the proxy for the risk-free rate under the assumption that gold is assumed to be a zero-beta asset, this assumption provides one motivation for this research: to test gold as the zero-beta asset.

The result from the test on hedge quality also provides evidence of gold as a zero-beta asset. For instance, Rubio (1989) applies the Intertemporal Capital Asset Pricing Model (ICAPM) introduced in Merton (1973), which shows that expected return on one asset in excess of the risk-free rate equals the expected excess return on the true market portfolio and the expected return on the hedging portfolio in excess of the risk-free rate. Gold is mentioned as the asset with hedging possibilities for investors and is used as the hedging portfolio in the tests. In addition, the test of the correlation coefficient between gold and the market portfolio suggests that there is no correlation, which is promising for further tests in the zero-beta CAPM. However, the data on gold is from the London market, and the data of a market portfolio is in Spain. Although gold is traded internationally, the application of gold data in London and the data of market portfolio in Spain could cause bias since parts of the data are not in London but Spain. So, the effect between gold traded in London and the market in Spain may not be reasonable.

Although there has been a common acceptance of gold as a zero-beta asset, it is worth testing gold as a zero-beta asset in the zero-beta CAPM since the research mentioned above has flaws in the empirical tests. This motivates this thesis to use the tests in the zero-beta CAPM as a better way to test whether gold is a zero-beta asset in order to examine whether gold can be a proxy for the risk-free asset. We will point out the flaws by the statistical power in the empirical regression in the classic CAPM and use the Wald test and LRT in the zero-beta CAPM to test the zero-beta asset.

2.2.6 OIS and IBOR as proxies for the risk-free asset

Apart from T-bills and gold, Overnight Index Swap (OIS) and Interbank Offered Rate (IBOR) will also be tested in this thesis. An OIS is an interest rate swap over fixed terms with floating payment based on the return from a daily compound interest investment. The fixed rate of OIS is an interest rate considered less risky than IBOR since the counterparty risk is less.

Hull and White (2013) discuss the derivatives discounting dilemma of using the LIBOR or OIS in portfolio discounting. In 2010, LCH. Clearnet announced that they had started discounting their USD 218 trillion interest rate portfolios using OIS. A change followed with discounting collateralised transactions off the OIS and uncollateralized transactions off the LIBOR. They suggest that OIS discounting should be adopted by many markets. It is evidence that the OIS is considered a proxy for the risk-free asset for different markets.

Other literature related to the OIS also focuses on the discussion of whether major financial markets should adopt the OIS discounting instead of using the IBOR (Smith 2013; Jakarasi et al, 2015). Smith (2013) finds that the switch from the LIBOR to OIS discounting in the valuation of collateralized interest rates swaps is more conceptual in that it establishes the counterparty risk and LIBOR is no longer a reasonable proxy for the risk-free asset. Jakarasi et al (2015) discuss whether the OIS discounting can be adopted in South Africa. However, the lack of consensus and the inaccessibility of an overnight rate in South Africa prevent them from developing an OIS market. The key to their argument in both studies is based on the credit risk carried by the IBOR, which would affect the portfolio discounting. In other words, the OIS and IBOR are considered proxies for the risk-free asset, even though the IBOR carries more credit risks than the OIS.

Since LIBOR and OIS are considered proxies for the risk-free asset, it is necessary for us to include OIS and IBOR in the tests in Chapter 5 comparing gold and T-bills. This research is a contribution to the literature in that it is the first to examine whether the OIS or IBOR is a zero-beta asset in the zero-beta CAPM.

2.3 Literature Review for Chapter 6

2.3.1 Risk-free portfolio

The measure of the risk in a portfolio derives from Markowitz (1952). In Markowitz's paper, the geometrical relation between the beliefs and choices of a portfolio is illustrated under the rule of "expected return – variance of returns". The variance of return is mentioned as the undesirable thing to investors while the expected return is the desirable one. Although the variance of returns is not clearly stated as a measure of risk, Holton (2004) comments that subsequent research (Fama and French, 1993; Breeden, 2005) suggested the variance of return as a proxy for risk from Markowitz (1952). The variance of returns measures the variability from the mean return. For investors, this variability causes volatility, which can cause risks. According to the commonly accepted rule for the measure of risks in the modern portfolio theory or mean-variance analysis, we will use the variance of returns as a measure for risks to find a risk-free portfolio. The asset or portfolio can be viewed as risk-free if the variance of its return on an asset or a portfolio equals zero.

As shown in the descriptive statistics in Chapter 3, the variance of the return on T-bills is close to zero but not exactly zero, which suggests that the return on T-bills is not a risk-free return. And as mentioned in Section 2.2.3, Nippani et al. (2001) and Nippani and Smith (2010) questioned whether T-bills are suitable to be the proxy for the risk-free asset considering the potential default risk. However, this research is based on the standard of zero variance of returns on the portfolio to examine T-bills and other precious metals as a risk-free rate. We trace back to the origin of the risk-free asset, which is the asset with zero-variance on returns.

2.3.2 Other precious metals

Unlike Chapter 5, Chapter 6 considers extending the list of possible assets in the investigation of the risk-free asset. The reason for this is to increase the possibility of discovering the risk-free portfolio by adding more potential allocations in constructed portfolios. The other assets focus on the white precious metals - silver, platinum and palladium. A number of studies have tested the characteristics of silver, platinum and palladium.

Previous research has been done on precious metals, notably silver, platinum and palladium as precious metals are a popular topic for investors. Batten et al. (2010) used the monthly price volatilities of precious metals, including gold, silver, platinum and palladium, to investigate their macroeconomic determinants (business cycle, monetary environment, etc.). It provides support for investors who would consider adding these precious metals in their portfolio as a good diversifier. This is one reason why silver, platinum and palladium are chosen in this thesis. Since it is becoming accepted that precious metals (silver, platinum and palladium) can provide diversification in the investment portfolio, the trade in the precious metal market is becoming more important as a segment of the financial market.

Hillier et al. (2006) investigate precious metals, including gold, silver and platinum, from 1976 to 2004 by examining the relationship of precious metals to S&P 500 and MSCI Australia/ Europe/ Far East index. Their regression model is modified with high and low market volatility to examine the correlation between precious metals and the market. The results show the low correlation, which suggests that they have the potential to provide diversification in the portfolio. As their correlation to stock markets is low, this provides evidence to conclude that silver, platinum and palladium are not zero-beta assets. However, it is necessary to test whether these precious metals can be used to compose a zero-beta portfolio. Further similar evidence can be found in Lucey and Li (2015). The safe haven analysis is extended using gold, silver, platinum and palladium to stock markets. The low correlation between these precious metals, and stock markets is suggested in their results. The same statements on low correlations are mentioned in Vigne et al. (2017), who review the research literature of financial economics on silver, platinum and palladium.

So far, these are the only studies that we can find in the literature on the topic of silver, platinum and palladium. According to the research reviewed in this section, silver, platinum and palladium are tested as uncorrelated to the stock market, and can even replace gold as a safe haven during times of market stress. White precious metals, such as silver, platinum and palladium, are worth testing in Chapter 6 since they might be candidates for components in a risk-free portfolio, or the zero-beta asset or components in the zero-beta portfolio.

2.3.3 Zero-beta portfolio

One origin of the risk-free asset is from the assumption in the Sharpe-Linter CAPM (Sharpe, 1964; Lintner, 1965). It assumed that there is a borrowing or lending at a risk-free rate, and that the expected return on the assets uncorrelated with market return must equal the risk-free rate (Fama and French, 2004). In other words, the risk-free rate is the zero-beta asset against the market portfolio. The beta coefficient is the measure of the systematic risk of an individual financial asset against the market.

As the beta coefficient is another measure of risk of an asset or portfolio, many researchers have considered the zero-beta as zero risk, or risk-free. However, we have concluded that the commonly accepted risk-free assets (T-bills and gold), which have extremely low beta coefficient (close to zero) against the market (He et al., 2018), are not zero-beta assets in the zero-beta CAPM. It is not that simple to find a proxy for the risk-free asset. According to He et al. (2018), T-bills and gold are not assets with zero betas, which suggests that gold and T-bills are not zero-beta assets. Also, the results in Chapter 5 suggest that none of gold, T-bills, OIS or IBOR can be a zero-beta asset in the zero-beta CAPM for all markets (the UK, US, China, Japan and India). To solve this dilemma, a risk-free portfolio must be constructed. If no assets can simply be risk-free in all markets, it would be another way to construct a portfolio that can be the proxy for the risk-free portfolio for all markets. And a zero-beta portfolio must also be constructed and tested when a risk-free portfolio cannot be constructed. In addition, a zero-beta portfolio is necessary even if a risk-free portfolio can be constructed. In that case, it would be necessary to test which portfolio is better. In a word, a risk-free portfolio will be constructed as well as a zero-beta portfolio in this research.

Fig. 2-1 follows the mean-variance portfolio. According to Modern Portfolio Theory in Markowitz (1952), any portfolio, on the efficient frontier, that is tangent to the Capital Market Line is more efficient than any other portfolio in the set of possible portfolios. Intuitively, *Fig. 2-1* illustrates a concept for investors. As the risk of the portfolio is increasing, there would be a portfolio at the trade-off point to provide the maximum return. In other words, this is an equilibrium.

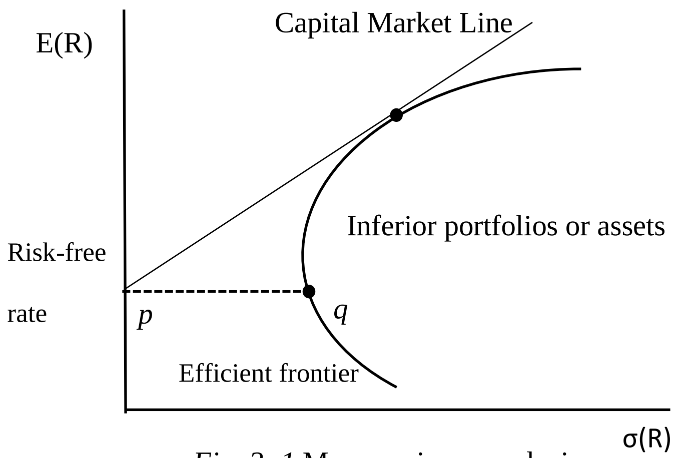

Fig. 2- 1 Mean-variance analysis.

In *Fig. 2-1*, the points p and q on the portfolio frontier are the portfolios, respectively. Let R^{γ} and R^{*} be the return of the portfolio p and q. *Fig. 2-1* illustrates the zero-beta return R^{γ} with respect to the efficient portfolio R^{*}. The corresponding zero-beta return of the portfolio is different when the portfolio is different, that is to say, the zero-beta portfolio return for the market portfolio will not be the zero-beta return for a certain single asset or portfolio in the market.

$$R^{\gamma} = R^{*} + \frac{var(R^{*})}{E(R^{*})E(R^{e*})} R^{e*} \tag{2.3.1}$$

where R^{γ} is the zero-beta return with respect to portfolio R^{*}, R^{γ} is the efficient portfolio return on the portfolio frontier in *Fig. 2-1*, R^{e*} is the excess return on the mean-variance frontier.

Chapter 3 Data

3.1 Introduction

This chapter will describe and explain the data used in the empirical test sections of this thesis. Since gold is the major topic of this thesis, the data of gold prices are used in all the empirical tests. Section 3.2 will discuss the gold data in the London Bullion Market and New York Gold Market. Section 3.3 will describe the data of market indices in the UK, US, China, Japan and India, and the index constituents for each index. Section 3.4 will describe the government Treasury bill in the UK and the US. Section 2.5 will show the data of OIS and IBOR for the UK, US, China, Japan and India. Section 3.6 will demonstrate the data of excess return on gold, and market portfolio in the UK and the US. Section 3.7 will discuss the data of other precious metals, including silver, platinum, and palladium. As we will run empirical tests daily, weekly, and monthly in Chapter 5, the data with weekly and monthly frequency will be converted from the daily data.

3.2 Gold Data

3.2.1 Gold price

The international benchmark of the gold price is set by the London Bullion Market Association (LBMA). The London Bullion Market Association was established in 1987 and is one of the international trade bullion markets. Gold price is fixed twice each business day, at 10:30 AM and 3:00 PM London time (there is only fixing in the morning of Christmas Eve and New Year’s Eve). The gold daily data in the UK and the US are collected from Federal Reserve Economic Data (FRED) validated by the LBMA from April 1st 1968 to October 31st 2019 as shown in *Table 3-1*.

Table 3- 1 Data of gold price in UK and US

	UK Gold price (£/troy ounce)	US gold price ($/troy ounce)
Base date	04/01/1968	04/01/1968
End date	10/31/2019	10/31/2019
Source	FRED	FRED

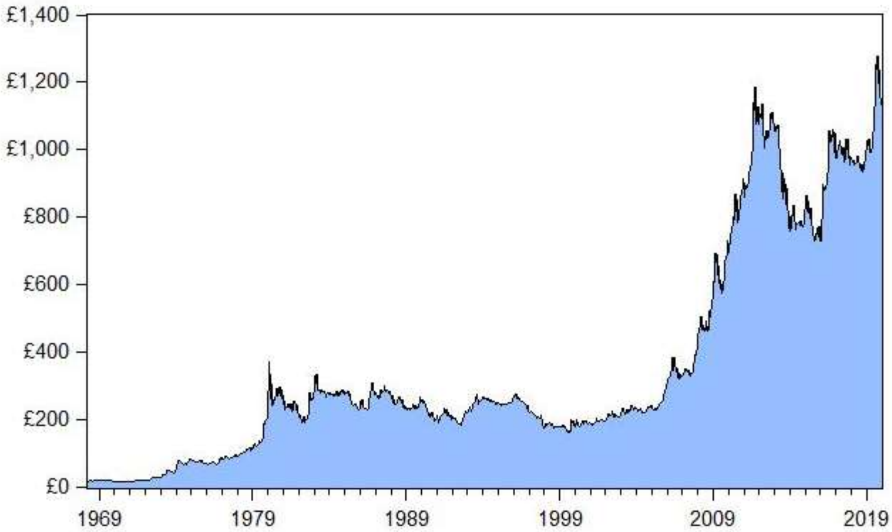

Fig. 3- 1 Gold fixing price 3:00 PM - UK

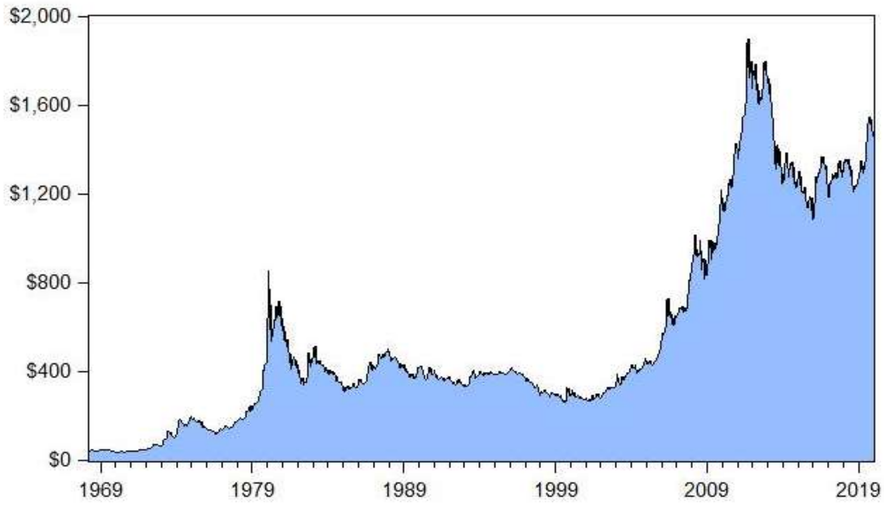

*Fig. 3- 2 G*old fixing price 3:00 PM - US

Fig. 3-1 shows the gold fixing price (£/troy ounce) at 3:00 PM London time in the UK market. *Fig. 3-2* depicts the gold fixing price ($/troy ounce) at 3:00 PM London time in the US market. *Fig. 3-1* and *Fig. 3-2* may intuitively be divided into three different date periods by the extent of the change in gold prices. The first period is from 1968 to 1979 with less fluctuation but a steady increase in the gold price. The second period starts at the first peak in 1980 to 2005 with many fluctuations but no higher gold prices than 1979. Finally, there is the dramatic increase in gold price shown from 2006 to 2011 and a quick drop and rise afterwards from 2012 to 2019 in the last period. Generally, the gold price has been much higher since 2007, when it was the beginning of the financial crisis in July 2007 (Baur and McDermott, 2010). However, it is worth mentioning that the gold price in 1987 didn't rise dramatically after the worldwide stock market crash, called Black Monday, caused a significant drop of the index in both the UK and the US market in October 1987 (Shiller et al., 1987).

As explained in O'Connor et al. (2015), gold trading is offered in many gold markets throughout the world, including the London Bullion market, New York gold market (COMEX, NYMEX), Shanghai Exchanges, Tokyo etc. Nevertheless, the London gold market has been dominating the gold market resulting in the gold price standard. However, later research by Lucey et al. (2013) applied the Error Correction Model to gold prices in the London gold market and the New York gold market. The results suggest that there is no evidence to prove whether the London market or the New York market is dominant. It turns out that the dominant role switches between the two. However, more recent research in Hauptfleisch et al. (2016) concluded that the US futures market provides more support for the gold price discovery than the London OTC spot market. Based on the different types of operations in the London gold market and the New York gold market, the regression model is conducted after the determinant variables are selected in the markets. However, it cannot prove that the New York gold market can set the gold price. This research will make the conclusion that the dominance switches between the UK and US market as in Lucey et al. (2013) to collects gold prices from the UK gold market for the analysis of the UK market, and the US gold price for the analysis of the US market.

3.2.2 Descriptive statistics of gold prices

Table 3- 2 Descriptive data of gold price in UK and US

	Gold price - UK	Gold price - US
Mean	337.507	534.215
Median	230.877	380.5
Std. Dev.	307.7565	442.2512
Skewness	1.280	1.154
Kurtosis	3.365	3.1749
Jarque-Bera	3614.57** [0.000]	2901.06** [0.000]
Observations	12966	12977
Notes: ** indicates the statistical significance at the 1% level.		

Table 3-2 presents the descriptive data of the gold price in the UK and the US. Since the monetary units in the UK and the US are different, the mean and median cannot be intuitively compared in *Table 3-2.* The standard deviation of the gold price in the UK is less than that in the US, which implies that the data of gold price in the US is more dispersed. It can be seen from *Fig. 3-1* and *Fig. 3-2* that the extent of change in the gold price is more dramatic in the US. The gold prices in both the UK and the US are positively skewed, which is also mentioned in Lucey et al. (2006). None of the variables follow the normal distribution according to the probability value of the Jarque-Bera results (less than 5%), which suggests rejecting the null hypothesis of the normal distribution.

3.2.3 Gold return

The return on any asset can be calculated as the raw return or the logarithmic return. The raw return is calculated by subtraction between the final value and the initial value, divided by the initial value. The logarithmic return is calculated by the natural logarithmic of the division between the final value and the initial value. The calculation of the raw return allows any non-zero initial values and any final value, but the logarithmic return can only be calculated when the division between the final value and initial value is greater than zero. *Fig. 3-3* shows the raw return on gold in the UK, *Fig. 3-4* shows the logarithmic return on gold in the UK, *Fig. 3-5* shows the raw return on gold in the US, and *Fig. 3-6* shows the logarithmic return on gold in the US. The returns by using two different calculation methods are approximately equal when the returns are small. It can be seen by the comparison between *Fig. 3-3* and *Fig. 3-4* in the UK, and between *Fig. 3-5* and *Fig. 3-6* in the US. However, a large difference occurs when the percent change is large. A large difference between different calculation in returns would cause a large difference in the results. Therefore, the calculation method of returns must be chosen carefully.

Although the logarithmic return on assets is often used in empirical tests, the methodology is mainly based on the CAPM. And the return is the raw return on assets in CAPM. Using logarithmic return on assets in CAPM is not appropriate. The calculation of the raw return is chosen in this thesis.

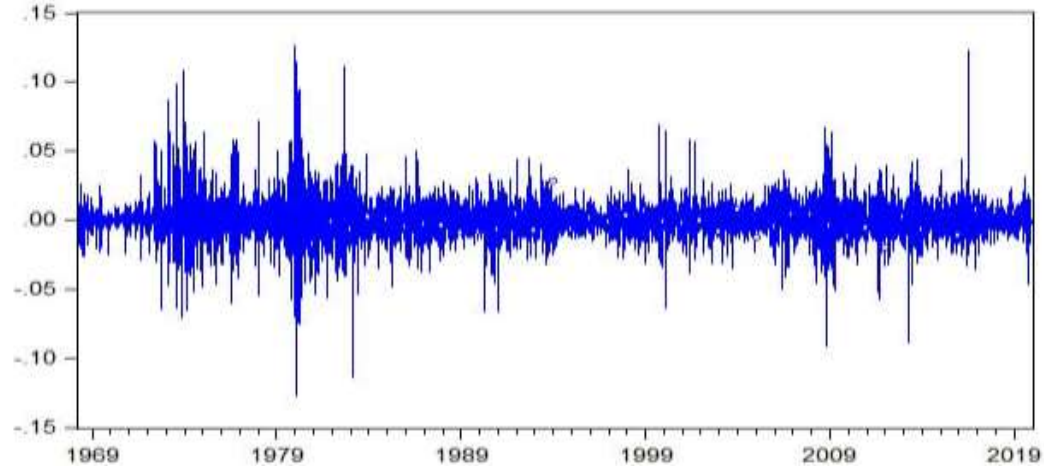

Fig. 3- 3 Raw return on gold - UK

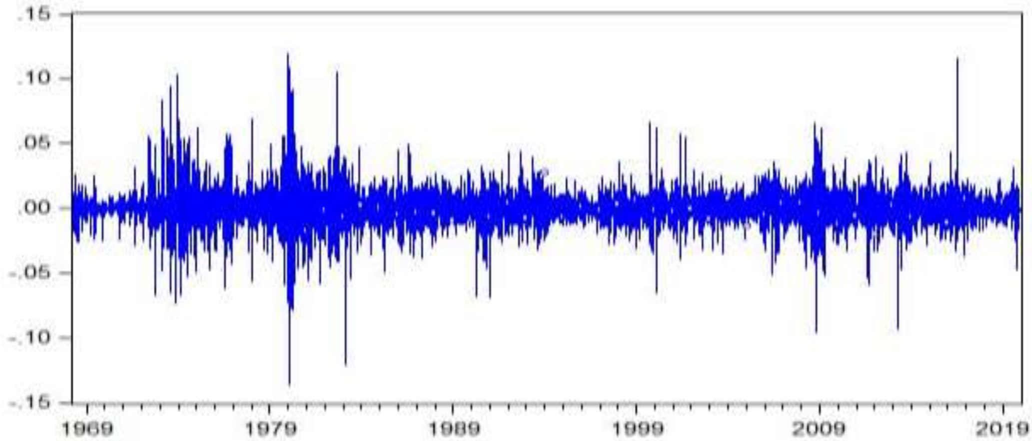

Fig. 3- 4 Logarithmic return on gold - UK

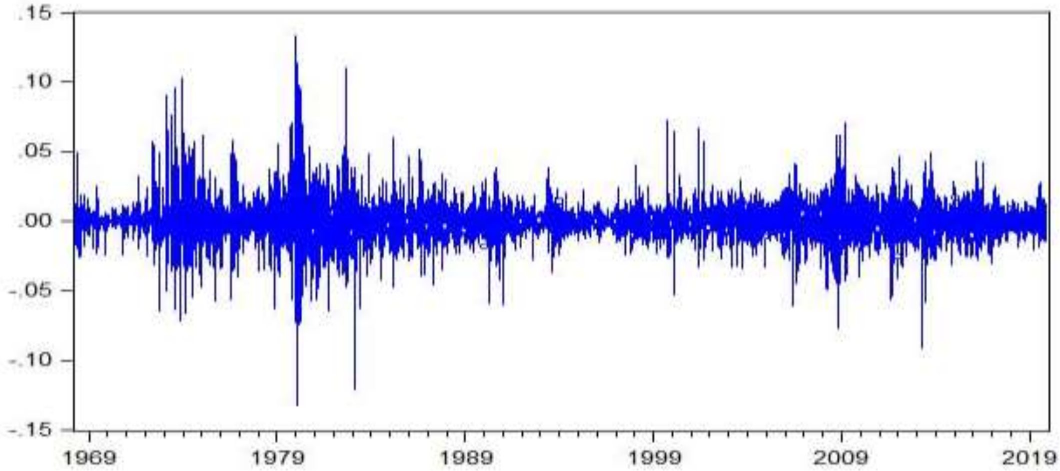

Fig. 3- 5 Raw return on gold - US

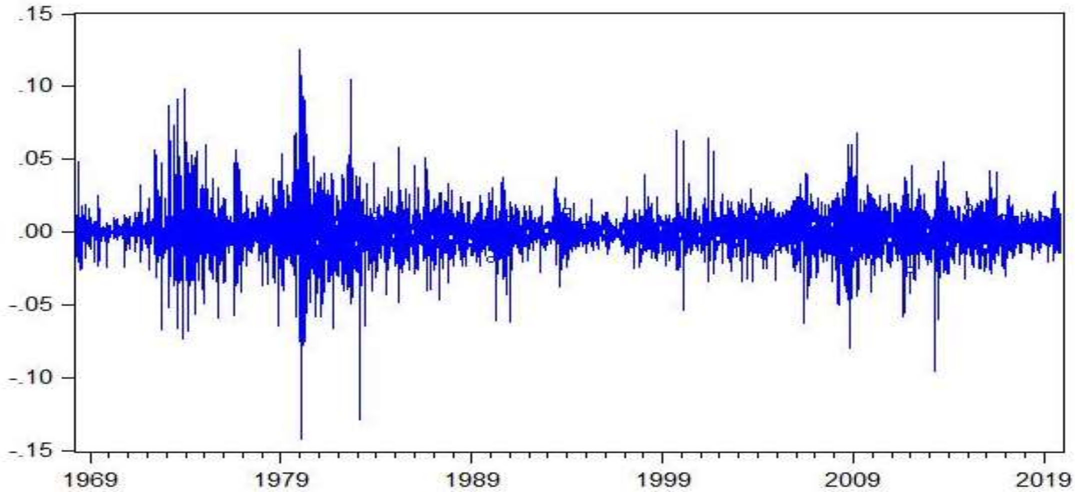

Fig. 3- 6 Logarithmic return on gold - US

As shown in *Fig. 3-3*, for the gold return in the UK, there exist many fluctuations around the zero natural logarithmic return on gold. The highest return (11.9%) on gold is on January 3rd, 1980. Shafiee and Topal (2010) did an overview of the gold prices from 1968 to 2008, and explained the trend and the fluctuations within those 40 years. The huge increase on January 3rd 1980 was indeed mentioned in the analysis. However, the factors or the events that may have caused the increase were not included. Sujit and Kumar (2011) have listed the events that can influence the dramatic price changes in gold and oil. The events that caused the temporary spike of the gold price included the sharp increase in the price of crude oil for the first time by OPEC (Organization of Petroleum Exporting Countries) between 1975 and 1980 and the Soviet Union's invasion of Afghanistan. In addition, the second highest spike was on June 24th 2016. This was caused by Britain voting to leave the EU, as there is no corresponding spike in the gold price shown on that day in the US market. The lowest return (-13.6%) is on January 22nd 1980. Although there was no breaking event on that day, Williams (1995) explained that silver may well have had some influence on gold during 1979 and 1980, meaning that the price changes in silver were highly correlated with the changes in gold price. However, the correlation may not necessarily be the causality. The drop in the gold price on January 22nd 1980 was as much as the drop of the silver price on the same day and followed the imposition of trading for liquidation only in the silver market. Although the causality may not be perfectly correlated between silver and gold in Williams (1995), this is the only event that could be significant enough as a reason for the dramatic decrease of the gold price on January 22nd 1980. So far, the events that caused the significant increase and decrease in the gold prices have provided the evidence that the gold price to some extent may be influenced by political or economic events rather than the markets.

3.3 Market indices

3.3.1 Market indices and index constituents

Chapter 4 focuses on the UK and US markets first. The Financial Times Stock Exchange (FTSE) 100 index is a share index of 100 companies with the highest market capitalisation in the London Stock Exchange. FTSE 250 is the index of the 101^{st} to 250^{th} largest companies listed on the London Stock Exchange. FTSE 350 is the stock market index incorporating the largest 350 companies, including listed companies in FTSE 100 and FTSE 250, listed on the London Stock Exchange. As explained in Laura and Fahad (2017), the FTSE All share index is a mix of the FTSE 100, FTSE 350 and FTSE Small cap indices, which means that the FTSE All share contains all the market stocks and other portfolios in the UK market. In addition, the FTSE All share can represent 98-99% capitalization in the UK market. Thus, it is reasonable to apply the FTSE All share as a proxy variable in the analysis. Since the S&P 500 and the Dow Jones are the commonly agreed proxies for the US market, there will be no more prolix explanation for the reason to use them. In summary, as shown in *Table 3-3*, the FTSE 100, FTSE 350 and the FTSE All share will be selected as the proxy for the UK market, while the S&P 500 and the Dow Jones are used as the proxy for the US market.

Table 3- 3 Market Indices in the UK and the US

	FTSE 100	FTSE 350	FTSE All share	Dow Jones	S&P 500
Base date	12/30/1983	12/30/1985-	01/01/1985 –	04/01/1968	04/01/1968
End date	10/31/2019	10/31/2019	10/31/2019	10/31/2019	10/31/2019
Source	Datastream	Datastream	Datastream	Measuring Worth.com	Datastream

For Chapter 5 and 6, all data used are collected at a daily frequency. As shown in *Table 3- 4,* we choose five indices in five different countries, which include FTSE (Financial Times Stock Exchange) 350 in the UK, S&P (Standard and Poor) 500 in the US, SSE (Shanghai Stock Exchange) 180 in China, NIKKEI 225 in Japan and SENSEX (Bombay Stock Exchange Sensitive Index) in India. The index constituents are presented in *Table B-1* for FTSE 350, *Table B-2* for S&P 500, *Table B-3* for SSE 180, *Table B-4* for Nikkei 225 and *Table B-5* for SENSEX in Appendix B. As the start date of each constituent is not the same, we choose to use the earliest starting date for each constituent and set the end date as October 31st 2019. These five countries cover the mature market of gold trading (the UK, US and Japan) and the emerging market of gold trading (China and India). It would be sufficient to explain the characteristic of gold, T-bills, OIS and IBOR as the proxy for the risk-free asset for each country or for every country.

Table 3- 4 Data source

	Start date	End date	Data Source
Indices			
FTSE 350 – UK	12/31/1985	10/31/2019	Datastream
S&P 500 – US	12/31/1963	10/31/2019	Datastream
SSE 180 – China	01/02/1992	10/31/2019	Datastream
Nikkei 225– Japan	04/03/1950	10/31/2019	Datastream
SENSEX - India	04/03/1979	10/31/2019	Datastream
Index constituents			
FTSE 350	Earliest data	10/31/2019	Datastream
S&P 500	Earliest data	10/31/2019	Datastream
SSE 180	Earliest data	10/31/2019	Datastream
NIKKEI 225	Earliest data	10/31/2019	Datastream
SENSEX	Earliest data	10/31/2019	Datastream

3.3.2 Descriptive statistics

The returns on market portfolio in the UK and the US are calculated as the raw return. *Table 3-5* shows the descriptive data of the raw returns on market portfolio in the UK and the US. The raw returns in the UK market are close to each other. As mentioned in Section 3.3.1, the FTSE 100 incorporates 100 companies, FTSE 350 incorporates 350 companies, and FTSE All share incorporates the companies in FTSE 100 and FTSE 350. Unsurprisingly, the mean of raw return is increasing with the increasing number of companies included in the index. However, the mean of raw returns in the UK market is less than the mean of raw return in the US market. The standard deviation of all raw returns is close. The raw returns are negatively skewed in both the UK and the US market. None of the variables follow the normal distribution according to the probability value of the Jarque-Bera results (less than 5%), which suggests rejecting the null hypothesis of the normal distribution.

Table 3- 5 Descriptive data of return on market portfolio in UK and US

	UK market			US market	
	Raw return on market portfolio (FTSE 100) - %	Raw return on market portfolio (FTSE 350) - %	Raw return on market portfolio (FTSE All share) - %	Raw return on market portfolio (S&P 500) - %	Raw return on market portfolio (Dow Jones) -%
Mean	0.020941	0.021544	0.0225	0.025074	0.024522
Std. Dev.	1.082672	1.039725	1.017	1.037369	1.047223
Skewness	-0.48413	-0.54093	-0.566	-1.01897	-1.25896
Kurtosis	12.83869	12.64862	13.575	29.74516	39.95554
Jarque-Bera	34790.44*	32533.68*	40267.2*	381222.1*	679108.5*
Observation	9244	8983	9253	13417	12579

Notes: * indicates the statistical significance at the 5% level.

Table 3-6 shows the descriptive statistics of the return of market indices in the UK, US, China, Japan and India. The Jaque-Bera test is used to test whether the series are normally distributed or not. From *Table 3-6*, it can be deduced that none of the series are normally distributed.

Table 3- 6 Descriptive Statistics – Return of the market indices in UK, US, China, Japan and India

	Mean	Std. Dev.	Skewness	Kurtosis	Jaque-Bera
FTSE 350	0.000457	0.010044	-2.15937	25.42477	30400*
S&P 500	0.000307	0.010236	-0.64904	24.71511	292377*
SSE 180	0.000596	0.024906	13.04389	540.0625	90961943*
Nikkei	0.000369	0.0119	-0.17991	13.04102	77455*
SENSEX	0.000645	0.015053	0.341756	14.45369	59507*

Note: * presents the statistical significance at 5% level for p-value.

Table B-6 to *B-10*, in Appendix B, are the descriptive statistics of the constituents for FTSE 350, S&P 500, SSE 180, Nikkei 225 and SENSEX.

3.4 Government Treasury bills

3.4.1 T-bills

Table 3-7 shows the daily data of returns on the government Treasury bill in the UK and the US market. The returns on T-bills are selected from the daily data of the return on the 3-month T-bill in the UK and the US market. It is due to the wide acceptance that the 3-month T-bill is considered as the risk-free asset. The time for the UK 3-month T-bill is from January 4th 1985 to October 31st 2019, and the time for the US 3-month T-bill is from January 2nd 1972 to October 31st 2019. The data of both the UK and the US T-bill are collected from Datastream.

Table 3- 7 Data of return on 3-month government Treasury bills in the UK and US

	UK 3-month Treasury bill return	US 3-month Treasury bill return
Base date	01/04/1985	01/02/1972
End date	10/31/2019	10/31/2019
Source	Datastream	Datastream

3.4.2 Descriptive statistics

Table 3-8 presents the descriptive data of the raw return on the 3-month government T-bills in UK and US. The mean of the raw return on the UK T-bills (0.0139) is slightly greater than the raw return on the US T-bills (0.0095), which implies that the UK T-bills has a higher expected raw return. The larger standard deviation in returns on the US T-bills (0.073) implies more dispersed data on the returns of the US T-bills. Both data are positively skewed. None of the variables follow the normal distribution according to the probability value of the Jarque-Bera results (less than 5%).

*Table 3- 8 D*escriptive data of return on 3-month T-bills in the UK and US (Daily)

	Return on UK 3-month Treasury bills - %	Return on US 3-month Treasury bills - %
Mean	0.0139	0.0095
Std. Dev.	0.00037	0.0073
Skewness	0.4275	0.2240
Kurtosis	2.3721	1.9921
Jarque-Bera	413.118*	441.33*
Observations	9141	12117

Notes: * indicates the statistical significance at the 5% level.

3.5 Overnight Index Swap (OIS) and IBOR

Table 3-9 shows the data of OIS in the UK, the US and Japan, and shows IBOR in China and India. As well as the gold and T-bills, we choose the OIS and IBOR for other candidates of the proxy for the risk-free asset, since OIS is an alternative benchmark for the interbank offered rate (IBOR) as the risk-free rate. SONIA is the Sterling Overnight Average Index in the UK, SOFR is the Secured Overnight Financing Rate in the US, and TONA is the Tokyo Overnight Average Rate in Japan. However, there is no such benchmark for the Overnight Index Swaps in China and India at the moment. As we discussed in Section 2.2.6, we choose the IBOR in China and India as another candidate for the proxy for the risk-free asset instead of the missing data of the OIS and make a comparison with the OIS in the UK, the US and Japan.

Table 3- 9 Data of OIS and IBOR in UK, US, China, Japan and India

	Start date	End date	Data Source
UK			
SONIA	03/24/1997	10/31/2019	Bank of England
US			
SOFR	04/03/2018	10/31/2019	FRED
China			
IBOR	09/01/1988	10/31/2019	DataStream
Japan			
TONA	11/12/2018	10/31/2019	DataStream
India			
IBOR	02/19/1996	10/31/2019	DataStream

3.6 Excess Return

3.6.1 Excess return used in classic CAPM

In this thesis, the data is firstly gathered at the daily frequency. The data are collected mainly from Datastream, Federal Reserve Economic Data (FRED) and the database of Measuring Worth.

The time series starts from April 1985 to September 2017 for the FTSE 100 and FTSE 350, and from January 1969 to September 2017 for the rest of the data in order to employ data as long as possible. In the weekly and monthly data, the FTSE 100, FTSE 350 and FTSE All shares are the proxy for the UK stock market, while the S&P 500 and Dow Jones remain the proxies for the US stock market. The weekly data are converted from the daily data in two ways: the first observation in each period and the average value. The monthly data are chosen in two ways for frequency conversion, the end of each periods and the monthly average. The data of FTSE All share, S&P 500, Dow Jones, 3-month Treasury bill rates in the US and the UK for both methods can be collected from Datastream. Only the gold prices are converted from the daily data into the monthly in terms of the two frequency conversion methods. It aims to ensure that the results are sufficient enough for further analysis to be conducted. Thus, the data is tested in these two ways, respectively. The following figures from *Fig. 3-7* to *Fig. 3-13* will present the series of excess returns that are calculated by subtracting the return on market portfolios by the proxies of the risk-free rate in the UK and US market.

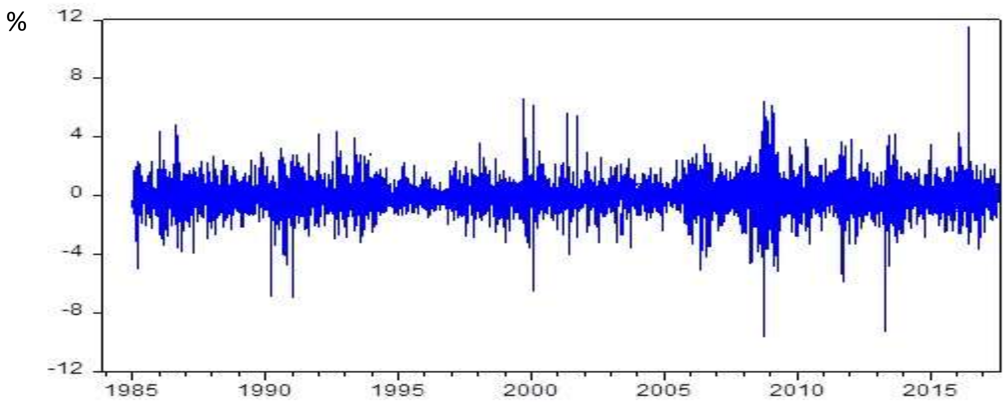

Fig. 3- 7 Excess return on gold in UK market (daily)

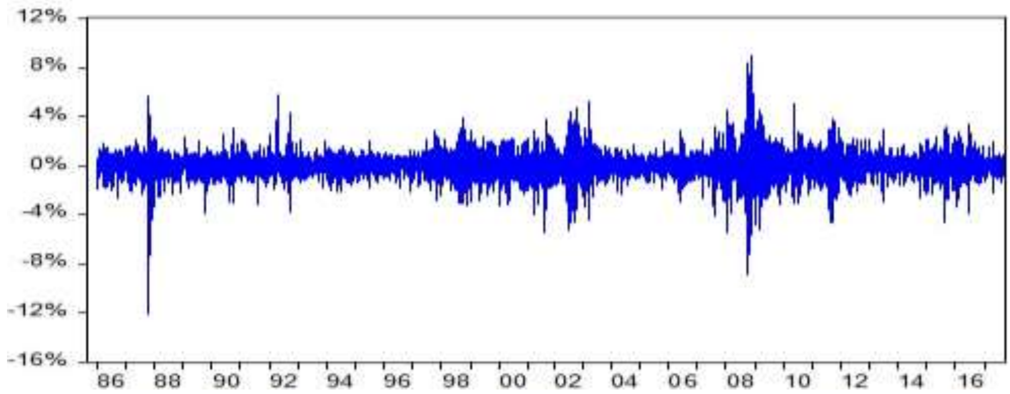

Fig. 3- 8 Excess return on gold in US market (daily)

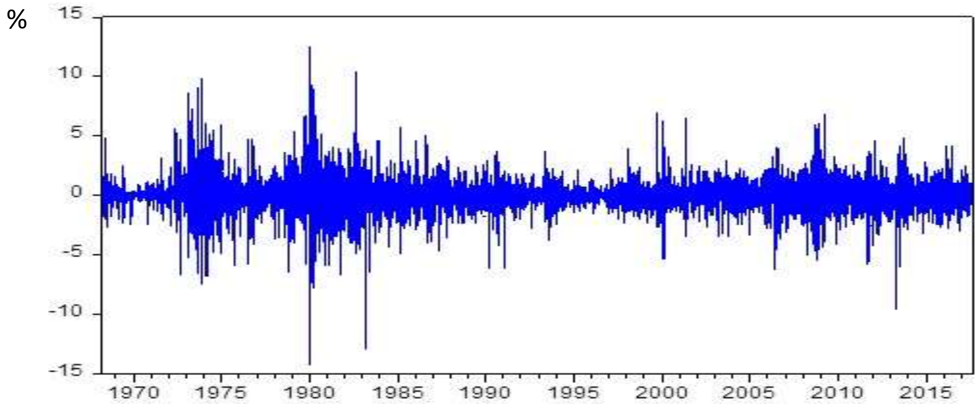

Fig. 3- 9 Excess return on market portfolio (FTSE 100, daily)

Fig. 3-7 is the graph of the excess return on asset for gold in the UK market from April 1985 to August 2017. *Figure 3-8* is the graph of the excess return on gold in the US market. Both figures show that there is no trend over time. However, the excess return on gold in the US market has more extreme values than that in the UK market. It may suggest that the change in the gold price in the US market is frequent and significant. *Fig. 3-9*, *Fig. 3-10* and *Fig. 3-11* are the excess returns on market portfolio at daily frequency in the FTSE 100, FTSE 350 and FTSE All shares. Since the FTSE All shares contains the FTSE 100 and FTSE 350, and FTSE 350 contains FTSE 100, the figures in these three different indices generally follow a similar shape. *Fig. 3-12* and *Fig. 3-13* represent the excess return on market portfolio in the S&P 500 and Dow Jones, respectively. No obvious trend can be found in these figures. The common drop indicates that the US market also suffered from the stock market crash in October 1987 as explained earlier.

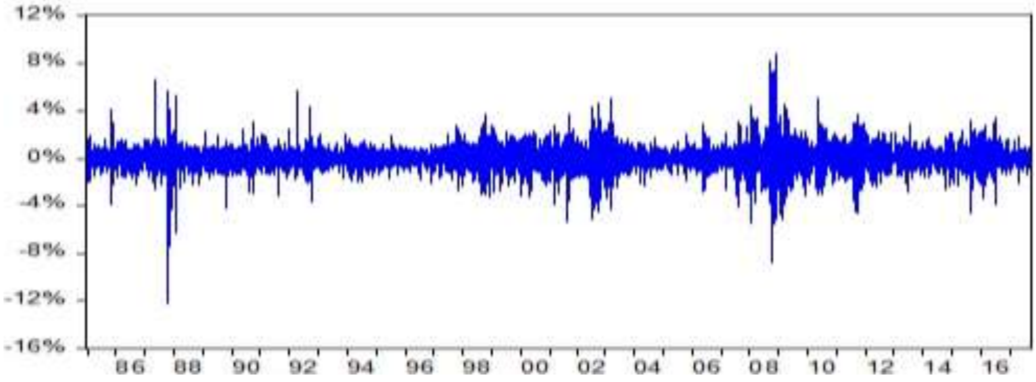

Fig. 3- 10 Excess return on market portfolio (FTSE 350, daily)

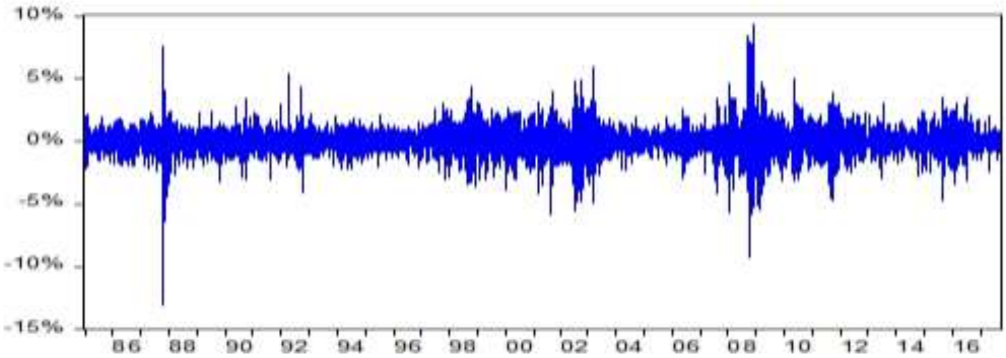

Fig. 3- 11 Excess return on market portfolio (FTSE All share, Daily)

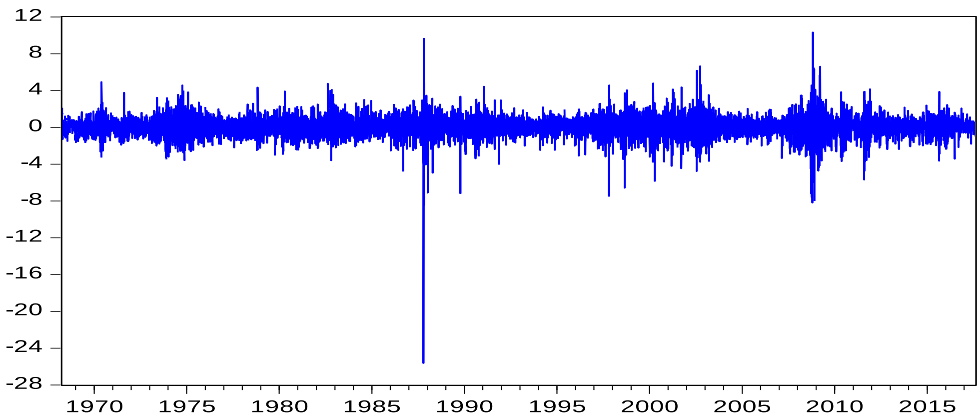

Fig. 3- 12 Excess return on market portfolio (S&P 500, daily)

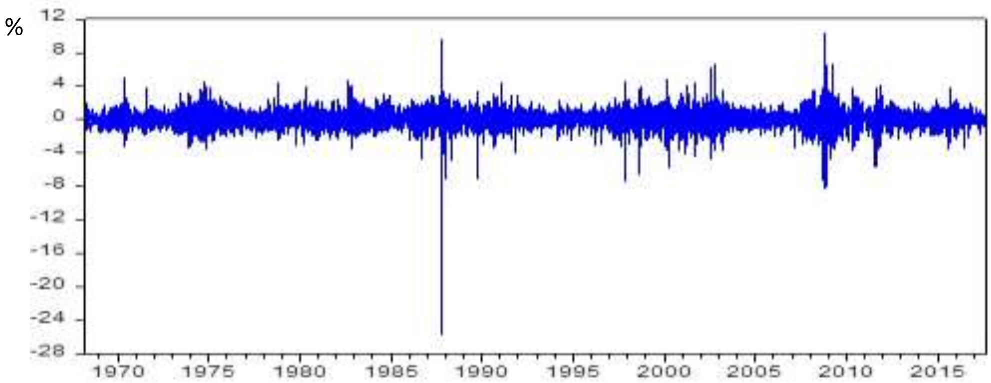

Fig. 3- 13 Excess return on market portfolio (Dow Jones, daily)

3.6.2 Descriptive statistics

Table 3-10 and *3-11* show the descriptive statistics of all the variables used in classic CAPM in daily frequency in the UK and the US market. None of the variables follow the normal distribution according to the p-value of the Jarque-Bera results (less than 5%), which suggests rejecting the null hypothesis of the normal distribution. In addition, the only significant difference between series of the UK gold price and the US gold price is the skewness. The skewness is measured by $S(X) = E\left[\left(\frac{X-\mu}{\sigma}\right)^3\right]$, where μ is the mean, and σ is the standard deviation. The value of skewness in the US (0.00436) is relatively much larger than that in the UK (0.0879717), which implies that the distribution of the excess return of gold in the US has a longer right tail. The difference in kurtosis between excess return of gold in the UK and the US is a higher peak in the distribution of the excess return of gold in the US. In terms of the UK and the US stock markets, they are generally statistically significantly different. Both distributions of the excess return in the market portfolio in the US market (S&P 500 index and Dow Jones index) have a longer left tail than that of excess return in the market portfolio in the UK (FTSE 100, FTSE 350, and FTSE All share). Moreover, the peak in the distribution of the excess return in the market portfolio in the US is significantly higher than the excess return in the market portfolio in the UK. It is worth mentioning that the distribution of the excess return in the market portfolio (Dow Jones) has the longest left tail (skewness of 28.50481) and the highest peak (kurtosis of 40.06316) in *Table 3-10* and *3-11*. This skewness can lead to either too wide or too narrow confidence intervals in the regression model. And the positive kurtosis (also called leptokurtic) implies fat tails in the distribution.

Table 3- 10 Descriptive data of excess return used in classic CAPM – UK (Daily)

	Excess return on gold (UK) -%	Excess return on market portfolio (FTSE 100) - %	Excess return on market portfolio (FTSE 350) - %	Excess return on market portfolio (FTSE All share) - %
Mean	-0.0007	0.006943	0.007792	0.008462
Std. Dev.	1.026588	1.082649	1.039738	1.017595
Skewness	0.00436	-0.48194	-0.53802	-0.56356
Kurtosis	10.60499	12.85687	12.66388	13.5917
Jarque-Bera	19317.2*	34906.7*	32631*	40375*

Notes: * indicates the statistical significance at the 5% level.

Table 3- 11 Descriptive data of excess return used in classic CAPM – US (Daily)

	Excess return on gold (US) - %	Excess return on market portfolio (S&P 500) - %	Excess return on market portfolio (Dow Jones) -%
Mean	0.009261	0.009768	0.007932
Std. Dev.	1.239922	1.050833	1.043644
Skewness	0.087917	-1.11281	-1.3685
Kurtosis	13.95581	28.50481	40.06316
Jarque-Bera	58014*	332558*	675967

Notes: * indicates the statistical significance at the 5% level.

3.7 Other precious metals

3.7.1 Silver, platinum, and palladium

Table 3-12 shows the data source and the time range of the precious metals – silver, platinum, and palladium – in both the UK and the US market. The data of silver prices in the Quandl database are validated by the LBMA. The price data of platinum and palladium that are collected from the Quandl database are validated by the LPPM (London Platinum and Palladium Market). Although the LPPM has a much shorter history than the LBMA, London has become a significant centre for trading platinum and palladium. The LPPM provides the fixing prices of platinum and palladium twice a day. The reason why the Quandl database is chosen is due to the lack of data from Datastream. But the Quandl database provides the longest and most reliable data from the original sources. The price of silver is the fixing price set per troy ounce from January 2nd 1968 to June 31st 2019. The AM fixing price of platinum and palladium is selected to ensure a larger sample size in the data from April 2nd 1990 to October 31st 2019.

Table 3- 12 Data of Precious metals

	UK			US		
	Silver	Platinum	Palladium	Silver	Platinum	Palladium
Base Date	02/01/1968	02/04/1990	02/04/1990	02/01/1968	02/04/1990	02/04/1990
End Date	31/10/2019	31/10/2019	31/10/2019	31/10/2019	31/10/2019	31/10/2019
Source	Quandl	Quandl	Quandl	Quandl	Quandl	Quandl

According to Lucey and Li (2015), silver, platinum and palladium have a low correlation (both positive and negative) with the stock market. *Table 3-13* shows the covariance between the assets and the stock markets in the UK and the US. The raw returns on silver, platinum and palladium have very low covariance with the FTSE 100, FTSE 350, Dow Jones, and S&P 500. It is much closer to zero of the covariance between the raw return of silver, platinum and palladium and the FTSE 100, FTSE 350, Dow Jones and S&P 500 than T-bills and gold. If T-bills and gold are accepted as the risk-free asset, silver, platinum and palladium could be the candidate proxies for the risk-free asset due to the covariance shown in *Table 3-13*.

Table 3- 13 Covariance between assets and market indices

	T-bills	Gold	Silver	Platinum	Palladium
FTSE100	6.37E-05	-0.038619	4.92E-06	5.93E-06	2.37E-05
FTSE 350	3.93E-05	-0.042079	4.83E-06	1.03E-05	2.42E-05
Dow Jones	-0.000103	-0.047049	-4.23E-07	-8.52E-06	3.46E-06
S&P 500	-8.09E-05	-0.037391	-4.96E-06	1.15E-05	1.48E-05

Chapter 4 Gold as a hedge or a safe haven in Markov-switching CAPM

4.1 Introduction

This chapter aims to investigate the characteristics of gold as a hedge or a safe haven by the examination of gold's beta in the UK and the US market. There are two models that will be explained and used in Section 4.2 and 4.3. The first model is the classic CAPM, and the second model is the Markov-switching model. Using the classic CAPM is the straightforward method to estimate gold's beta, which can suggest the relationship between gold and the market portfolio. The application of the classic CAPM in the approach of Markov-switching examines gold's beta from a different angle. There will be regimes assumed in the Markov-switching CAPM to examine which regime gold's beta would be during the certain time period.

This chapter will present the methodology used to investigate the characteristics of gold as a hedge or a safe haven in Section 4.2. Section 4.3 will present the empirical results. Section 4.4 will explain the conclusion drawn from the results in Section 4.3. Unlike the published paper in He et al. (2018), the data here has been extended to include the period up to 31/10/2019. So, there are more observations in the sample for the test. In addition, this chapter also includes the results from using the data with different frequencies (daily, weekly, monthly), while the published paper only presents the results for daily and weekly data. As mentioned in He et al. (2018), the results with monthly data can be accessed by requests. Choosing the results in daily and weekly data is a sufficient way to present this research since this data can provide sufficient results and monthly data lack sufficient observations in the sample. Also, the weekly and monthly data are using different frequency conversion in order to examine whether the results would differ.

4.2 Methodology

This section will present and describe the test methods and models used in the chapter. Section 4.2.1 will describe the method of testing the unit root and the reason why testing the unit root is necessary before the empirical test. Section 4.2.2 will describe the first model used to investigate gold's beta. The reason for applying the rolling window regression will be explained in Section 4.2.3. Section 4.2.4 will describe the 2nd model to investigate gold's beta.

4.2.1 Ordinary Least Squares

The Ordinary Least Squares (OLS) is a common tool used for regression. The explanation of OLS is for a better introduction for the ADF unit roots test and the Wald test in Chapter 5. It starts with linear approximation. According to Verbeek (2008), assume that there are N observations in one sample denoting y_i as the observed response variable and x_i the observed explanatory variable, $i = 1, \dots, N$. In order to study the relationship between the observations and explanatory variables, a good approximation will be needed. The explanatory variables that contain a constant are shown as the linear combination of $x_2, \dots, x_K$ in (4.1.1).

$$\beta_1 + \beta_2 x_2 + \beta_3 x_3 + \cdots + \beta_K x_K \qquad (4.1.1)$$

where $\beta_1, \dots, \beta_K$ are the constants.

So, the difference between the values of observations and the linear approximation is written as,

$$y_i - (\beta_1 + \beta_2 x_2 + \beta_3 x_3 + \cdots + \beta_K x_K) \tag{4.1.2}$$

To generalize the expression in (4.1.2), the x values and β values will be expressed in vectors as,

$$x_i = (1, x_{i2}, x_{i3}, \dots, x_{iK})' \tag{4.1.3}$$

$$\beta_i = (\beta_{1\,,}\beta_2, \dots, \beta_K)' \tag{4.1.4}$$

According to equation 4.1.3 and 4.1.4, the linear approximation of (4.1.2) can be written as

$$y_i - x_i{}'\beta_i \tag{4.1.5}$$

The key point in this approximation is to find the values for β_i such that the difference in (4.1.5) is small. So, the common approach is to find β_i with the sum of the squared difference, which is as small as possible, shown in equation 4.1.6.

$$S(\beta_i) = \sum_{i=1}^{N} (y_i - x_i{}'\beta_i)^2 \tag{4.1.6}$$

Examining the constant β_i in the approach in equation 4.1.6 is referred to as the Ordinary Least Squares (OLS). Differentiating equation 4.1.6 with respect to β_i will solve the minimization problem to find β_i. After the differentiation, equation 4.1.6 is written as,

$$-2\sum_{i=1}^{N} x_i(y_i - x_i{}'\beta_i) = 0 \tag{4.1.7}$$

After rearrangement,

$$\left(\sum_{i=1}^{N} x_i\, x_i{}'\right)\beta_i = \left(\sum_{i=1}^{N} x_i\, y_i\right)$$

So, the solution of β_i can be written as equation 4.1.8.

$$\beta_i = \left(\sum_{i=1}^{N} x_i\, x_i{}'\right)^{-1} \left(\sum_{i=1}^{N} x_i\, y_i\right) \tag{4.1.8}$$

Defining the residual $e_i = (e_{1,}e_2, \dots, e_N)$, the difference between the observed value and the values in the approximation can be written as,

$$y_i - x_i{}'\beta_i = e_i \tag{4.1.9}$$

Substituting equation 4.1.9 into equation 4.1.7,

$$\sum_{i=1}^{N} x_i(y_i - x_i'\beta_i) = \sum_{i=1}^{N} x_i e_i = 0 \qquad (4.1.10)$$

Equation 4.1.10 implies that the residual vector must be orthogonal to the x_i vector. Since there is a constant in the x_i vector, it implies $\sum_{i=1}^{N} e_i = 0$. In other words, the mean of the residual is zero. This is useful due to the fact that the approximation is best when the residual is zero.

4.2.2. Unit root test

Before processing the CAPM for the estimation of gold's beta, all the variables need to be tested for stationarity. The importance of stationarity in the variables in the data has been emphasised by Dickey and Fuller (1979), (1981). In addition, the reason why the unit root test is important is that a series in the regression model may have some unexpected change or error term during a period of time. That series may provide a misleading result in the regression. In other words, the employment of the non-stationary series may cause spurious results. To prevent this, each variable in the regression equation needs to be tested by the unit root null hypothesis of the non-stationary variables before the process of the regression.

The hypotheses are as follows:

H_0 (Null hypothesis): The series has a unit root.

H_1 (Alternative hypothesis): The series is stationary (no unit root).

According to Dickey and Fuller (1979) and Mackinnon (1996), series y_t is assumed to have a unit root, and the basic objective in the Augmented Dickey-Fuller unit root test is to examine the null hypothesis ($\phi = 1$) in the following equation,

$$y_t = \phi y_{t-1} + \mu_t \tag{4.2.1}$$

where $\mu_t = y_t - y_{t-1}$.

Furthermore, the series that may be estimated based on Ordinary Least Square (OLS) can have the following forms,

$$\Delta y_t = \psi y_{t-1} + \mu_t \tag{4.2.2}$$

$$\Delta y_t = \alpha + \psi y_{t-1} + \mu_t \tag{4.2.3}$$

$$\Delta y_t = \alpha + \beta t + \psi y_{t-1} + \mu_t \tag{4.2.4}$$

$$\Delta y_t = \alpha + \beta t + \gamma t^2 + \psi y_{t-1} + \mu_t \tag{4.2.5}$$

where, $\Delta y_t = y_t - y_{t-1}$, which indicates the null hypothesis by $\Delta y_t = \mu_t$ in another way, $\psi = \phi - 1$, α is the random variable (also the intercept), β, γ are the coefficients of the time and the time squared (also the coefficient of the trend). The equations 4.2.1, 4.2.2, 4.2.3 and 4.2.4 above represent the different types of series. In equation 4.2.2, the series y_t has zero mean when $\phi < 1$. Equation 4.2.3 allows an intercept α in the series, equation 4.2.4 allows an intercept α and a trend over time βt, and equation 4.2.5 allows an intercept α, a trend βt and another trend γt^2 where its gradient is changing over time. In the later analysis, all these cases will be tested to examine the unit root.

In the following, the Augmented Dickey-Fuller unit root test is used in levels at first, and if the results show non-stationarity it will be tested in 1st difference or 2nd difference if needed. The lag length selection follows Schwarz Information Criterion (SIC) with the default maximum lags of 36 for daily data and maximum lags of 12 for monthly data. Schwarz information criterion (SIC) or Bayesian information criterion (BIC) is a criterion for model selection in a finite number of models. And the model that has the lowest BIC will be preferred (Nealth and Cavanaugh, 2012). Another criterion is Akaike information criterion (AIC). Akaike information criterion (AIC) is the estimator of the out-of-sample prediction error and the quality of models for given data. Both BIC and AIC are based on the likelihood function, but the penalty terms are different in each criterion. The main reason for using Schwarz information criterion is that it penalizes free parameters more strongly than AIC in general.

4.2.3 Capital Asset Pricing Model

Since the Capital Asset Pricing Model (CAPM) is applied in the analysis, we assume that the investors are risk averse and the market is complete (Blitz et al., 2014). In the following analysis, the returns on gold and the market portfolios with respect to indices are calculated as the following equations (Laura and Fahad, 2017):

$$R_{i,t} = \frac{P_{i,t} - P_{i,t-1}}{P_{i,t-1}} \qquad (4.3.1)$$

Here, $R_{i,t}$ denotes the raw return on asset i in period t, where $i = g, M; t = 1, 2, \dots, T$. g stands for the asset gold, and M stands for the market portfolio. R_g denotes as the raw return on the asset gold, $P_{g,t}$ denotes the current price of gold in period t, and $P_{g,(t-1)}$ denotes the price of gold in period $(t-1)$, $R_{M,t}$ is the raw return on the market portfolio in period t, $P_{M,t}$ denotes the current index level in period t, and $P_{M,(t-1)}$ denotes the previous index level in period $(t-1)$.

The Capital Asset Pricing Model will be used to examine gold's beta in Chapter 5. The empirical interpretation of CAPM is written as follows:

$$(R_{g,t} - R_{f,t}) = \alpha + \beta(R_{M,t} - R_{f,t}) + \varepsilon_t \tag{4.3.2}$$

where $R_{f,t}$ is the risk-free rate in period t, α the intercept term and ε_t the error term. Note that ε_t is assumed to be an independent and identically distributed random variable that does not necessarily follow the normal distribution.

Following the assumption of Sharpe-Lintner CAPM (Sharpe, 1964, Lintner, 1965), by taking the expectations on both sides of equation 4.2.2, the following equation 4.2.3 must hold,

$$E\left(R_g^e\right) = \beta E(R_m^e) \tag{4.3.3}$$

where the excess return on the asset gold is denoted by $R_g^e = R_g - R_f$, the excess return on the market portfolio is denoted by $R_m^e = R_M - R_f$. It implies that the intercept term α in equation 4.3.2 must be zero in order to be consistent with Sharpe-Lintner CAPM.

The objective in the application of CAPM is to estimate gold's beta coefficient (β) by employing the gold excess return rate and the market excess rate of return in the UK and the US. According to equation 4.3.3, the excess return on gold will be on the left-hand side, and excess return on the market portfolio will be the right-hand side for both the UK and the US markets. As mentioned in Chapter 3, excess return in gold in the UK and the excess return on market portfolio (FTSE 100, FTSE 350, and FTSE All share) will be used in the CAPM to estimate gold's beta coefficient in equation 4.2.2 for the UK market. Gold's beta coefficient will be estimated in the US market by using the data of the excess returns in the US market.

4.2.4 Rolling windows

The rolling regression is applied for the investigation of the time-varying β in the UK and the US markets. In Hung and Liu (2005), the rolling beta estimation has been conducted in the stocks of airline companies according to the breakpoints that are decided by the highest and lowest indexes and the time of crashes. Although the estimation model relies on the Fama and French Three-factor model (Fama and French, 1995), the way of dividing the observation may provide some insight for the periods that gold and the market influence. Unlike Hung and Liu (2005), Groenewold and Fraser (1999) used the monthly Australian data from 1979 to 1994 in 23 sectors in the market to test the time-variation of the betas by rolling regression. And the sample size chosen is at the window size of 50 (months). Similarly, the time range and the number of the observations are relatively close to this research. The rolling regression type is the Fixed Window, which means that the number of observations in each window for the estimation is fixed. Thus, the window size of 50 (months) will be chosen first to conduct the rolling regression in the UK market and the US market respectively. The step size of 1 is defined as the one observation that will be moved ahead for the next rolling window so the figure is filled with lines and not scattered.

4.2.5 Markov-switching CAPM

As stated in Section 4.2.3: CAPM, the linear regression models deal with the constant risk coefficient beta. The graphs of the rolling windows do show some variation in gold’s beta coefficient. Since Markov-switching models estimate regime shifting endogenously, the application of Markov-switching in CAPM will facilitate the analysis of gold’s beta coefficient. The Markov-switching model was introduced in Hamilton (1989) for the non-stationary time series analysis of the business cycle.

We apply a Markov-switching model to test whether there are regime shifts in gold's beta within a CAPM framework. The only application of the Markov-switching model in the research of gold to our knowledge is Lucey and O'Connor (2013) who look at whether bubbles occur in gold prices. Here, the model is applied to see whether a data driven model finds two distinct states that exist between gold returns and returns on diversified equity portfolios.

According to Hamilton (1989) and Huang (2001), we denote s_t the state variable that reflects the regimes in the market. Further, we assume that there are two different regimes in the model. The assumption of two assumed different regimes aims to determine whether there is some negative beta regime and whether the likelihood of gold’s beta stays in the negative beta regime. The CAPM equation (4.3.2) can take the form after the application of the Markov-switching model of equation 4.5.1,

$$\left(R_{g,t} - R_{f,t}\right) = \alpha_{s_t} + \beta_{s_t}\left(R_{M,t} - R_{f,t}\right) + \varepsilon_{s_t} \tag{4.5.1}$$

or

$$R_g^e = \alpha_{s_t} + \beta_{s_t} R_M^e + \varepsilon_{s_t} \tag{4.5.2}$$

where $s_t = 0{,}1$, the error term ε_{s_t} is assumed to be $iid\ N(0, {\sigma_{s_t}}^2)$. s_0 represents one regime with the parameters of $\alpha_{s_0}, \beta_{s_0}, {\sigma_{s_0}}^2$, while s_1 is another regime with the corresponding parameters of $\alpha_{s_1}, \beta_{s_1}, {\sigma_{s_1}}^2$. The reason for applying regime-switching in the variances of the error term will be explained in Chapter 5.

Following the Markov-switching model in Hamilton (1989), the state variable s_t in this thesis will only take the binary values of 0 or 1. Thus, the transition probabilities in the first-order Markov process are modelled in the following,

$$p[s_t = 0 | s_{t-1} = 0\,] = p \tag{4.5.3}$$

$$p[s_t = 1 | s_{t-1} = 0\,] = 1 - p \tag{4.5.4}$$

$$p[s_t = 1 | s_{t-1} = 1\,] = q \tag{4.5.5}$$

$$p[s_t = 0 | s_{t-1} = 1\,] = 1 - q \tag{4.5.6}$$

Equation 4.5.3 shows that the transition probability equals to p or q, if the state variable remains 0 or 1 in the transition while the state variable at previous s_{t-1} and the current s_t are unchanged. The transition probability equals to $1 - p$ or $1 - q$, if the previous state variable s_{t-1} transits from the original state to another state at the current state variable s_t.

Since the original model is the Sharpe-Lintner CAPM (Sharpe, 1964, Lintner, 1965), the following hypothesis must be tested,

$$\alpha_{s_t} = 0 \tag{4.5.7}$$

Where s_t= 0 or 1.

4.3 Empirical Results

This section will present the empirical results. Section 4.3.1 will present the results of Augmented Dickey-Fuller unit root test in the time series data that will be used in the empirical tests in this chapter. The results of the classic CAPM will be presented in Section 4.3.2. Section 4.3.3 will present the results of the residual normality test in the CAPM by using data in the UK and the US market. The results of rolling window will be presented in Section 4.3.4. The results of the Markov-switching CAPM will presented in Section 4.3.5. The summary of the empirical results will be in Section 4.3.6.

4.3.1 Results of Augmented Dickey-Fuller unit root test

The Augmented Dickey-Fuller unit root test will be conducted on all the variables in the regression model based on all ADF test types, including intercept, intercept, and trend, and none of them. The results from the ADF test in variables in daily frequency are shown in this section, and the results from the ADF test in variables in weekly and monthly frequency are shown from *Table A-1* to *Table A-14* in Appendix A.

Table 4- 1 ADF unit root test on excess return on gold in UK (daily, %)

Variable	Excess return on gold in UK		
ADF test	Intercept	Intercept and trend	None
t-statistic	-89.16032	-89.18857	-89.1659
critical value	-2.566906	-3.126946	-1.16167
Probability value	0.0001	0.0001	0.0001
Note: t-statistic is statistically significant at the 5% level			

Table 4- 2 ADF unit root test on excess return on gold in US market (daily, %)

Variable	Excess return on gold in US		
ADF test	Intercept	Intercept and trend	None
t-statistic	-44.36561	-46.58156	-18.06231
critical value	-3.4308686	-3.959033	-2.565309
Probability value	0.0000	0.0000	0.0000
Note: t-statistic is statistically significant at the 5% level			

Table 4- 3 ADF unit root test on excess return on UK market portfolio (FTSE 100, daily, %)

Variable	Excess return on UK market portfolio (FTSE 100, daily)		
ADF test	Intercept	Intercept and trend	None
t-statistic	-43.23678	-43.23483	-43.23434
critical value	-3.43094	-3.95911	-2.56233
Probability value	0.0000	0.0000	0.0001
Note: t-statistic is statistically significant at the 5% level			

Table 4- 4 ADF unit root test on excess return on UK market portfolio (FTSE 3500, daily, %)

Variable	Excess return on UK market portfolio (FTSE 350, daily)		
ADF test	Intercept	Intercept and trend	None
t-statistic	-41.80121	-41.79881	-41.79655
critical value	-3.430964	-3.959144	-2.56241
Probability value	0.0000	0.0000	0.0000
Note: t-statistic is statistically significant at the 5% level			

Table 4- 5 ADF unit root test on excess return on UK market (FTSE All share daily, %)

Variable	Excess return on market (FTSE All share)		
ADF test	Intercept	Intercept and trend	None
t-statistic	-42.25647	-42.25415	-42.25096
critical value	-3.430940	-3.959110	-2.565233
Probability value	0.0000	0.000	0.0001
Note: t-statistic is statistically significant at the 5% level			

Table 4- 6 ADF unit root test on excess return on US market (S&P 500 daily, %)

Variable	Excess return on market (S&P 500)		
ADF test	Intercept	Intercept and trend	None
t-statistic	-99.10712	-102.6281	-59.69404
critical value	-3.43076	-3.958854	-2.565179
Probability value	0.0001	0.0001	0.0001
Note: t-statistic is statistically significant at the 5% level			

Table 4- 7 ADF unit root test on excess return on US market (Dow Jones daily, %)

Variable	Excess return on market (Dow Jones)		
ADF test	Intercept	Intercept and trend	None
t-statistic	-101.5121	-104.9984	-92.30752
critical value	-3.430738	-3.958823	-2.565161
Probability value	0.0001	0.0001	0.0001
Note: t-statistic is statistically significant at the 5% level			

In the Augmented Dickey-Fuller (ADF) unit roots test, the null hypothesis is that the series has a unit root. The ADF unit root test has been conducted on all the variables in the daily data, the weekly data and the monthly data. According to the results from *Table 4-1* to *Table 4-7* in this section and from *Table A-1* to *Table A-14* in Appendix A, the results of all three ADF unit root test types show that the t-statistic value exceeds the critical value at each level in the absolute value and that their p-value is less than 5%. The results suggest that the null hypothesis of the existence of a unit root is rejected, which means that all the variables are stationary series. Thus, these series can be directly employed in the regression.

4.3.2 Results of the classic CAPM

The results in this section are estimated based on equation 4.3.2 in Section 4.2 applying the Ordinary Least Squares (OLS) in the regression model. The objective in this section is to investigate whether gold is a hedge. The null hypothesis in this regression is that the beta of excess return on gold is zero, while the alternative hypothesis is the non-zero beta. This section will present the empirical results of the classic CAPM in the US and UK markets with daily, weekly and monthly frequency data.

4.3.2.1 Results in Daily Data

According to *Table 4-8*, since all the p-values of the intercept in the CAPM are statistically insignificant, the assumption of the CAPM holds for employing the gold data. The OLS regression results have a statistically significant beta in either the US market or the UK market; the p-value is especially significant (below the 1% level) in the FTSE 350 in the UK market, both the S&P 500 and Dow Jones. Thus, the null hypothesis is rejected, implying that there is strong evidence that the beta is not zero based on daily data. Commonly, the betas are all estimated as negative value, which suggests that the excess return on gold would increase while the excess return on the market portfolio (either UK or US) would decrease, and vice versa. However, the absolute value of the relatively largest beta is -0.037531. Since it is close to zero, the changes in the excess return on gold may not be significantly large enough with respect to the change of excess return of the market portfolio.

In addition, the results in R-squared are all close to zero with the highest value of 0.001488 among all R-squared. This indicates a poor description of the data set in the regression. In other words, the data used in the regression fit poorly in the linear regression. While in most research this would be a negative, here this is further evidence that gold is a good hedge for stock market risk. The low R-squared implies that stock market returns do not have any explanatory power for gold returns, making the gold price independent of the stock market indices looked at over the periods examined.

Table 4- 8 Estimated results of beta on gold in the UK and US markets (data of daily frequency)

	UK-FTSE 100	UK-FTSE 350	UK-FTSE All Share	US-S&P 500	US-Dow Jones
Intercept (α)	-0.000572 [0.9602]	0.002750 [0.8136]	-0.000499 [0.9653]	0.009481 [0.4102]	0.010641 [0.3619]
Beta (β)	-0.0302*** [0.0037]	-0.03753*** [0.0007]	-0.03570*** [0.0013]	-0.02876*** [0.0087]	-0.03706*** [0.0009]
R-squared	0.001049	0.001488	0.000833	0.000594	0.000969
Durbin-Watson	2.027316	2.027689	2.379337	2.075808	2.073821
Note: **, *** represent the statistical significance at the 5% and 1% levels.					

4.3.2.2 *Results in Weekly Data*

(1) Weekly data with the conversion method of the average in each period

In *Table 4-9,* the assumption of CAPM does not hold in the US market due to the significant intercept. Although the CAPM can be applied in the UK market, gold's beta in each market is not statistically significant. Thus, the null hypothesis of the zero gold's beta is accepted. In addition, all the values in R-squared are close to zero; importantly, the value of R-squared in the case of the Dow Jones is the smallest (0.000000) and the closest to zero in *Table 4-9*. As the R-squared is close to zero, this implies that the return on the market portfolio does not have any explanatory power for gold returns. In other words, the gold excess return is uncorrelated with the excess return in the market portfolio in both the UK and the US market due to the magnitude of the value in R-squared. Gold is a hedge against the stock market risk in both the UK and US markets.

Table 4- 9 Estimated results of beta on gold in UK and US market (weekly, average frequency conversion)

	UK-FTSE 100	UK-FTSE 350	UK-FTSE All Share	US-S&P 500	US-Dow Jones
Intercept (α)	0.059839 [0.1819]	0.072300 [0.1135]	0.060007 [0.1809]	0.118410*** [0.0074]	0.121472*** [0.0060]
Beta (β)	0.019015 [0.4236]	0.013113 [0.5920]	0.015814 [0.5180]	0.027842 [0.2478]	0.000674 [0.9777]
R-squared	0.000375	0.000174	0.000245	0.000526	0.000000
Durbin-Watson	1.472537	1.461666	1.472586	1.534604	1.534044
Note: **, *** represent the statistical significance at the 5% and 1% levels.					

(2) Weekly data with the conversion method of the first observation in each period

Similarly, with the results in *Table 4-10*, the CAPM cannot be applied in the US market either, and the same proof of the zero gold's beta in the UK market can be discovered. The magnitude of R-squared is similarly close to zero, which suggests that the excess return on gold is uncorrelated to the excess return in the market portfolio in both the UK and US markets in this frequency conversion method. Thus, gold is a hedge against stock market risk in both the UK and US markets.

Table 4- 10 Estimated results of beta on gold in the UK and US markets (weekly, first-observation frequency conversion)

	UK-FTSE 100	UK-FTSE 350	UK-FTSE All Share	US-S&P 500	US-Dow Jones
Intercept (α)	0.059653 [0.2669]	0.072945 [0.1828]	0.059828 [0.2657]	0.118553** [0.0235]	0.121329** [0.0205]
Beta (β)	0.017573 [0.4381]	0.013368 [0.5707]	0.014326 [0.5447]	0.028170 [0.2354]	0.003478 [0.8841]
R-squared	0.000352	0.000194	0.000215	0.000554	0.000008
Durbin-Watson	1.931704	1.927178	1.931756	1.924904	1.924122
Note: **, *** represent the statistical significance at the 5% and 1% levels.					

4.3.2.3 Results in Monthly Data

Due to the previous data frequency employed in the estimation, the monthly frequency of both the average and the end value of each period is applied. This allows this section to cover as many ways as possible to estimate the monthly analysis. The following demonstrate the results of both methods.

(1) Monthly data with the conversion method of the average in each period

As shown in *Table 4-11*, the assumptions of zero intercept in CAPM holds. Although the beta is estimated as having negative values, none of the beta in the cases of the FTSE All share, S&P 500 and Dow Jones are statistically significant (p- values are all larger than 0.05). Thus, the null hypothesis of zero beta is accepted regarding all market portfolios. Gold has zero beta in both the UK market and US market on the basis of monthly data. Following the definitions of hedge and safe haven in Baur and McDermott (2016), these results may provide the evidence to confirm that gold is a hedge against stock market risk in the US and UK market. Furthermore, the R-squared values are close to zero, which suggests that there should be no correlation between the variables. Thus, gold is a hedge against stock market risk in both the UK and US markets.

Table 4- 11 Estimated results of beta on gold in the UK and US markets (data of monthly frequency by using the average value of each month starting)

	UK-FTSE 100	UK-FTSE 350	UK-FTSE All Share	US-S&P 500	US-Dow Jones
Intercept (α)	0.321983 [0.0943]	0.385333* [0.0492]	0.148821 [0.4573]	0.648567 [0.1149]	0.678028 [0.0990]
Beta (β)	-0.00818 [0.8702]	-0.017282 [0.7288]	-0.049277 [0.2538]	-0.092790 [0.4077]	-0.149827 [0.1824]
R-squared	0.000069	0.000318	0.002249	0.001129	0.003052
Durbin-Watson	1.588782	1.573434	1.445643	2.364894	2.364998
Note: **, *** represent the statistical significance at the 5% and 1% levels.					

(2) Monthly data with the conversion method of the value of the last observation in each period

In *Table 4-12*, the assumption of the zero intercept in CAPM also holds in the monthly data in terms of the method of the end value in each period. The results show another beta estimation with monthly data, but it only includes the data of every end of each period for all variables. Also, the magnitude of R-squared is extremely close to zero, which implies that stock market returns do not have any explanatory power for gold returns. Although the conversion methods are different, the results suggest that gold is a hedge against the stock market risk in both the UK and US markets.

Table 4- 12 Estimated results of beta on gold in the UK and US market (data of monthly frequency by using the value of the end date of each month)

	UK-FTSE 100	UK-FTSE 350	UK-FTSE All Share	US-S&P 500	US-Dow Jones
Intercept (α)	0.302093 [0.2117]	0.359711 [0.1457]	0.148821 [0.4573]	0.201387 [0.3183]	0.205316 [0.3088]
Beta (β)	0.013803 [0.7994]	0.011223 [0.8384]	-0.049277 [0.2538]	-0.007621 [0.8903]	-0.033401 [0.5465]
R-squared	0.000166	0.000110	0.002249	0.000033	0.000625
Durbin-Watson	2.104110	2.110669	1.445643	1.441389	1.442238
Note: **, *** represent the statistical significance at the 5% and 1% levels.					

4.3.3 Results of Residual Normality Test

The estimation so far is based on the framework according to the CAPM assumption of the constant risk coefficient β. The following normality test of the residuals is presented in this section for further analysis.

(1) Results in Daily data

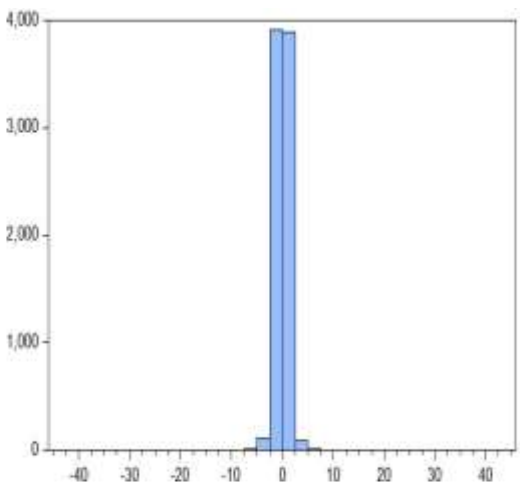

Fig. 4- 1 Residual normality test of CAPM (FTSE 100 daily data employed)

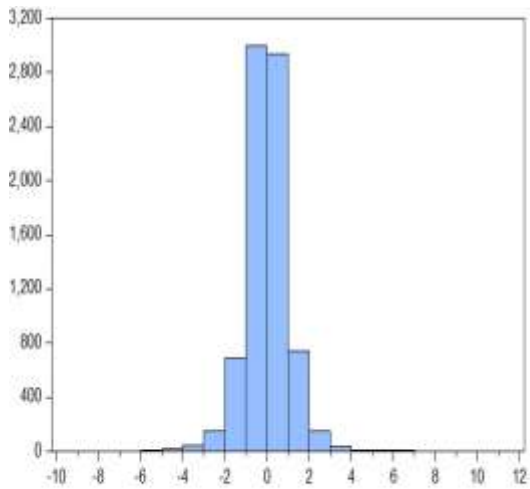

Fig. 4- 2 Residual normality test of CAPM (FTSE 350 daily data employed)

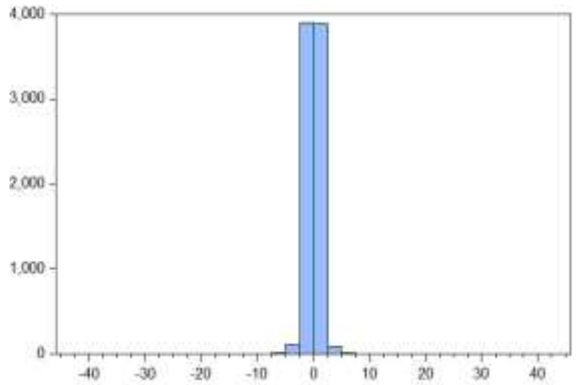

Fig. 4- 3 Residual normality test of CAPM (FTSE All share daily data employed)

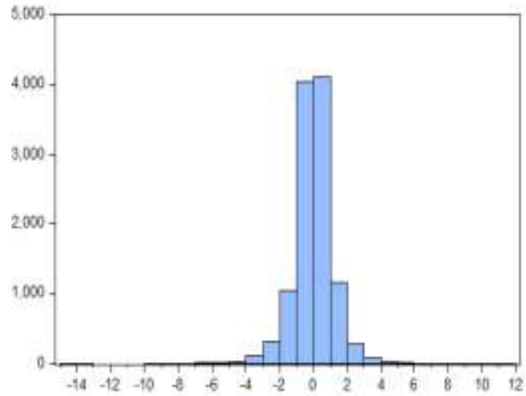

Fig. 4- 4 Residual normality test of CAPM (Dow Jones daily data)

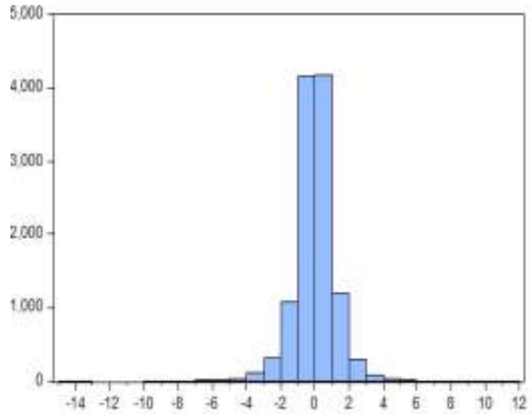

Fig. 4- 5 Residual normality test of CAPM (S&P 500 daily data)

Table 4- 13 Normality test results in residuals

	UK-FTSE 100	UK-FTSE 350	UK-FTSE All share	US-S&P 500	US-Dow Jones
Std. Dev.	1.240124	1.028152	1.240066	1.274134	1.269741
Skewness	0.198357	0.008420	0.193585	-0.214573	-0.210452
Kurtosis	403.8232	10.44000	404.0717	13.11769	13.06281
Jarque-Bera	53660225*** [0.00000]	17923.12*** [0.0000]	53726795*** [0.000000]	485193.8*** [0.00000]	49015.39*** [0.00000]
Note that the significant level is at 5% for the probability value of Jarque-Bera. **, *** represent the statistical significance at the 5% and 1% levels.					

Fig. 4-1, 4-2 and 4-3 are the figures from normality tests in the residuals of the CAPM employing the daily UK market indices, including the FTSE 100, FTSE 350 and FTSE All share. According to the figures, these distributions all have high peaks around the median zero. *Fig. 4-4 and 4-5* are the figures from normality tests in the residuals of the CAPM by using daily US market indices such as the Dow Jones and S&P 500. Both distributions have higher peaks than those in the UK and have longer tails. From the results in *Table 4-13*, the p-value of the Jarque-Bera is less than 5%, meaning the null hypothesis of the normal distribution is rejected in the residuals. Thus, all the residuals are not normally distributed. According to the Gauss-Markov Theorem, the normality of the residuals in a linear regression model (OLS) is not a strict requirement to produce unbiased estimates. But the normality of the residuals can ensure the reliable confidence interval if the assumption of normality in residuals is satisfied by statistical hypothesis testing (Chipman, 2011). In other words, the results of testing the normality on the residuals suggest no normality, which could lead to biased estimates. That is to say, the p-value cannot be used as a tool to draw a valid conclusion that the estimated coefficient is different from zero.

Results for weekly data and monthly data are presented in *Table A-15* to *Table A-18* in Appendix A. According to the results, the same conclusion of the normality in the residuals can be drawn for the non-normal distribution in the residuals compared to the normality test results in daily data. The p-value of Jarque-Bera in the results in weekly data and monthly data are shown as statistically significant. Regarding the null hypothesis of the normal distribution, all the probability values are less than 5%. These results suggest that the null hypothesis of the normal distribution in variables is rejected. Since the residuals in the regression are the difference between the value of the observation and the estimated value, the residuals would not be normally distributed if the normality of the observation data is not met. The p-value in the regression model cannot be used to conclude that the estimated coefficient is different from zero.

4.3.4 Results of Rolling Window

For testing the time variation of gold's beta, the monthly data with the market proxies of the FTSE All share, Dow Jones and S&P 500 are only applied in the rest of the estimations. The rolling beta regression is conducted at window size of 50 and 100 with 1 step. All the figures show variations over time and some regime shifts.

The results from the rolling window are shown from *Fig. A-1* to *Fig. A-30* in Appendix A. According to the figures from *Fig. A-1* to *Fig. A-30,* there is a variation in gold's beta coefficient over time. This is one motivation to use Markov-switching CAPM to find the regimes that the gold's beta would be during the specific time period.

4.3.5 Results of Markov-switching CAPM

In this section, the estimation is the Markov-switching CAPM on the α and β in the model with daily, weekly and monthly data. Before estimating the major results, the number of regimes in the model is assumed to be two regimes. One regime is assumed as the negative beta regime and the other regime is the non-negative beta regime. This is to directly examine whether gold beta would remain in the negative beta regime during the time of the market crash. Also, it shows no results in the case of three regimes or more in the test for gold in the UK and the US market. The assumption of two regimes in this analysis will suffice. The results show that all the cases follow the discrete Markov chain due to the constant transition probability. The results of the Markov-switching regimes will be shown in the figures for the probability of being in the negative gold beta regime. The high probability of being the negative gold beta regime will shade some time in the figures of the excess return of the market portfolio.

(1) Results of daily data in Markov-switching CAPM

Table 4-14 shows the results of the Markov-switching CAPM estimations using daily data. Using daily data may be a better way of determining whether gold acts as a safe haven, as some of the previous research indicates that gold only fulfils this role for about 15 days at a time (Baur and Lucey (2010)).

Table 4- 14 Results from Markov-switching CAPM - Daily

	UK-FTSE 100	UK- FTSE 350	UK-FTSE All share	US-Dow Jones	US-S&P 500
Regime 1					
Intercept (α)	0.0021 [0.9911]	0.0214 [0.6765]	-0.0064 [0.9717]	0.0153 [0.0772]	0.0144 [0.0923]
Beta (β)	-0.2207** [0.0167]	-0.1272*** [0.0002]	-0.023*** [0.0160]	-0.0466*** [0.0000]	-0.0388*** [0.0004]
log (σ)	1.3495*** [0.0000]	0.5820*** [0.0000]	1.3497*** [0.0000]	-0.3907*** [0.0000]	-0.3905*** [0.0000]
Regime 2					
Intercept (α)	-0.0037 [0.7079]	-0.0061 [0.5547]	-0.0038 [0.7048]	-0.0160 [0.6710]	-0.01937 [0.6053]
Beta (β)	0.0207** [0.0486]	0.0268*** [0.0002]	0.0208 [0.0641]	-0.0050 [0.8673]	0.0064 [0.8281]
log (σ)	-0.194*** [0.0000]	-0.2973*** [0.0000]	-0.194*** [0.0000]	0.6954*** [0.0000]	0.7062*** [0.0000]
P12	0.2061	0.0710	0.2062	0.0186	0.0194
P21	0.0136	0.0168	0.0136	0.0449	0.0475
Note; the probability value in [] suggests statistical significance at the level less than 5%. **, *** represent the statistical significance at the 5% and 1% levels.					

In *Fig. 4-6*, we can again see that neither regime maps onto the data well as a safe haven. Regime 2 (the non-shaded region of *Fig. 4-6*) covers most of the period including the 2008 financial crisis and the 1987 crash indicating that gold's role does not switch for the UK at a daily level into a safe haven in times of severe market movements.

For the US market proxies, the results show that Regime 2 has significant but negative betas. However, Regime 1 now has betas that are insignificantly different from zero, even with the large number of observations used. In *Fig. 4-7*, two regimes again do not, bear any relationship to extreme movements in the stock market. Regime 1 (the non-shaded area) covers the global financial crisis in 2008 while Regime 2 covers the 1987 crash.

Again, these regimes do not map in a way that indicates that gold offers special characteristics that we might think of in terms of the definition of a safe haven.

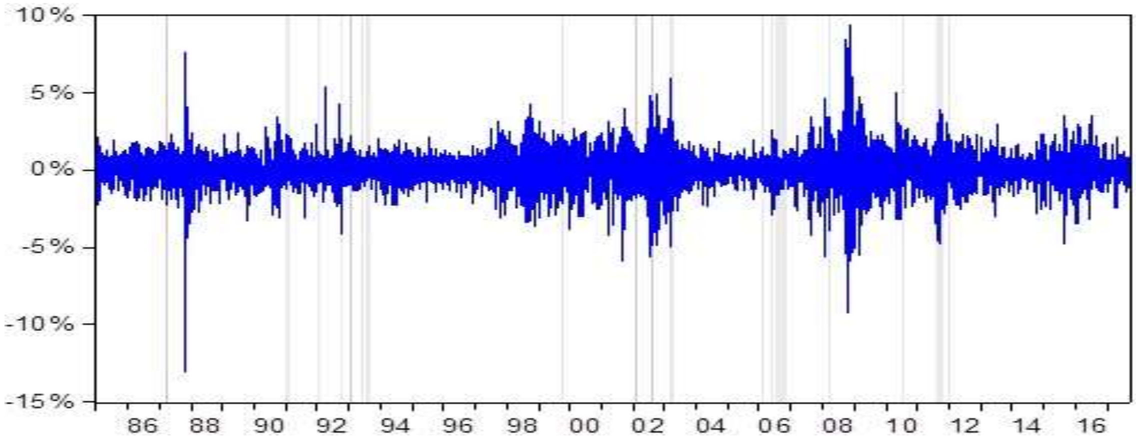

Fig. 4- 6 Excess return on market portfolio (FTSE 100) and regime - daily

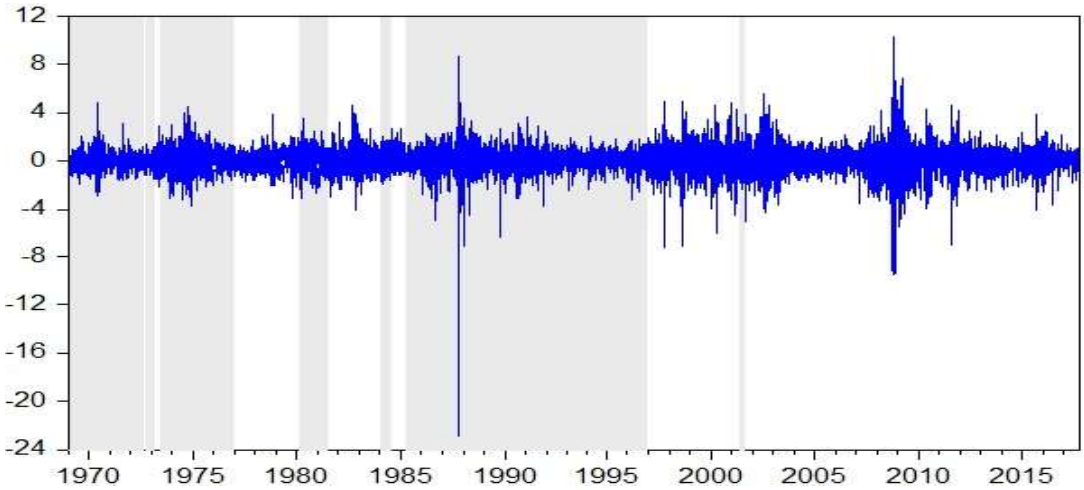

Fig. 4- 7 Excess return on market portfolio (S&P 500) and regime - daily

(2) Results of weekly data with the conversion method of the value of the first observation in each period

Table 4- 15 Results from Markov-switching CAPM – Weekly (first observation)

	UK-FTSE 100	UK- FTSE 350	UK-FTSE All share	US-Dow Jones	US-S&P 500
Regime 1					
Intercept (α)	-0.064934 [0.2508]	-0.056708 [0.3223]	0.170272 [0.2792]	0.308839 [0.0612]	0.302320 [0.0591]
Beta (β)	0.042898 [0.1454]	0.045641 [0.1462]	0.043011 [0.4916]	0.162184** [0.0156]	0.204215*** [0.0013]
log (σ)	0.448675*** [0.0000]	0.446749*** [0.0000]	1.089158*** [0.0000]	1.415382*** [0.0000]	1.399854*** [0.0000]
Regime 2					
Intercept (α)	0.311138* [0.0357]	0.319169* [0.0345]	-0.044241 [0.4830]	0.058445 [0.1883]	0.054989 [0.2166]
Beta (β)	-0.010149 [0.8535]	-0.016131 [0.7803]	0.019735 [0.5798]	-0.08321*** [0.0000]	-0.080767*** [0.0001]
log (σ)	1.152856*** [0.0000]	1.157925*** [0.00000]	0.459188*** [0.0000]	0.461682*** [0.00000]	0.456340*** [0.0000]
Note that the probability value in [] suggests statistical significance at the level less than 5%. **, *** represent the statistical significance at the 5% and 1% level.					

Table 4-15 shows the results of the weekly data with the conversion of the first observation in each period. In the UK market, the assumption of CAPM does not hold due to the intercept which is significantly different from zero in the negative systematic risk regime in the FTSE 100 and the FTSE 350. Although the assumption of CAPM holds in the FTSE All share, gold's betas are statistically insignificant, which suggests that gold's beta in the negative systematic regime is zero. In addition, gold's beta in all UK market indices is estimated as statistically insignificant from zero. There is no clear evidence to prove whether gold is a safe haven to the UK stock market.

More interestingly, gold's betas in both Dow Jones and S&P 500 show statistical significance in both high and low systematic risk regimes. The following filtered regime probability and the change in the Dow Jones and S&P 500 are shown to analyse whether gold is a safe haven to the US stock market.

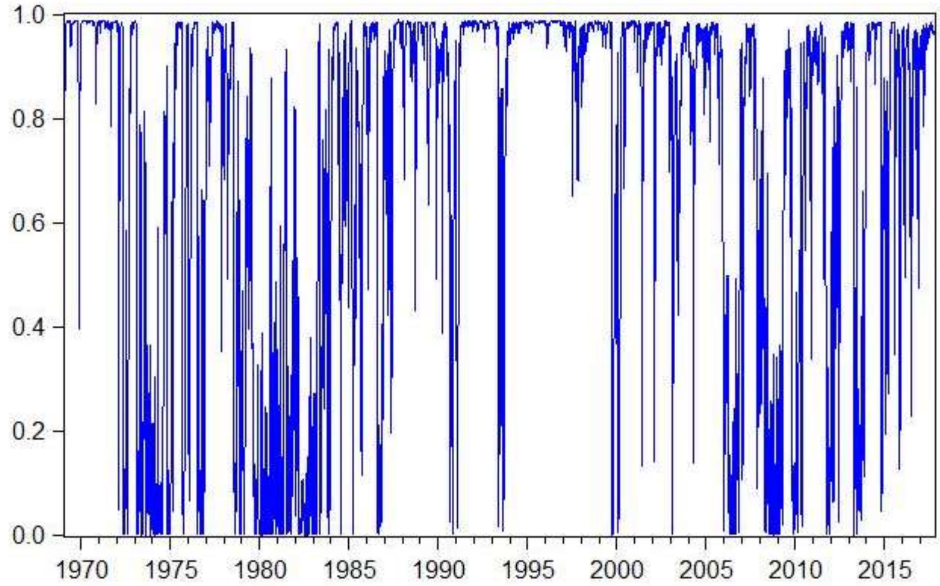

Fig. 4- 8 The probability of being in the regime of negative gold's beta

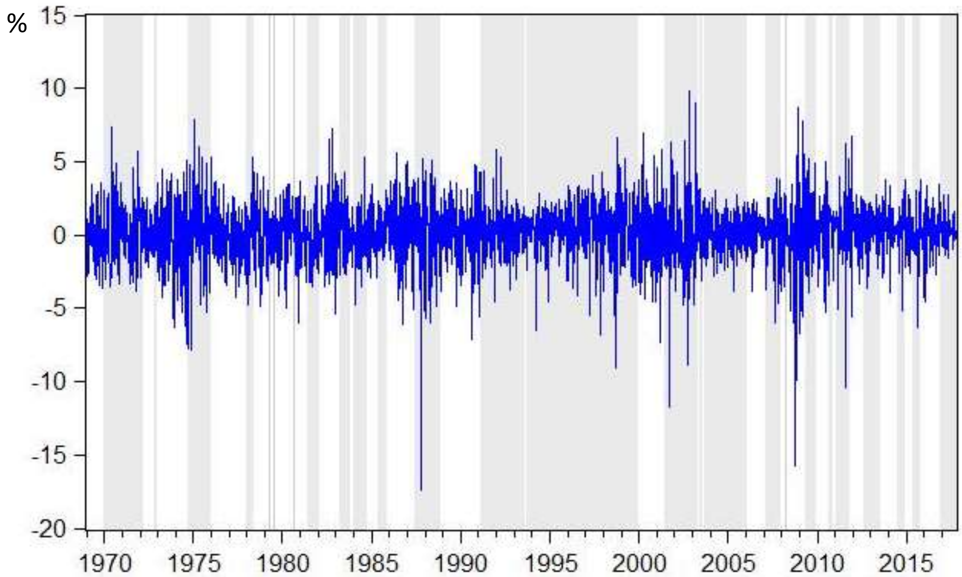

Fig. 4- 9 Excess return on market portfolio (Dow Jones), shading in the regime of negative beta

Fig. 4-8 demonstrates the regime probability of being in the regime of negative beta. Thus, a higher probability implies a higher likelihood of being in the regime. *Fig. 4-9* represents the excess return on gold in the US. The time with the probability above 0.5 is selected from *Fig. 4-8* due to the high probability of being the regime of negative beta. Thus, the time in the regime of negative beta is shaded in *Fig. 4-9* correspondingly. According to *Fig. 4-9*, the regime of negative beta covers most of the time, including some of the major stock market stress during the time of the dramatic drop in the index. However, the time of one major stock market stress period is not covered, is around August 10th 2008, the subprime mortgage crisis in the US. This result suggests that the beta is more likely to be in the regime of positive beta. From the results, gold is not a safe haven to the Dow Jones during stock market stress.

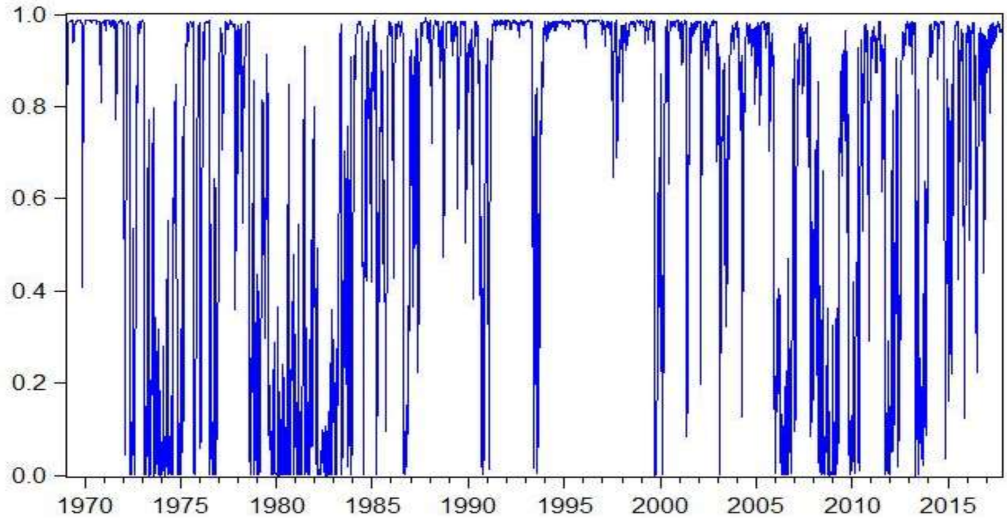

Fig. 4- 10 The probability of being in the regime of negative gold's beta

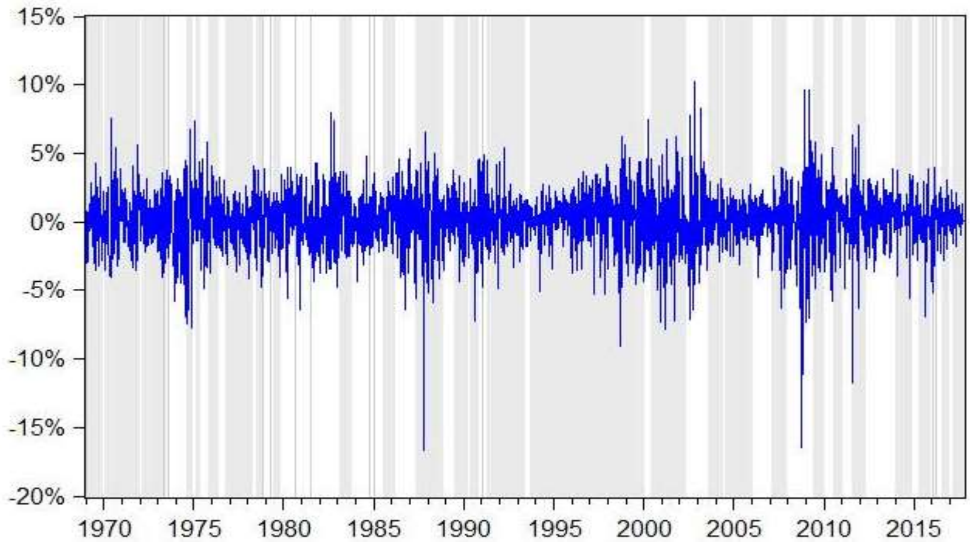

Fig. 4- 11 Excess return on market portfolio (S&P 500), shading in the regime of negative beta

Similarly, with the analysis in the case of the Dow Jones, *Fig. 4-10* demonstrates the transition probability of being in the regime of negative beta. In addition, the shaded areas in *Fig. 4-11* are the times of transition probability higher than 0.5 in the regime of negative beta. The same market stress period around August 10th 2008 is not covered, which indicates that gold's beta is more likely to be in the regime of positive beta. Thus, gold is not a safe haven to the S&P 500.

(3) Results of weekly data with the conversion method of the average value in each period

Table 4-16 demonstrates the results by applying the weekly frequency conversion of the average value in each period. The CAPM assumption of the zero intercept is violated in both the UK and US stock markets in the positive systematic risk regime. Thus, all the results in the positive systematic risk regime are not appropriate to produce suggestions in terms of gold as a safe haven. Gold's betas in the UK stock market are insignificantly different from zero, as they are in the S&P 500 in the US stock market. Only gold's beta in the Dow Jones is statistically significant, even though it is close to zero (-0.062896).

Table 4- 16 Results from Markov-switching CAPM – weekly (average)

	UK-FTSE 100	UK- FTSE 350	UK-FTSE All share	US-Dow Jones	US-S&P 500
Regime 1					
Intercept (α)	0.370523* [0.0189]	0.391366* [0.0148]	0.376762* [0.0168]	0.412629* [0.0385]	0.412362* [0.0380]
Beta (β)	0.055685 [0.3439]	0.058619 [0.3312]	0.041012 [0.4933]	0.106828 [0.1385]	0.120869 [0.0808]
log (σ)	0.948412*** [0.0000]	0.952706*** [0.0000]	0.949993*** [0.0000]	1.309860*** [0.0000]	1.307130*** [0.0000]
Regime 2					
Intercept (α)	-0.074680 [0.1528]	-0.067866 [0.1920]	-0.076627 [0.1426]	0.042797 [0.3080]	0.038126 [0.3655]
Beta (β)	-7.05E-05 [0.9979]	-3.76E-05 [0.9989]	0.006471 [0.8168]	-0.06289*** [0.0018]	-0.037022 [0.0721]
log (σ)	0.232549*** [0.0000]	0.233672*** [0.0000]	0.234715*** [0.0000]	0.301963*** [0.0000]	0.303509*** [0.0000]
Note that the probability value in [] suggests statistical significance at the level less than 5%. **, *** represent the statistical significance at the 5% and 1% level.					

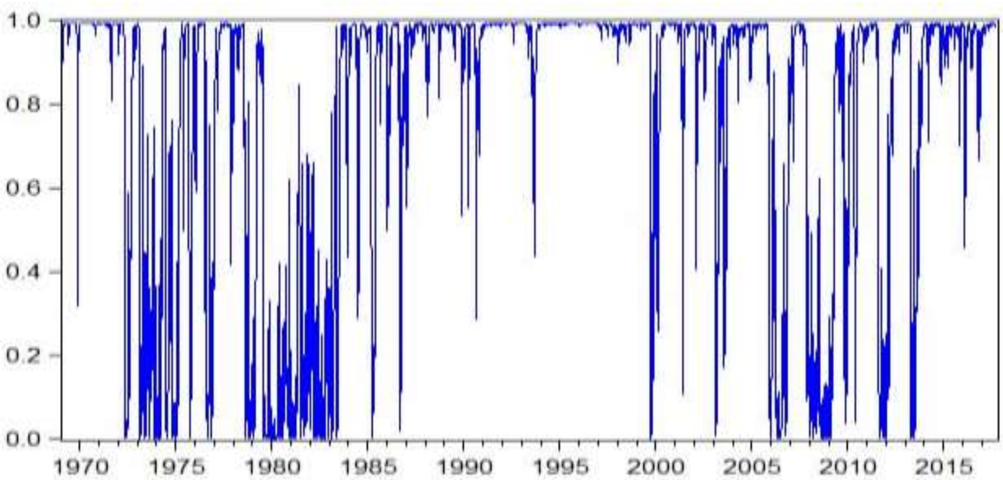

Fig. 4- 12 The probability of being in the regime of negative gold's beta

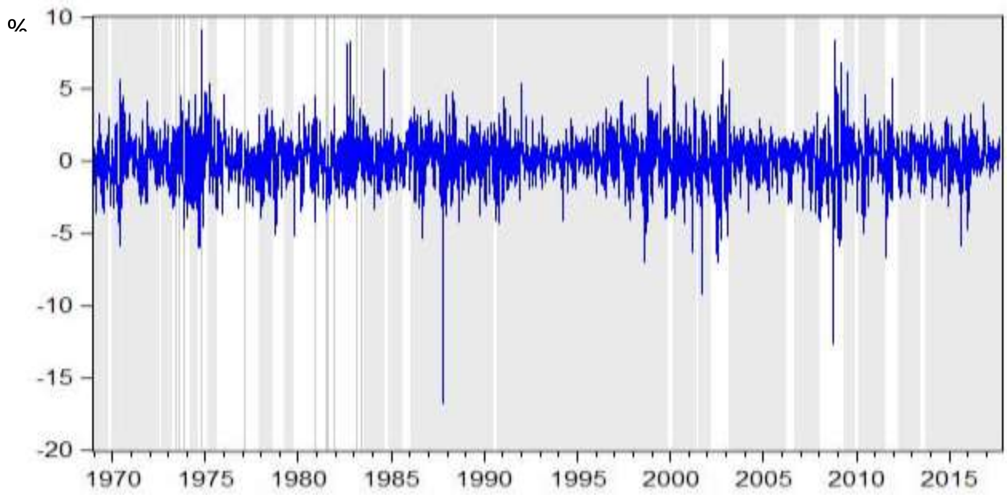

Fig. 4- 13 Excess return on market portfolio (Dow Jones), shading in the regime of negative beta

Fig. 4-12 demonstrates the transition probability to be in the regime of negative beta. It is obvious that a higher probability suggests a higher likelihood to stay in the regime. *Fig. 4-13* shows the excess return on market portfolio in the Dow Jones. In addition, *Fig. 4-13* is shaded according to the time of the probabilities above 0.5 in *Fig. 4-12*. According to the shaded areas in *Fig. 4-13*, gold's beta is mostly in the regime of negative beta, while covers most of the stock market stress time in 1987, 1998 and 2002. However, the probabilities are less than 0.5, which suggest that gold's beta is more likely to stay in the regime of the positive beta. Thus, the stock market stress time during October 2008 is not shaded. The results suggest that gold's beta does not always stay in the regime of the negative beta during times of the market stress. So, gold cannot be confirmed as a safe haven to the US stock market, while there is no clear evidence to prove whether or not gold is a safe haven to the UK stock market.

(4) Results of monthly data with the conversion method of the value of the last observation in each period.

The results in *Table 4-17* suggest that most of the data are consistent with the CAPM due to the result that the intercept α is statistically insignificantly different from zero, except for the results in the FTSE 100 and FTSE 350 in the negative systematic risk regime. The results in the UK FTSE 100, FTSE 350 and FTSE All share show that gold's beta in both the positive and negative risk regimes is statistically insignificant. Thus, there is no clear evidence to prove whether gold is a safe haven to the UK stock market.

Table 4- 17 Results from Markov-switching CAPM – Monthly (last observation)

	UK-FTSE 100	UK-FTSE 350	UK-FTSE All share	US-Dow Jones	US-S&P 500
Regime 1					
Intercept (α)	-0.412913 [0.0664]	-0.375423 [0.0896]	1.582555 [0.1238]	1.808082 [0.0723]	1.849457 [0.0634]
Beta (β)	0.039897 [0.5255]	0.047513 [0.4415]	0.140950 [0.4161]	0.425943 [0.0657]	0.478184** [0.0189]
log (σ)	1.248769 [0.0000]	1.24380 [0.0000]	2.256912*** [0.0000]	2.257185*** [0.0000]	2.243689*** [0.0000]
Regime 2					
Intercept (α)	1.699263* [0.0312]	1.734925* [0.0239]	-0.318947 [0.1740]	-0.104394 [0.6470]	-0.11824 [0.6016]
Beta (β)	-0.037404 [0.7832]	-0.038314 [0.7738]	-0.072394 [0.0601]	-0.151094*** [0.0022]	-0.144859*** [0.0034]
log (σ)	1.822041 [0.0000]	1.826406 [0.0000]	1.347051*** [0.0000]	1.314651*** [0.0000]	1.319495*** [0.0000]
Note that the probability value in [] suggests statistical significance at the level less than 5%. **, *** represent the statistical significance at the 5% and 1% levels.					

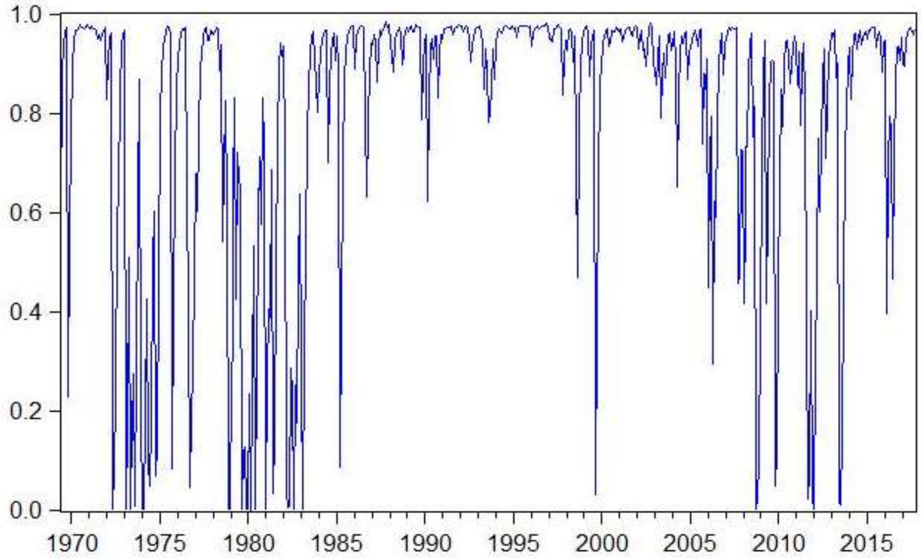

Fig. 4- 14 The probability of being in the regime of negative gold's beta

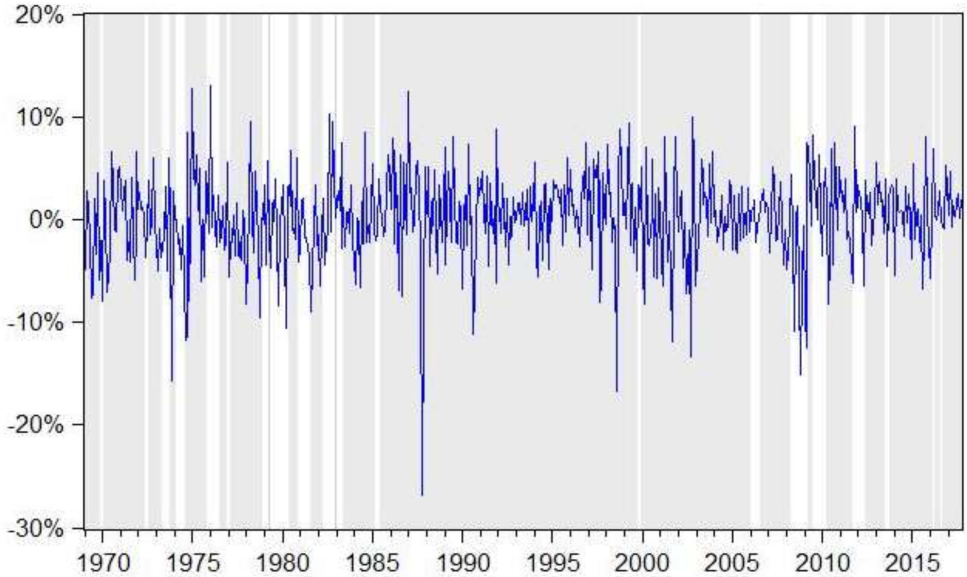

Fig. 4- 15 Excess return on market portfolio (Dow Jones), shading in the regime of negative beta

Gold's beta to the Dow Jones in the low systematic risk regime is statistically significant at -0.151094. In *Fig. 4-14*, the probability of being in the regime of negative beta is shown.

The shaded areas in *Fig. 4-15* are the time when gold's beta stays in the regime of the negative beta from *Fig. 4-14*. As shown in *Fig. 4-15*, most of the stock market stress time is in the regime of negative beta. However, gold's beta during the market stress times of October 2008 is estimated not to be in the regime of negative beta. This suggests that gold cannot be confirmed as a safe haven to the Dow Jones according to the refined definition of the safe haven in Baur and McDermott (2010).

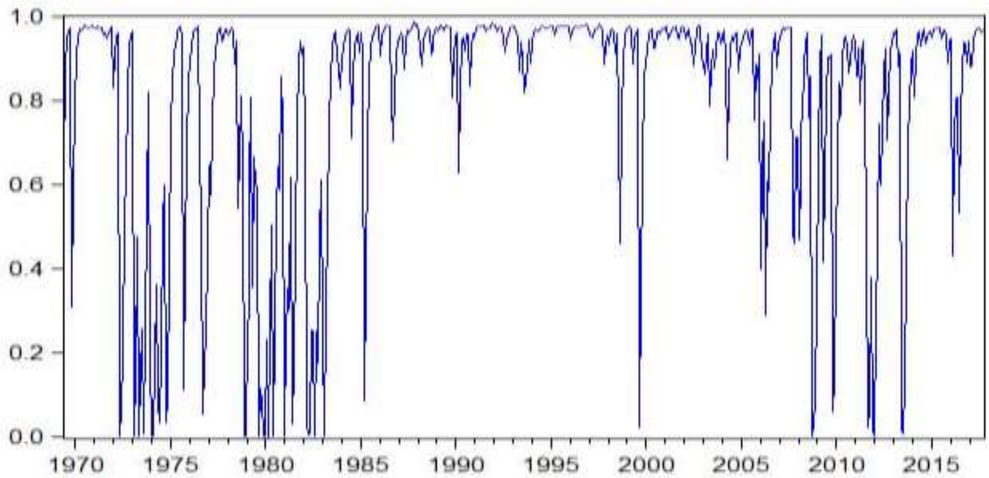

Fig. 4- 16 The probability of being in the regime of negative gold's beta

According to *Table 4-17*, gold's betas in both high and low risk regimes are statistically significant at the 5% level. These results suggest that gold's beta is significantly different from zero (0.478184) and positive in the positive systematic risk regime, while gold's beta is significantly different from zero (-0.144859) and negative in the negative systematic risk regime. *Fig. 4-16* demonstrates the probability of being in the regime of negative beta. *Fig. 4-17* is shaded for the time it is in the regime of negative beta from *Fig. 4-16*. Similarly, the probability during the stock market stress of October 2008 is less than 0.5, which suggests that gold's beta is more likely to be positive. Thus, there is no clear evidence that gold is a safe haven in the stock market of the S&P 500.

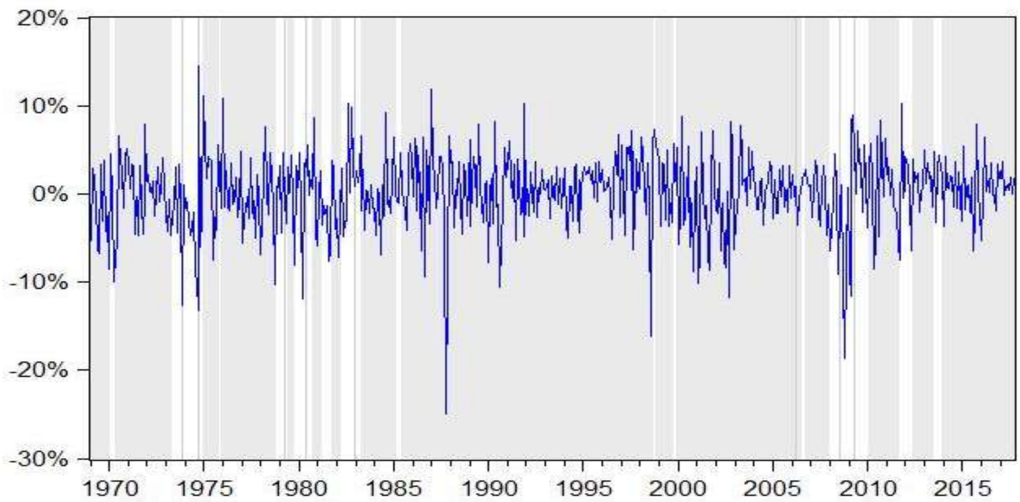

Fig. 4- 17 Excess return on market portfolio (S&P 500), shading in the regime of negative beta

(5) Results of monthly data with the conversion method of the average in each period

Table 4- 18 Results from Markov-switching CAPM – Monthly (average)

	UK-FTSE 100	UK-FTSE 350	UK-FTSE All share	US-Dow Jones	US-S&P 500
Regime 1					
Intercept (α)	-0.531337* [0.0203]	-0.491793* [0.0276]	-0.671584*** [0.0019]	1.837376 [0.0640]	1.800692 [0.0648]
Beta (β)	0.108217 [0.0675]	0.105220 [0.0661]	0.100198* [0.0482]	0.209320 [0.2621]	0.227819 [0.1937]
log (σ)	0.997822 [0.0000]	0.987377 [0.0000]	1.023901*** [0.000]	2.050246*** [0.0000]	2.043154*** [0.0000]
Regime 2					
Intercept (α)	1.741114** [0.0043]	1.816484*** [0.0020]	1.432547*** [0.0130]	-0.130146 [0.5489]	-0.131873 [0.5429]
Beta (β)	-0.182493 [0.0796]	-0.196351 [0.0572]	-0.161219 [0.0619]	-0.098941* [0.0432]	-0.098339 [0.0518]
log (σ)	1.502159 [0.0000]	1.497887 [0.0000]	1.848611*** [0.0000]	1.119212*** [0.0000]	1.119026*** [0.0000]
Note that the probability value in [] suggests statisticall significance at the level less than 5%. **, *** represent the statistical significance at 5% and 1% levels.					

In *Table 4-18*, the intercepts α are statistically significant in both regimes. While one α has negative effects on the gold return, the other α has positive effects. However, the assumption of CAPM is violated due to the non-zero intercept. It suggests that the data is inconsistent with the CAPM and there exists an abnormal return in the model. Thus, the results in the UK FTSE All Share cannot provide more information about gold's beta. Although the intercepts α in the US Dow Jones and S&P 500 prove the consistency of the data to CAPM in the US market, there is only one where gold's beta is significantly different from zero. It's -0.098941 with a probability value of 0.0432. This estimated gold beta is tested by a further Wald test with the null hypothesis of zero beta. The results of a probability value of 0.0437 suggests that the null hypothesis is rejected, and it is different from zero.

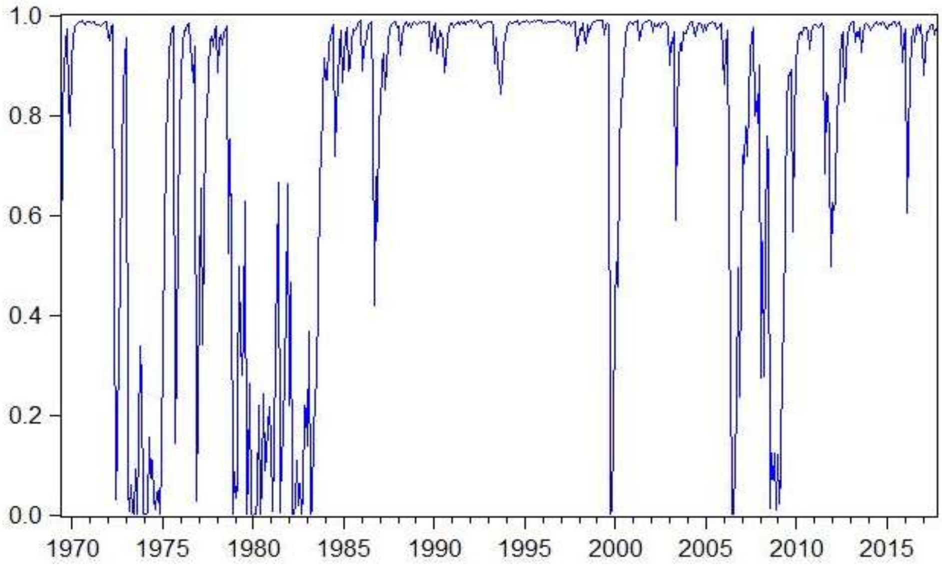

Fig. 4- 18 The probability of being in the regime of negative gold's beta

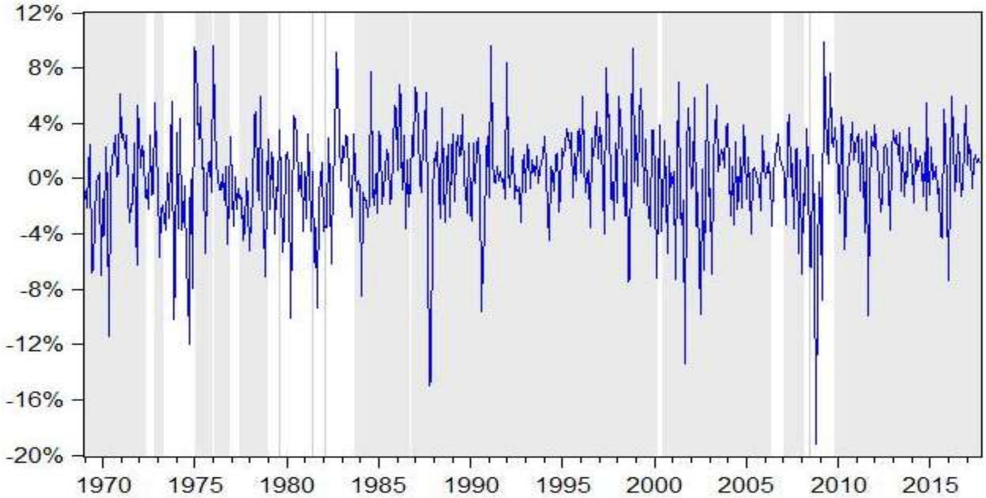

Fig. 4- 19 Excess return on market portfolio (Dow Jones), shading in the regime of negative beta

Fig. 4-18 shows the probability of staying in the regime of negative gold's beta. All the times of probabilities higher than 0.5 are correspondingly selected in *Fig. 4-18* and shaded in *Fig. 4-19*. *Fig. 4-19* demonstrates the excess return on market portfolio in the Dow Jones. Most of the time are in the regime of negative gold's beta. However, the market stress time of 1974 and 2008 are not in the regime of the negative gold's beta. Thus, gold is not a safe haven to the Dow Jones.

4.3.6 Summary

In Section 4.3, I have tested whether gold is a hedge or a safe haven in the UK and the US markets. The results in the classic CAPM suggest that gold is a hedge to both the UK and the US stock markets. The results in the Markov-switching CAPM suggest that gold is not a safe haven in the UK and the US markets.

4.4 Conclusion

The first objective in this thesis was to estimate gold's beta in CAPM with two different frameworks to test whether gold is a hedge or a safe haven to the UK and US stock markets. This research employed the daily, weekly and monthly data of gold prices in the UK and the US, the FTSE 100 index, the FTSE 350 index, the FTSE All share index, the Dow Jones index and the S&P 500 index under different frequency conversions. It re-examines the idea that gold has a special relationship with other assets in times of severe market down moves, its safe haven characteristic. Previous studies chose to set cut-off points to define when a safe haven could be present, which introduces a preconceived notion about what a safe haven should be. However, we achieve this by applying a Markov-switching model to allow the data to determine if such a relationship is present.

Our first framework is the basic CAPM in order to follow the definition of a hedge as set out by Buar (2010). The intercepts in all cases are checked as the zero value, which means that the assumption of the Sharpe-Lintner CAPM is not violated. Although the estimated gold's betas in the daily data are statistically significant and different from zero, they are all close to zero. The monthly results suggest that gold's beta is zero, which means that the excess return of gold is uncorrelated with the excess return on the market portfolios. Thus, gold is a hedge to both the UK and US stock markets in this framework.

The second framework concerns the nonstationarity in gold's beta in the UK and the US markets. According to the results in the residual normality tests, there is no residual that follows the normal distribution. In addition, the beta rolling regressions of fixed window size of 50 and 100 observations are tested. The graphs show the time variation in gold's beta to the stock markets and some regime shifts over time.

We find that while gold does act as a very good diversifier in both regimes estimated by the model and for all proxies of the market portfolio in the US and the UK, neither one maps well onto periods of time where a safe haven would be beneficial to investors such as the 1987 crash or the 2008 financial crisis. Instead, we think that a review of the results from earlier papers on this issue, coupled with our findings, points to the fact that gold is always a hedge or, at worst, always an excellent diversifier of portfolio risk. Gold's usefulness in managing risk does not disappear in a crisis when the prices of the vast majority of assets tend to be perfectly correlated.

Chapter 5 Is there a Real-world Proxy to the Risk-free Asset? Empirical tests of the Zero-beta CAPM model for the UK, US, China, Japan and India

5.1 Introduction

This chapter is motivated by the results and the conclusion in Chapter 4. In Chapter 4, gold's beta is estimated as being statistically insignificantly different from zero, and we concluded that there is evidence that gold returns are uncorrelated with the equity market in the UK and the US.

This raises the question as to whether gold can be a proxy for the risk-free asset in the UK and the US markets. In other words, can gold be a proxy for the risk-free asset based on these empirical test results? We will also assess whether government Treasury bills (T-bills), Interbank Offered Rate (IBOR) and Overnight Indexed Swap (OIS) are proxies for the risk-free assets, as they are commonly thought of in finance textbooks (Henrard, 2014) and empirical studies (Smith, 2013; Kapan and Minoiu, 2018; Lloyd, 2020).

The classic CAPM is the first choice to investigate the relationship between gold and equity market portfolios in this thesis. However, there are two reasons for why CAPM is not a sufficient method to examine whether gold or T-bills are a good proxy for the risk-free asset. One is that there are biases due to the test results discussed in Section 5.3.3 when using the classic CAPM. The second is that the T-bills or IBOR or OIS cannot be tested in the classic CAPM since they are already assumed to be risk-free assets in the classic CAPM.

To avoid these problems in the classic CAPM, the zero-beta CAPM (Black, 1972) is chosen as it has a different set of assumptions. First of all, the zero-beta CAPM assumes that the risk-free asset is missing. Neither T-bills nor gold are found to have zero variance which satisfies the condition of a risk-free asset. And it is indeed difficult to discover an asset as risk-free according to this condition. So, the assets are commonly used as the proxy for the risk-free asset due to the results that suggest that they are uncorrelated with the market. In other words, assets are used as the proxy for the risk-free asset if they are examined as zero-beta assets, which suggests zero systematic risk. The zero-beta CAPM is employed to test the candidate assets as zero-beta assets in order to investigate whether they can be a proxy for the risk-free asset. The zero-beta CAPM is the ideal model for this research question. Secondly, T-bills, IBOR and OIS can be examined in the zero-beta CAPM due to the assumption that there is no risk-free asset in the zero-beta CAPM. In other words, the assumption in the zero-beta CAPM will not cause the same problem in the results where it is not possible to examine T-bills, IBOR and OIS in the classic CAPM.

Since the classic CAPM has already been described in Section 4.2.2, there will not be more description of the classic CAPM in this chapter. Section 5.2 will describe the methodology of the Zero-beta CAPM and the hypothesis test related to it. Section 5.3 will present the empirical results. The conclusion will be presented in Section 5.4.

5.2 Methodology

This section will present the methodology. Section 5.2.1 will describe the derivation of the zero-beta CAPM and the null hypothesis in the zero-beta CAPM. Section 5.2.2 will describe the general idea of the methods of hypothesis testing. Section 5.2.3 will describe the Wald test, the Likelihood Ratio Test (LRT) and the derivation to prove that the Wald test is asymptotically equivalent to the Likelihood Ratio Test (LRT). Section 5.2.4 will describe the Likelihood Ratio Test (LRT) for testing the null hypothesis in the zero-beta CAPM.

5.2.1 Hypothesis testing methods

In hypothesis testing, we assume that there are two mutually exclusive hypotheses: the null hypothesis (H_0) and the alternative hypothesis (H_1). If the parameter is θ, and the parameter space is Θ, the null and alternative hypotheses are the complementary hypothesis in Θ.

$H_0 : \theta \in \Theta_0 \subset \Theta$

$H_1 : \theta \in \Theta_0^c$ (the complement of Θ_0, and $\Theta_0^c \subset \Theta$)

A test statistic is defined as some function $T_n \equiv T(X_1, X_2, \ldots, X_n)$ of the data $X_1, X_2, \ldots, X_n$. The test is the function that is mapping the values of the test statistics into the set $\{0,1\}$, where,

a. Mapping to "0" implies that the null hypothesis H_0 cannot be rejected, and the alternative hypothesis H_1 is rejected.
b. Mapping to "1" implies that the null hypothesis H_0 is rejected, and the alternative hypothesis H_1 cannot be rejected.

This chapter shows the hypothesis testing for whether gold or T-bills or OIS or IBOR is the zero-beta asset in the zero-beta CAPM.

5.2.2 Zero-beta CAPM

The following equation presents the statistical model that is used to test the classic CAPM. Equation 5.2.1 is written as:

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i(R_{M,t} - R_{f,t}) + \varepsilon_{i,t} \qquad (5.2.1)$$

where $i = 1, \dots, N; t = 1, \dots, T,$

$R_{i,t} = the\ raw\ return\ on\ asset\ i\ in\ period\ t$

$R_{M,t} = the\ raw\ return\ on\ the\ market\ portfolio\ m\ in\ period\ t$

$R_{f,t} = the\ raw\ return\ on\ the\ risk - free\ asset\ in\ period\ t$

$\varepsilon_{i,t} = the\ error\ term\ for\ asset\ i\ in\ period\ t$

$\beta_i = cov(r_{i,t}, r_{m,t})/var(r_{m,t})$

$N = the\ number\ of\ assets\ in\ the\ sample$

$T = the\ number\ of\ periods\ in\ time\ series$

The error terms are assumed to be independent and identically distributed with mean zero and a constant variance-covariance matrix as follows:

$$E[\varepsilon_{is}\varepsilon_{jt}] = \begin{cases} \sigma_{ij}, & if\ s = t, j = i \\ 0, & s \neq t, j \neq i \end{cases} \qquad (5.2.2)$$

The term α_i denotes an unknown constant for asset i, β_i denotes the market risk coefficient for asset i.

The zero-beta CAPM introduced by Black (1972) assumes that the risk-free rate is missing or unknown in the model, which is different from the classic CAPM shown in equation 5.2.1. The zero-beta CAPM is written as follows:

$$E[R_{i,t}] - \gamma = \beta_i(E[R_{M,t}] - \gamma) \tag{5.2.3}$$

After rearrangement, that is:

$$E[R_{i,t}] = \gamma(1 - \beta_i) + \beta_i E[R_{M,t}] \tag{5.2.4}$$

where γ is an unknown constant that represents the expected return on a zero-beta asset since there is no risk-free asset. The zero-beta asset is uncorrelated to the underlying market portfolio m.

Let $R_{j,t}$ be the return on other assets, and the asset j can be the asset of gold or T-bills, OIS or IBOR in the following empirical tests in Section 5.3. To start the analysis of tests in the zero-beta CAPM, the parameter γ in equation 5.2.4 is substituted by $E(R_{j,t})$. The core of this analysis is to use the expected return on asset j in the zero-beta CAPM. In other words, the expected return on the zero-beta asset is replaced by the expected return on the asset j, which means that the expected return of the asset j is assumed to be the return of the zero-beta asset in the zero-beta CAPM in equation 5.2.5.

$$E[R_{i,t}] = E[R_{j,t}](1 - \beta_i) + \beta_i E[R_{m,t}] \tag{5.2.5}$$

To let the model in equation 5.2.5 coincide with the zero-beta CAPM shown in equation 5.2.4, the null hypothesis is as follows:

$$H_0: \alpha_i = E\left[R_{j,t}\right](1 - \beta_i) \tag{5.2.6}$$

The null hypothesis can also be written if beta is not 1:

$$H_0: \frac{\alpha_i}{(1 - \beta_i)} = E[R_{j,t}] \tag{5.2.7}$$

against the alternative hypothesis:

$$H_A: \frac{\alpha_i}{(1 - \beta_i)} \neq E[R_{j,t}] \tag{5.2.8}$$

Since $i = 1, \dots, N$ and γ is unknown, there are $(N + 1)$ restrictions:

$$H_0{}' : \frac{\alpha_1}{(1 - \beta_1)} = \frac{\alpha_2}{(1 - \beta_2)} = \cdots = \frac{\alpha_N}{(1 - \beta_N)} = E[R_{j,t}] \tag{5.2.9}$$

$H_0{}'$ is another form of the null hypothesis. It puts a stricter requirement that this hypothesis in equation 5.2.9 must hold at the relevant significant level for gold, T-bills, OIS or IBOR against each individual company in the UK, the US, China, Japan and India.

5.2.3 Wald Test and Likelihood Ratio Test

The Wald test is a method to assess the linear constraints on the parameters regarding the weighted distance (the weight is the precision of the estimates) between the unrestricted estimates and the hypothesized value in the null hypothesis (Fahrmeir et al., 2013). In other words, the test aims to investigate whether the sample distribution of the Wald test asymptotically follow the Chi-square distribution under the null hypothesis H_0.

In this chapter, the Wald test is used to test whether T-bills, gold, OIS or IBOR is a zero-beta asset in the zero-beta CAPM. So, the null hypothesis is assumed to be $H_0 : \theta = \theta_0$, in which $\theta = \frac{\alpha_i}{(1-\beta_i)}$ and $\theta_0 = E[R_{j,t}]$. The null hypothesis is accepted if the sample distribution of the Wald test follows the chi-square distribution in equation 5.3.3 and the sample distribution follows the normal distribution in equation 5.3.2, and vice versa. Let $\hat{\theta}_n$ (asymptotically normal) be the estimator of the parameter θ, and $Var(\hat{\theta})$ be the asymptotic variance.

The Wald test starts with the distribution in the following:

$$\sqrt{N}\left(\hat{\theta} - \theta_0\right) \to N(0, 1) \tag{5.3.1}$$

The test statistics can be written as follows:

$$\sqrt{W} = \frac{\hat{\theta} - \theta_0}{\sqrt{(N-1)^{-1} Var(\hat{\theta}_n)}} \to N(0,1) \tag{5.3.2}$$

Or

$$W = \frac{(N-1)\left(\hat{\theta} - \theta_0\right)^2}{Var\left(\hat{\theta}_n\right)} \rightarrow \chi^2_{N-1} \tag{5.3.3}$$

The LRT is used to assess two statistical models, one is under the null hypothesis, and the other is unrestricted, with the likelihood ratio (Moreira, 2003). Let the data follow the distribution: $X = X_1, X_2, \dots, X_n$ distributed as $f(X)$, and the likelihood function $f(\theta \mid X)$.

The Likelihood Ratio Test statistics $\lambda(X)$ is given by,

$$\lambda(X) = \frac{Sup_{\theta \in \Theta_0} f(\theta \mid X)}{Sup_{\theta \in \Theta} f(\theta \mid X)} \tag{5.3.4}$$

Θ is the parameter space. Θ_0 the parameter space in the null hypothesis and Θ_0 is the subset of Θ.

According to Wilk's Theorem (Wilks, 1938): for testing $H_0 : \theta = \theta_0$ against $H_1 : \theta \neq \theta_0$, if the data sample size $n \rightarrow \infty, -2ln\lambda(X)$ asymptotically converges to the chi-square (χ^2) distribution with (N-1) degrees of freedom under the null hypothesis H_0:

$$LR = -2\, ln\lambda(X) = -2\, ln\left[\frac{Sup_{\theta \in \Theta_0} f(\theta \mid X)}{Sup_{\theta \in \Theta} f(\theta \mid X)}\right] \tag{5.3.5}$$

Under Wilk's Theorem, this shows the evidence of the equivalence of asymptotic distribution between the Wald test and the LRT.

Apply the nth order Taylor-series expansion of the log-likelihood function around $\hat{\theta}_n$:

$$\sum_i lnf(X_i|\theta_0\ ) = \sum_i lnf\big(X_i|\ \hat{\theta}_n\big) + \sum_i \frac{\partial}{\partial\theta} lnf(X_i|\theta\ )|_{\theta=\hat{\theta}_n} \cdot \big(\theta_0 - \hat{\theta}_n\big) + \frac{1}{2}\sum_i \frac{\partial^2}{\partial\theta^2} lnf(X_i|\ \theta)|_{\theta=\hat{\theta}_n} \cdot \big(\theta_0 - \hat{\theta}_n\big)^2 + \cdots$$

$$= \sum_i lnf\big(X_i|\ \hat{\theta}_n\big) + + \frac{1}{2}\sum_i \frac{\partial^2}{\partial\theta^2} lnf(X_i|\ \theta)|_{\theta=\hat{\theta}_n} \cdot \big(\theta_0 - \hat{\theta}_n\big)^2 \quad + \cdots \quad (5.3.6)$$

According to the general property of maximum likelihood estimation (Verbeek, 2008: p. 166), the term of the first-order condition is $\sum_i \frac{\partial}{\partial\theta} lnf(X_i|\theta\ )|_{\theta=\hat{\theta}_n} = 0$. Let the remainder term be τ. And we take the second-order Taylor-series expansion.

Rearrange equation 5.3.6 as:

$$-2\sum_i ln\left(\frac{f(X_i|\theta_0\ )}{f\big(X_i|\ \hat{\theta}_n\big)}\right) = -\frac{1}{n}\sum_i \frac{\partial^2}{\partial\theta^2} lnf(X_i|\ \theta)|_{\theta=\hat{\theta}_n} \cdot \left[\sqrt{n}\big(\theta_0 - \hat{\theta}_n\big)\right]^2 + \tau \quad (5.3.7)$$

where the first term on the right-hand side of equation 5.3.7 can be rewritten as the Fisher Information $I(\theta)$ multiplied by $\left[\sqrt{n}\big(\theta_0 - \hat{\theta}_n\big)\right]^2$.

$$-\frac{1}{n}\sum_i \frac{\partial^2}{\partial\theta^2} lnf(X_i|\ \theta)|_{\theta=\hat{\theta}_n} \overset{p}{\to} -E_{\theta_0} \frac{\partial^2}{\partial\theta^2} lnf(X_i|\ \theta_0) = I(\theta) \quad (5.3.8)$$

Fisher Information is one measurement of a distribution which can measure the information obtained from a random variable or data sample. According to the definition in a random variable, one expression of Fisher Information can be written as:

$$I(\theta) = \frac{1}{Var(\hat{\theta}_n)} \tag{5.3.9}$$

Substitute equation 5.3.8 and 5.3.9 in equation 5.3.7:

$$-2\ ln\lambda(X) = \frac{n\left(\hat{\theta} - \theta_0\right)^2}{Var\left(\hat{\theta}_n\right)} \xrightarrow{d} \chi^2 \tag{5.3.10}$$

Hence, the Likelihood Ratio Test (LRT) is asymptotically equivalent to the Wald test.

5.2.4 LRT in the zero-beta CAPM

As the Wald test is asymptotically equivalent to the LRT, the LRT in the research is the alternative robustness test method to ensure that both results from the Wald test and LRT are consistent. The zero-beta CAPM is the form in equation 5.2.4 as rearranged in Section 5.2.2.

$$E\left[r_{i,t}\right] = (1 - \beta_i)\gamma + \beta_i E\left[r_{m,t}\right] \tag{5.4.1}$$

The real return model of the zero-beta CAPM is equation 5.4.2.

$$r_{i,t} = (1-\beta_i)\gamma + \beta_i r_{m,t} + \varepsilon_t \tag{5.4.2}$$

$$E[\varepsilon_t \varepsilon_t'] = \Sigma \tag{5.4.3}$$

$$E[\varepsilon_t] = 0 \tag{5.4.4}$$

To start with the Likelihood Ratio Test (LRT) on the zero-beta CAPM, the Probability Density Function (PDF) of the real return is conditional on the return of market portfolios. Thus, the joint normality of returns in terms of the PDF of $r_{i,t}$ is shown in the following equation:

$$f(r_{i,t} \mid r_{m,t}) =$$

$$(2\pi)^{-\frac{N}{2}}|\Sigma|^{-\frac{1}{2}} \times exp\left[-\frac{1}{2}\left(r_{i,t} - (1-\beta_i)\gamma - \beta_i r_{m,t}\right)' \Sigma^{-1}\left(r_{i,t} - (1-\beta_i)\gamma - \beta_i r_{m,t}\right)\right] \tag{5.4.5}$$

Assume that there are N observations in the sample, the joint probability density function is:

$$f(r_{1,t}, r_{2,t}, \dots, r_{Z,t} \mid r_{m1,t}, r_{m2,t}, \dots, r_{mZ,t})$$

$$= \prod_{z=1}^{N} p(r_{z,t} \mid r_{mz,t})$$

$$= \prod_{z=1}^{N} (2\pi)^{-\frac{N}{2}}|\Sigma|^{-\frac{1}{2}} \times exp\left[-\frac{1}{2}\left(r_{z,t} - (1-\beta_i)\gamma - \beta_i r_{mz,t}\right)' \Sigma^{-1}\left(r_{z,t} - (1-\beta_i)\gamma - \beta_i r_{mz,t}\right)\right] \tag{5.4.6}$$

As shown in equation 5.4.5, the form of the probability density function depends on the unknown parameters, $\gamma, \beta\ and\ \Sigma$. Thus, the log-likelihood function is defined as the logarithm of the joint probability density function as in equation 5.4.6, and $\mathcal{L}$ is denoted as the log-likelihood function. The log-likelihood function is:

$$\mathcal{L}(\gamma, \beta, \Sigma) = -\frac{NZ}{2} log(2\pi) - \frac{Z}{2} log|\Sigma| - \frac{1}{2}\sum_{z=1}^{Z}\left(r_{z,t} - (1-\beta_i)\gamma - \beta_i r_{mz,t}\right)' \Sigma^{-1}\left(r_{z,t} - (1-\beta_i)\gamma - \beta_i r_{mz,t}\right) \quad (5.4.7)$$

Differentiating the log-likelihood function in equation 5.4.7 with respect to $\gamma, \beta,\ and\ \Sigma$, the equations are as follows:

$$\frac{\partial \mathcal{L}}{\partial \gamma} = (1-\beta_i)'\Sigma^{-1}\left[\sum_{z=1}^{N}\left(r_{z,t} - (1-\beta_i)\gamma - \beta_i r_{mz,t}\right)\right] \quad (5.4.8)$$

$$\frac{\partial \mathcal{L}}{\partial \beta} = \Sigma^{-1}\left\{\sum_{z=1}^{N}\left[\left(r_{z,t} - (1-\beta_i)\gamma - \beta_i r_{mz,t}\right)\left(r_{mz,t} - \gamma\right)'\right]\right\} \quad (5.4.9)$$

$$\frac{\partial \mathcal{L}}{\partial \Sigma} = -\frac{N}{2}\Sigma^{-1} + \frac{1}{2}\Sigma^{-1}\left\{\sum_{z=1}^{N}\left[(r_{z,t} - (1-\beta_i)\gamma - \beta_i r_{mz,t})(r_{mz,t} - \gamma)'\right]\right\}\Sigma^{-1} \quad (5.4.10)$$

To find the maximum likelihood estimators, equations 5.4.8, 5.4.9, and 5.4.10 are set to equal zero.

$$\hat{\gamma}^* = \frac{\left(1-\hat{\beta}^*\right)'\hat{\Sigma}^{*\,-1}\left(\hat{r}_i - \hat{\beta}^*\hat{r}_m\right)}{\left(1-\hat{\beta}^*\right)'\hat{\Sigma}^{*\,-1}\left(1-\hat{\beta}^*\right)} \quad (5.4.11)$$

$$\hat{\beta}^* = \frac{\sum_{z=1}^{Z}\left(r_{z,t} - \hat{\gamma}^*\right)\left(r_{mz,t} - \hat{\gamma}^*\right)}{\sum_{z=1}^{Z}\left(r_{mz,t} - \hat{\gamma}^*\right)^2} \quad (5.4.12)$$

$$\hat{\Sigma}^* = \frac{1}{N}\sum_{z=1}^{N}\left(r_{z,t} - \hat{\gamma}^*\left(1-\hat{\beta}^*\right) - \hat{\beta}^* r_{mz,t}\right)\left(r_{z,t} - \hat{\gamma}^*\left(1-\hat{\beta}^*\right) - \hat{\beta}^* r_{mz,t}\right)' \quad (5.4.13)$$

The LRT follows the null hypothesis:

$$H_0\colon \alpha_i = (1-\beta_i)\gamma \quad (5.4.14)$$

$$H_A\colon \alpha_i \neq (1-\beta_i)\gamma \quad (5.4.15)$$

Defining H as the test statistic, we have

$$H = Z\left[log\left|\hat{\Sigma}^*\right| - log\left|\hat{\Sigma}\right|\right] \overset{a}{\rightarrow} \chi^2_{N-1} \quad (5.4.16)$$

According to equation 5.4.16, the test aims to check whether the null distribution of H will relatively match the chi-square distribution. In other words, it is to examine whether $Z\left[log\left|\hat{\Sigma}^*\right| - log\left|\hat{\Sigma}\right|\right]$ asymptotically matches the chi-square (χ^2) distribution with (N-1) degrees of freedom.

5.3 Empirical Results

This section will present the results in the classic CAPM and the Wald test and the Likelihood Ratio Test (LRT) in the zero-beta CAPM. The results of the Augmented Dickey-Fuller (ADF) unit root test will be presented in Section 5.3.1. The results in the classic CAPM will be presented in Section 5.3.2. Section 5.3.3 will present the results of the calculated power of the test in the classic CAPM regression. The results of the Wald test will be presented in Section 5.3.4. The robustness test for the Wald test will be explained in Section 5.3.5.

5.3.1 ADF unit roots test result

The Augmented Dickey-Fuller (ADF) unit root test is conducted before the regression. This aims to investigate whether the series of variables in the regression model is stationary. And the null hypothesis of the ADF unit root test assumes that the series has a unit root. The unit root tests have been undertaken for excess return of gold and excess rate of return in market portfolios in the UK, the US, China, Japan, and India. The results in *Table 5-1* suggest that the null hypothesis, in which the ADF unit root test assumes the existence of a unit root, is rejected for all variables. The data show in *Table 5-1* can be used for the estimation in the classic CAPM for the UK, the US, China, Japan, and India.

Table B-11, B-12, B-13, B-14 and *B-15* in Appendix B present the t-statistics in the ADF unit root test for all selected stocks in the UK (FTSE 350), the US (S&P 500), China (SSE 180), Japan (NIKKEI 225), and India (SENSEX). The results suggest that the null hypothesis is rejected for all stocks. All data for the variables can be directly used in the regression.

Table 5- 1 t-Statistics in Augmented Dickey-Fuller Unit root test, daily data

	t-statistics (c)	t-statistics (c, t)	t-statistics (none)
UK			
Gold return	-89.3***	-89.3***	-89.3***
FTSE 350	-41.8***	-41.8***	-41.7***
US			
Gold return	-112.2***	-112.2***	-112.2***
S&P 500	-81.6***	-81.6***	-81.5***
China			
Gold return	-40.79**	-40.78**	-40.73**
SSE 180	-46.7**	-46.8**	-46.8**
Japan			
Gold return	-36.1**	-36.1**	-36.0**
NIKKEI 225	-70.8**	-70.9**	-70.8**
India			
Gold return	-60.5**	-60.4**	-60.5**
SENSEX	-89.0**	-89.1**	-89.0**

Notes: the ADF unit root tests are applied in three ways with (c) as the only constant, (c, t) as a time trend and a constant, and (none) as neither trend nor constant. The lag length in ADF unit root test is selected by the Schwarz information criterion.

5.3.2 Results in the classic CAPM

Table 5-2 provides the estimates of the classic CAPM in the UK, the US, China, Japan and India. According to *Table 5-2*, the assumption of no intercept in the classic CAPM holds since the estimates of the intercept are suggested to be statistically insignificant in all markets except for Japan and India. So, there is no clear evidence to show that gold's beta is zero in Japan and India. The OLS regression results in the UK, the US and China have statistically significant betas. Thus, the null hypothesis is rejected, and the beta is not zero in the UK, the US and China based on the daily data. The beta has a negative coefficient, which suggests that the excess return on gold would increase while the excess return on the market portfolio (either in the UK or the US) would decrease, and vice versa. However, the relatively largest beta in absolute value is -0.037. Since it is close to zero, the changes in the excess return on gold may not be significantly large enough with respect to the change of excess return of the market portfolio. The R squared values for all estimations are all close to zero with a highest value of 0.0014. These indicate that the return on market portfolio has nearly no explanatory power in relation to the gold returns; in other words, the relationship between the excess return on gold and the excess return on market portfolio is weak and has close to no correlation.

Table 5- 2 Estimated results of gold's beta from basic CAPM to equity markets in the UK, the US, China, Japan, and India (daily data)

	UK-FTSE 350	US-S&P 500	China-SSE 180	Japan-NIKKEI-225	India-SENSEX
Intercept (α)	0.003 [0.81]	0.009 [0.4102]	0.001 [0.06]	-0.005** [0.00]	-0.006** [0.00]
Beta (β)	-0.037** [0.0007]	-0.028** [0.0087]	0.032** [0.00]	0.165** [0.00]	-0.088** [0.00]
R-squared	0.0014	0.0005	0.0027	0.048	0.008
Note: *, ** represent the statistical significance at the 5% and 1% levels.					

Similarly, with the results in *Table 5-3* and *Table 5-4,* the CAPM does not provide the explanatory power for the results in equity markets in the UK, the US, China, Japan, and India in weekly data and monthly data. The magnitudes of R-squared are similarly close to zero, which suggests that the excess return in gold is uncorrelated to the excess return in market portfolio in each equity market in the weekly data and monthly data. Thus, we conclude that gold cannot be rejected as a zero-beta asset in the UK, the US, China, Japan and India in the weekly and monthly data.

Table 5- 3 Estimated results of gold's beta from CAPM to equity markets in the UK, the US, China, Japan, and India (weekly data)

	UK-FTSE 350	US-S&P 500	China-SSE 180	Japan-NIKKEI 225	India-SENSEX
Intercept (α)	0.072 [0.1828]	0.118** [0.0235]	0.0002 [0.08]	-0.004** [0.00]	-0.006** [0.00]
Beta (β)	0.013 [0.5707]	0.028 [0.2354]	0.046* [0.03]	0.19** [0.00]	-0.06 [0.09]
R-squared	0.0001	0.0005	0.0065	0.069	0.0053
Note: **, *** represent the statistical significance at the 5% and 1% levels.					

Table 5- 4 Estimated results of gold's beta from CAPM to equity markets in the UK, the US, China, Japan, and India (monthly data)

	UK-FTSE 350	US-S&P 500	China-SSE 180	Japan-NIKKEI 225	India-SENSEX
Intercept (α)	-0.0016** [0.00]	-0.028** [0.00]	0.0004 [0.07]	-0.004** [0.00]	-0.005** [0.00]
Beta (β)	0.566** [0.00]	0.07 [0.89]	0.101* [0.02]	0.202** [0.00]	0.024 [0.75]
R-squared	0.295	0.0001	0.033	0.063	0.0008
Note: **, *** represent the statistical significance at the 5% and 1% levels.					

5.3.3 Statistical power in CAPM regression

It is important to consider the power of one test while giving inferences from its results. Given the alternative hypothesis, the power is the probability to reject the null hypothesis. The lower power of the test against the alternative hypothesis suggests that the test is not useful in distinguishing between the null hypothesis and the alternative hypothesis. In other words, the test's lower power is more likely to cause a type II error, which may occur when the null hypothesis is rejected, but cannot be rejected due to the type II error. Following the statistical power analysis in Faul et al. (2009), we use G*power, statistical software, to calculate the statistical power of the regressions for the classic CAPM. The calculated statistical powers of the regression model of the classic CAPM are shown in *Table 5-5, 5-6, 5-7, 5-8,* and *5-9* in daily, weekly, monthly frequency for the UK, the US, China, Japan, and India.

To decide the minimum level of a high power, we consider a standard of 80%, following Cohen's (1988) assessment that this has commonly been used. Thus, we can directly distinguish between the high power and low power in *Table 5-5, 5-6, 5-7, 5-8* and *5-9* for the UK, the US, China, Japan, and India.

According to information from *Table 5-5, 5-6, 5-7, 5-8* and *5-9,* high statistical power can be found in the UK, China and India in daily data and in Japan in daily, weekly and monthly frequency, while the rest show low power. Specifically, low statistical power can be found in the US for daily, weekly, and monthly data. The low power causes the type II error in the test, in which the null hypothesis cannot be rejected. The difference between the high power and the low power is primarily due to the sample size between different data frequencies. A larger sample size will increase the power. However, a test with high power may reject the null hypothesis against the alternative hypothesis. From the results of the power in the CAPM test, the basic CAPM test is not a sufficiently good method for testing the zero-beta asset.

Table 5- 5 Calculated power of test of CAPM in the UK (daily, weekly and monthly frequency)

UK	Daily	Weekly	Monthly
	FTSE 350	FTSE 350	FTSE 350
R squared	0.001488	0.000194	0.00011
Sample size	7771	1656	381
Effect size	0.0015	0.00017	0.0001
Power	0.9254	0.0875	0.0548

Table 5- 6 Calculated power of test of CAPM in the US (daily, weekly and monthly frequency)

US	Daily	Weekly	Monthly
	S&P 500	S&P 500	S&P 500
R squared	0.000594	0.000554	0.000062
Sample size	11597	2541	584
Effect size	0.0006	0.0005	0.00006
Power	0.7471	0.2205	0.0541

Table 5- 7 Calculated power of test of CAPM in China (daily, weekly and monthly frequency)

China	Daily	Weekly	Monthly
	SSE 180	SSE 180	SSE 180
R squared	0.0028	0.0065	0.033
Sample size	3623	725	168
Effect size	0.0028	0.0065	0.034
Power	0.938	0.70	0.77

Table 5- 8 Calculated power of test of CAPM in Japan (daily, weekly and monthly frequency)

Japan	Daily	Weekly	Monthly
	NIKKEI	NIKKEI	NIKKEI
R squared	0.0483	0.0695	0.0634
Sample size	3459	693	160
Effect size	0.0507	0.0747	0.0677
Power	0.98	0.97	0.95

Table 5- 9 Calculated power of test of CAPM in India (daily, weekly and monthly frequency)

India	Daily	Weekly	Monthly
	SENSEX	SENSEX	SENSEX
R squared	0.0081	0.0053	0.0008
Sample size	2710	543	126
Effect size	0.0082	0.0053	0.0008
Power	0.99	0.52	0.20

5.3.4 Results of Wald test in zero-beta CAPM

To test the zero-beta CAPM, the raw stock price returns are used as the dependant variable in the regression with the raw returns of the market portfolios used as the explanatory variable. The hypothesis of the Wald test in zero-beta CAPM is assumed to be $\frac{\alpha_i}{1-\beta_i} = \gamma$, which assumes that the estimated α_i divided by 1 minus the estimated β_i equals the expected return of the zero-beta asset γ.

The main objective is to test whether the asset used can be seen as a zero-beta asset, which is to examine whether the p-value of the Wald test for each stock is higher or lower than 0.05. If the probability is higher than 0.05, the null hypothesis of the Wald test cannot be rejected, which suggests that the asset used in the test is a zero-beta asset. On the other hand, if the probability is less than 0.05, the hypothesis is rejected, which suggests that this asset is not a zero-beta asset.

In Appendix B, *Table B-16* to *Table B-20* show the results of the Wald test in the zero-beta CAPM for gold and T-bills in five countries, OIS in the UK, the US and Japan and IBOR in China and India. Table 5-10 summarizes the results from *Table B-16* to *B-20* in Appendix B.

Gold is qualified as a zero-beta asset in the UK and China, since the percentage of insignificant results in the Wald test is larger than 95% as we have applied a 5% level of significance in each test. T-bills are qualified as a zero-beta asset in Japan as 96% of the individual tests are insignificant. And only IBOR in China is qualified as a zero-beta asset rather than other OIS.

Table 5- 10 The percentages of insignificant results in the Wald test in the UK, US, China, Japan, India-daily

UK	
Gold	0.9629
T-Bill	0.0114
SONIA	0.0171
US	
Gold	0.8400
T-bill	0.0880
SOFR	0.1020
China	
Gold	0.9778
T-bill	0.0889
IBOR	0.9556
Japan	
Gold	0.9289
T-bill	0.9600
TONAR	0.0933
India	
Gold	0.8333
T-bill	0.1000
IBOR	0.0667

The results in *Table 5-10* show that none of the assets examined (gold, T-bills, OIS and IBOR) are found to be consistently zero-beta/risk-free assets in all countries. This also raises the question of generalisability for one asset to be the proxy for the risk-free asset for all markets. Furthermore, there would be an impact on the comparability of the estimated results using the same or different proxies among different markets.

5.3.5 Robustness check for the Wald test

As shown in Section 5.2.3 in this chapter, the Likelihood Ratio Test (LRT) is asymptotically equivalent to the Wald test. The LRT can be used as the robustness tool for checking the results in the Wald test in the zero-beta CAPM. The LRT is based on equation 5.4.16 in Section 5.2.4 to test whether the null distribution of H follows the chi-square distribution. We have run the LRT using the 30 largest companies in each country as the robustness check shown in *Table 5-11*. The results suggest the same conclusions as those in the Wald test. Further, we will test all the companies for each country.

Table 5- 11 The percentages of insignificant results in the LRT in the UK, US, China, Japan, India-daily

UK	
Gold	0.97
T-Bill	0.09
SONIA	0.03
US	
Gold	0.90
T-bill	0.08
SOFR	0.18
China	
Gold	0.97
T-bill	0.09
IBOR	0.96
Japan	
Gold	0.90
T-bill	0.97
TONAR	0.10
India	
Gold	0.85
T-bill	0.16
IBOR	0.08

5.4 Conclusion

This chapter aimed to investigate whether government gold, T-bills, OIS and IBOR are zero-beta assets, which could then be used as the proxy for the risk-free asset in the UK, the US, China, Japan and India under the zero-beta CAPM framework. We assumed that gold, T-bills, OIS, or IBOR are a zero-beta asset in the zero-beta CAPM and applied the Wald test to examine whether the null hypothesis in the zero-beta CAPM can be rejected or not. It is the first empirical test in the literature for whether gold, T-bills, OIS or IBOR are zero-beta assets against each individual company in the FTSE 350, S&P 500, SSE 180, NIKKEI 225, and SENSEX in the zero-beta CAPM.

In Section 5.3.2, the null hypothesis, gold as a zero-beta asset, has been tested in the classic CAPM using daily, weekly and monthly data. According to the results in classic CAPM, we find that the null hypothesis cannot be rejected.

To ensure we have robust conclusions, the power of the test is assessed. Due to the results for the power of the CAPM test, we find that the power is high in daily frequency for the UK, China, Japan and India and low in weekly and monthly frequency except for Japan. The high power of the test in daily frequency shows that it is less likely to have a type II error. And the low power suggests that the test may be more likely to have a type II error, so the null hypothesis cannot be rejected. Therefore, using the CAPM test may not be a sufficiently good method for a zero-beta asset since the difference between the high power and low power may be due to the different sample size.

Next, we applied the Wald test and Likelihood Ratio Test (LRT) in the zero-beta CAPM which can avoid the problems in the results in the classic CAPM. We examine the p-value of test-statistics of the Wald test and LRT under the null hypothesis in the zero-beta

CAPM instead of the p-value in the regression. The Wald tests are run with the data at a daily frequency in Section 5.3, and LRT can be a robustness tool to check the results in the Wald test. According to the results of the Wald tests, we find that gold is a zero-beta asset in the UK and China; T-bills are a zero-beta asset in Japan; and IBOR is a zero-beta asset in China.

So, we can conclude: gold can be a proxy for the risk-free asset in the UK and China; T-bill is still a proxy for the risk-free asset in Japan; IBOR is a proxy for the risk-free asset in China. The results show that none of the OIS are qualified as a zero-beta asset in the Wald test of the zero-beta CAPM, even though they are alternative benchmarks for the existing interbank offered rates.

Instead of setting risk-free assets, we show that the Wald test under the zero-beta CAPM is the method to test zero-beta assets in order to find out whether they can be used as the proxy for the risk-free asset. That is to say, an asset cannot be considered a consistent proxy for the risk-free asset in all markets without running this test. Also, we find that there would be problem with the generalizability of the risk-free asset in different markets; this will be a useful focus for future research.

Chapter 6 Constructing the Risk-free Portfolio

6.1 Introduction

This chapter is motivated by the conclusion in Chapter 5. The results show that gold, T-bills, OIS or IBOR are not always a zero-beta asset under the Wald test in the UK, the US, China, Japan and India in the zero-beta CAPM. The question is raised: Is it possible to construct a risk-free portfolio in both the UK and the US? Gold, T-bills or any other potential assets are chosen to construct the risk-free portfolio in order to continue pursuing the proxy for the risk-free portfolio. Related research focuses on the empirical work on silver, platinum and palladium as discussed in Section 2.3.2. So, we choose silver, platinum and palladium as the other potential assets. The objective of this chapter is to discover any potential risk-free portfolios that can be constructed using gold, T-bills, silver, platinum and palladium in the UK and US.

The content in this chapter will be delivered as follows. Section 6.2 will describe the methodology in this chapter. Section 6.3 will present the empirical results. And the conclusion will be drawn in Section 6.4.

6.2 Methodology

Two methods of constructing portfolios are described in this section. Section 6.2.1 will describe a method of portfolio construction in one time period. Section 6.2.2 will describe a method of portfolio construction in continuous time.

6.2.1 Portfolio in one time period

We start the portfolio construction with two assets by assuming that there is a weight α for one asset and another weight $(1-\alpha)$ for another asset. The objective of constructing a risk-free portfolio is achieved by finding solutions for the weights which allows the variance of the returns of the portfolio to equal zero. Thus, the portfolio is a risk-free portfolio if the variance on the return of the portfolio is equal to zero.

Let $\widetilde{R_\iota}$ be the raw return on one asset, and $\widetilde{R_J}$ be the raw return on another asset. We will construct a portfolio in one time period. The return on the portfolio is written as:

$$\tilde{R}_p = \alpha\widetilde{R_\iota} + (1-\alpha)\widetilde{R_J} \tag{6.1.1}$$

where R_p is the raw return on the portfolio. In order to discover whether the portfolio is risk-free, the variance of the portfolio p must equal zero. That is to say, the portfolio must satisfy the following conditions:

$$Var(\tilde{R}_p) = 0 \tag{6.1.2}$$

Substituting $\tilde{R}_p$ from equation 6.1.1 in equation 6.1.2:

$$\alpha^2 Var(\widetilde{R_\iota}) + (1-\alpha)^2 Var(\widetilde{R_J}) + 2\alpha(1-\alpha)Cov(\widetilde{R_\iota}, \widetilde{R_J}) = 0 \tag{6.1.3}$$

After rearrangement, equation 6.1.3 can be written as:

$$\alpha^2\left(Var(\widetilde{R_\iota}) + Var(\widetilde{R_J}) - 2Cov(\widetilde{R_\iota}, \widetilde{R_J})\right) + \alpha\left(2Cov(\widetilde{R_\iota}, \widetilde{R_J}) - 2Var(\widetilde{R_J})\right) + Var(\widetilde{R_J}) = 0$$

The discriminants D for equation 6.1.3 can be written as:

$$D = \left(2Cov(\widetilde{R_\iota}, \widetilde{R_J}) - 2Var(\widetilde{R_J})\right)^2 - 4 \times \left(Var(\widetilde{R_\iota}) + Var(\widetilde{R_J}) - 2Cov(\widetilde{R_\iota}, \widetilde{R_J})\right) \times Var(\widetilde{R_J}) \qquad (6.1.4)$$

And the calculation of roots for equation 6.1.3 are as follows:

$$roots = \frac{\left(2Var(\widetilde{R_J}) - 2Cov(\widetilde{R_\iota}, \widetilde{R_J})\right) \pm \sqrt{D}}{2 \times \left(Var(\widetilde{R_\iota}) + Var(\widetilde{R_J}) - 2Cov(\widetilde{R_\iota}, \widetilde{R_J})\right)} \qquad (6.1.5)$$

The estimation is focused on $Var(\widetilde{R_\iota}), Var(\widetilde{R_J})$ and $Cov(\widetilde{R_\iota}, \widetilde{R_J})$ of the time series. There are certain weights $(0 \le \alpha \le 1)$ between the two chosen assets that would allow a risk-free portfolio to be constructed if there is a solution in real numbers in equation 6.1.3. The process will involve checking whether the discriminants are no less than zero in the first step. In the second step, if discriminants are greater than zero or equal to zero, there will surely be a weight for the assets in the portfolio in the real numbers. If the discriminants are less than zero, there will not be a weight for assets in real numbers.

However, it is neither reasonable nor sufficient to construct the portfolio by only two assets. Investors would choose multiple assets to reduce the risk and secure the future return. Moving one step further, choosing three assets will also be a way to discover the risk-free portfolio.

Assume the weights for the assets (i, j, k) in the portfolio are α, β, γ. The relationship among three weights is shown as:

$$\alpha + \beta + \gamma = 1 \tag{6.1.6}$$

Let $\widetilde{R_i}$ be the raw return on the first asset, $\widetilde{R_j}$ be the raw return on the second asset, $\widetilde{R_k}$ be the raw return on the third asset. The return on the constructed portfolio will be:

$$\tilde{R}_p = \alpha\widetilde{R_i} + \beta\widetilde{R_j} + \gamma\widetilde{R_k} \tag{6.1.7}$$

The variance of the portfolio is written as:

$$Var(\tilde{R}_p) = \alpha^2 R_i^2 + \beta^2 R_j^2 + \gamma^2 R_k^2 + 2\alpha\beta R_i R_j + 2\alpha\gamma R_i R_k + 2\beta\gamma R_j R_k \tag{6.1.8}$$

By considering equation 6.1.6 and 6.1.7, equation 6.1.8 is written as:

$$Var(\tilde{R}_p) = \alpha^2(R_i^2 + R_k^2 - 2R_i R_k) + \beta^2(R_j^2 + R_k^2 - 2R_j R_k) + 2\alpha(R_i R_k - R_k^2)$$
$$+ 2\beta(R_j R_k - R_k^2) + 2\alpha\beta(R_k^2 + R_i R_j - R_i R_k - R_j R_k) + R_k^2 \tag{6.1.9}$$

Following the same rule in equation 6.1.2, $Var(\tilde{R}_p) = 0$. In the case of three assets with three weights, it is to solve variable α, β in equation 6.1.8 as γ can be substituted by $(1 - \alpha - \beta)$. Mathematically, it is impossible to solve two variables in this quadratic equation since there are only two equations aiming to solve three variables. The same problem will happen in the case of more than three assets. This causes problems in discovering a risk-free portfolio with more than two assets. It is the method that hinders us in discovering the weights for assets in the portfolio. In other words, another method of portfolio construction would have to be considered to avoid this mathematical problem if the case of more than two assets is examined. Therefore, we limit our analysis to the two-asset case.

6.2.2 Portfolio in continuous time

In this section, we construct the portfolio in continuous time. Brownian motion is applied in the portfolio construction according to Dixit and Pindyck (1994: 63-72).

A Wiener process W_t, also called Brownian motion, is a continuous time stochastic process. Wiener process has the following properties:

1. The value of a Wiener process at time 0 equals zero, $W_0 = 0$.
2. The Wiener process has independent increments. The probability distribution for any change over a time interval is independent of changes over other time intervals. For every t, the increment $W_{t+\mu} - W_t, (\mu > 0)$, is independent of the past value $W_s, s < t$. In addition, $0 < t_1 < t_2 < t_3 < t_4, W_{t_2} - W_{t_2}$ and $W_{t_4} - W_{t_3}$ are also independent from each other.
3. Normal distribution. Changes in the Wiener process over any finite time interval follows the normal distribution with a mean of 0 and the variance increases linearly over the interval of time. $W_{t+\mu} - W_t \sim N(0, dt)$.
4. Continuity. The Wiener process is continuous over the sample paths.

The relationship between ΔW and Δt is given by:

$$\Delta W = \epsilon_t \sqrt{\Delta t} \tag{6.2.1}$$

where ϵ_t is a random variable following the normal distribution with mean of 0 and standard deviation of 1, $N(0,1)$.

To examine the change in W over some finite interval of time T, this interval can be divided into units by $n = T/\Delta t$. The changes in Wiener process over time interval T are given by:

$$W_{t+T} - W_t = \sum_{i=1}^{n} \epsilon_t \sqrt{\Delta t} \tag{6.2.2}$$

If T in equation 6.2.2 is infinitely small, equation 6.2.2 can be rewritten as:

$$dW = \epsilon_t \sqrt{dt} \tag{6.2.3}$$

In equation 6.2.3, the increment of Wiener process dW is represented in continuous time. According to property 3 in the Wiener process, the expected value of the increment Wiener process is equal to zero, $E(dW) = 0$, and its variance equals the increment of the time $Var[dW] = E[(dW)^2] = dt$.

The Ito diffusion can be written as:

$$dx = \alpha x dt + \sigma x dW \tag{6.2.4}$$

Where x is a random variable, dW is the increment of the Wiener process, α is the drift parameter, and σ is the variance parameter.

Let r_i and r_j be the logarithmic return on asset i and asset j. Assume that r_i and r_j follow the generalized Brownian motion with drift in equation 6.2.4.

$$dr_i = \mu_i dt + \sigma_i dW_i \tag{6.2.5}$$

$$dr_j = \mu_j dt + \sigma_j dW_j \tag{6.2.6}$$

with $E\left[dW_i dW_j\ \right] = \rho dt$, where ρ is the coefficient of the correlation between the two processes.

Thus, the portfolio constructed p is written as:

$$r_p = \alpha r_i + (1-\alpha) r_j \tag{6.2.7}$$

Taking the derivative on both sides of equation 6.2.7:

$$dr_p = \alpha dr_i + (1-\alpha) dr_j \tag{6.2.8}$$

Substituting equation 6.2.5 and 4.11.6 into equation 6.2.8:

$$dr_p = \ \alpha(\mu_i dt + \ \sigma_i dW_i) + (1-\alpha)\left(\mu_j dt + \ \sigma_j dW_j\right) \tag{6.2.9}$$

After arrangement, equation 6.2.9 is in the following form:

$$dr_p = \ \left[\alpha\mu_i + (1-\alpha)\mu_j\right] dt \ + \ \alpha\sigma_i dW_i \ + (1-\alpha)\sigma_j dW_j$$

$$= \ \left[\alpha\mu_i + (1-\alpha)\mu_j\right] dt \ + \ \sigma_p dW_p \tag{6.2.10}$$

where W_p is the standard Brownian motion. The variance of portfolio p is:

$$\sigma_p{}^2 = \alpha^2\sigma_i{}^2 + (1-\alpha)^2\sigma_j{}^2 + 2\alpha(1-\alpha)\sigma_i\sigma_j\rho \qquad (6.2.11)$$

After rearrangement, equation 6.2.11 can be written as:

$$\sigma_p{}^2 = \alpha^2\left(\sigma_i{}^2 + \sigma_j{}^2 - 2\sigma_i\sigma_j\rho\right) + \alpha\left(2\sigma_i\sigma_j\rho - 2\sigma_j{}^2\right) + \sigma_j{}^2 \qquad (6.2.12)$$

To find α in equation 6.2.12, such as that $\sigma_p{}^2 = 0$, if the discriminate in α were no less than zero, there would be weights in real numbers as discussed in Section 6.2.1.

The discriminants D for equation 6.2.12 can be written as:

$$D = \left(2\sigma_i\sigma_j\rho - 2\sigma_j{}^2\right)^2 - 4 \times \left(\sigma_i{}^2 + \sigma_j{}^2 - 2\sigma_i\sigma_j\rho\right) \times \sigma_j{}^2$$

$$= 4 \times \sigma_i{}^2\sigma_j{}^2\rho^2 - 4 \times \sigma_i{}^2\sigma_j{}^2 \qquad (6.2.13)$$

In order to have roots in equation 6.2.12 in real numbers, the discriminant must not be less than zero in (6.2.13). Thus, we have the following inequality:

$$4 \times \sigma_i{}^2\sigma_j{}^2\rho^2 - 4 \times \sigma_i{}^2\sigma_j{}^2 \geq 0 \qquad (6.2.14)$$

which can be written as,

$$\rho^2 \geq 1 \qquad (6.2.15)$$

As mentioned before, ρ is the coefficient of correlation (or the covariance per unit of time) between two processes for asset i and j. If, and only if, the two processes are perfectly correlated, will there be a solution in equation 6.2.12, that is to say, $\rho = 1 \; or - 1$.

For $\rho = 1$, the weight α for asset i is:

$$\alpha = \frac{{\sigma_i}^2 - 2\sigma_i\sigma_j}{{\sigma_i}^2 + {\sigma_j}^2 - 2\sigma_i\sigma_j} \tag{6.2.16}$$

and the other weight $(1-\alpha)$ for asset j is:

$$(1-\alpha) = \frac{{\sigma_j}^2}{{\sigma_i}^2 + {\sigma_j}^2 - 2\sigma_i\sigma_j} \tag{6.2.17}$$

For $\rho = -1$, the weight α for asset i is:

$$\alpha = \frac{{\sigma_i}^2 + 2\sigma_i\sigma_j}{{\sigma_i}^2 + {\sigma_j}^2 + 2\sigma_i\sigma_j} \tag{6.2.18}$$

and the other weight $(1-\alpha)$ for asset j is:

$$(1-\alpha) = \frac{{\sigma_j}^2}{{\sigma_i}^2 + {\sigma_j}^2 + 2\sigma_i\sigma_j} \tag{6.2.19}$$

However, it would be extremely difficult to find two perfectly correlated processes in the real world. Despite this dilemma, this mathematically establishes the standard and criterion for the risk-free portfolio, rather than assuming some asset as the risk-free asset in the market.

6.3 Empirical Results

This section will present the steps for examining possible proxies for the risk-free asset or risk-free portfolio. This is the first study to investigate whether constructed portfolios can meet the requirement of a portfolio with zero-variance in its returns. If there was a portfolio with the zero variance returns, a risk-free portfolio would be found. If none is found, then we examine whether the constructed portfolio can satisfy the requirement of a zero-beta portfolio in order to serve as the proxy for the risk-free portfolio. Section 6.3.1

shows the results of the roots in the quadratic equation in the method of portfolio construction in one time period. Section 6.3.2 will describe the results of the ADF unit root test. Section 6.3.3 will present the results of the Wald test assessing all portfolio combinations among gold, T-bills, silver, platinum and palladium as the zero-beta portfolio in the zero-beta CAPM, in order to examine whether these portfolios can be a proxy for the risk-free portfolio. The summary will be presented in Section 6.3.4.

6.3.1 Portfolio in one time period

Table 6-1 presents the variance and the covariance among gold (1958 - 2019), T-bills (1985 - 2019), silver (1968 - 2019), platinum (1990 - 2019) and palladium (1990 - 2019) in the daily data set. The combination of each two pairs is selected to construct the risk-free portfolio. The variance of the two assets, and the covariance between them are used in equation 6.1.3 in order to solve the quadratic equation and find certain weights (adding up to 1 in total) between two assets in the prospective risk-free portfolio.

Table 6- 1 Variance and Covariance – UK (Daily)

	Gold	T-bill	Silver	Platinum	Palladium
Gold	0.000153				
T-bill	-1.13E-06	5.36E-05			
Silver	0.000148	2.89E-07	0.000386		
Platinum	0.003043	6.26E-06	7.91E-05	0.002979	
Palladium	0.005215	-8.16E-07	0.000132	0.00012	0.000422

For the pair consisting of gold and T-bills, the daily variance of gold and T-bills returns, and the covariance of both gold and T-bill returns are written in the following equation after the substitution of the variances and the covariance in equation 6.1.3.

$$\alpha^2 \times 0.000153 + (1-\alpha)^2 \times 0.0000536 - 0.00000113 \times \alpha(1-\alpha) = 0$$

To find the existence of roots in the quadratic equation, it is necessary to examine the results of the discriminant in equation 6.1.4. If the discriminant is negative, there are no real roots in the quadratic equation. Thus, certain weights cannot be found in the portfolio constructed by the gold and T-bills pair in the UK daily data. But if the discriminant is positive, there are real roots in the quadratic equation. Certain weights can be found in the constructed portfolio.

The same method is used for the possible pairs in the UK data. And the results are shown in Table 6-2. The discriminant is calculated as the positive results in the portfolios constructed by the pairs of gold & platinum and gold & palladium. These pairs are the only pairs that have the real roots for their weights to construct a risk-free portfolio.

Table 6- 2 Results of solution to quadratic equation for all portfolio combination in the UK-daily data

1st asset and 2nd asset	Discriminant	Real Roots
Gold & T-bill	Negative	No
Gold & Silver	Negative	No
Gold & Platinum	Positive	Yes
Gold & Palladium	Positive	Yes
T-bill & Silver	Negative	No
T-bill & Platinum	Negative	No
T-bill & Palladium	Negative	No
Silver & Platinum	Negative	No
Silver & Palladium	Negative	No
Platinum & Palladium	Negative	No

Table 6- 3 Variance and Covariance – US (daily data)

	Gold	T-bill	Silver	Platinum	Palladium
Gold	0.000196				
T-bill	1.51E-07	7.59E-06			
Silver	0.009627	-5.03E-06	0.000417		
Platinum	0.004093	0.000177	7.06E-05	0.000355	
Palladium	0.007565	1.79E-06	0.000132	0.000157	0.000404

Table 6-3 shows the variance and covariance for gold (1968 - 2019), T-bills (1972 - 2019), silver (1968 - 2019), platinum (1990 - 2019) and palladium (1990 - 2019) in the US market at the daily frequency. The same process used to find the weight in the UK daily data is used for the US daily data.

The same calculation has been done for the portfolios in the US. The results are shown in *Table 6-4*. The discriminant is calculated as the positive results in the portfolios constructed by the pairs of gold & silver, gold & platinum, gold & palladium and T-bills & platinum, which means that they will have real roots for their weights to construct a risk-free portfolio.

Table 6- 4 Results of solution to quadratic equation for all portfolio combinations in the US-daily

1st asset and 2nd asset	Discriminant	Real Roots
Gold & T-bill	Negative	No
Gold & Silver	Positive	Yes
Gold & Platinum	Positive	Yes
Gold & Palladium	Positive	Yes
T-bill & Silver	Negative	No
T-bill & Platinum	Positive	Yes
T-bill & Palladium	Negative	No
Silver & Platinum	Negative	No
Silver & Palladium	Negative	No
Platinum & Palladium	Negative	No

As shown in *Table 6-2* and *Table 6-4*, there are two sets of results for the weights in the risk-free portfolio shown in *Table 6-5*. It can be obviously seen that gold plays an essential role in constructing the risk-free portfolio, while T-bills is the single case in the construction of the risk-free portfolio in the US. In both the UK and US cases, the weight of gold is less than the weight of the other asset in the portfolio. And interestingly, the weight of gold and the weight of the other asset are almost equal weights, except for the case of gold & platinum in the UK. That is the difference between the weights for gold & platinum in the UK and US, which suggests that platinum would have more impact on constructing a risk-free portfolio in the UK while gold and platinum have almost the same amount of impact in the US. In the UK, T-bills cannot be used to construct a risk-free portfolio, while T-bills can be used in the US even though their proportion is far less than platinum. The risk-free portfolio can be constructed by using the weights for the corresponding assets in *Table 6-5*.

Table 6- 5 Results of weights for the risk-free portfolio - daily data

	Set 1		Set 2	
1st asset & 2nd asset	α	β	α	β
UK				
Gold & Platinum	0.016	0.984	0.028	0.972
Gold & Palladium	0.481	0.519	0.492	0.508
US				
Gold & Silver	0.484	0.516	0.504	0.496
Gold & Platinum	0.485	0.515	0.494	0.506
Gold & Palladium	0.485	0.515	0.5	0.5
T-bill & Platinum	0.021	0.979	0.021	0.979

Note: α is the weight for the 1st asset, and β is the weight for the 2nd asset.

In order to assess the sensitivity of our results to the time horizon. *Table 6-6* and *Table 6-7* present the variance and covariance among gold, T-bills, silver, platinum and palladium in the UK and US using monthly average data. The same method is applied in the monthly data set. The discriminants for all portfolios are negative, which means that the weights cannot be solved in real numbers in the monthly data set.

Table 6- 6 Variance and Covariance – UK (Monthly)

	Gold	T-bill	Silver	Platinum	Palladium
Gold	5.22E-06				
T-bill	-5.28E-07	7.66E-05			
Silver	6.10E-06	-2.06E-06	1.46E-05		
Platinum	3.91E-06	-1.51E-06	6.63E-06	8.62E-06	
Palladium	3.07E-06	-2.91E-06	6.47E-06	7.64E-06	2.20E-05

*Table 6- 7 V*ariance and Covariance – US (Monthly)

	Gold	T-bill	Silver	Platinum	Palladium
Gold	1.49E-03				
T-bill	-2.46E-06	3.68E-05			
Silver	8.85E-06	-9.24E-07	1.47E-05		
Platinum	5.24E-06	1.22E-07	6.64E-06	8.16E-06	
Palladium	6.93E-06	3.34E-07	6.59E-06	7.60E-06	2.21E-05

Table 6- 8 Results of solution to quadratic equation for all portfolio combinations in the UK-monthly

1st asset and 2nd asset	Discriminant	Real Roots
Gold & T-bill	Negative	No
Gold & Silver	Negative	No
Gold & Platinum	Negative	No
Gold & Palladium	Negative	No
T-bill & Silver	Negative	No
T-bill & Platinum	Negative	No
T-bill & Palladium	Negative	No
Silver & Platinum	Negative	No
Silver & Palladium	Negative	No
Platinum & Palladium	Negative	No

Table 6- 9 Results of solution to quadratic equation for all portfolio combinations in the US-monthly

1st asset and 2nd asset	Discriminant	Real Roots
Gold & T-bill	Negative	No
Gold & Silver	Negative	No
Gold & Platinum	Negative	No
Gold & Palladium	Negative	No
T-bill & Silver	Negative	No
T-bill & Platinum	Negative	No
T-bill & Palladium	Negative	No
Silver & Platinum	Negative	No
Silver & Palladium	Negative	No
Platinum & Palladium	Negative	No

In summary, all the possible pairs of the assets in the portfolio have been tested in both markets and at different frequencies. The results from daily data show that the risk-free portfolio can be constructed by gold & platinum and gold & palladium in the UK and gold & silver, gold & platinum, gold & palladium and T-bills & silver in the US. However, the results show no solutions that allow a risk-free portfolio to be constructed in the monthly data set in *Table 6-8* and *Table 6-9*. The reason why there are no roots in the monthly data set in real numbers may be due to the fact that the covariance between two assets in the portfolio is too small in the absolute value compared to the daily data set.

6.3.2 Augmented Dicken-Fuller unit test

Before the OLS regressions can be undertaken in the next section, the time series in the data need to be tested for unit roots. The aim of the unit root test is to investigate whether the time series variables used in the regression model are stationary. The null hypothesis of the ADF unit root test assumes that there is a unit root in the series, which is non-stationary. A unit root in the series is one feature of the stochastic process that would cause problems of the statistical interference. If a time series has a unit root, it means that the time series is not stationary and does not always have a trend. In other words, if a time series has unit roots, the underlying probability distribution could be interfered with in the regression process. The null hypothesis is rejected for the sample period being examined, which suggests that all the data are stationary and can be used in the regression. In this chapter, we are using some of the same data from Chapter 5 (See results of these tests in Section 5.3.1).

6.3.3 Results of Zero-Beta Portfolio

Table 6-10 presents all the portfolio combinations by gold, T-bills, silver, platinum and palladium. Motivated by the results of the weights for the constructed risk-free portfolio in *Table 6-5*, we apply the naïve portfolio construction by using equal weights among the assets in each portfolio expect for the pairs where a risk-free portfolio can be constructed. We use equal weights for the portfolio combinations shown in *Table 6-5*, except for the portfolio of gold & platinum in the UK and the portfolio of T-bill & platinum. We choose to use 2% of gold and 98% of platinum in the portfolio in the UK and 2% of T-bills and 98% of platinum in the portfolio in this test. The portfolio P1 to P10 are constructed using only two assets. Since there are some portfolios that cannot be constructed as the risk-free portfolio according to the condition of the zero variance in returns, it would be another way to test whether these portfolio can be a zero-beta portfolio in the zero-beta CAPM.

Although we have shown that it is impossible to find a risk-free portfolio by the asset combination of more than three assets, it is possible to test whether the portfolio with more than three assets can be a zero-beta portfolio in the zero-beta CAPM. The portfolios with three assets are presented from P11 to P20. P21 to P25 are portfolios with four assets. And P26 presents the portfolio with all five assets.

Table 6- 10 Portfolio combinations in both the UK and US

	Gold	T-bill	Silver	Platinum	Palladium	Risk-free portfolio
P1	√	√				No
P2	√		√			Only US
P3	√			√		UK and US
P4	√				√	UK and US
P5		√	√			No
P6		√		√		Only US
P7		√			√	No
P8			√	√		No
P9			√		√	No
P10				√	√	No
P11	√	√	√			
P12	√	√		√		
P13	√	√			√	
P14	√		√	√		
P15	√		√		√	
P16	√			√	√	
P17		√	√	√		
P18		√	√		√	
P19		√		√	√	
P20			√	√	√	
P21	√	√	√	√		
P22	√	√	√		√	
P23	√	√		√	√	
P24	√		√	√	√	
P25		√	√	√	√	
P26	√	√	√	√	√	

Note: √ presents the assets that are used to construct the portfolio. The analysis of constructing a risk-free portfolio is limited due to the mathematical problem as discussed in Section 6.2.1. So, the diagonal line is drawn for the portfolio from P11 to P26 as we cannot use the method in Section 6.3.1 to examine whether these portfolios can be a risk-free portfolio.

The constructed portfolios are examined using the Wald test in zero-beta CAPM as in Section 5.3.4. As the results from LRT provide a similar set of conclusions to those in the Wald test, the Wald test is sufficient to test the zero-beta portfolios. The test results using daily data are shown in *Table C-1* to *Table C-9* in the UK market and in *Table C-10* to *Table C-18* in the US market. For the rest of the constructed portfolio combinations see Appendix C.

We have undertaken the tests for all the portfolio combinations against each individual company in the FTSE 350 in the UK and in the S&P 500 in the US. According to the null hypothesis of the Wald test in equation 5.2.5 in the zero-beta CAPM in Section 5.2.1, a portfolio can be considered as a zero-beta portfolio if the p-value of the Wald test statistics suggests the results are insignificant. However, the results show that there are always some significant p-values (at the 5% level) for the Wald test statistics shown in *Table C-1* to *Table C-18*.

We summarize the insignificant results from *Table C-1* to *Table C-18* in *Table 6-11*. *Table 6-11* shows the percentage of the insignificant results of the Wald test for each portfolio combination against each individual company in the UK and US. In the UK, there are more portfolio combinations that show the potential to be a zero-beta portfolio. The percentage of insignificant results are all above 95% in P2, P3, P4, P8, P9, P10, P14, P15, P16 and P24. As the cut-off point in our tests is a 5% level of significance, if more than 95% of the portfolios are found to be insignificant, this would indicate that a particular portfolio is a zero-beta portfolio. As shown in *Table 6-10*, the portfolios P3 and P4 can be seen as zero-beta portfolios, and these were also found to be risk-free portfolios in Section 6.3.1. This is further evidence for the finding that the portfolios constructed using gold & platinum and gold & palladium can be considered risk-free portfolios for UK investors.

For the rest of the portfolios, with over 95% of the companies having insignificant results, we could consider these to be the candidates for zero-beta portfolios, and therefore possibly to be proxies for the risk-free portfolio in the UK.

In the US, the percentage of the insignificant results from the Wald test is shown above 95% in the portfolios P9, P10, and P20. These portfolios could, in a similar way to above, be zero-beta portfolios in the US. However, the portfolios P2, P3, P4 and P6 have percentages lower than 95% in *Table 6-11*. This suggests that these portfolios are not the zero-beta portfolio. This would be further evidence to show that the risk-free portfolio and zero-beta portfolio are not the same. In other words, this may show that the zero-beta asset/portfolio may not be a good proxy for the risk-free asset/portfolio.

Table 6- 11 Percentage of the insignificant results from the Wald Test in the UK and US

	UK	US		UK	US
P1	0.0057	0.0560	P14	0.9857	0.0900
P2	0.9571	0.0400	P15	0.9829	0.0800
P3	0.9686	0.0360	P16	0.9800	0.0840
P4	0.9771	0.0460	P17	0.0114	0.0780
P5	0.0057	0.0700	P18	0.0200	0.0700
P6	0.0086	0.0600	P19	0.0286	0.0800
P7	0.0057	0.0640	P20	0.0143	0.9760
P8	0.9657	0.8320	P21	0.0286	0.1060
P9	0.9771	0.9720	P22	0.0343	0.1140
P10	0.9714	0.9540	P23	0.0429	0.1200
P11	0.0114	0.0980	P24	0.9829	0.0820
P12	0.0143	0.1040	P25	0.0314	0.0860
P13	0.0086	0.1100	P26	0.0286	0.1660

It is interesting that identical portfolios of assets in the UK and the US, such as portfolios P2 and P3 in *Table 6-10,* are not found to be zero-beta/risk-free portfolio in both markets. This also raises questions about the generalisability of certain assets or portfolios in a broader context, which is why portfolios P2 and P3 might be qualified as zero-beta portfolios in the UK but not in the US as mentioned earlier in Section 5.3.4.

6.4 Conclusion

This chapter aimed to discover whether the portfolio, constructed using T-bills, gold, silver, platinum and palladium, can be considered as risk-free portfolios or the zero-beta portfolios as the proxy for the risk-free portfolio. T-bill, gold, silver, platinum and palladium are the assets that are uncorrelated with the market and which have been examined in much research. Therefore, we use a combination of these five assets to construct portfolios in one period of time and in continuous time. The idea is based on the variance of the portfolio's return which measures its risk. If there are solutions in the constructed portfolio under zero variance returns, this portfolio is a risk-free portfolio.

According to the hypothesis of the risk-free rate, which is that the variance of the portfolio's returns equals zero, the risk-free portfolio can be constructed using the following combinations using daily data in the UK: gold & platinum, gold & palladium. For the US, the portfolio combinations which are qualified using daily data are: gold & silver, gold & platinum, gold & palladium, T-bill & silver. From these results, gold seems to play an essential role in the construction of a risk-free portfolio with fairly equal weights between assets, except for the pair of gold & platinum in the UK.

One major contribution in this chapter is that T-bills, the assumed proxy for the risk-free asset in many empirical studies, can be replaced by real risk-free portfolios constructed using gold & platinum, gold & palladium in the UK, and gold & silver, gold & platinum, gold & palladium, and T-bills & silver in the US.

There are no solutions in real numbers using the monthly data set. Hypothetically, this result may be due to the small covariance, in the calculation, between each asset in the constructed portfolios. This causes the discriminants to be less than zero, which means that quadratic equations cannot be solved in real numbers. Also, the mathematical model in equation 6.2.15 in Section 6.2.2 shows that the risk-free portfolio of two assets can be constructed if, and only if, their covariance equals 1 or -1 between the two Wiener processes of assets in the portfolio.

Further, all the portfolio combinations are tested against each individual company in the UK and US using the Wald test based on the zero-beta CAPM. The results show that some constructed portfolios may be qualified as the zero-beta portfolio in both the UK and US. Typically, the risk-free portfolio constructed by gold & platinum and gold & palladium are also tested as the zero-beta portfolio in the UK. This provides the evidence that portfolios of gold & platinum and gold & palladium with certain weights can be a zero-beta portfolio.

The constructed risk-free portfolios from Section 6.3.1 are tested as the zero-beta portfolio in the Wald test in Section 6.3.3, but a risk-free portfolio is not always found to be a zero-beta portfolio and vice versa. This is the evidence that a risk-free asset/portfolio and a zero-beta portfolio are not the same. Combining the two results in the UK and US, we can conclude that not all zero-beta portfolios can be risk-free portfolios and not all risk-free portfolios can be zero-beta portfolios. This conclusion would prevent the misuse and misunderstanding of the risk-free portfolio. Also, a risk-free portfolio can be constructed in the real world. And the constructed portfolios satisfy the condition of a risk-free portfolio. In the future, we would like to discover more potential risk-free portfolios across different markets and examine whether the finding is time varying.

Chapter 7 Discussion and Further Research

7.1 Discussion on Chapter 4

There are many different conclusions regarding the quality of gold as a hedge or a safe haven against the equity market, exchange rate and inflation rate. This thesis has explored whether gold is a hedge or a safe haven for the UK and US stock markets. The key difference between this thesis and other work in the field is that this thesis applies a new methodology in this examination, a Markov-switching CAPM.

In this thesis, we first found that gold is always a hedge against stock market risk so no separate safe haven state exists based on the classic CAPM and the Markov-switching CAPM. Gold's beta is straightforwardly estimated by the classic CAPM in the UK and US markets. The near zero beta of gold and the poor explanatory power of the model, as seen in the low R-squared calculated across specifications, suggests gold as a hedge as its returns are not explained by systematic stock market risks.

As a hedge, gold has a near zero beta which implies that adding gold in an investment portfolio should lower the overall risk of the portfolio and reduce potential losses. For investors, gold is a good choice for diversifying a risky portfolio.

Unlike previous research, the method employed in this thesis is to examine which regime gold's beta is likely to stay in during the time of market stress. As gold is concluded to be always a hedge for the equity market, investing gold as a diversifier in the portfolio is also a good choice for investors. And most research is using the logarithmic in the CAPM, though some research does not even mention which rate is used. This is one point that most research seemingly neglects, resulting in deficiencies in the methodology. As the classic CAPM is an equilibrium model under the normal distribution, the raw return is the only form of return that can be used in the regression.

Based on the same Markov-switching CAPM, this thesis investigates which regime the gold's beta remains in during a certain period of time. This method is both rigorous and straightforward to produce the results in the test. The Markov-switching approach can also be applied to other models (market model or APT model) to examine the regimes for other assets' betas. Further, it can also be used to discover potential regimes, which this thesis does not include. Finding the technical regimes is another way to examine whether an asset is a safe haven during times of market stress.

Future research can be conducted using the same framework of the methodology to examine other assets. In other words, other precious metals (silver, platinum and palladium), for instance, can also be investigated for the role of the safe haven to the stock market since much previous research has mentioned and focused on the same topic but not the same method. In order to search for a good safe haven, it would be helpful to try other similar precious metals or other financial instruments with similar quality. As far as we are concerned, it would not be possible to find a perfect safe haven. A stronger safe haven would be beneficial as there are debates about whether gold or Bitcoin would be a better safe haven. The fact is that the existence of the Bitcoin is far too short in comparison with gold. It would be inappropriate to make a strong inclusive statement that Bitcoin is not as good as gold. It is more reasonable to wait for Bitcoin to perform for a longer time in the market. Even if the results are still the same that gold is a stronger safe haven than Bitcoin, it would be beneficial to compare which safe haven is good at sheltering investors for which risk in the market.

7.2 Discussion on Chapter 5

Chapter 5 further pursues the discussions started in Chapter 4. It explores the topic of whether the risk-free asset exists for investments in practice, as reviewed in Section 2.2.1. A large amount of research has investigated the issues the CAPM has regarding the capability of estimating the beta. This thesis has focused on what proxy is used for the risk-free asset, which has a large impact on the CAPM model and the interpretation of the beta. In Chapter 5, there are two models (the classic CAPM (Jensen, 1972) and the zero-beta CAPM (Black, 1972) and two methods of hypothesis testing (the Wald test and the LRT). In practice, the classic CAPM can estimate returns that the asset or the portfolio should earn based on its riskiness. This is a major reason why the classic CAPM is widely used, with estimates of a stock beta being freely available on sites such as Yahoo Finance.

However, the power of the test in CAPM is often neglected after the estimation. The existence of the type II errors could lead to different conclusions for investors in making a real-world investment decision. In other words, it is not sufficient for investment decisions to rely on only the classic CAPM to estimate returns based on risks. Although there are problems in the classic CAPM, investors are still willing to use the classic CAPM as a part of their investment decisions. This might be due to the fact that the core problem of the classic CAPM has not been discovered or solved. We believe that a core problem is the proxy for the risk-free asset, which is used in practice.

According to the classic CAPM, the result of the beta would not be the same if the risk-free asset is not the same. In other words, the estimated beta cannot interpret the results properly if the risk-free asset is not a proper proxy. In addition, the risk-free assets can be different in different countries or different situations. The set of the risk-free assets contains risk-free bonds, T-bills, LIBOR, etc. This shows the lack of a standard for confirming the risk-free asset, or even if the measurement of the risk-free asset could be improved. The future research could explore a new interpretation of the measurement for the risk-free asset since the zero variance is the promising measurement in the milestone. However, there are still some limitations in the examination of the risk-free asset, which will be discussed in Section 7.3.

According to the standard of using the proxy for the risk-free asset, the zero-beta assets are often used as a proxy since the zero-variance in the asset's return can not be easily found. Examining the zero-beta is the major point in this thesis. From Black (1972), the zero-beta CAPM was the second model used in this chapter along with two hypothesis testing methods (the Wald test and the LRT).

We have concluded that gold, T-bills, OIS and IBOR are not consistently a zero-beta asset in the zero-beta CAPM in five countries: the UK, the US, China, Japan, and India. Although we have found a proxy for the risk-free asset for each of these countries, it can still cause problems of comparability when we run tests in different countries with different proxies. Therefore, in Chapter 6 we continued our examination by looking for a portfolio which qualifies as the zero-beta portfolio for all markets.

7.3 Discussion on Chapter 6

According to our portfolio constructions, we assume that the weights of the assets in the portfolio must be positive and their sum must be equal to 1. In Chapter 6, we found that the risk-free portfolios could be constructed by using gold & platinum, gold & palladium in the UK, and gold & silver, gold & platinum, gold & palladium, T-bills & silver in the US in the daily data set. More interestingly, gold & platinum and gold & palladium are the pairs that can be used to construct the risk-free portfolios in both UK and US markets.

This is a breakthrough for the assumption of a risk-free rate in the CAPM, which implies that risk-free portfolios can be constructed using a set of assets rather than assuming a single asset as the proxy for the risk-free asset.

The results would be different in many finance models by using these constructed risk-free portfolios; this motivates our further research, which is to test models with the constructed risk-free portfolios.

However, this would bring another problem, which is whether there is a standard risk-free portfolio or different risk-free portfolios for certain industries or markets. For instance, should we use precious metals to construct the risk-free portfolio against crude oil or an exchange rate? Should we consider the correlation between the constructed risk-free portfolio and target markets? These areas will be discussed in the future research.

In addition, we investigated whether, in theory, more than three assets could be used to construct a risk-free portfolio. However, it is impossible to find the answers to the equation since there are three variables and two equations. This is a limitation of using the zero variance in the returns to examine the risk-free asset or portfolio.

A new interpretation of the measurement would be a future research topic to solve this problem as we mentioned in Section 7.2. The first thought would be the application of Set Theory (or Topology in general) into the examination of the risk-free asset or portfolio. It would be useful to define the properties of the set of risk-free assets by applying the zero variance criteria. And the set of the zero-beta assets or portfolio would be also defined. The application of Set theory could avoid the limitation of the discriminant problems in the quadratic equations since there would not be any numerical calculations. One important thing, which we are concerned with, is how this method can be applied in practice. Nevertheless, it would improve the measurement in theory first.

Another direction for further research would be to improve the classic CAPM, the APT model, and other finance models without the risk-free rate. The results when using monthly data show that a risk-free portfolio is still difficult to find. Although the daily risk-free portfolios are constructed, the risk-free portfolios are not found to exist at other frequencies. Thus, replacing the risk-free rate in models would be another way. It is similar to, but not the same as, the assumption in the Black zero-beta CAPM, in which the risk-free rate is missing.

That is to say, the question is whether these models can be calibrated without the risk-free rate. One possible method would be based on the derivation of the classic CAPM by replacing the risk-free rate by the marginal rate of substitution. It would be a much-improved way to replace the risk-free rate in models by substitution since the major problem will be lifted from the models. But the difficult part is to link the new replacement for the risk-free rate in practice. This would be another direction for further research.

Appendix A

Table A- 1 ADF unit root test on excess return on gold in US (weekly, %)

Variable	Excess return on gold in US (weekly, 1st observation)			Excess return on gold in US (weekly, average)		
ADF test	Intercept	Intercept and trend	None	Intercept	Intercept and trend	None
t-statistic	-48.524	-48.532	-48.435	-39.75	-39.760	-39.663
critical value	-3.4327	-3.9616	-2.5658	-3.432	-3.9616	-2.565
Probability value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table A- 2 ADF unit root test on excess return on market portfolio in US (Dow Jones, weekly, %)

Variable	Excess return on market portfolio (Dow Jones, weekly, 1st observation)			Excess return on market portfolio (Dow Jones, weekly, average)		
ADF test	Intercept	Intercept and trend	None	Intercept	Intercept and trend	None
t-statistic	-51.117	-51.12	-50.990	-41.13	-41.14	-41.012
critical value	-3.4329	-3.96165	-2.5652	-3.432	-3.961	-2.5658
Probability value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table A- 3 ADF unit root test on excess return on market portfolio in US (S&P 500, weekly, %)

Variable	Excess return on market portfolio (S&P 500, weekly, 1st observation)			Excess return on market portfolio (S&P 500, weekly, average)		
ADF test	Intercept	Intercept and trend	None	Intercept	Intercept and trend	None
t-statistic	-51.85	-51.855	-51.724	-41.562	-41.56	-41.436
critical value	-3.432	-3.9616	-2.5658	-3.432	-3.9616	-2.5658
Probability value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table A- 4 ADF unit root test on excess return on gold in UK (weekly, %)

Variable	Excess return on gold in UK (weekly, 1st observation)			Excess return on gold in UK (weekly, average)		
ADF test	Intercept	Intercept and trend	None	Intercept	Intercept and trend	None
t-statistic	-39.922	-39.980	-39.903	-27.42	-27.50	-27.400
critical value	-3.4339	-3.9634	-2.5663	-3.433	-3.963	-2.5663
Probability value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table A- 5 ADF unit root test on excess return on market portfolio in UK (FTSE 100, weekly, %)

Variable	Excess return on market portfolio (FTSE 100, weekly, 1st observation)			Excess return on market portfolio (FTSE 100, weekly, average)		
ADF test	Intercept	Intercept and trend	None	Intercept	Intercept and trend	None
t-statistic	-33.118	-33.127	-33.066	-33.11	-33.12	-33.066
critical value	-3.433	-3.9634	-2.5663	-3.433	-3.963	-2.5663
Probability value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table A- 6 ADF unit root test on excess return on market portfolio in UK (FTSE 350, weekly, %)

Variable	Excess return on market portfolio (FTSE 350, weekly, 1st observation)			Excess return on market portfolio (FTSE 350, weekly, average)		
ADF test	Intercept	Intercept and trend	None	Intercept	Intercept and trend	None
t-statistic	-31.625	-31.630	-31.569	-31.625	-31.630	-31.569
critical value	-3.434	-3.963	-2.566	-3.4341	-3.9636	-2.566
Probability value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table A- 7 ADF unit root test on excess return on market portfolio in UK (FTSE All share, weekly, %)

Variable	Excess return on market portfolio (FTSE All share, weekly, 1st observation)			Excess return on market portfolio (FTSE All share, weekly, average)		
ADF test	Intercept	Intercept and trend	None	Intercept	Intercept and trend	None
t-statistic	-42.078	-42.083	-42.012	-31.87	-31.88	-31.813
critical value	-3.4339	-3.934	-2.566	-3.433	-3.963	-2.566
Probability value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table A- 8 ADF unit root test on excess return on gold in UK (monthly, %)

Variable	Excess return on gold in UK (monthly, last observation)			Excess return on gold in UK (monthly, average)		
ADF test	Intercept	Intercept and trend	None	Intercept	Intercept and trend	None
t-statistic	-23.351	-23.331	-23.370	-16.51	-16.49	-16.508
critical value	-3.4413	-3.9738	-2.5689	-3.441	-3.9739	-2.5689
Probability value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table A- 9 ADF unit root test on excess return on gold in US (monthly, %)

Variable	Excess return on gold in US (monthly, last observation)			Excess return on gold in US (monthly, average)		
ADF test	Intercept	Intercept and trend	None	Intercept	Intercept and trend	None
t-statistic	-23.324	-23.307	-23.317	-16.36	-16.35	-16.349
critical value	-3.441	-3.973	-2.568	-3.441	-3.973	-2.568
Probability value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table A- 10 ADF unit root test on excess return on market portfolio in UK (FTSE All share, monthly, %)

Variable	Excess return on market portfolio (FTSE All share, monthly, last observation)			Excess return on market portfolio (FTSE All share, monthly, average)		
ADF test	Intercept	Intercept and trend	None	Intercept	Intercept and trend	None
t-statistic	-21.97	-21.97	-21.99	-16.067	-16.07	-16.081
critical value	-3.441	-3.973	-2.568	-3.441	-3.973	-2.5689
Probability value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table A- 11 ADF unit root test on excess return on market portfolio in UK (FTSE 100, monthly, %)

Variable	Excess return on market portfolio (FTSE 100, monthly, last observation)			Excess return on market portfolio (FTSE 100, monthly, average)		
ADF test	Intercept	Intercept and trend	None	Intercept	Intercept and trend	None
t-statistic	-19.47	-19.507	-19.31	-16.48	-16.51	-16.327
critical value	-3.446	-3.981	-2.5708	-3.446	-3.9817	-2.570
Probability value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table A- 12 ADF unit root test on excess return on market portfolio in UK (FTSE 350, monthly, %)

Variable	Excess return on market portfolio (FTSE 350, monthly, last observation)			Excess return on market portfolio (FTSE 350, monthly, average)		
ADF test	Intercept	Intercept and trend	None	Intercept	Intercept and trend	None
t-statistic	-18.588	-18.602	-18.434	-13.99	-14.01	-15.793
critical value	-3.4473	-3.9823	-2.5710	-3.447	-3.982	-2.5710
Probability value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table A- 13 ADF unit root test on excess return on market portfolio in US (Dow Jones, monthly, %)

Variable	Excess return on market portfolio (Dow Jones, monthly, last observation)			Excess return on market portfolio (Dow Jones, monthly, average)		
ADF test	Intercept	Intercept and trend	None	Intercept	Intercept and trend	None
t-statistic	-23.242	-23.357	-23.23	-18.623	-18.742	-18.612
critical value	-3.441	-3.973	-2.568	-3.441	-3.973	-2.5689
Probability value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table A- 14 ADF unit root test on excess return on market portfolio in US (S&P 500, monthly, %)

Variable	Excess return on market portfolio (S&P 500, monthly, last observation)			Excess return on market portfolio (S&P 500, monthly, average)		
ADF test	Intercept	Intercept and trend	None	Intercept	Intercept and trend	None
t-statistic	-22.893	-22.973	-22.880	-18.260	-18.345	-18.248
critical value	-3.4413	-3.9738	-2.5689	-3.4413	-3.9738	-2.5689
Probability value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table A- 15 Normality test results in residuals - Weekly

	UK-FTSE 100	UK-FTSE 350	UK-FTSE All share	US-S&P 500	US-Dow Jones
Std. Dev.	1.84929	1.855371	1.849411	2.223189	2.223773
Skewness	0.35203	0.357055	0.352216	0.436249	0.430426
Kurtosis	6.424613	6.489054	6.434034	12.17195	12.19604
Jarque-Bera	869.9199*** [0.00000]	875.1579*** [0.0000]	874.5539*** [0.000000]	8994.369*** [0.00000]	9039.125*** [0.00000]
Note that the significant level is at 5% for the probability value of the value of Jarque-Bera. **, *** represent the statistical significance at the 5% and 1% levels.					

Table A- 16 Normality test results in residuals - Weekly

	UK-FTSE 100	UK-FTSE 350	UK-FTSE All share	US-S&P 500	US-Dow Jones
Std. Dev.	2.217808	2.224706	2.217961	2.633285	2.634004
Skewness	0.262844	0.262783	0.262724	0.218324	0.211851
Kurtosis	6.285538	6.346068	6.293034	9.695597	9.747896
Jarque-Bera	787.894*** [0.00000]	791.5952*** [0.0000]	791.3854*** [0.000000]	4770.423*** [0.00000]	4843.739*** [0.00000]
Note that the significant level is at 5% for the probability value of the value of Jarque-Bera. **, *** represent the statistical significance at the 5% and 1% levels.					

Table A- 17 Results of the Normality test in residuals - Monthly

	UK-FTSE 100	UK-FTSE 350	UK-FTSE All share	US-Dow Jones	US-S&P500
Std. Dev.	3.771	3.782	5.666578	5.68563	5.676952
Skewness	0.419	0.405	0.28331	0.288929	0.310298
Kurtosis	3.824	3.814	6.683581	6.67721	6.586789
Jarque-Bera	22.6*** [0.000]	20.95*** [0.0000]	337.9858*** [0.0000]	337.1576*** [0.0000]	332.4215*** [0.0000]
Note that the significant level is at 5% for the probability value of the value of Jarque-Bera. **, *** represent the statistical significance at the 5% and 1% levels.					

Table A- 18 Results of the Normality test in residuals - Monthly

	UK-FTSE 100	UK-FTSE 350	UK-FTSE All share	US-Dow Jones	US-S&P500
Std. Dev.	4.752	4.785	5.667	5.676	5.677
Skewness	0.273	0.249	0.283	0.289	0.310
Kurtosis	3.794	3.778	6.684	6.677	6.587
Jarque-Bera	15.17*** [0.0005]	13.55*** [0.0011]	337.98*** [0.0000]	337.16*** [0.0000]	322.42*** [0.0000]
Note that the significant level is at 5% for the probability value of the value of Jarque-Bera. **, *** represent the statistical significance at the 5% and 1% levels.					

Fig. A- 1 Rolling Coefficients (Window size=50), excess return on market portfolio (FTSE 100, average)

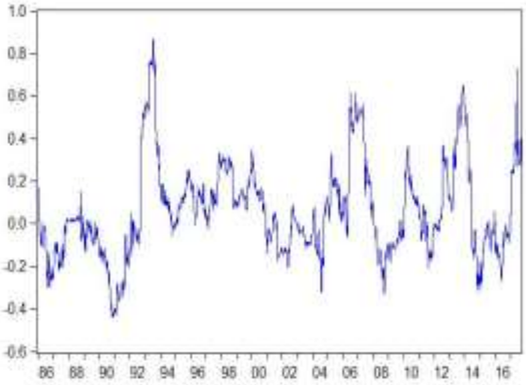

Fig. A- 2 Rolling Coefficient (Window size=100), excess return on market portfolio (FTSE 100, average)

Fig. A- 3 Rolling Coefficients (Window size=50), excess return on market portfolio (FTSE 350, average)

Fig. A- 4 Rolling Coefficients (Window size=100), excess return on market portfolio (FTSE 350, average)

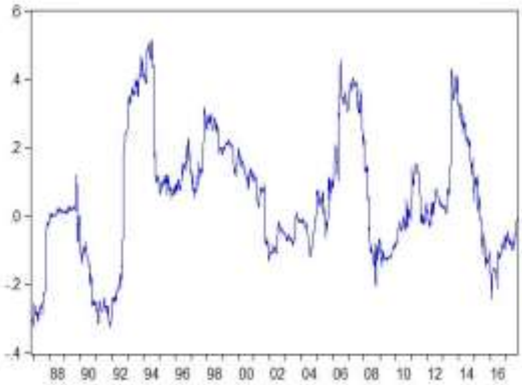

Fig. A- 5 Rolling Coefficients (Window size=50), excess return on market portfolio (FTSE All share, average)

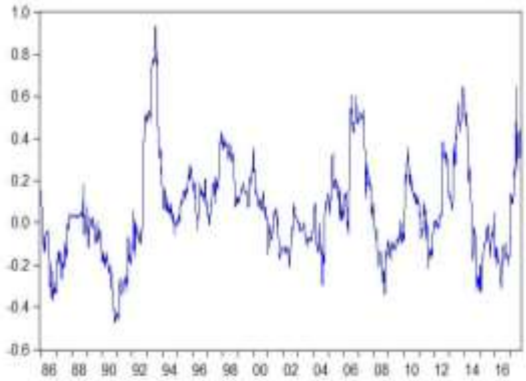

Fig. A- 6 Rolling Coefficients (Window size=100), excess return on market portfolio (FTSE All share, average)

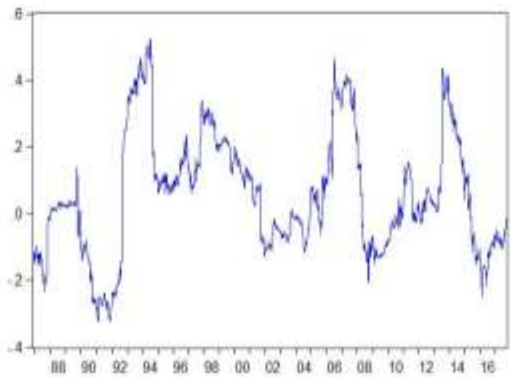

Fig. A- 7 Rolling Coefficients (Window size=50), excess return on market portfolio (Dow Jones, average)

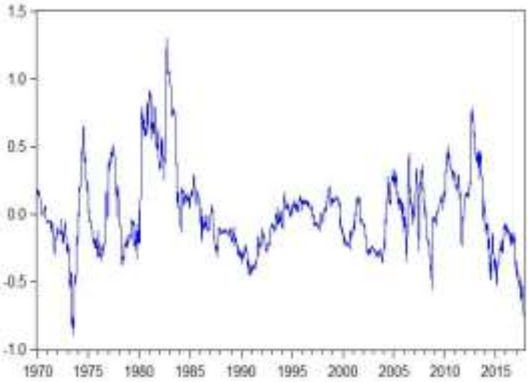

Fig. A- 8 Rolling Coefficients (Window size=100), excess return on market portfolio (Dow Jones, average)

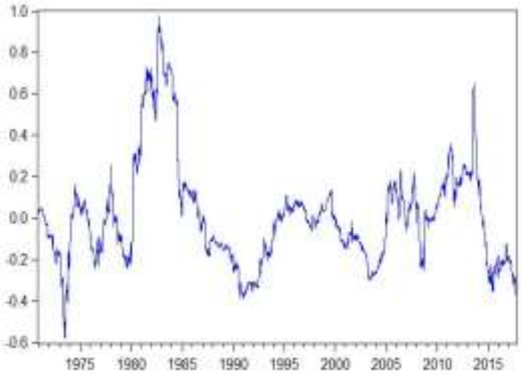

Fig. A- 9 Rolling Coefficients (Window size=50), excess return on market portfolio (S&P 500, average)

Fig. A- 10 Rolling Coefficients (Window size=100), excess return on market portfolio (S&P 500, average)

Fig. A- 11 Rolling Coefficients (Window size=50), excess return on market portfolio (FTSE 100, 1st observation)

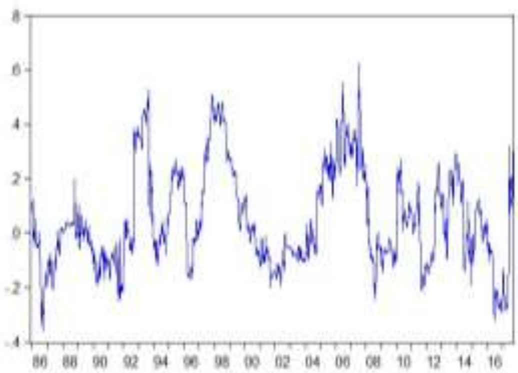

Fig. A- 12 Rolling Coefficients (Window size=100), excess return on market portfolio (FTSE 100, 1st observation)

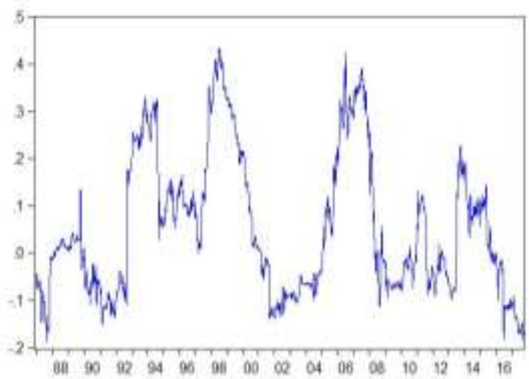

Fig. A- 13 Rolling Coefficients (Window size=50), excess return on market portfolio (FTSE 350, 1st observation)

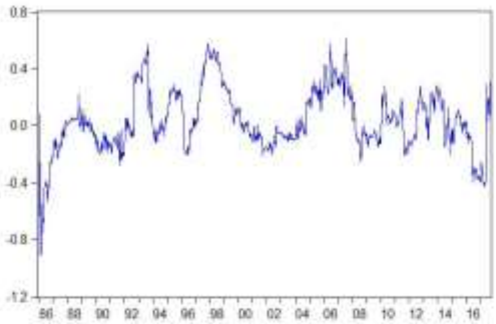

Fig. A- 14 Rolling Coefficients (Window size=100), excess return on market portfolio (FTSE 350, 1st observation)

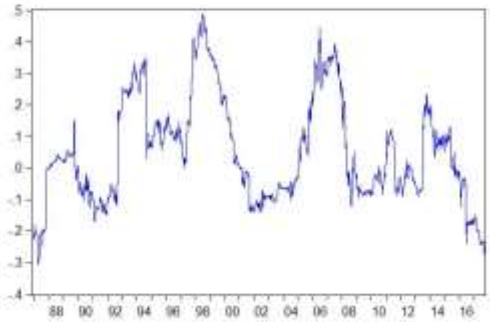

Fig. A- 15 Rolling Coefficients (Window size=50), excess return on market portfolio (FTSE All share, 1st observation)

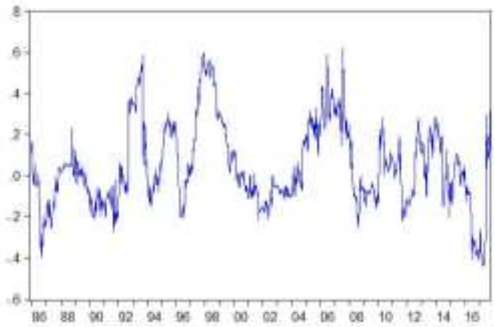

Fig. A- 16 Rolling Coefficients (Window size=100), excess return on market portfolio (FTSE All share, 1st observation)

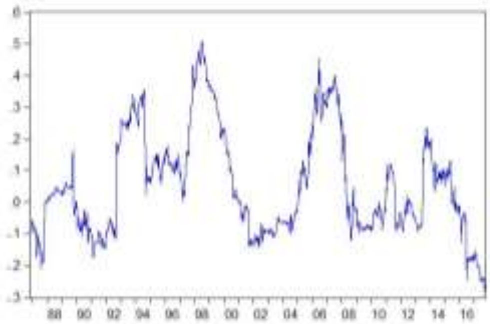

Fig. A- 17 Rolling Coefficients (Window size=50), excess return on market portfolio (S&P 500, 1st observation)

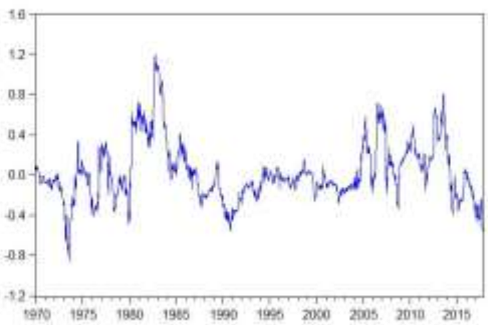

Fig. A- 18 Rolling Coefficients (Window size=100), excess return on market portfolio (S&P 500, 1st observation)

Fig. A- 19 Rolling Coefficients (Window size=50), excess return on market portfolio (Dow Jones, 1st observation)

Fig. A- 20 Rolling Coefficients (Window size=100), excess return on market portfolio (Dow Jones, 1st observation)

Fig. A- 21 Rolling Coefficients (Window size=50), excess return on market portfolio (FTSE 100, end of period)

Fig. A- 22 Rolling Coefficients (Window size=100), excess return on market portfolio (FTSE 100, end of period)

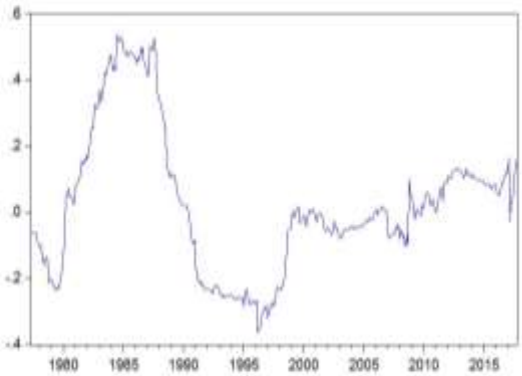

Fig. A- 23 Rolling Coefficients (Window size=50), excess return on market portfolio (FTSE 350, end of period)

Fig. A- 24 Rolling Coefficients (Window size=100), excess return on market portfolio (FTSE 350, end of period)

Fig. A- 25 Rolling Coefficients (Window size=50), excess return on market portfolio (FTSE All share, end of period)

Fig. A- 26 Rolling Coefficients (Window size=100), excess return on market portfolio (FTSE All share, end of period)

Fig. A- 27 Rolling Coefficients (Window size=50), excess return on market portfolio (S&P 500, end of period)

Fig. A- 28 Rolling Coefficients (Window size=100), excess return on market portfolio (S&P 500, end of period)

Fig. A- 29 Rolling Coefficients (Window size=50), excess return on market portfolio (Dow Jones, end of period)

Fig. A- 30 Rolling Coefficients (Window size=100), excess return on market portfolio (Dow Jones, end of period)

Appendix B

Table B- 1 UK FTSE 350 Constituents List

Code	Stock	Code	Stock
3IN	3i Infrastructure	JAM	JPMorgan American
888	888 Holding	JD.	JD Sports
AAF	Airtel Africa	JDW	Wetherspoon (J.D)
AAL	Anglo American	JEO	Jupiter European Opportunities Trust
ABF	AB Foods	JESC	Jpmorg.eur
ACI	Alt Credit Inv	JET	Just Eat Takeaw
ADM	Admiral	JFJ	JPMorgan Japanese
AGK	Aggreko	JLEN	Jlen Env
AGR	Assura	JLG	John Laing
AGT	Avi Global Tst	JMAT	Johnson Matthey
AHT	Ashtead Group	JMG	JPMorgan Emerging Markets Investment Trust
AJB	Aj Bell	JUP	Jupiter Fund Management
AML	Aston Martin Lagonda	JUST	Just Group
ANTO	Antofagasta	KAZ	KAZ Minerals
AO.	Ao World	KGF	Kingfisher
APAX	Apax Glb	KNOS	Kainos Group
ASCL	Ascential	LAND	Land Securities
ASHM	Ashmore	LGEN	Legal & General
ASL	Aberforth Smaller Companies Trust Plc	LIO	Liontrust Asset Management
ATST	Alliance Trust	LLOY	Lloyds
ATT	Allianz Technology Trust	LMP	LondonMetric
AUTO	Auto Trader	LRE	Lancashire Holdings
AV.	Aviva	LSE	London Stock Exchange
AVON	Avon Rubber	LWDB	Law Debenture
AVST	Avast	LXI	Lxi Reit
AVV	Aveva Group	MAB	Mitchells & Butlers
AZN	Astrazeneca	MCRO	Micro Focus
BA.	BAE Systems	MDC	Mediclinic International
BAB	Babcock	MGAM	Morgan Advanced Materials
BARC	Barclays	MGGT	Meggitt
BATS	British American Tobacco	MGNS	Morgan Sindall Group
BBGI	BBGI	MKS	Marks & Spencer
BBH	Bb Healthcare	MNDI	Mondi
BBOX	Tritax Big Box	MNG	M&g Plc
BBY	Balfour Beatty	MNKS	Monks Inv
BCPT	Bmo Comm Prop.	MONY	Moneysupermarket .Com

Table B - 1 UK FTSE 350 Constituents List – continued (1)			
Code	Stock	Code	Stock
BDEV	Barratt Developments	MRC	Mercantile Investment Trust PLC
BEZ	Beazley	MRO	Melrose
BGFD	Baillie Gifford Japan Trust PLC	MRW	Morrison (WM)
BGS	Baillie Gifford Shin Nippon PLC	MSLH	Marshalls
BGSC	BMO Global Smaller Companies Trust	MYI	Murray International
BHP	BHP Group	N91	Ninety One Plc
BIFF	Biffa	NESF	NextEnergy Solar
BKG	Berkeley Group	NETW	Network Intl
BLND	British Land	NEX	National Express
BME	B&M	NG.	National Grid
BNKR	Bankers Investment Trust	NWG	Natwest Grp
BNZL	Bunzl	NXT	Next
BOY	Bodycote	OCDO	Ocado
BP.	BP	OSB	OneSavings Bank
BRBY	Burberry	OXB	Oxford Biomedica
BRSC	BlackRock Smaller Companies Trust PLC	OXIG	Oxford Instruments
BRW	Brewin Dolphin	PAG	Paragon Group
BRWM	Blackrock Wld	PAGE	PageGroup
BT.A	BT	PCT	Polar Capital Technology Trust
BVIC	Britvic	PETS	Pets At Home
BWY	Bellway	PFC	Petrofac
BYG	Big Yellow	PFD	Premier Foods
CAPC	Capital & Counties	PFG	Provident Financial
CBG	Close Bros	PHNX	Phoenix Group Holdings
CCC	Computacenter	PHP	Primary Health
CCH	Coca-Cola HBC	PIN	Pantheon International
CCL	Carnival	PLI	Perpetual Income and Growth Investment Trust PLC
CCR	C&c Grp	PLP	Polypipe
CEY	Centamin PLC	PLUS	Plus500
CHG	Chemring	PNL	Personal Assets Trust
CINE	Cineworld	PNN	Pennon
CKN	Clarkson	POG	Petropavlovsk
CLDN	Caledonia	POLY	Polymetal International
CLI	CLS Holdings	PRTC	Puretech
CLSN	Calisen	PRU	Prudential
CMCX	Cmc Mkts	PSH	Pershing Square Holdings
CAN	Centrica	PSN	Persimmon

Table B - 1 UK FTSE 350 Constituents List – continued (2)			
Code	Stock	Code	Stock
CNE	Cairn Energy	PSON	Pearson
COA	Coats	PTEC	Playtech
CPG	Compass Group	PZC	Pz Cussons
CPI	Capita	QLT	Quilter
CRDA	Croda International	QQ.	Qinetiq
CRH	CRH	RAT	Rathbone
CRST	Crest Nicholson	RB.	Reckitt Benckiser
CSH	Civitas Social Housing	RCP	RIT Capital Partners
CSP	Countryside Properties	RDSA	Royal Dutch Shell A
CTEC	ConvaTec	RDSB	Royal Dutch Shell B
CTY	City Of London Investment	RDW	Redrow
CWK	Cranswick	REL	Relx
DC.	Dixons Carphone	RHIM	RHI Magnesita
DCC	DCC	RIO	Rio Tinto
DGE	Diageo	RMG	Royal Mail
DGOC	Diversified Gas	RMV	Rightmove
DIGS	Gcp Student Liv	RNK	Rank
DLG	Direct Line	ROR	Rotork
DLN	Derwent London	RR.	Rolls-Royce Holdings
DNLM	Dunelm	RSA	RSA Insurance
DOM	Dominos	RSW	Renishaw
DPH	Dechra	RTO	Rentokil Initial
DPLM	Diploma	SAFE	Safestore
DRX	Drax	SAIN	Scot.amer.inv.
ECM	Electrocomponents	SBRE	Sabre Insur
EDIN	Edinburgh Investment Trust PLC	SBRY	Sainsbury (J)
EMG	Man	SCIN	Scottish Inv
ENOG	Energean Oil & Gas	SCT	Softcat
ERM	Euromoney	SDP	Schroder AsiaPacific Fund
ESNT	Essentra	SDR	Schroders
EVR	Evraz	SEQI	Sequoia Economic Infrastructure Fund
EWI	Edin.wwide Inv	SGE	Sage Group
EXPN	Experian	SGRO	Segro
EZJ	easyJet	SHB	Shaftesbury
FCIT	F&C Investment Trust	SIG	Signature Aviat
FCSS	Fidelity China Special Situations PLC	SKG	Smurfit Kappa
FDM	FDM Group	SLA	Standard Life Aberdeen
FERG	Ferguson	SMDS	Smith (DS)
FEV	Fidelity European Values	SMIN	Smiths Group
FGP	Firstgroup	SMP	St.Modwen Properties

Table B - 1 UK FTSE 350 Constituents List – continued (3)			
Code	Stock	Code	Stock
FGT	Finsbury Growth	SMT	Scottish Mortgage
FLTR	Flutter Ent	SMWH	Wh Smith
FOUR	4Imprint	SN.	Smith & Nephew
FRAS	Frasers Grp	SNN	Sanne Group
FRES	Fresnillo	SOI	Schroder Orient
FSFL	Foresight Solar	SONC	Hipgnosis Son.c
FSJ	James Fisher and Sons	SONG	Hipgnosis Song.
FSV	Fidelity	SPT	Spirent
FUTR	Future	SPX	Spirax-Sarco
FXPO	Ferrexpo	SRE	Sirius R E.
GAW	Games Workshop	SRP	Serco
GCP	GCP Infrastructure Investments	SSE	SSE
GFS	G4S	SSON	Smithson Invest
GFTU	Grafton Group	SSPG	SSP Group
GLEN	Glencore	STAN	Standard Chartered
GLO	ContourGlobal	STJ	St James Place
GNC	Greencore	SVS	Savills
GNS	Genus	SVT	Severn Trent
GPOR	Great Portland	SXS	Spectris
GRG	Greggs	SYNC	Syncona
GRI	Grainger plc	SYNT	Synthomer
GSK	Glaxosmithkline	TALK	TalkTalk
GSS	Genesis	TATE	Tate & Lyle
GVC	GVC Holdings	TBCG	TBC Bank Group
GYS	Gamesys Group	TCAP	TP ICAP
HAS	Hays	TEM	Templeton Emerging Markets
HFG	Hilton Foods	TEP	Telecom Plus
HGT	HgCapital Trust plc	TIFS	TI Fluid Systems
HICL	HICL Infrastructure	TPK	Travis Perkins
HIK	Hikma Pharmaceuticals	TRIG	Renewables Infrastructure Group
HILS	Hill & Smith	TRN	Trainline
HL.	Hargreaves Lansdown	TRY	TR Property Investment Trust
HLMA	Halma	TSCO	Tesco
HOC	Hochschild	TUI	TUI AG
HRI	Herald	TW.	Taylor Wimpey
HSBA	HSBC Holdings	UDG	UDG Healthcare
HSL	Henderson Smaller Companies Trust	UKCM	UK Commercial Property Trust
HSTG	Hastings	UKW	Greencoat UK Wind
HSV	Homeserve	ULE	Ultra Electronics
HSX	Hiscox	ULVR	Unilever
HTWS	Helios Towers	USA	Baillie Gifford

Table B - 1 UK FTSE 350 Constituents List – continued (4)			
Code	Stock	Code	Stock
HVPE	HarbourVest Private Equity	UTG	Unite
HWDN	Howden Joinery	UU.	United Utilities
IAG	International Airlines	VCT	Victrex
IBST	Ibstock	VEC	Vectura
ICGT	Icg Ent Trst	VEIL	Vietnam Enterprise Investments
ICP	Intermediate Capital	VMUK	Virgin Money Uk
IEM	Impax Asset Management	VOD	Vodafone
IGG	Ig Group Holdings	VOF	VinaCapital vietnam Opportunity Fund
IHG	InterContinental Hotels	VSVS	Vesuvius
IHP	IntegraFin Holdings	VTY	Vistry Grp
III	3i Group	VVO	Vivo Energy
IMB	Imperial Brands	WEIR	Weir Group
IMI	IMI	WG.	Wood Group (J)
INCH	Inchcape	WIZZ	Wizz Air
INDV	Indivior	WKP	Workspace
INF	Informa	WMH	William Hill
INPP	International Public Partnerships	WOSG	Watches Switz
INVP	Investec	WPP	WPP
IPO	Ip Group	WTAN	Witan
ITRK	Intertek Group	WTB	Whitbread
ITV	ITV	WWH	Worldwide Healthcare Trust
IWG	IWG	XPP	XP Power

Table B- 2 US S&P 500 Constituents List

Code	Stock	Code	Stock
ATVI	Activision Blizzard	MTD	Mettler Toledo
GOOGL	Alphabet Inc. (Class A)	MYL	Mylan N.V.
GOOG	Alphabet Inc. (Class C)	PKI	PerkinElmer
T	AT&T Inc.	PRGO	Perrigo
CTL	CenturyLink Inc	PFE	Pfizer Inc.
CHTR	Charter Communications	DGX	Quest Diagnostics
CMCSA	Comcast Corp.	REGN	Regeneron Pharmaceuticals
DISCA	Discovery Inc. (Class A)	RMD	ResMed
DISCK	Discovery Inc. (Class C)	STE	STERIS plc
DISH	Dish Network	SYK	Stryker Corp.
EA	Electronic Arts	TFX	Teleflex
FB	Facebook Inc.	COO	The Cooper Companies
FOXA	Fox Corporation (Class A)	TMO	Thermo Fisher Scientific
FOX	Fox Corporation (Class B)	UNH	United Health Group Inc.
IPG	Interpublic Group	UHS	Universal Health Services
LYV	Live Nation Entertainment	VAR	Varian Medical Systems
NFLX	Netflix Inc.	VRTX	Vertex Pharmaceuticals Inc
NWSA	News Corp. Class A	WAT	Waters Corporation
NWS	News Corp. Class B	WST	West Pharmaceutical Services
OMC	Omnicom Group	ZBH	Zimmer Biomet Holdings
TMUS	T-Mobile US	ZTS	Zoetis
TTWO	Take-Two Interactive	MMM	3M Company
DIS	The Walt Disney Company	AOS	A.O. Smith Corp
TWTR	Twitter Inc.	ALK	Alaska Air Group Inc
VZ	Verizon Communications	ALLE	Allegion
VIAC	ViacomCBS	AAL	American Airlines Group
AAP	Advance Auto Parts	AME	AMETEK Inc.
AMZN	Amazon.com Inc.	BA	Boeing Company
APTV	Aptiv PLC	CHRW	C. H. Robinson Worldwide
AZO	AutoZone Inc	CARR	Carrier Global
BBY	Best Buy Co. Inc.	CAT	Caterpillar Inc.
BKNG	Booking Holdings Inc	CTAS	Cintas Corporation
BWA	BorgWarner	CPRT	Copart Inc
KMX	Carmax Inc	CSX	CSX Corp.
CCL	Carnival Corp.	CMI	Cummins Inc.
CMG	Chipotle Mexican Grill	DE	Deere & Co.
DHI	D. R. Horton	DAL	Delta Air Lines Inc.
DRI	Darden Restaurants	DOV	Dover Corporation
DG	Dollar General	ETN	Eaton Corporation
DLTR	Dollar Tree	EMR	Emerson Electric Company
DPZ	Domino's Pizza	EFX	Equifax Inc.
EBAY	eBay Inc.	EXPD	Expeditors

Table B- 2 US S&P 500 Constituents List – continued (1)

Code	Stock	Code	Stock
EXPE	Expedia Group	FAST	Fastenal Co
F	Ford Motor Company	FDX	FedEx Corporation
GPS	Gap Inc.	FLS	Flowserve Corporation
GRMN	Garmin Ltd.	FTV	Fortive Corp
GM	General Motors	FBHS	Fortune Brands Home & Security
GPC	Genuine Parts	GD	General Dynamics
HRB	H&R Block	GE	General Electric
HBI	Hanesbrands Inc	GWW	Grainger (W.W.) Inc.
HAS	Hasbro Inc.	HON	Honeywell Int'l Inc.
HLT	Hilton Worldwide Holdings Inc	HWM	Howmet Aerospace
HD	Home Depot	HII	Huntington Ingalls Industries
KSS	Kohl's Corp.	IEX	IDEX Corporation
LB	L Brands Inc.	INFO	IHS Markit Ltd.
LVS	Las Vegas Sands	ITW	Illinois Tool Works
LEG	Leggett & Platt	IR	Ingersoll Rand
LEN	Lennar Corp.	JBHT	J. B. Hunt Transport Services
LKQ	LKQ Corporation	J	Jacobs Engineering Group
LOW	Lowe's Cos.	JCI	Johnson Controls International
MAR	Marriott Int'l.	KSU	Kansas City Southern
MCD	McDonald's Corp.	LHX	L3Harris Technologies
MGM	MGM Resorts International	LMT	Lockheed Martin Corp.
MHK	Mohawk Industries	MAS	Masco Corp.
NWL	Newell Brands	NLSN	Nielsen Holdings
NKE	Nike Inc.	NSC	Norfolk Southern Corp.
NCLH	Norwegian Cruise Line Holdings	NOC	Northrop Grumman
NVR	NVR Inc.	ODFL	Old Dominion Freight Line
ORLY	O'Reilly Automotive	OTIS	Otis Worldwide
PHM	PulteGroup	PCAR	PACCAR Inc.
PVH	PVH Corp.	PH	Parker-Hannifin
RL	Ralph Lauren Corporation	PNR	Pentair plc
ROST	Ross Stores	PWR	Quanta Services Inc.
RCL	Royal Caribbean Group	RTX	Raytheon Technologies
SBUX	Starbucks Corp.	RSG	Republic Services Inc
TPR	Tapestry Inc.	RHI	Robert Half International
TGT	Target Corp.	ROK	Rockwell Automation Inc.
TIF	Tiffany & Co.	ROL	Rollins Inc.
TJX	TJX Companies Inc.	ROP	Roper Technologies
TSCO	Tractor Supply Company	SNA	Snap-on
ULTA	Ulta Beauty	LUV	Southwest Airlines
UAA	Under Armour (Class A)	SWK	Stanley Black & Decker
UA	Under Armour (Class C)	TDY	Teledyne Technologies
VFC	VF Corporation	TXT	Textron Inc.
WHR	Whirlpool Corp.	TT	Trane Technologies plc
WYNN	Wynn Resorts Ltd	TDG	TransDigm Group

Table B- 2 US S&P 500 Constituents List – continued (2)			
Code	Stock	Code	Stock
YUM	Yum! Brands Inc	UNP	Union Pacific Corp
MO	Altria Group Inc	UAL	United Airlines Holdings
ADM	Archer-Daniels-Midland Co	UPS	United Parcel Service
BF.B	Brown-Forman Corp.	URI	United Rentals Inc.
CPB	Campbell Soup	VRSK	Verisk Analytics
CHD	Church & Dwight	WAB	Wabtec Corporation
KO	Coca-Cola Company	WM	Waste Management Inc.
CL	Colgate-Palmolive	XYL	Xylem Inc.
CAG	Conagra Brands	ACN	Accenture plc
STZ	Constellation Brands	ADBE	Adobe Inc.
COST	Costco Wholesale Corp.	AMD	Advanced Micro Devices Inc
COTY	Coty Inc	AKAM	Akamai Technologies Inc
EL	EstÃ©e Lauder Companies	APH	Amphenol Corp
GIS	General Mills	ADI	Analog Devices Inc.
HRL	Hormel Foods Corp.	ANSS	ANSYS
SJM	JM Smucker	AAPL	Apple Inc.
K	Kellogg Co.	AMAT	Applied Materials Inc.
KMB	Kimberly-Clark	ANET	Arista Networks
KHC	Kraft Heinz Co	ADSK	Autodesk Inc.
KR	Kroger Co.	ADP	Automatic Data Processing
LW	Lamb Weston Holdings Inc	AVGO	Broadcom Inc.
MKC	McCormick & Co.	BR	Broadridge Financial Solutions
TAP	Molson Coors Beverage Company	CDNS	Cadence Design Systems
MDLZ	Mondelez International	CDW	CDW
MNST	Monster Beverage	CSCO	Cisco Systems
PEP	PepsiCo Inc.	CTXS	Citrix Systems
PM	Philip Morris International	CTSH	Cognizant Technology Solutions
PG	Procter & Gamble	GLW	Corning Inc.
SYY	Sysco Corp.	DXC	DXC Technology
CLX	The Clorox Company	FFIV	F5 Networks
HSY	The Hershey Company	FIS	Fidelity National Information Services
TSN	Tyson Foods	FISV	Fiserv Inc
WBA	Walgreens Boots Alliance	FLT	FleetCor Technologies Inc
WMT	Walmart	FLIR	FLIR Systems
APA	Apache Corporation	FTNT	Fortinet
BKR	Baker Hughes Co	IT	Gartner Inc
COG	Cabot Oil & Gas	GPN	Global Payments Inc.
CVX	Chevron Corp.	HPE	Hewlett Packard Enterprise
CXO	Concho Resources	HPQ	HP Inc.
COP	ConocoPhillips	INTC	Intel Corp.
DVN	Devon Energy	IBM	International Business Machines
FANG	Diamondback Energy	INTU	Intuit Inc.
EOG	EOG Resources	IPGP	IPG Photonics Corp.
XOM	Exxon Mobil Corp.	JKHY	Jack Henry & Associates

Table B- 2 US S&P 500 Constituents List – continued (3)

Code	Stock	Code	Stock
HAL	Halliburton Co.	JNPR	Juniper Networks
HES	Hess Corporation	KEYS	Keysight Technologies
HFC	HollyFrontier Corp	KLAC	KLA Corporation
KMI	Kinder Morgan	LRCX	Lam Research
MRO	Marathon Oil Corp.	LDOS	Leidos Holdings
MPC	Marathon Petroleum	MA	Mastercard Inc.
NOV	National Oilwell Varco Inc.	MXIM	Maxim Integrated Products Inc
NBL	Noble Energy	MCHP	Microchip Technology
OXY	Occidental Petroleum	MU	Micron Technology
OKE	ONEOK	MSFT	Microsoft Corp.
PSX	Phillips 66	MSI	Motorola Solutions Inc.
PXD	Pioneer Natural Resources	NTAP	NetApp
SLB	Schlumberger Ltd.	NLOK	NortonLifeLock
FTI	TechnipFMC	NVDA	Nvidia Corporation
VLO	Valero Energy	ORCL	Oracle Corp.
WMB	Williams Companies	PAYX	Paychex Inc.
AFL	AFLAC Inc	PAYC	Paycom
ALL	Allstate Corp	PYPL	PayPal
AXP	American Express Co	QRVO	Qorvo
AIG	American International Group	QCOM	QUALCOMM Inc.
AMP	Ameriprise Financial	CRM	Salesforce.com
AON	Aon plc	STX	Seagate Technology
AJG	Arthur J. Gallagher & Co.	NOW	ServiceNow
AIZ	Assurant	SWKS	Skyworks Solutions
BAC	Bank of America Corp	SNPS	Synopsys Inc.
BRK.B	Berkshire Hathaway	TEL	TE Connectivity Ltd.
BLK	BlackRock	TXN	Texas Instruments
COF	Capital One Financial	TYL	Tyler Technologies
CBOE	Cboe Global Markets	VRSN	Verisign Inc.
SCHW	Charles Schwab Corporation	V	Visa Inc.
CB	Chubb Limited	WDC	Western Digital
CINF	Cincinnati Financial	WU	Western Union Co
C	Citigroup Inc.	XRX	Xerox
CFG	Citizens Financial Group	XLNX	Xilinx
CME	CME Group Inc.	ZBRA	Zebra Technologies
CMA	Comerica Inc.	APD	Air Products & Chemicals Inc
DFS	Discover Financial Services	ALB	Albemarle Corp
ETFC	E*Trade	AMCR	Amcor plc
RE	Everest Re Group Ltd.	AVY	Avery Dennison Corp
FITB	Fifth Third Bancorp	BLL	Ball Corp
FRC	First Republic Bank	CE	Celanese
BEN	Franklin Resources	CF	CF Industries Holdings Inc
GL	Globe Life Inc.	CTVA	Corteva
GS	Goldman Sachs Group	DOW	Dow Inc.

Table B- 2 US S&P 500 Constituents List – continued (4)			
Code	Stock	Code	Stock
HIG	Hartford Financial Svc.Gp.	DD	DuPont de Nemours Inc
HBAN	Huntington Bancshares	EMN	Eastman Chemical
ICE	Intercontinental Exchange	ECL	Ecolab Inc.
IVZ	Invesco Ltd.	FMC	FMC Corporation
JPM	JPMorgan Chase & Co.	FCX	Freeport-McMoRan Inc.
KEY	KeyCorp	IFF	International Flavors & Fragrances
LNC	Lincoln National	IP	International Paper
L	Loews Corp.	LIN	Linde plc
MTB	M&T Bank Corp.	LYB	LyondellBasell
MKTX	MarketAxess	MLM	Martin Marietta Materials
MMC	Marsh & McLennan	NEM	Newmont Corporation
MET	MetLife Inc.	NUE	Nucor Corp.
MCO	Moody's Corp	PKG	Packaging Corporation of America
MS	Morgan Stanley	PPG	PPG Industries
MSCI	MSCI Inc	SEE	Sealed Air
NDAQ	Nasdaq Inc.	SHW	Sherwin-Williams
NTRS	Northern Trust Corp.	MOS	The Mosaic Company
PBCT	People's United Financial	VMC	Vulcan Materials
PNC	PNC Financial Services	WRK	WestRock
PFG	Principal Financial Group	ARE	Alexandria Real Estate Equities
PGR	Progressive Corp.	AMT	American Tower Corp.
PRU	Prudential Financial	AIV	Apartment Investment & Management
RJF	Raymond James Financial Inc.	AVB	AvalonBay Communities
RF	Regions Financial Corp.	BXP	Boston Properties
SPGI	S&P Global Inc.	CBRE	CBRE Group
STT	State Street Corp.	CCI	Crown Castle International Corp.
SIVB	SVB Financial	DLR	Digital Realty Trust Inc
SYF	Synchrony Financial	DRE	Duke Realty Corp
TROW	T. Rowe Price Group	EQIX	Equinix
BK	The Bank of New York Mellon	EQR	Equity Residential
TRV	The Travelers Companies Inc.	ESS	Essex Property Trust Inc.
TFC	Truist Financial	EXR	Extra Space Storage
USB	U.S. Bancorp	FRT	Federal Realty Investment Trust
UNM	Unum Group	PEAK	Healthpeak Properties
WRB	W. R. Berkley Corporation	HST	Host Hotels & Resorts
WFC	Wells Fargo	IRM	Iron Mountain Incorporated
WLTW	Willis Towers Watson	KIM	Kimco Realty
ZION	Zions Bancorp	MAA	Mid-America Apartments
ABT	Abbott Laboratories	PLD	Prologis
ABBV	AbbVie Inc.	PSA	Public Storage
ABMD	ABIOMED Inc	O	Realty Income Corporation
A	Agilent Technologies Inc	REG	Regency Centers Corporation
ALXN	Alexion Pharmaceuticals	SBAC	SBA Communications

Table B- 2 US S&P 500 Constituents List – continued (5)			
Code	Stock	Code	Stock
ALGN	Align Technology	SPG	Simon Property Group Inc
ABC	AmerisourceBergen Corp	SLG	SL Green Realty
AMGN	Amgen Inc.	UDR	UDR Inc.
ANTM	Anthem	VTR	Ventas Inc
BAX	Baxter International Inc.	VNO	Vornado Realty Trust
BDX	Becton Dickinson	WELL	Welltower Inc.
BIO	Bio-Rad Laboratories	WY	Weyerhaeuser
BIIB	Biogen Inc.	Symbol	Name
BSX	Boston Scientific	AES	AES Corp
BMY	Bristol-Myers Squibb	LNT	Alliant Energy Corp
CAH	Cardinal Health Inc.	AEE	Ameren Corp
CNC	Centene Corporation	AEP	American Electric Power
CERN	Cerner	AWK	American Water Works Company Inc
CI	CIGNA Corp.	ATO	Atmos Energy
CVS	CVS Health	CNP	CenterPoint Energy
DHR	Danaher Corp.	CMS	CMS Energy
DVA	DaVita Inc.	ED	Consolidated Edison
XRAY	Dentsply Sirona	D	Dominion Energy
DXCM	DexCom	DTE	DTE Energy Co.
EW	Edwards Lifesciences	DUK	Duke Energy
GILD	Gilead Sciences	EIX	Edison Int'l
HCA	HCA Healthcare	ETR	Entergy Corp.
HSIC	Henry Schein	EVRG	Evergy
HOLX	Hologic	ES	Eversource Energy
HUM	Humana Inc.	EXC	Exelon Corp.
IDXX	IDEXX Laboratories	FE	FirstEnergy Corp
ILMN	Illumina Inc	NEE	NextEra Energy
INCY	Incyte	NI	NiSource Inc.
ISRG	Intuitive Surgical Inc.	NRG	NRG Energy
IQV	IQVIA Holdings Inc.	PNW	Pinnacle West Capital
JNJ	Johnson & Johnson	PPL	PPL Corp.
LH	Laboratory Corp. of America Holding	PEG	Public Service Enterprise Group (PSEG)
LLY	Lilly (Eli) & Co.	SRE	Sempra Energy
MCK	McKesson Corp.	SO	Southern Company
MDT	Medtronic plc	WEC	WEC Energy Group
MRK	Merck & Co.	XEL	Xcel Energy Inc

Table B- 3 China SSE 180 constituents list

Code	Stock	Code	Stock
600000	Shanghai Pudong Development Bank Co Ltd	600895	Shanghai Zhangjiang Hi-tech Park Development Co Ltd
600004	Guangzhou Baiyun International Airport Co Ltd	600900	China Yangtze Power Co Ltd
600009	Shanghai International Airport Co Ltd	600909	HUAAN SECURITIES CO., LTD.
600010	Inner Mongolia Baotou Steel Union Co Ltd	600919	Bank of Jiangsu Co., Ltd
600011	Huaneng Power International Inc	600926	BANK OF HANGZHOU CO., LTD
600015	Hua Xia Bank Co Ltd	600928	BANK OF XI'AN CO., LTD.
600016	China Minsheng Banking Corp Ltd	600958	ORIENT SECURITIES COMPANY LIMITED
600018	Shanghai International Port (Group) Co Ltd	600968	CNOOC Energy Technology & Services Limited
600019	Baoshan Iron &Steel Co Ltd	600977	CHINA FILM CO., LTD.
600025	HuanengLancang River Hydropower Inc.	600989	Ningxia Baofeng Energy Group Co., Ltd.
600028	China Petroleum & Chemical Corporation	600999	China Merchants Securities Co Ltd
600029	China Southern Airlines Co Ltd	601006	Daqin Railway Co Ltd
600030	CITIC Securities Co Ltd	601009	Bank of Nanjing Co Ltd
600031	Sany Heavy Industry Co Ltd	601012	Longi Green Energy Technology Co., Ltd.
600036	China Merchants Bank Co Ltd	601021	Spring Airlines Co., Ltd.
600038	AVIC Helicopter Co.,Ltd.	601066	China Securities Co., Ltd.
600048	Poly Developments and Holdings Group Co., Ltd.	601077	Chongqing Rural Commercial Bank Co., Ltd.
600050	China United Network Communications Co Ltd	601088	China Shenhua Energy Co Ltd
600061	SDIC Capital Co., Ltd	601099	The Pacific Securities Co.Ltd
600066	Zhengzhou Yutong Bus Co Ltd	601100	Jiangsu Hengli Hydraulic CO., Ltd.
600068	China Gezhouba Group Co Ltd	601108	CAITONG SECURITIES CO.,LTD.
600085	Beijing Tongrentang Co Ltd	601111	Air China Ltd
600089	TBEA Co Ltd	601138	Foxconn Industrial Internet Co., Ltd.
600104	SAIC Motor Co Ltd	601155	Future Land Holdings Co., Ltd.
600109	Sinolink Securities Co. Ltd.	601162	TIANFENG SECURITIES CO., LTD.
600111	China Northern Rare Earth (Group) High-Tech Co.,Ltd	601166	Industrial Bank
600115	China Eastern Airlines Corp Ltd	601169	Bank of Beijing Co Ltd
600118	China Spacesat Co Ltd	601186	China Railway Construction Co Ltd
600150	China CSSC Holdings Limited	601198	DONGXING SECURITIES CO., LTD.
600155	Polaris Bay Group Co.,Ltd.	601211	Guotai Junan Securities Co., Ltd.
600176	CHINA JUSHI CO., LTD.	601225	Shaanxi Coal Industry Company Limited
600177	Youngor Group Co Ltd	601229	Bank of Shanghai Co., Ltd.
600183	Shengyi Technology Co.,Ltd.	601233	Tongkun Group Co Ltd
600196	Shanghai Fosun Pharmaceutical (Group) Co Ltd	601236	HONGTA SECURITIES CO., LTD.
600201	Jinyu Bio-Technology Co.,Ltd.	601238	Guangzhou Automobile Group Co., Ltd.
600208	Xinhu Zhongbao Co Ltd	601288	Agricultural Bank of China Co Ltd

Table B- 3 China SSE 180 constituents list – continued (1)			
Code	Stock	Code	Stock
600271	Aisino Co.,Ltd	601318	Ping An Insurance (Group) Company of China Ltd
600276	Jiangsu Hengrui Medicine Co Ltd	601319	The People's Insurance Company (Group) of China Limited
600298	Angel Yeast Co Ltd	601328	Bank of Communications Co LTD
600309	Wanhua Chemical Group Co., Ltd.	601336	New China Life Insurance Co Ltd
600332	GUANGZHOU BAIYUNSHAN PHARMACEUTICAL HOLDINGS COMPANY LIMITED	601377	Industrial Securities Co Ltd
600340	China Fortune Land Development Co., Ltd.	601390	China Railway Group Limited
600346	Hengli Petrochemical Co.,Ltd.	601398	Industrial and Commercial Bank of China Ltd
600352	Zhejiang Longsheng Group Co Ltd	601519	Shanghai Great Wisdom Co Ltd
600362	Jiangxi Copper Co Ltd	601555	Soochow Securities Co Ltd
600383	Gemdale Corporation	601601	China Pacific Insurance (Group) Co Ltd
600406	NARI Technology Co., Ltd.	601607	Shanghai Pharmaceuticals Holding Co.,Ltd
600436	Zhangzhou Pientzehuang Pharmaceutical Co Ltd	601618	Metallurgical Corporation of China Co Ltd
600438	Tongwei Co Ltd	601628	China Life Insurance Company Limited
600487	Hengtong Optic-Electric Co.,Ltd	601633	Great Wall Motor Co Ltd
600489	Zhongjin Gold Co Ltd	601658	POSTAL SAVINGS BANK OF CHINA CO., LTD.
600516	Fangda Carbon New Material Co.,Ltd	601668	China State Construction Engineering Co Ltd
600519	Kweichow Moutai Co Ltd	601669	Power Construction Corporation of China,Ltd
600521	Zhejiang Huahai Pharmaceutical Co Ltd	601688	Huatai Securities Co Ltd
600522	Jiangsu Zhongtian Technologies Co Ltd	601698	China Satellite Communications Co.,Ltd.
600536	China National Software & Service Co Ltd	601766	CRRC Corporation Limited
600547	Shandong Gold-Mining Co Ltd	601788	Everbright Securities Co Ltd
600570	Hundsun Technologies Inc.	601800	China Communications Construction Company Limited
600572	Zhejiang Conba Pharmaceutical Co Ltd	601816	Beijing-Shanghai High Speed Railway Co.,Ltd
600585	Anhui Conch Cement Co Ltd	601818	China Everbright Bank Co Ltd
600588	Yonyou Network Technology Co., Ltd.	601857	PetroChina Co Ltd
600598	Heilongjiang Agriculture Co Ltd	601860	Jiangsu Zijin Rural Commercial Bank Co., Ltd.
600600	Tsingtao Brewery Co Ltd	601872	China Merchants Energy Shipping Co., Ltd.
600604	Shanghai Shibei Hi-Tech Co.,Ltd.	601877	Zhejiang Chint Electrics Co Ltd
600606	Greenland Holdings Corporation Limited	601878	ZHESHANG SECURITIES CO., LTD.
600621	SHANGHAI CHINAFORTUNE CO., LTD	601881	China Galaxy Securities Co., Ltd.
600637	Shanghai Oriental Pearl Media Co., Ltd.	601888	China Tourism Group Duty Free Corporation Limited
600660	Fuyao Glass Industry Group Co.,Ltd	601899	Zijin Mining Group Co Ltd
600690	Haier Smart Home Co., Ltd.	601901	Founder Securities Co Ltd
600699	Ningbo Joyson Electronic Corp.	601916	CHINA ZHESHANG BANK CO.,LTD
600703	Sanan Optoelectronics Co.,Ltd	601933	Yonghui Superstores Co Ltd
600705	AVIC CAPITAL CO.,LTD.	601939	China Construction Bank

Table B- 3 China SSE 180 constituents list – continued (2)			
Code	Stock	Code	Stock
600733	BAIC BluePark New Energy Technology Co.,Ltd	601985	China National Nuclear Power Co.,Ltd.
600737	COFCO TUNHE SUGAR CO.,LTD.	601988	Bank of China Ltd
600741	HUAYU Automotive Systems Company Limited	601989	China Shipbuilding Industry Co Ltd
600745	Wingtech Technology Co.,Ltd.	601990	Nanjing Securities Co., Ltd.
600760	AVIC SHENYANG AIRCRAFT COMPANY LIMITED	601998	China Citic Bank Corporation Limited
600763	TOPCHOICE MEDICAL CORPORATION	603019	Dawning Information Industry Co., Ltd.
600779	Sichuan Swellfun Co., Ltd.	603160	Shenzhen Huiding Technology Co., Ltd.
600795	GD Power Development Co Ltd	603259	WuXi AppTec Co., Ltd.
600801	Huaxin Cement Co Ltd	603288	Foshan Haitian Flavouring and Food Company Ltd.
600809	Shanxi Xinghuacun Fen Wine Factory Co Ltd	603369	Jiangsu King's Luck Brewery Joint-Stock Co., Ltd.
600837	Haitong Securities Company Limited	603501	Will Semiconductor CO.,Ltd. Shanghai
600848	Shanghai Lingang Holdings Corporation Limited	603517	Juewei Food Co., Ltd.
600867	Tonghua Dongbao Pharmaceutical Co.,Ltd.	603589	Anhui Kouzi Distillery Co., Ltd.
600872	Jonjee Hi-Tech Industrial and Commercial Holding Co.,Ltd.	603799	ZHEJIANG HUAYOU COBALT CO., LTD.
600875	Dongfang Electric Corporation Limited	603833	Oppein Home Group Inc.
600886	SDIC Power Holdings Co.,Ltd.	603983	Guangdong Marubi Biotechnology Co., Ltd.
600887	Inner Mongolia Yili Industrial Group Co Ltd	603986	GigaDevice Semiconductor (Beijing) Inc.
600893	AVIC AVIATION ENGINE CORPORATION PLC.	603993	China Molybdenum Co., Ltd.

Table B- 4 Japan Nikkei Constituents List

Code	Stock	Code	Stock
4503	Astellas Pharma Inc.	1605	Inpex Corp.
4519	Chugai Pharmaceutical Co., Ltd.	3401	Teijin Ltd.
4568	Daiichi Sankyo Co., Ltd.	3402	Toray Industries, Inc.
4506	Sumitomo Dainippon Pharma Co., Ltd.	3101	Toyobo Co., Ltd.
4523	Eisai Co., Ltd.	3103	Unitika, Ltd.
4151	Kyowa Hakko Kirin Co., Ltd.	3863	Nippon Paper Group, Inc.
4578	Otsuka Holdings Co. Co., Ltd.	3861	Oji Paper Co., Ltd.
4507	Shionogi & Co., Ltd.	3407	Asahi Kasei Corp.
4502	Takeda Pharmaceutical Company, Ltd.	4061	Denki Kagaku Kogyo K.K.
6857	Advantest Corp.	4631	DIC Corporation
6770	Alps Electric Co., Ltd.	4901	Fujifilm Holdings Corp.
7751	Canon Inc.	4452	Kao Corp.
6952	Casio Computer Co., Ltd.	3405	Kuraray Co., Ltd.
7735	Dainippon Screen Mfg. Co., Ltd.	4188	Mitsubishi Chemical Holdings Corp.
6902	Denso Corp.	4183	Mitsui Chemicals, Inc.
6954	FANUC Corp.	4021	Nissan Chemical Industries, Ltd.
6504	Fuji Electric Co., Ltd.	6988	Nitto Denko
6702	Fujitsu Ltd.	4063	Shin-Etsu Chemical Co., Ltd.
6674	GS Yuasa Corp.	4911	Shiseido Co., Ltd.
6501	Hitachi, Ltd.	4004	Showa Denko K.K.
6971	Kyocera Corp.	4005	Sumitomo Chemical Co., Ltd.
6479	MinebeaMitsumi, Inc.	4043	Tokuyama Corporation
6503	Mitsubishi Electric Corp.	4042	Tosoh Corp.
6701	NEC Corp.	4208	Ube Industries, Ltd.
3105	Nisshinbo Holdings Inc.	5020	JXTG Holdings
6703	Oki Electric Industry Co., Ltd.	5019	Idemitsu Kosan Co., Ltd.
6645	Omron Corp.	5108	Bridgestone Corp.
6752	Panasonic Corp.	5101	The Yokohama Rubber Co., Ltd.
7752	Ricoh Co., Ltd.	5201	AGC Inc.
6724	Seiko Epson Corp.	5333	NGK Insulators, Ltd.
6758	Sony Corp.	5214	Nippon Electric Glass Co., Ltd.
6976	Taiyo Yuden Co., Ltd.	5202	Nippon Sheet Glass Co., Ltd.
6762	TDK Corp.	5232	Sumitomo Osaka Cement Co., Ltd.
8035	Tokyo Electron Ltd.	5233	Taiheiyo Cement Corp.
6506	Yaskawa Electric Corporation, Limited	5301	Tokai Carbon Co., Ltd.
6841	Yokogawa Electric Corp.	5332	Toto Ltd.
7205	Hino Motors, Ltd.	5411	JFE Holdings, Inc.
7267	Honda Motor Co., Ltd.	5406	Kobe Steel, Ltd.
7202	Isuzu Motors Ltd.	5401	Nippon Steel Corp.

Table B- 4 Japan Nikkei Constituents List – continued (1)

Code	Stock	Code	Stock
7261	Mazda Motor Corp.	5541	Pacific Metals Co., Ltd.
7211	Mitsubishi Motors Corp.	5714	Dowa Holdings Co., Ltd.
7201	Nissan Motor Co., Ltd.	5803	Fujikura Ltd.
7270	Subaru Corp.	5801	The Furukawa Electric Co., Ltd.
7269	Suzuki Motor Corp.	5711	Mitsubishi Materials Corp.
7203	Toyota Motor Corp.	5706	Mitsui Mining & Smelting Co., Ltd.
7272	Yamaha Motor Corp.	5703	Nippon Light Metal Co., Ltd
7762	Citizen Holdings Co., Ltd.	3436	SUMCO Corp.
4902	Konica Minolta Holdings, Inc.	5802	Sumitomo Electric Industries, Ltd.
7731	Nikon Corp.	5713	Sumitomo Metal Mining Co., Ltd.
7733	Olympus Corp.	5707	Toho Zinc Co., Ltd.
4543	Terumo Corp.	5901	Toyo Seikan Kaisha, Ltd.
9433	KDDI Corp.	8001	Itochu Corp.
9432	Nippon Telegraph & Telephone Corp.	8002	Marubeni Corp.
9613	NTT Data Corp.	8058	Mitsubishi Corp.
9437	NTT Docomo, Inc.	8031	Mitsui & Co., Ltd.
9412	SKY Perfect JSAT Holdings Inc.	2768	Sojitz Corp.
9434	SoftBank Corp.	8053	Sumitomo Corp.
9984	SoftBank Group Corp.	8015	Toyota Tsusho Corp.
8304	Aozora Bank, Ltd.	1721	Comsys Holdings Corp.
8331	The Chiba Bank, Ltd.	1925	Daiwa House Industry Co., Ltd.
7186	Concordia Financial Group, Inc.	1808	Haseko Corp.
8309	Sumitomo Mitsui Trust Holdings, Inc.	1963	JGC Corporation
8354	Fukuoka Financial Group, Inc.	1812	Kajima Corp.
8306	Mitsubishi UFJ Financial Group, Inc.	1802	Obayashi Corp.
8411	Mizuho Financial Group, Inc.	1928	Sekisui House, Ltd.
8308	Resona Holdings, Inc.	1803	Shimizu Corp.
8303	Shinsei Bank, Ltd.	1801	Taisei Corp.
8355	The Shizuoka Bank, Ltd.	6113	Amada Co. Ltd.
8316	Sumitomo Mitsui Financial Group, Inc.	6367	Daikin Industries, Ltd.
8253	Credit Saison Co., Ltd.	6367	Ebara Corp.
8697	Japan Exchange Group Inc.	6305	Hitachi Construction Machinery Co., Ltd.
8601	Daiwa Securities Group Inc.	7004	Hitachi Zōsen Corporation
8628	Matsui Securities Co., Ltd.	7013	IHI Corp.
8604	Nomura Holdings, Inc.	5631	The Japan Steel Works, Ltd.
8750	Dai-ichi Life Insurance Company, Limited	6473	JTEKT Corp.
8725	MS&AD Insurance Group, Inc.	6301	Komatsu Ltd.
8630	Sompo Holdings, Inc.	6326	Kubota Corp.
8795	T&D Holdings, Inc.	7011	Mitsubishi Heavy Industries, Ltd.
8766	Tokio Marine Holdings, Inc.	6471	NSK Ltd.
1332	Nippon Suisan Kaisha, Ltd.	6472	NTN Corp.

Table B- 4 Japan Nikkei Constituents List – continued (2)			
Code	Stock	Code	Stock
1333	Maruha Nichiro Holdings, Inc.	6103	Okuma Holdings, Inc.
2802	Ajinomoto Co., Inc.	6302	Sumitomo Heavy Industries, Ltd.
2502	Asahi Group Holdings, Ltd.	7012	Kawasaki Heavy Industries, Ltd.
2914	Japan Tobacco Inc.	7003	Mitsui Engineering & Shipbuilding Co., Ltd.
2801	Kikkoman Corp.	7832	Bandai Namco Holdings, Inc.
2503	Kirin Brewery Co., Ltd.	7912	Dai Nippon Printing Co., Ltd.
2269	Meiji Holdings Company, Limited	7911	Toppan Printing Co., Ltd.
2871	Nichirei Corp.	7951	Yamaha Corp.
2282	NH Foods, Ltd.	8802	Mitsubishi Estate Co., Ltd.
2002	Nisshin Seifun Group Inc.	8801	Mitsui Fudosan Co.,Ltd
2501	Sapporo Holdings Ltd.	8830	Sumitomo Realty & Development Co., Ltd.
2531	Takara Holdings Inc.	8804	Tokyo Tatemono Co., Ltd.
8267	Aeon Co., Ltd.	3289	Tokyu Land Corp.
8028	FamilyMart Co., Ltd.	9022	Central Japan Railway Company
9983	Fast Retailing Co., Ltd.	9020	East Japan Railway Company
3099	Isetan Mitsukoshi Holdings Ltd.	9008	Keio Corp.
3086	J. Front Retailing Co., Ltd.	9009	Keisei Electric Railway Co., Ltd.
8252	Marui Group Co., Ltd.	9007	Odakyu Electric Railway Co., Ltd.
3382	Seven & I Holdings Co., Ltd.	9001	Tobu Railway Co., Ltd.
8233	Takashimaya Co., Ltd.	9005	Tokyu Corp.
4751	Cyberagent Inc.	9021	West Japan Railway Company
2432	Dena Co., Ltd.	9062	Nippon Express Co., Ltd.
4324	Dentsu Inc.	9064	Yamato Holdings Co., Ltd.
6178	Japan Post Holdings Co., Ltd.	9107	Kawasaki Kisen Kaisha, Ltd.
9766	Konami Corp.	9104	Mitsui O.S.K. Lines, Ltd.
2413	M3 Inc.	9101	Nippon Yusen K.K.
4755	Rakuten Inc.	9302	All Nippon Airways Co., Ltd.
6098	Recruit Holdings Co., Ltd.	9301	Mitsubishi Logistics Corp.
9735	Secom Co., Ltd.	9502	Chubu Electric Power Co., Inc.
9602	Toho Co., Ltd.	9503	The Kansai Electric Power Co., Inc.
4704	Trend Micro Inc.	9501	Tokyo Electric Power Company Holdings, Incorporated
4689	Z Holdings Corp.	9532	Osaka Gas Co., Ltd.
		9531	Tokyo Gas Co., Ltd.

Table B- 5 India SENSEX Constituents List

Code	Stock	Code	Stock
500820	Asian Paints	500510	Larsen & Toubro
532215	Axis Bank	500520	Mahindra & Mahindra
532977	Bajaj Auto	532500	Maruti Suzuki
500034	Bajaj Finance	500790	Nestlé India
532978	Bajaj Finserv	532555	NTPC
532454	Bharti Airtel	500312	Oil and Natural Gas Corporation
532281	HCL Technologies	532898	Power Grid Corporation of India
500010	HDFC	500325	Reliance Industries Limited
500180	HDFC Bank	500112	State Bank of India
500696	Hindustan Unilever Limited	524715	Sun Pharma
532174	ICICI Bank	500470	Tata Steel
532187	IndusInd Bank	532540	Tata Consultancy Services
500209	Infosys	532755	Tech Mahindra
500875	ITC Limited	500114	Titan Company
500247	Kotak Mahindra Bank	532538	UltraTech Cement

Table B- 6 Descriptive statistics - UK stocks

Code	Mean	Std. Dev.	Skewness	Kurtosis	Code	Mean	Std. Dev.	Skewness	Kurtosis
3IN	0.0007	0.0148	2.2694	30.33	JAM	0.0002	0.0122	0.9954	25.11
888	-0.0005	0.0195	-6.9578	147.44	JD.	0.0003	0.0249	-0.3576	30.5
AAF	0.0003	0.0133	0.3002	34.65	JDW	0.0002	0.0161	2.3822	38.43
AAL	-0.0006	0.0326	0.0058	19.75	JEO	0.0014	0.062	1.5148	44.95
ABF	0.0008	0.0183	6.4586	136.43	JESC	0.0002	0.0211	0.5238	23.57
ACI	-0.0003	0.0216	1.1661	17.42	JET	0.0001	0.0064	-0.2792	7.96
ADM	0.0003	0.0172	1.7363	40.24	JFJ	0.0006	0.0131	0.0146	10.91
AGK	-0.0009	0.0445	-20.1155	453.54	JLEN	0.0007	0.0127	1.9638	28.96
AGR	-0.0001	0.0345	-0.0907	5.71	JLG	0.0004	0.0143	1.0865	78.83
AGT	0.0007	0.0351	-17.8638	513.99	JMAT	0.0002	0.0092	-0.6257	10.91
AHT	0.0012	0.0116	1.801	25.59	JMG	0.0001	0.0098	-0.5746	11.64
AJB	0.0005	0.0139	4.1196	139.2	JUP	0.0005	0.0119	-1.8899	82.6
AML	0.0008	0.0169	3.1005	45.58	JUST	0.0009	0.0187	0.6786	8.71
ANTO	0.0002	0.0125	-0.256	13.46	KAZ	0.0011	0.0238	0.2909	11.43
AO.	0.0009	0.0145	0.0348	8.19	KGF	-0.0004	0.0275	-2.4234	51.46
APAX	0.0013	0.0241	1.2037	11.35	KNOS	0.0013	0.0405	-10.1096	276.49
ASCL	0.001	0.0363	0.8915	15.88	LAND	0.0016	0.0415	0.3616	10.87
ASHM	0.0002	0.0112	-0.0228	14.56	LGEN	0.0016	0.0223	4.3896	82.25
ASL	0.0003	0.027	1.008	11.67	LIO	0.0007	0.0154	-1.0657	23.85
ATST	0.0006	0.0084	0.635	7.39	LLOY	0.0006	0.0147	2.4252	30.35
ATT	0.001	0.0336	2.042	22.1	LMP	0.0002	0.0116	-5.6268	148.77
AUTO	0.0008	0.0189	1.5822	20.79	LRE	0.0002	0.0172	0.1775	23.16
AV.	-0.0002	0.0128	-0.1702	16.51	LSE	0.0009	0.0209	5.4334	105.39
AVON	0.0003	0.014	3.1242	65.01	LWDB	0.0008	0.0235	0.4358	5.05
AVST	-0.0008	0.0383	-16.1756	426.07	LXI	0.0008	0.0218	0.7894	28.37
AVV	0.0029	0.041	1.871	17.49	MAB	0.0001	0.0103	0.1589	11.44
AZN	0.0011	0.0107	-0.895	11.28	MCRO	-0.0008	0.0349	-24.0173	691.5
BA.	0.0011	0.0177	2.0471	19.36	MDC	-0.0038	0.0757	-8.3226	116
BAB	0.0001	0.0062	-0.7172	11.57	MGAM	0.0008	0.0139	0.9623	9.79
BARC	-0.0012	0.0462	-12.9261	279.71	MGGT	0.0004	0.0115	0.742	12.63
BATS	0.0002	0.0308	0.7632	13.04	MGNS	-0.0003	0.0163	0.8153	25.62
BBGI	0.0007	0.032	18.4025	724.87	MKS	0.0002	0.021	0.2121	16.27
BBH	-0.0026	0.0682	-8.7367	131.28	MNDI	0.0007	0.04	1.9327	33.66
BBOX	0.0004	0.0156	1.37	26.32	MNG	0	0.025	1.5817	27.51
BBY	0.0003	0.0083	-0.8042	21.23	MNKS	0.0007	0.0336	15.5245	610.71
BCPT	-0.0007	0.0231	-0.3919	16.94	MONY	0.0013	0.0327	-3.0477	50.84
BDEV	0.0005	0.007	1.6077	40.35	MRC	0.0004	0.0208	1.3844	16.93
BEZ	0	0.0206	0.2834	6.48	MRO	0.0005	0.0266	0.4778	10.43
BGFD	0.0004	0.0118	2.3188	31.45	MRW	0.0004	0.0306	-0.1625	15.45
BGS	0.0003	0.0148	1.4903	19.21	MSLH	0.0003	0.0111	3.3731	87.77
BGSC	0.0009	0.0192	1.0601	12.99	MYI	0.0004	0.0139	0.2437	24.2

Table B- 6 Descriptive statistics - UK stocks – continued (1)									
Code	Mean	Std. Dev.	Skewness	Kurtosis	Code	Mean	Std. Dev.	Skewness	Kurtosis
BHP	0.0007	0.0149	3.465	52.19	N91	0.0007	0.0181	7.5183	153.29
BIFF	0.0005	0.0225	0.8626	8.56	NESF	-0.0001	0.021	0.2964	14.61
BKG	0.0003	0.0135	0.8719	21.93	NETW	0.0006	0.0155	-0.8879	30.87
BLND	0.0007	0.0218	2.105	142.1	NEX	0.0013	0.0113	2.0964	22.87
BME	-0.0003	0.0323	-26.2593	811.86	NG.	0.0008	0.0177	0.2247	9.96
BNKR	0.001	0.0381	7.0579	151.24	NWG	0.0002	0.0113	1.4262	21.36
BNZL	-0.0008	0.0441	-9.3982	219.69	NXT	-0.0033	0.0641	-9.1821	146.64
BOY	0.0005	0.0136	0.3748	6.14	OCDO	0.0004	0.0095	1.0798	28.13
BP.	-0.0024	0.0483	-13.4523	281.25	OSB	0.0001	0.0063	-0.1054	8.6
BRBY	0.0011	0.0196	0.3111	6.04	OXB	-0.0037	0.0858	-9.7463	114.46
BRSC	-0.0009	0.0648	-9.6078	155.12	OXIG	0.0012	0.0364	1.6548	18.53
BRW	0.0005	0.0138	1.0017	17.4	PAG	0.001	0.0256	-1.1155	31.98
BRWM	0.0017	0.0107	1.2538	13	PAGE	0.0005	0.0524	2.6367	42.86
BT.A	0.0004	0.0119	2.668	53.05	PCT	0	0.0186	-0.2548	17.98
BVIC	0.0001	0.0146	0.0155	12.4	PETS	0.0007	0.0226	-0.2878	10.03
BWY	0.0008	0.0152	0.3197	6.29	PFC	0.0004	0.0125	-1.241	73.1
BYG	0.0006	0.0132	-0.7913	25.3	PFD	0.0004	0.0201	0.3727	15.43
CAPC	0.0011	0.0248	-0.5992	16.44	PFG	-0.0007	0.0168	-0.3287	10.31
CBG	0.0008	0.0219	-0.1557	6.94	PHNX	0.0007	0.0145	2.8058	37.24
CCC	0.0004	0.0057	4.2456	48.51	PHP	0.0003	0.0106	-0.0939	7.22
CCH	0.0013	0.0143	1.6805	31.62	PIN	-0.0003	0.0368	-21.9353	598.89
CCL	0.0001	0.0252	1.015	23.88	PLI	0.0015	0.0182	1.9148	35.81
CCR	0	0.0253	0.1042	36.98	PLP	0.0003	0.0185	-0.8831	12.42
CEY	-0.0013	0.041	-22.9082	560.01	PLUS	0.0018	0.0271	0.3062	6.27
CHG	0.0007	0.0072	0.4478	13.06	PNL	0.0018	0.0242	-0.1486	11.78
CINE	0.0002	0.0154	0.0969	91.75	PNN	0.0001	0.0207	0.1138	12.92
CKN	-0.0005	0.0228	2.6885	50.54	POG	0.0002	0.0165	0.5183	11.08
CLDN	0.0006	0.0135	5.4193	68.77	POLY	0.0006	0.0291	-2.5432	44.23
CLI	-0.0066	0.0828	-9.3292	112.67	PRTC	0.0025	0.0356	-0.839	27.84
CLSN	0.0013	0.0151	3.851	62.48	PRU	0.0008	0.0261	0.0939	5.8
CMCX	0.0011	0.0159	4.7609	95.14	PSH	0.0003	0.0244	-0.042	5.67
CAN	0.0011	0.0228	0.0536	13.34	PSN	0.0005	0.0173	-0.1365	9.54
CNE	0.0016	0.0275	1.0322	11.19	PSON	-0.0005	0.0328	0.3644	23.05
COA	0.0009	0.0217	0.4502	7.6	PTEC	0.0004	0.0126	0.2567	13.77
CPG	0.0009	0.0181	8.496	324.59	PZC	-0.0001	0.0373	-13.5372	371.46
CPI	0.0005	0.0227	0.5571	16.47	QLT	0.001	0.0158	4.5113	77.14
CRDA	0.0003	0.0141	0.5285	17.13	QQ.	-0.0002	0.0197	0.8404	10.84
CRH	-0.0008	0.0328	-27.0043	825.44	RAT	-0.0016	0.0456	-17.1766	376.74
CRST	0.0007	0.0141	2.2302	24.61	RB.	0.001	0.0196	1.2592	19.46
CSH	-0.0013	0.0336	-22.7527	664.49	RCP	0.0006	0.0141	1.1847	20.94
CSP	0.0002	0.0085	-0.0353	37.03	RDSA	0.0003	0.0126	1.2257	18.28
CTEC	-0.0001	0.04	-12.9526	327.75	RDSB	0.0003	0.0156	0.8137	11.19
CTY	0.0004	0.0366	3.7358	57.8	RDW	-0.0001	0.0132	0.1279	15.05
CWK	0.0004	0.0155	0.1364	6.82	REL	0.0005	0.0186	1.6982	20.96

Table B- 6 Descriptive statistics - UK stocks – continued (2)									
Code	Mean	Std. Dev.	Skewness	Kurtosis	Code	Mean	Std. Dev.	Skewness	Kurtosis
DC.	-0.0003	0.0218	-0.8825	18.52	RHIM	0.0001	0.0153	0.4405	16.9
DCC	0.0003	0.0347	-0.1534	13.12	RIO	-0.0013	0.0427	-16.3978	382.59
DGE	-0.0013	0.0445	-14.5017	328.43	RMG	0.0012	0.0263	0.2468	10.85
DGOC	-0.0008	0.0388	-17.241	431.63	RMV	0.0013	0.0209	4.6299	68.51
DIGS	-0.0002	0.0371	-16.1902	434.6	RNK	0.0005	0.0114	0.9639	14.07
DLG	0.0002	0.0188	0.6348	18.14	ROR	0.0001	0.0222	2.7558	57.59
DLN	0.0007	0.0218	-1.4866	27	RR.	-0.0002	0.0248	-0.3815	20.01
DNLM	0.0003	0.0199	-0.0159	7.41	RSA	0.0002	0.0174	0.5785	10.84
DOM	0.0012	0.0175	2.5119	32.69	RSW	0.0005	0.0124	1.0557	14.43
DPH	0.0007	0.0178	13.0953	336.2	RTO	0.0001	0.0198	4.0383	104.95
DPLM	0.0006	0.0198	-2.7809	68.24	SAFE	0	0.012	0.0198	20.97
DRX	0.0011	0.0155	4.5145	61.53	SAIN	-0.0011	0.042	-17.6562	424.68
ECM	0.0003	0.0107	0.8731	18	SBRE	-0.0002	0.0278	-0.197	7.31
EDIN	0.0012	0.0212	0.9252	13.37	SBRY	0.0014	0.0137	-1.6209	77.41
EMG	0.0006	0.0126	0.2988	14.8	SCIN	0.0005	0.0214	0.3924	7.21
ENOG	-0.0003	0.0383	-12.9841	368.69	SCT	0.0011	0.023	-2.1101	41.75
ERM	0.0005	0.0303	0.4088	11.29	SDP	-0.0001	0.0231	1.3867	26.38
ESNT	0.0016	0.0328	10.3302	233.9	SDR	-0.0001	0.0192	-0.2409	8.33
EVR	0.0001	0.0198	0.1227	6.77	SEQI	0.0005	0.0178	-0.4284	9.53
EWI	0.0011	0.025	0.5501	8.04	SGE	0.0008	0.0122	2.2634	26.79
EXPN	0.0007	0.03	0.3649	14.69	SGRO	0.0003	0.0146	-0.391	27.83
EZJ	-0.0002	0.0152	0.0923	7.5	SHB	0.0012	0.0471	21.7656	754.08
FCIT	0.0013	0.0213	6.566	137.32	SIG	0.0004	0.0167	0.7757	26.56
FCSS	-0.0006	0.0523	-9.9696	200.48	SKG	0.001	0.0594	23.3686	737.14
FDM	0.0003	0.0235	0.8465	10.92	SLA	0.0005	0.0138	3.1339	38.62
FERG	0.0003	0.0229	-1.5714	90.91	SMDS	0.0001	0.0111	2.4821	167.98
FEV	0.0004	0.0106	-0.2988	10.48	SMIN	0.0012	0.0062	1.0663	35
FGP	0.0002	0.0346	0.2476	6.16	SMP	0.0007	0.0148	2.2694	30.33
FGT	0.0006	0.013	0.1904	5.95	SMT	-0.0005	0.0195	-6.9578	147.44
FLTR	0.0005	0.0135	0.6217	19.24	SMWH	0.0003	0.0133	0.3002	34.65
FOUR	0.0008	0.019	0.4905	11.08	SN.	-0.0006	0.0326	0.0058	19.75
FRAS	0.0002	0.0138	1.2618	20.73	SNN	0.0008	0.0183	6.4586	136.43
FRES	0.0013	0.0454	0.3444	7.98	SOI	-0.0003	0.0216	1.1661	17.42
FSFL	0.0003	0.0144	-0.535	9.01	SONC	0.0003	0.0172	1.7363	40.24
FSJ	0.0004	0.0075	-0.7423	11.75	SONG	-0.0009	0.0445	-20.1155	453.54
FSV	0.0004	0.0158	1.9803	51.53	SPT	-0.0001	0.0345	-0.0907	5.71
FUTR	-0.0001	0.0325	3.551	110.58	SPX	0.0007	0.0351	-17.8638	513.99
FXPO	0.0007	0.0151	8.5511	249.76	SRE	0.0012	0.0116	1.801	25.59
GAW	0.0014	0.0149	-1.3883	48.04	SRP	0.0005	0.0139	4.1196	139.2
GCP	0.0001	0.0058	-0.2487	6.69	SSE	0.0008	0.0169	3.1005	45.58
GFS	0.0006	0.0325	0.2597	9.21	SSON	0.0002	0.0125	-0.256	13.46
GFTU	0.001	0.0344	0.2229	8.17	SSPG	0.0009	0.0145	0.0348	8.19
GLEN	-0.0005	0.0382	-1.6101	46.55	STAN	0.0013	0.0241	1.2037	11.35
GLO	0.0007	0.0256	1.0027	15.76	STJ	0.001	0.0363	0.8915	15.88

Table B- 6 Descriptive statistics - UK stocks – continued (3)									
Code	Mean	Std. Dev.	Skewness	Kurtosis	Code	Mean	Std. Dev.	Skewness	Kurtosis
GNC	0.0008	0.0355	4.2978	154.13	SVS	0.0002	0.0112	-0.0228	14.56
GNS	-0.0002	0.0372	-19.803	536.73	SVT	0.0003	0.027	1.008	11.67
GPOR	0.0002	0.0051	-0.4318	10.54	SXS	0.0006	0.0084	0.635	7.39
GRG	0.0003	0.0054	0.6757	16.08	SYNC	0.001	0.0336	2.042	22.1
GRI	0.0008	0.0157	1.8684	59.96	SYNT	0.0008	0.0189	1.5822	20.79
GSK	0.0008	0.0266	2.4958	48.47	TALK	-0.0002	0.0128	-0.1702	16.51
GSS	0.001	0.0141	2.043	20.58	TATE	0.0003	0.014	3.1242	65.01
GVC	-0.0002	0.0303	-0.0973	15.14	TBCG	-0.0008	0.0383	-16.1756	426.07
GYS	0.0013	0.0159	0.7064	21.43	TCAP	0.0029	0.041	1.871	17.49
HAS	0.0015	0.0168	1.1656	19.77	TEM	0.0011	0.0107	-0.895	11.28
HFG	0.0003	0.0181	-12.4649	368.05	TEP	0.0011	0.0177	2.0471	19.36
HGT	0.0002	0.0069	0.2808	24.86	TIFS	0.0001	0.0062	-0.7172	11.57
HICL	0.0008	0.0098	1.5555	21.92	TPK	-0.0012	0.0462	-12.9261	279.71
HIK	0.001	0.0128	5.3665	112.39	TRIG	0.0002	0.0308	0.7632	13.04
HILS	0.0001	0.0372	0.3198	21.75	TRN	0.0007	0.032	18.4025	724.87
HL.	-0.0001	0.0372	0.9566	12.48	TRY	-0.0026	0.0682	-8.7367	131.28
HLMA	0.0002	0.0244	-4.8356	187.62	TSCO	0.0004	0.0156	1.37	26.32
HOC	0.0013	0.0252	1.6935	22.07	TUI	0.0003	0.0083	-0.8042	21.23
HRI	-0.0003	0.0329	-21.1885	650.66	TW.	-0.0007	0.0231	-0.3919	16.94
HSBA	0.0008	0.0107	0.3647	9.52	UDG	0.0005	0.007	1.6077	40.35
HSL	-0.0017	0.0709	-10.2389	146.53	UKCM	0	0.0206	0.2834	6.48
HSTG	0.0003	0.0122	-1.3586	43.4	UKW	0.0004	0.0118	2.3188	31.45
HSV	-0.0077	0.0816	-11.9556	145.85	ULE	0.0003	0.0148	1.4903	19.21
HSX	0.0001	0.0094	12.0316	364.16	ULVR	0.0009	0.0192	1.0601	12.99
HTWS	0.0001	0.0093	0.456	17.52	USA	0.0007	0.0149	3.465	52.19
HVPE	0.0009	0.0217	-0.057	10.83	UTG	0.0005	0.0225	0.8626	8.56
HWDN	0	0.0237	1.297	24.29	UU.	0.0003	0.0135	0.8719	21.93
IAG	0.0005	0.0199	0.2892	6.9	VCT	0.0007	0.0218	2.105	142.1
IBST	-0.0013	0.041	-22.8904	559.13	VEC	-0.0003	0.0323	-26.2593	811.86
ICGT	0.0002	0.0155	1.7541	37.35	VEIL	0.001	0.0381	7.0579	151.24
ICP	0.0009	0.0364	0.4903	10.24	VMUK	-0.0008	0.0441	-9.3982	219.69
IEM	0.0012	0.0077	9.6169	147.85	VOD	0.0005	0.0136	0.3748	6.14
IGG	0.0002	0.0188	-0.175	18.98	VOF	-0.0024	0.0483	-13.4523	281.25
IHG	0.0012	0.0165	-0.2436	5.88	VSVS	0.0011	0.0196	0.3111	6.04
IHP	-0.0013	0.041	-22.8904	559.13	VTY	-0.0009	0.0648	-9.6078	155.12
III	-0.0005	0.0363	-16.2432	444.22	VVO	0.0005	0.0138	1.0017	17.4
IMB	0.0003	0.0151	2.7533	61.31	WEIR	0.0017	0.0107	1.2538	13
IMI	0.0015	0.0291	-1.0159	19.41	WG.	0.0004	0.0119	2.668	53.05
INCH	0.0004	0.0173	0.3754	56.14	WIZZ	0.0001	0.0146	0.0155	12.4
INDV	0.0002	0.0083	-0.4236	12.99	WKP	0.0008	0.0152	0.3197	6.29
INF	0.0008	0.0184	0.2352	5.94	WMH	0.0006	0.0132	-0.7913	25.3
INPP	0.0008	0.0142	3.7164	78.16	WOSG	0.0011	0.0248	-0.5992	16.44
INVP	0.0006	0.0439	-3.9168	73.62	WPP	0.0008	0.0219	-0.1557	6.94
IPO	0.0003	0.027	0.1796	19.84	WTAN	0.0004	0.0057	4.2456	48.51

Table B- 6 Descriptive statistics - UK stocks – continued (4)									
Code	Mean	Std. Dev.	Skewness	Kurtosis	Code	Mean	Std. Dev.	Skewness	Kurtosis
ITRK	0.0001	0.0435	-17.0348	407.07	WTB	0.0013	0.0143	1.6805	31.62
ITV	0.0006	0.0173	0.2233	6.19	WWH	0.0001	0.0252	1.015	23.88
IWG	0.0007	0.0082	1.8276	30.07	XPP	0	0.0253	0.1042	36.98

Table B- 7 Descriptive statistics - US stocks

Code	Mean	Std. Dev.	Skewness	Kurtosis	Code	Mean	Std. Dev.	Skewness	Kurtosis
ATVI	0.0003	0.0146	-0.3806	16.06	MTD	0.0005	0.0276	-3.5227	150.47
GOOGL	0.0006	0.0328	-3.6911	140.29	MYL	0.0004	0.0210	-10.6648	516.34
GOOG	0.0006	0.0189	-12.1664	672.27	PKI	0.0005	0.0176	0.7774	23.92
T	0.0004	0.0224	-9.3128	412.74	PRGO	0.0007	0.0325	-4.5152	170.78
CTL	0.0005	0.0164	0.2676	21.87	PFE	0.0006	0.0185	0.2042	10.45
CHTR	0.0007	0.0215	-10.1081	488.14	DGX	0.0008	0.0331	-3.6454	115.20
CMCSA	0.0010	0.0278	-5.5787	216.18	REGN	0.0003	0.0281	-9.6781	377.00
DISCA	0.0004	0.0296	-3.4121	184.90	RMD	0.0007	0.0222	0.1890	11.68
DISCK	-0.0003	0.0344	-15.5987	453.55	STE	0.0016	0.0402	-2.1846	80.12
DISH	0.0011	0.0376	-2.6244	115.30	SYK	0.0010	0.0256	-8.1087	338.08
EA	0.0006	0.0265	-11.5622	443.32	TFX	0.0008	0.0244	-9.2788	401.87
FB	0.0002	0.0180	-0.7179	35.16	COO	0.0003	0.0221	-0.5632	42.42
FOXA	0.0007	0.0248	-5.2043	232.10	TMO	0.0010	0.0333	-3.0128	117.99
FOX	0.0004	0.0149	-0.0681	16.76	UNH	0.0005	0.0186	0.1225	10.83
IPG	0.0013	0.0336	-4.0510	147.11	UHS	0.0004	0.0227	-25.9805	1153.1
LYV	0.0004	0.0161	0.3266	13.02	VAR	0.0004	0.0201	-0.4222	40.20
NFLX	0.0009	0.0258	2.1847	58.47	VRTX	0.0011	0.0313	-3.1762	129.61
NWSA	0.0004	0.0188	0.0669	20.56	WAT	-0.0040	0.0838	-10.4941	125.83
NWS	0.0006	0.0186	0.2636	21.06	WST	0.0006	0.0200	0.1061	8.83
OMC	0.0005	0.0349	-6.7108	203.76	ZBH	0.0004	0.0245	-12.3453	517.82
TMUS	0.0004	0.0200	-0.0119	13.19	ZTS	0.0005	0.0194	-0.0376	10.68
TTWO	0.0003	0.0133	-1.2487	47.10	MMM	0.0007	0.0239	-7.2815	320.82
DIS	0.0006	0.0238	-8.2704	373.35	AOS	0.0017	0.0378	-10.7081	293.21
TWTR	0.0004	0.0302	-5.9019	242.11	ALK	0.0007	0.0341	-18.1707	538.86
VZ	0.0009	0.0271	-7.2721	281.49	ALLE	0.0007	0.0201	0.1618	12.83
VIAC	0.0005	0.0248	-0.1270	17.27	AAL	0.0005	0.0311	-7.9863	281.30
AAP	-0.0019	0.0598	-12.4569	208.80	AME	0.0004	0.0246	-7.3547	333.41
AMZN	0.0006	0.0223	-12.8657	581.53	BA	0.0005	0.0153	0.2060	10.84
APTV	-0.0009	0.0387	-8.5087	241.74	CHRW	0.0006	0.0229	-0.0188	15.00
AZO	0.0008	0.0334	-4.0809	152.11	CARR	0.0003	0.0263	-7.6955	286.27
BBY	0.0005	0.0216	-9.3345	444.69	CAT	0.0004	0.0170	-0.0304	7.16
BKNG	0.0005	0.0218	0.3126	11.31	CTAS	-0.0001	0.0230	-25.0404	1084.8
BWA	0.0005	0.0193	-0.0747	12.28	CPRT	-0.0001	0.0292	-18.1124	623.31
KMX	0.0008	0.0318	-3.8092	140.07	CSX	0.0002	0.0170	12.1283	661.76
CCL	0.0006	0.0176	0.1031	9.50	CMI	0.0004	0.0306	-5.9464	196.86
CMG	0.0009	0.0294	1.3583	25.75	DE	0.0004	0.0193	0.4289	44.24
DHI	0.0005	0.0256	-8.7357	363.10	DAL	0.0006	0.0240	-11.0183	466.71
DRI	0.0007	0.0286	-7.0993	281.33	DOV	0.0005	0.0171	0.0558	9.82
DG	0.0005	0.0197	0.0639	8.29	ETN	0.0002	0.0136	-0.1098	15.20
DLTR	0.001	0.037	-5.049	146.80	EMR	0.0003	0.0319	-5.5946	215.10
DPZ	0.0006	0.0242	-8.0218	343.28	EFX	0.0004	0.0140	-1.1504	45.34

Table B-7 Descriptive statistics – US stock – continued (1)

Code	Mean	Std. Dev.	Skewness	Kurtosis	Code	Mean	Std. Dev.	Skewness	Kurtosis
EBAY	0.0003	0.0300	-1.2580	222.47	EXPD	0.0008	0.0191	0.5057	17.71
EXPE	0.0012	0.0388	-3.4697	126.38	FAST	0.0004	0.0266	-8.7296	352.21
F	0.0002	0.0375	-9.7374	253.25	FDX	0.0003	0.0314	-5.8983	230.68
GPS	0.0006	0.0261	-13.4106	526.53	FLS	0.0003	0.0141	0.1150	12.73
GRMN	0.0006	0.0441	-0.8904	63.35	FTV	0.0003	0.0199	-11.9995	617.95
GM	0.0004	0.0332	-7.6648	247.22	FBHS	0.0010	0.0316	0.8112	13.39
GPC	0.0002	0.0269	-12.6830	485.16	GD	0.0006	0.0200	-2.3859	69.38
HRB	0.0002	0.0280	-14.3075	518.55	GE	0.0006	0.0261	0.3564	13.21
HBI	0.0007	0.0336	-3.0971	133.40	GWW	0.0012	0.0447	-1.3567	51.02
HAS	0.0006	0.0246	-23.5131	957.56	HON	0.0011	0.0329	-2.9284	124.14
HLT	0.0008	0.0287	-6.7470	235.40	HWM	0.0008	0.0350	-4.9982	147.05
HD	0.0002	0.0159	-25.4476	1594.07	HII	0.0006	0.0230	-13.2375	583.18
KSS	0.0008	0.0281	-11.0745	399.62	IEX	0.0003	0.0276	-7.5664	288.12
LB	0.0006	0.0174	0.1058	8.99	INFO	0.0007	0.0258	-5.4528	240.85
LVS	-0.0020	0.0585	-11.8375	202.37	ITW	0.0005	0.0171	-0.2611	14.95
LEG	0.0007	0.0283	0.3760	14.54	IR	0.0003	0.0217	-14.2794	678.18
LEN	0.0002	0.0133	0.0212	15.26	JBHT	0.0001	0.0228	-11.9485	542.22
LKQ	0.0003	0.0138	-0.0300	15.66	J	0.0012	0.0432	-0.2360	66.86
LOW	0.0003	0.0264	-6.2245	269.57	JCI	0.0009	0.0262	-5.4700	227.05
MAR	-0.0015	0.0419	-16.2868	391.99	KSU	0.0009	0.0425	9.8629	274.96
MCD	0.0007	0.0261	0.4743	27.16	LHX	0.0003	0.0231	-13.9476	617.79
MGM	0.0008	0.0443	-1.0440	60.07	LMT	0.0010	0.0287	-6.0233	232.20
MHK	0.0011	0.0349	-2.6889	135.90	MAS	0.0009	0.0253	1.3189	30.58
NWL	0.0005	0.0167	0.5725	16.61	NLSN	0.0006	0.0197	-0.0833	14.08
NKE	0.0003	0.0169	0.2370	64.93	NSC	0.0006	0.0204	0.6820	16.43
NCLH	0.0008	0.0248	-13.0577	515.81	NOC	0.0008	0.0248	-8.5557	362.19
NVR	0.0005	0.0254	-8.7449	350.95	ODFL	0.0008	0.0283	-4.4917	178.52
ORLY	0.0010	0.0323	-3.2657	120.53	OTIS	0.0005	0.0317	-4.4589	152.04
PHM	0.0004	0.0165	-0.0311	12.40	PCAR	0.0006	0.0186	0.3245	13.11
PVH	0.0002	0.0154	-0.2108	18.05	PH	0.0008	0.0255	-7.5878	319.72
RL	0.0005	0.0264	-6.6906	261.01	PNR	0.0011	0.0309	-7.6667	267.21
ROST	0.0007	0.0428	-1.0910	79.95	PWR	0.0012	0.0402	-1.9284	88.58
RCL	0.0002	0.0227	-11.6327	546.74	RTX	0.0004	0.0213	-0.1827	10.89
SBUX	0.0003	0.0208	-16.1481	778.60	RSG	0.0005	0.0323	-6.4956	206.91
TPR	0.0005	0.0225	-13.1160	606.88	RHI	0.0006	0.0236	-1.9655	125.73
TGT	0.0004	0.0222	-13.6946	639.74	ROK	0.0003	0.0139	-0.2336	17.80
TIF	0.0002	0.0137	-0.4877	22.49	ROL	0.0013	0.0331	-12.6151	386.82
TJX	0.0003	0.0226	-14.2137	632.31	ROP	0.0007	0.0184	-0.0101	13.49
TSCO	0.0002	0.0147	0.0457	13.07	SNA	0.0002	0.0244	-9.5012	417.70
ULTA	0.0002	0.0151	0.1604	14.59	LUV	0.0014	0.0425	0.9920	14.18
UAA	0.0005	0.0312	-8.3000	276.77	SWK	0.0012	0.0435	-0.7391	40.81
UA	0.0008	0.0247	-6.7262	290.48	TDY	0.0009	0.0282	0.5056	9.05
VFC	0.0005	0.0261	-13.1527	520.25	TXT	0.0003	0.0289	-6.2175	259.68

Table B-7 Descriptive statistics – US stock – continued (2)									
Code	Mean	Std. Dev.	Skewness	Kurtosis	Code	Mean	Std. Dev.	Skewness	Kurtosis
WHR	0.0003	0.0147	-0.0473	17.79	TT	0.0004	0.0186	-0.0564	10.23
WYNN	0.0011	0.0416	-1.5275	72.14	TDG	0.0003	0.0129	0.0576	18.65
YUM	0.0009	0.0253	-7.0453	289.03	UNP	0.0009	0.0242	0.2128	10.04
MO	0.0004	0.0166	0.0163	22.39	UAL	0.0005	0.0198	0.2577	11.41
ADM	0.0006	0.0231	-7.2318	323.98	UPS	0.0009	0.0266	-7.0717	279.88
BF.B	0.0011	0.0374	-1.9652	95.00	URI	0.0007	0.0220	-0.6976	65.31
CPB	0.0004	0.0231	-16.1040	711.19	VRSK	0.0008	0.0275	-6.8056	248.21
CHD	0.0006	0.0274	-18.7970	692.88	WAB	0.0008	0.0229	-7.3520	343.46
KO	0.0007	0.0319	-4.0878	149.69	WM	0.0010	0.0314	-3.9773	132.69
CL	0.0006	0.0233	-0.4272	21.80	XYL	0.0009	0.0292	-6.2611	229.02
CAG	0.0006	0.0196	-0.0501	16.37	ACN	-0.0003	0.0342	-15.6268	453.41
STZ	0.0003	0.0220	0.5724	18.30	ADBE	0.0006	0.0276	-6.4526	240.97
COST	0.0009	0.0314	-11.1517	368.67	AMD	0.0006	0.0175	-0.0952	18.68
COTY	-0.0002	0.0346	-21.1501	615.47	AKAM	0.0004	0.0323	-8.6810	275.17
EL	0.0006	0.0285	-18.1155	637.80	APH	0.0007	0.0258	-6.1188	257.36
GIS	-0.0029	0.0544	-14.4063	265.07	ADI	0.0010	0.0359	-2.7948	117.08
HRL	0.0012	0.0409	-1.9133	89.49	ANSS	0.0006	0.0306	-6.7155	227.79
SJM	-0.0031	0.0543	-14.5492	268.27	AAPL	0.0006	0.0199	-0.0381	15.32
K	0.0019	0.0839	63.0843	4748.82	AMAT	0.0002	0.0265	-15.3133	585.16
KMB	0.0004	0.0341	-3.6348	119.95	ANET	-0.0024	0.0450	-11.2114	248.52
KHC	0.0007	0.0283	-3.7146	145.18	ADSK	0.0005	0.0241	-14.8033	611.09
KR	0.0005	0.0278	-8.9790	330.54	ADP	0.0008	0.0293	-6.8308	269.60
LW	0.0007	0.0292	-5.2782	211.35	AVGO	0.0007	0.0188	0.5035	11.62
MKC	0.0006	0.0184	0.2293	10.63	BR	0.0006	0.0238	0.1718	10.49
TAP	0.0003	0.0177	0.1853	12.13	CDNS	0.0004	0.0223	0.2803	39.06
MDLZ	0.0004	0.0137	0.2901	9.26	CDW	0.0004	0.0200	0.4598	19.13
MNST	-0.0002	0.0283	-16.9202	604.17	CSCO	0.0005	0.0181	-0.0388	13.96
PEP	0.0005	0.0229	-8.3238	384.25	CTXS	0.0007	0.0367	-0.0540	95.84
PM	0.0000	0.0284	-24.2330	854.17	CTSH	0.0005	0.0160	0.3628	19.44
PG	0.0003	0.0155	0.3067	12.78	GLW	0.0003	0.0286	-5.4165	186.79
SYY	0.0009	0.0328	-3.4578	122.61	DXC	0.0004	0.0175	0.2755	17.81
CLX	0.0007	0.0246	-12.8447	536.75	FFIV	0.0005	0.0199	-12.5332	624.19
HSY	0.0005	0.0175	0.1352	14.67	FIS	0.0005	0.0194	-0.1746	14.70
TSN	0.0003	0.0269	-8.6290	349.02	FISV	0.0007	0.0224	0.6005	11.65
WBA	0.0005	0.0170	0.2717	11.07	FLT	0.0007	0.0264	-5.7330	247.92
WMT	0.0005	0.0216	0.0209	13.01	FLIR	0.0008	0.0238	0.0422	14.05
APA	0.0004	0.0248	-0.4501	22.10	FTNT	0.0008	0.0275	-6.6700	261.77
BKR	0.0004	0.0312	-8.6257	294.55	IT	0.0005	0.0193	-0.1603	13.86
COG	0.0004	0.0351	0.5431	244.03	GPN	0.0008	0.0270	-13.3128	503.71
CVX	0.0003	0.0128	-0.3381	20.35	HPE	0.0004	0.0180	0.4680	22.96
CXO	0.0008	0.0257	0.8372	21.06	HPQ	0.0001	0.0409	-8.2538	202.02
COP	0.0004	0.0295	-15.5526	532.29	INTC	0.0010	0.0311	0.5770	25.75
DVN	0.0002	0.0210	-11.2869	565.93	IBM	0.0005	0.0265	-0.1700	26.70
FANG	0.0005	0.0247	-10.1519	423.39	INTU	0.0008	0.0226	0.5110	16.64

Table B-7 Descriptive statistics – US stock – continued (3)

Code	Mean	Std. Dev.	Skewness	Kurtosis	Code	Mean	Std. Dev.	Skewness	Kurtosis
EOG	0.0004	0.0234	-0.1415	13.47	IPGP	0.0005	0.0223	-9.0664	443.05
XOM	-0.0006	0.0357	-16.7402	469.05	JKHY	0.0003	0.0198	-12.4188	628.87
HAL	0.0000	0.0294	-21.8418	744.01	JNPR	0.0007	0.0350	-6.8865	206.96
HES	0.0010	0.0304	0.3851	16.23	KEYS	0.0006	0.0353	-5.7764	173.60
HFC	0.0009	0.0355	-2.5693	89.16	KLAC	-0.0013	0.0429	-10.7198	248.30
KMI	0.0010	0.0237	-7.6022	324.42	LRCX	0.0005	0.0170	-0.0904	9.11
MRO	0.0003	0.0225	-12.3498	557.79	LDOS	0.0006	0.0452	-1.7049	87.44
MPC	0.0004	0.0218	-10.3680	502.03	MA	0.0010	0.0274	-5.1633	206.10
NOV	0.0006	0.0157	0.4138	11.84	MXIM	0.0001	0.0200	-22.6594	1145.92
NBL	0.0005	0.0245	0.5617	16.50	MCHP	0.0002	0.0248	-9.4896	401.30
OXY	0.0004	0.0226	0.1007	13.56	MU	0.0008	0.0354	-3.8700	115.42
OKE	0.0005	0.0225	-0.0213	10.49	MSFT	0.0006	0.0254	-5.8745	248.90
PSX	0.0009	0.0254	-0.0542	11.69	MSI	0.0003	0.0264	-7.0674	257.92
PXD	0.0005	0.0244	2.1941	60.09	NTAP	0.0006	0.0281	-3.9063	155.89
SLB	0.0003	0.0263	-21.9535	834.48	NLOK	0.0007	0.0221	0.7556	14.97
FTI	0.0005	0.0383	10.8745	581.95	NVDA	0.0006	0.0285	-5.3936	200.63
VLO	0.0010	0.0275	-7.5293	268.34	ORCL	0.0010	0.0380	-2.7549	93.66
WMB	0.0008	0.0244	-15.9448	674.76	PAYX	0.0004	0.0230	-28.5152	1245.8
AFL	0.0002	0.0293	-23.5488	830.36	PAYC	0.0002	0.0181	-17.4829	980.32
ALL	0.0006	0.0174	0.1501	23.62	PYPL	0.0010	0.0380	-1.0284	86.30
AXP	0.0010	0.0391	-2.5979	96.25	QRVO	0.0010	0.0298	-3.9266	138.75
AIG	0.0013	0.0431	-1.3220	55.03	QCOM	0.0006	0.0192	0.0536	12.17
AMP	-0.0002	0.0415	-15.4878	375.35	CRM	0.0003	0.0269	-6.0034	252.78
AON	0.0009	0.0264	-0.1483	10.84	STX	0.0007	0.0257	-17.7447	699.37
AJG	0.0007	0.0309	-8.0926	298.26	NOW	0.0006	0.0230	1.0573	21.09
AIZ	0.0003	0.0163	0.0170	13.53	SWKS	0.0005	0.0174	0.3965	14.65
BAC	0.0003	0.0174	0.0463	10.08	SNPS	0.0006	0.0212	-8.0539	414.58
BRK.B	0.0003	0.0198	0.1348	13.76	TEL	0.0004	0.0266	-7.9321	308.31
BLK	0.0002	0.0291	-23.4262	809.35	TXN	0.0006	0.0176	0.1124	8.66
COF	0.0005	0.0215	0.3609	22.22	TYL	0.0008	0.0185	0.2752	9.14
CBOE	0.0010	0.0315	-3.8848	153.53	VRSN	0.0005	0.0246	-7.3178	347.70
SCHW	0.0012	0.0347	-3.5899	143.05	V	0.0011	0.0317	0.6071	8.86
CB	-0.0001	0.0334	-7.8444	247.72	WDC	0.0008	0.0266	-7.9415	324.92
CINF	0.0007	0.0327	-7.3863	253.35	WU	0.0004	0.0121	-0.2388	15.66
C	0.0003	0.0283	-22.6403	801.26	XRX	0.0004	0.0205	1.2069	31.48
CFG	0.0003	0.0232	-13.3196	581.76	XLNX	0.0002	0.0191	-13.0371	688.38
CME	0.0006	0.0259	-6.0123	242.21	ZBRA	0.0006	0.0184	0.7872	16.62
CMA	0.0010	0.0332	-1.4622	127.15	APD	0.0014	0.0602	18.3730	859.33
DFS	0.0008	0.0252	0.8795	12.87	ALB	0.0000	0.0258	-16.2119	626.49
ETFC	0.0005	0.0163	-0.2375	13.74	AMCR	-0.0007	0.0363	-15.0007	415.24
RE	-0.0043	0.0849	-9.7917	123.46	AVY	0.0003	0.0199	-0.0814	13.98
FITB	0.0004	0.0142	-0.1004	10.52	BLL	0.0004	0.0214	0.3086	12.31
FRC	0.0005	0.0263	-6.6437	301.15	CE	0.0005	0.0301	-16.1901	532.94
BEN	0.0004	0.0215	0.4363	17.80	CF	0.0005	0.0284	1.6299	112.36

Table B-7 Descriptive statistics – US stock – continued (4)

Code	Mean	Std. Dev.	Skewness	Kurtosis	Code	Mean	Std. Dev.	Skewness	Kurtosis
GL	0.0005	0.0374	-2.6356	102.42	CTVA	0.0002	0.0217	-19.2401	893.31
GS	0.0009	0.0231	0.4134	11.26	DOW	0.0006	0.0346	-4.7221	157.24
HIG	0.0004	0.0154	0.1264	18.38	DD	0.0003	0.0139	-1.5611	76.75
HBAN	0.0004	0.0214	1.1547	64.29	EMN	0.0002	0.0229	0.1303	23.23
ICE	0.0004	0.0318	-19.5356	621.90	ECL	0.0009	0.0330	-3.3431	112.85
IVZ	0.0004	0.0148	-0.2469	15.49	FMC	0.0003	0.0263	-23.3030	890.80
JPM	0.0017	0.0386	-1.9411	85.21	FCX	0.0005	0.0235	-12.6300	552.24
KEY	0.0002	0.0240	-9.0105	419.22	IFF	0.0008	0.0282	-5.7004	215.80
LNC	-0.0006	0.0277	-18.6758	675.62	IP	0.0003	0.0225	-17.5175	783.63
L	0.0009	0.0336	-2.1381	81.62	LIN	0.0006	0.0205	0.2113	9.31
MTB	0.0005	0.0269	-6.8280	267.67	LYB	0.0005	0.0230	0.5561	23.17
MKTX	-0.0012	0.0330	-20.3139	613.44	MLM	0.0004	0.0272	-24.7074	912.23
MMC	0.0006	0.0198	-3.3314	130.49	NEM	0.0005	0.0236	-15.0999	650.57
MET	0.0008	0.0282	-2.9854	139.77	NUE	0.0006	0.0371	-11.7389	321.18
MCO	0.0005	0.0202	0.1449	10.44	PKG	0.0004	0.0189	-15.4391	835.25
MS	0.0005	0.0275	-6.0900	223.87	PPG	0.0004	0.0256	-13.8060	546.58
MSCI	0.0010	0.0367	-1.6568	66.62	SEE	0.0002	0.0188	-15.6969	847.21
NDAQ	-0.0026	0.0586	-13.6128	232.77	SHW	0.0003	0.0177	-18.9250	1073
NTRS	-0.0001	0.0374	-18.5064	493.36	MOS	0.0010	0.0307	-3.6048	132.89
PBCT	0.0005	0.0415	-1.6603	125.61	VMC	0.0006	0.0177	-0.2432	14.54
PNC	0.0005	0.0198	-0.2971	18.83	WRK	0.0011	0.0406	49.6689	3846.2
PFG	0.0001	0.0237	-20.8136	870.75	ARE	0.0003	0.0215	-14.2811	678.82
PGR	0.0009	0.0301	0.5864	10.66	AMT	0.0004	0.0193	0.2105	11.18
PRU	0.0004	0.0167	-0.4912	21.36	AIV	0.0010	0.0353	-2.7315	107.07
RJF	0.0005	0.0253	0.7918	52.43	AVB	0.0002	0.0280	-5.2488	198.54
RF	0.0005	0.0212	-14.0238	672.68	BXP	0.0006	0.0182	0.2400	11.32
SPGI	0.0006	0.0345	-5.9032	192.44	CBRE	0.0004	0.0238	0.6763	30.00
STT	0.0007	0.0274	-10.6807	406.70	CCI	0.0004	0.0174	-0.6387	15.76
SIVB	0.0001	0.0164	-25.6156	1562.69	DLR	0.0005	0.0161	-0.1054	13.47
SYF	0.0004	0.0206	-17.2331	844.37	DRE	0.0003	0.0190	-22.4343	1205.4
TROW	0.0005	0.0177	0.0565	15.35	EQIX	0.0011	0.0337	-3.0229	96.82
BK	0.0007	0.0220	0.0353	9.12	EQR	0.0006	0.0227	-7.5080	363.78
TRV	0.0003	0.0301	-13.6444	450.77	ESS	0.0011	0.0377	-2.1507	76.42
TFC	0.0005	0.0175	0.5108	22.14	EXR	0.0007	0.0256	-10.5903	429.58
USB	0.0001	0.0271	-6.9543	258.78	FRT	0.0012	0.0325	-3.1414	112.25
UNM	0.0001	0.0329	-11.7289	358.20	PEAK	0.0006	0.0205	0.1616	13.99
WRB	0.0010	0.0328	-6.3641	220.36	HST	0.0009	0.0423	-2.0647	72.61
WFC	0.0004	0.0253	-10.3983	422.60	IRM	0.0004	0.0249	-8.9150	373.71
WLTW	0.0004	0.0158	-0.1678	16.03	KIM	0.0010	0.0289	-14.1611	493.17
ZION	-0.0005	0.0395	-8.0979	242.06	MAA	0.0004	0.0239	-20.5426	871.19
ABT	0.0004	0.0237	-10.4466	458.07	PLD	0.0006	0.0161	0.3648	9.59
ABBV	0.0005	0.0215	0.1490	9.26	PSA	0.0010	0.0463	46.5473	3227.1
ABMD	0.0011	0.0270	-13.0920	504.63	O	0.0005	0.0270	-6.1164	241.31

Table B-7 Descriptive statistics – US stock – continued (5)									
Code	Mean	Std. Dev.	Skewness	Kurtosis	Code	Mean	Std. Dev.	Skewness	Kurtosis
A	0.0009	0.0301	-3.9639	149.49	REG	0.0008	0.0316	-4.0955	130.70
ALXN	0.0005	0.0166	-0.0807	29.21	SBAC	0.0004	0.0154	0.3315	10.40
ALGN	0.0005	0.0165	-0.0022	12.75	SPG	0.0005	0.0250	-12.8613	528.72
ABC	0.0004	0.0237	-12.3190	496.61	SLG	0.0007	0.0318	-4.7699	159.15
AMGN	0.0006	0.0201	-0.4396	14.11	UDR	0.0005	0.0216	-10.4564	482.73
ANTM	0.0004	0.0160	-0.3240	14.74	VTR	0.0007	0.0338	-3.1305	139.24
BAX	0.0003	0.0291	-7.2063	273.67	VNO	0.0001	0.0280	-8.9259	327.58
BDX	0.0006	0.0161	-0.0501	7.42	WELL	0.0012	0.0907	-8.2336	94.26
BIO	0.0002	0.0134	0.0532	23.17	WY	0.0004	0.0188	-0.1140	9.29
BIIB	0.0007	0.0234	-12.8793	565.75	Symbol	0.0001	0.0248	-24.3200	978.93
BSX	0.0006	0.0325	-2.5653	128.56	AES	0.0009	0.0384	-2.0838	146.76
BMY	0.0010	0.0324	-3.7878	134.13	LNT	0.0006	0.0290	-21.5678	746.72
CAH	0.0010	0.0396	-1.5734	48.91	AEE	0.0006	0.0297	-9.5103	321.59
CNC	0.0010	0.0236	-8.4777	365.27	AEP	0.0012	0.0387	0.5873	18.21
CERN	0.0002	0.0213	-14.7266	713.98	AWK	0.0009	0.0302	-7.7266	257.61
CI	0.0005	0.0279	-5.9070	230.78	ATO	0.0002	0.0180	1.8197	167.01
CVS	0.0004	0.0237	-4.8977	410.21	CNP	-0.0022	0.0562	-16.3382	293.38
DHR	0.0001	0.0195	-26.7728	1375.61	CMS	0.0009	0.0319	-3.2714	125.87
DVA	0.0110	0.8938	94.9456	9044.63	ED	0.0007	0.0331	-7.2589	218.18
XRAY	0.0005	0.0218	0.2207	12.97	D	0.0008	0.0301	-3.7782	147.26
DXCM	0.0006	0.0253	-10.6114	428.81	DTE	0.0008	0.0254	-21.4582	852.08
EW	0.0006	0.0318	-1.2615	224.76	DUK	0.0004	0.0167	0.0652	16.09
GILD	0.0005	0.0235	-0.0018	11.72	EIX	0.0009	0.0296	-9.8181	345.68
HCA	0.0007	0.0287	-12.6571	445.50	ETR	0.0004	0.0232	-10.7986	488.81
HSIC	0.0008	0.0308	-1.6527	122.49	EVRG	0.0006	0.0231	0.0164	33.91
HOLX	0.0005	0.0287	-8.3849	315.44	ES	0.0006	0.0127	1.9638	48.96
HUM	0.0004	0.0338	-4.0720	130.94	EXC	0.0003	0.0143	1.0865	71.83
IDXX	0.0011	0.0393	-1.8316	75.77	FE	0.0001	0.0092	-0.6257	19.91
ILMN	0.0017	0.0384	-3.4140	111.69	NEE	0.0002	0.0098	-0.5746	12.64
INCY	0.0004	0.0220	-0.1656	17.22	NI	0.0007	0.0119	-1.8899	82.60
ISRG	0.0004	0.0270	1.5686	113.38	NRG	0.0009	0.0187	0.6786	18.71
IQV	0.0004	0.0249	0.1643	13.39	PNW	0.0010	0.0363	0.8915	5.88
JNJ	-0.0005	0.0290	-21.2321	732.93	PPL	0.0002	0.0112	-0.0228	24.56
LH	-0.0005	0.0289	-21.5911	748.50	PEG	0.0003	0.0270	1.0080	13.67
LLY	0.0004	0.0132	0.1205	16.71	SRE	0.0006	0.0084	0.6350	9.39
MCK	-0.0004	0.0274	-19.4574	702.90	SO	0.0010	0.0343	2.0420	23.10
MDT	0.0008	0.0234	-7.3597	328.46	WEC	0.0008	0.0200	1.5822	20.79
MRK	0.0002	0.0145	-0.2682	15.94	XEL	0.0003	0.0195	-0.0018	9.72

Table B- 8 Descriptive statistics - China stocks

Code	Mean	Std. Dev.	Skewness	Kurtosis	Code	Mean	Std. Dev.	Skewness	Kurtosis
600000	0.0002	0.0250	-11.49	474	600895	0.0005	0.0298	-8.20	283
600004	-0.0007	0.0418	-18.02	436	600900	0.0010	0.0255	-11.30	454
600009	-0.0008	0.0346	-17.11	496	600909	0.0005	0.0286	-7.98	286
600010	0.0002	0.0359	-12.20	343	600919	0.0001	0.0288	-8.00	289
600011	-0.0012	0.0339	-24.74	731	600926	0.0009	0.0292	-7.74	271
600015	0.0002	0.0355	-8.98	257	600928	0.0003	0.0301	-6.96	240
600016	0.0001	0.0317	-13.85	445	600958	0.0009	0.0332	-6.17	191
600018	-0.0002	0.0234	-29.06	1248	600968	0.0006	0.0318	-6.16	199
600019	0.0003	0.0284	-12.21	437	600977	0.0007	0.0311	-7.29	242
600025	-0.0005	0.0285	-20.67	732	600989	0.0005	0.0320	-5.86	199
600028	-0.0004	0.0253	-17.54	700	600999	0.0005	0.0311	-6.39	215
600029	0.0002	0.0329	-11.86	371	601006	0.0009	0.0297	-8.51	294
600030	0.0000	0.0247	-13.23	544	601009	0.0008	0.0301	-9.41	299
600031	0.0001	0.0329	-10.44	329	601012	0.0009	0.0344	-5.60	168
600036	-0.0002	0.0284	-12.69	460	601021	0.0000	0.0264	-11.03	420
600038	0.0000	0.0234	-21.32	920	601066	0.0006	0.0321	-6.82	214
600048	-0.0001	0.0336	-9.58	288	601077	0.0007	0.0333	-6.51	196
600050	-0.0004	0.0384	-11.22	296	601088	0.0006	0.0331	-5.47	184
600061	-0.0001	0.0293	-11.69	405	601099	0.0011	0.0244	-13.47	567
600066	0.0005	0.0297	-4.50	201	601100	0.0008	0.0305	-7.63	255
600068	-0.0005	0.0279	-15.52	567	601108	0.0005	0.0312	-7.11	230
600085	0.0000	0.0296	-10.43	364	601111	0.0008	0.0356	-4.36	133
600089	0.0007	0.0328	-11.78	366	601138	0.0010	0.0334	-5.72	184
600104	0.0003	0.0315	-6.98	229	601155	0.0012	0.0349	-5.25	158
600109	-0.0048	0.0657	-14.52	221	601162	0.0004	0.0310	-7.67	254
600111	-0.0001	0.0271	-16.84	633	601166	0.0002	0.0268	-11.61	440
600115	-0.0003	0.0310	-13.99	459	601169	0.0008	0.0289	-8.36	297
600118	-0.0001	0.0317	-11.08	360	601186	0.0008	0.0327	-5.83	180
600150	0.0024	0.0675	-9.06	138	601198	0.0004	0.0311	-6.89	226
600155	0.0001	0.0288	-12.81	462	601211	0.0004	0.0279	-5.30	247
600176	-0.0002	0.0260	-21.19	827	601225	0.0011	0.0498	33.06	2060
600177	-0.0001	0.0327	-12.42	389	601229	0.0012	0.0521	35.12	2178
600183	-0.0053	0.0714	-12.77	179	601233	0.0008	0.0340	-2.94	113
600196	-0.0002	0.0260	-21.19	827	601236	0.0005	0.0341	-2.40	123
600201	0.0008	0.0313	-6.81	228	601238	0.0008	0.0308	-3.51	174
600208	-0.0009	0.0237	-22.00	934	601288	0.0010	0.0277	-7.02	274
600271	-0.0018	0.0551	-12.20	225	601318	0.0003	0.0248	-12.64	515
600276	0.0001	0.0314	-8.71	286	601319	0.0005	0.0395	12.20	747
600298	0.0000	0.0284	-15.47	549	601328	0.0003	0.0403	-9.74	247
600309	-0.0003	0.0456	-11.79	263	601336	0.0003	0.0213	-23.33	1103
600332	-0.0004	0.0419	-13.56	330	601377	-0.0007	0.0411	-13.87	344

Table B- 8 Descriptive statistics - China stocks – continued (1)									
Code	Mean	Std. Dev.	Skewness	Kurtosis	Code	Mean	Std. Dev.	Skewness	Kurtosis
600340	0.0011	0.0314	-11.12	362	601390	-0.0012	0.0332	-24.25	734
600346	0.0000	0.0304	-10.67	363	601398	-0.0025	0.0544	-13.83	257
600352	0.0001	0.0332	-11.05	344	601519	-0.0001	0.0413	-9.45	233
600362	-0.0047	0.0653	-14.26	218	601555	-0.0005	0.0374	-12.84	351
600383	0.0000	0.0331	-9.25	295	601601	-0.0032	0.0568	-15.08	266
600406	0.0001	0.0302	-13.95	470	601607	-0.0007	0.0379	-16.39	436
600436	-0.0002	0.0243	-20.29	840	601618	0.0002	0.0266	-9.85	382
600438	-0.0003	0.0310	-13.99	459	601628	-0.0035	0.0554	-15.08	272
600487	-0.0002	0.0232	-21.26	928	601633	-0.0001	0.0302	-12.35	421
600489	-0.0001	0.0305	-12.27	412	601658	0.0000	0.0268	-14.02	527
600516	0.0007	0.0535	-10.22	196	601668	0.0000	0.0273	-14.13	525
600519	-0.0003	0.0273	-13.74	514	601669	0.0016	0.0378	-8.17	222
600521	0.0019	0.0451	-6.85	157	601688	0.0004	0.0361	-13.86	393
600522	0.0014	0.0450	-10.23	233	601698	0.0007	0.0351	1.37	97
600536	0.0020	0.0498	-12.30	252	601766	-0.0003	0.0291	-15.65	541
600547	0.0005	0.0253	-12.57	512	601788	-0.0004	0.0280	-13.20	477
600570	0.0011	0.0339	-16.44	489	601800	-0.0003	0.0339	-7.56	230
600572	0.0008	0.0372	-11.66	316	601816	0.0000	0.0256	-11.42	454
600585	0.0031	0.0501	-8.59	177	601818	0.0008	0.0339	-11.34	330
600588	0.0010	0.0424	-13.68	327	601857	-0.0011	0.0464	-12.48	272
600598	0.0004	0.0395	-11.55	297	601860	0.0004	0.0330	-7.41	232
600600	0.0018	0.0474	-6.18	135	601872	-0.0018	0.0482	-14.01	292
600604	0.0002	0.0409	-15.37	380	601877	0.0017	0.0527	0.68	63
600606	-0.0002	0.0627	-12.01	193	601878	0.0006	0.0559	-10.57	193
600621	0.0027	0.0474	-8.38	184	601881	0.0002	0.0282	-12.34	446
600637	0.0001	0.0375	-8.81	243	601888	-0.0003	0.0262	-16.17	626
600660	0.0006	0.0320	-4.80	156	601899	-0.0001	0.0290	-12.14	429
600690	0.0008	0.0333	-7.16	222	601901	-0.0003	0.0391	-11.07	289
600699	0.0002	0.0269	-10.67	410	601916	0.0003	0.0221	-7.00	278
600703	0.0005	0.0320	-4.89	160	601933	0.0001	0.0198	-11.50	729
600705	0.0002	0.0262	-12.36	472	601939	0.0007	0.0264	-8.97	307
600733	0.0005	0.0265	-8.80	337	601985	0.0001	0.0267	-5.67	344
600737	0.0002	0.0278	-7.48	280	601988	0.0006	0.0314	-4.20	325
600741	0.0005	0.0257	-9.57	380	601989	0.0008	0.0164	-12.30	186
600745	0.0007	0.0313	0.48	403	601990	-0.0001	0.0247	-9.47	722
600760	0.0005	0.0275	-8.13	301	601998	0.0005	0.0269	-5.16	286
600763	0.0008	0.0365	4.17	359	603019	0.0009	0.0349	-8.23	466
600779	0.0008	0.0322	-4.68	158	603160	0.0004	0.0208	-4.72	827
600795	0.0001	0.0289	-6.65	243	603259	0.0003	0.0317	-6.53	860
600801	0.0009	0.0318	-4.97	167	603288	0.0008	0.0407	-5.19	340

Table B- 8 Descriptive statistics - China stocks – continued (2)

Code	Mean	Std. Dev.	Skewness	Kurtosis	Code	Mean	Std. Dev.	Skewness	Kurtosis
600809	0.0005	0.0311	-5.57	188	603369	0.0007	0.0347	-10.27	508
600837	0.0005	0.0247	-11.27	459	603501	0.0006	0.0234	-11.32	532
600848	0.0003	0.0287	-7.30	261	603517	0.0001	0.0333	-12.38	153
600867	0.0008	0.0307	-6.18	206	603589	0.0004	0.0241	-7.36	189
600872	0.0004	0.0276	-6.51	344	603799	0.0008	0.0277	-4.21	813
600875	0.0008	0.0313	-5.88	187	603833	0.0007	0.0307	-6.69	747
600886	0.0007	0.0284	-7.39	269	603983	0.0006	0.0257	-8.34	658
600887	0.0006	0.0288	-7.36	259	603986	0.0001	0.0268	-9.16	352
600893	0.0002	0.0310	-5.89	199	603993	0.0002	0.0210	-13.30	347

Table B- 9 Descriptive statistics - Japan stocks

Code	Mean	Std. Dev.	Skewness	Kurtosis	Code	Mean	Std. Dev.	Skewness	Kurtosis
4503	0.0005	0.0193	0.62	10	1605	0.0007	0.0247	1.13	19
4519	-0.0004	0.0286	-21.38	749	3401	0.0013	0.0361	-2.68	110
4568	0.0002	0.0239	-12.36	536	3402	0.0003	0.0203	0.36	8
4506	-0.0002	0.0277	-8.72	330	3101	0.0004	0.0213	-9.34	459
4523	-0.0020	0.0467	-19.83	424	3103	0.0003	0.0267	0.59	8
4151	0.0009	0.0357	-2.79	96	3863	0.0003	0.0240	0.44	8
4578	0.0004	0.0226	0.58	9	3861	0.0002	0.0209	0.40	8
4507	0.0003	0.0233	0.54	11	3407	0.0002	0.0230	-12.31	587
4502	0.0004	0.0203	0.32	9	4061	0.0004	0.0220	0.46	7
6857	0.0003	0.0202	0.54	9	4631	-0.0002	0.0283	-10.53	376
6770	0.0000	0.0291	-8.59	308	4901	0.0002	0.0163	1.21	27
7751	0.0003	0.0206	0.37	9	4452	0.0005	0.0228	0.62	13
6952	0.0002	0.0193	0.53	10	3405	0.0002	0.0177	0.67	13
7735	0.0003	0.0240	-6.04	271	4188	0.0002	0.0358	-1.71	82
6902	-0.0003	0.0286	-11.27	424	4183	0.0002	0.0215	0.58	9
6954	0.0003	0.0200	0.55	12	4021	0.0003	0.0195	0.81	10
6504	-0.0009	0.0354	-18.69	530	6988	0.0002	0.0224	0.91	14
6702	0.0000	0.0295	-4.61	175	4063	0.0002	0.0264	0.91	13
6674	0.0004	0.0236	0.69	10	4911	0.0003	0.0182	0.70	12
6501	0.0008	0.0314	-6.92	244	4004	0.0003	0.0189	0.93	22
6971	0.0005	0.0230	0.46	9	4005	0.0006	0.0215	0.44	7
6479	0.0004	0.0210	0.51	9	4043	0.0004	0.0182	0.46	10
6503	0.0004	0.0300	1.57	25	4042	0.0004	0.0253	0.45	8
6701	0.0003	0.0209	0.68	10	4208	0.0003	0.0221	0.35	7
3105	0.0004	0.0300	1.57	25	5020	0.0004	0.0248	0.66	12
6703	0.0004	0.0239	0.43	8	5019	0.0005	0.0261	0.86	16
6645	0.0003	0.0216	0.67	11	5108	0.0003	0.0239	0.65	11
6752	0.0003	0.0218	0.67	9	5101	-0.0001	0.0273	-13.37	496
7752	0.0003	0.0183	0.54	11	5201	0.0005	0.0196	0.46	11
6724	0.0003	0.0214	0.78	13	5333	0.0004	0.0195	0.24	10
6758	0.0003	0.0221	0.99	23	5214	0.0004	0.0227	0.64	10
6976	0.0003	0.0231	0.33	8	5202	0.0005	0.0297	-3.61	136
6762	0.0006	0.0223	0.30	7	5232	0.0002	0.0421	-1.42	55
8035	0.0003	0.0217	0.38	9	5233	0.0004	0.0209	0.39	10
6506	0.0002	0.0320	-6.64	237	5301	0.0005	0.0250	0.91	14
6841	0.0003	0.0280	-5.26	197	5332	0.0005	0.0211	0.39	9
7205	0.0002	0.0246	0.61	12	5411	0.0006	0.0248	-5.28	238
7267	0.0003	0.0257	0.34	8	5406	0.0004	0.0245	0.38	8
7202	0.0005	0.0279	0.99	12	5401	0.0004	0.0219	0.45	8
7261	0.0003	0.0247	0.22	8	5541	0.0005	0.0250	0.91	14
7211	0.0004	0.0216	0.34	8	5714	0.0004	0.0252	1.13	14
7201	0.0004	0.0210	0.44	10	5803	0.0003	0.0203	0.28	7

Table B- 9 Descriptive statistics - Japan stocks – continued (1)									
Code	Mean	Std. Dev.	Skewness	Kurtosis	Code	Mean	Std. Dev.	Skewness	Kurtosis
7270	0.0002	0.0208	0.43	8	5801	0.0004	0.0235	-5.20	285
7269	0.0004	0.0239	0.36	7	5711	0.0003	0.0239	0.62	10
7203	0.0003	0.0243	0.31	7	5706	0.0004	0.0220	0.33	8
7272	0.0003	0.0230	0.61	13	5703	0.0003	0.0216	0.27	8
7762	0.0005	0.0267	0.41	8	3436	0.0003	0.0228	0.46	11
4902	0.0004	0.0266	0.75	11	5802	0.0003	0.0258	0.57	12
7731	0.0003	0.0239	0.49	8	5713	0.0005	0.0235	0.40	7
7733	0.0002	0.0277	-9.05	343	5707	0.0003	0.0200	0.39	11
4543	0.0003	0.0231	0.43	8	5901	0.0005	0.0202	0.56	11
9433	-0.0001	0.0283	-18.65	698	8001	0.0003	0.0212	0.36	8
9432	0.0003	0.0217	0.99	24	8002	0.0000	0.0286	-9.14	338
9613	0.0000	0.0273	-17.75	655	8058	0.0004	0.0219	0.37	8
9437	-0.0001	0.0295	-8.91	308	8031	0.0007	0.0297	3.39	110
9412	0.0002	0.0258	-11.86	468	2768	0.0005	0.0241	0.44	7
9434	0.0004	0.0201	0.44	8	8053	0.0007	0.0283	-3.91	155
9984	0.0003	0.0228	0.71	11	8015	0.0006	0.0259	0.54	8
8304	-0.0003	0.0290	-23.79	824	1721	0.0005	0.0242	0.24	7
8331	0.0003	0.0249	0.68	10	1925	0.0003	0.0193	0.29	10
7186	0.0002	0.0266	0.53	11	1808	0.0004	0.0209	0.34	10
8309	0.0004	0.0181	0.56	10	1963	-0.0016	0.0408	-18.83	463
8354	0.0004	0.0172	0.38	9	1812	0.0004	0.0269	-4.46	183
8306	0.0001	0.0229	-12.12	545	1802	0.0002	0.0257	0.50	8
8411	0.0004	0.0198	0.34	9	1928	0.0003	0.0248	1.29	18
8308	-0.0003	0.0265	-20.86	795	1803	0.0003	0.0250	0.47	10
8303	0.0003	0.0241	-23.54	983	1801	0.0006	0.0266	0.54	9
8355	0.0005	0.0170	0.61	12	6113	0.0003	0.0191	0.43	10
8316	0.0003	0.0195	0.49	10	6367	0.0000	0.0291	-8.44	297
8253	0.0004	0.0179	-0.21	15	6367	0.0002	0.0240	0.51	9
8697	0.0004	0.0195	0.29	9	6305	0.0002	0.0210	0.61	9
8601	0.0003	0.0207	0.39	12	7004	0.0006	0.0334	1.28	16
8628	0.0004	0.0225	0.74	12	7013	0.0000	0.0254	-23.57	931
8604	0.0004	0.0268	-6.06	241	5631	0.0004	0.0251	0.50	10
8750	0.0002	0.0171	0.18	9	6473	0.0004	0.0213	0.48	9
8725	0.0003	0.0179	0.38	10	6301	0.0005	0.0281	0.82	11
8630	0.0004	0.0230	0.48	8	6326	0.0002	0.0251	0.49	9
8795	0.0003	0.0213	0.56	8	7011	-0.0002	0.0284	-3.01	239
8766	0.0004	0.0211	0.76	10	6471	0.0002	0.0211	0.42	9
1332	0.0004	0.0222	0.43	8	6472	0.0005	0.0240	0.55	9
1333	0.0005	0.0243	0.55	9	6103	0.0005	0.0231	0.72	10
2802	0.0005	0.0272	0.64	11	6302	0.0004	0.0186	0.60	10
2502	0.0004	0.0292	-3.05	139	7012	0.0004	0.0228	0.43	8
2914	0.0003	0.0222	-7.55	359	7003	0.0005	0.0209	0.46	8
2801	0.0004	0.0241	-7.88	352	7832	0.0001	0.0250	-10.90	477
2503	0.0009	0.0311	-4.60	164	7912	-0.0011	0.0303	-20.52	663

Table B- 9 Descriptive statistics - Japan stocks – continued (2)									
Code	Mean	Std. Dev.	Skewness	Kurtosis	Code	Mean	Std. Dev.	Skewness	Kurtosis
2269	0.0003	0.0226	0.23	10	7911	0.0004	0.0240	0.33	9
2871	0.0003	0.0230	0.37	13	7951	0.0006	0.0243	0.31	14
2282	0.0004	0.0206	0.32	9	8802	0.0004	0.0232	-7.70	360
2002	-0.0001	0.0263	-13.79	531	8801	0.0004	0.0254	0.62	10
2501	0.0004	0.0210	-9.79	497	8830	0.0004	0.0254	0.52	8
2531	0.0002	0.0215	0.44	10	8804	0.0004	0.0259	0.60	8
8267	0.0002	0.0210	-17.98	863	3289	0.0003	0.0252	0.61	8
8028	0.0000	0.0202	-17.08	850	9022	0.0004	0.0263	1.09	13
9983	0.0003	0.0176	0.52	13	9020	0.0004	0.0177	0.47	9
3099	0.0003	0.0165	0.36	10	9009	0.0002	0.0290	-3.39	144
3086	0.0002	0.0165	0.57	12	9007	0.0002	0.0358	-5.51	161
8252	0.0003	0.0206	0.64	10	9001	0.0003	0.0199	0.41	9
3382	0.0000	0.0210	-17.14	826	9005	0.0006	0.0259	0.73	9
8233	0.0010	0.0404	-2.48	76	9021	0.0005	0.0297	0.49	9
4751	0.0004	0.0247	0.45	7	9062	0.0004	0.0224	0.39	9
2432	0.0004	0.0349	-5.36	171	9064	0.0004	0.0206	-8.75	453
4324	0.0001	0.0261	-11.29	444	9107	0.0003	0.0264	-7.50	296
6178	-0.0013	0.0311	-25.24	811	9104	0.0000	0.0220	-9.90	494
9766	0.0005	0.0292	-4.56	173	9101	0.0004	0.0258	-8.59	343
2413	0.0012	0.0298	-11.46	397	9302	0.0011	0.0159	-8.14	254
4755	0.0006	0.0370	-2.02	123	9301	0.0002	0.0187	-9.02	69
6098	0.0004	0.0322	-18.85	588	9502	0.0007	0.0310	-7.45	35
9735	0.0005	0.0204	-9.28	487	9503	0.0006	0.0237	-6.57	99
9602	0.0005	0.0192	1.45	44	9501	-0.0001	0.0262	-9.68	63
4704	0.0006	0.0334	-4.23	145	9532	0.0003	0.0173	-11.30	123
4689	0.0006	0.0207	0.57	10	9531	0.0002	0.0126	-13.20	623

Table B- 10 Descriptive statistics - India stocks

Code	Mean	Std. Dev.	Skewness	Kurtosis
532215	0.0010	0.0192	0.50	10
532977	0.0009	0.0192	1.50	24
500034	0.0009	0.0309	-5.35	187
532978	0.0008	0.0339	-3.68	140
532454	0.0014	0.0278	-6.45	242
532281	0.0010	0.0225	1.12	23
500010	0.0010	0.0351	-2.21	107
500180	0.0009	0.0263	1.46	27
500696	0.0009	0.0263	0.46	11
532174	0.0008	0.0260	-12.54	491
532187	0.0009	0.0199	4.65	131
500209	0.0011	0.0315	-5.09	185
500875	0.0001	0.0242	-16.58	698
500247	0.0002	0.0275	-6.76	277
500510	0.0003	0.0296	-2.10	672
500520	0.0010	0.0263	1.89	35
532500	0.0010	0.0308	3.70	89
500790	0.0004	0.0354	-5.69	190
532555	0.0007	0.0276	0.25	8
500312	0.0007	0.0245	-15.94	661
532898	0.0007	0.0307	-7.75	333
500325	0.0013	0.0291	0.67	9
500112	0.0006	0.0258	-17.94	700
524715	0.0007	0.0256	-13.96	557
500470	0.0010	0.0305	-4.64	176
532540	0.0008	0.0302	-11.31	379
532755	0.0007	0.0277	-9.22	355
500114	0.0006	0.0319	-5.68	184
532538	0.0010	0.0247	-9.58	416

Table B- 11 Unit root test- UK

Code	t-Stat	Prob.	Code	t-Stat	Prob.	Code	t-Stat	Prob.	Code	t-Stat	Prob.
3IN	-33.957	0	JAM	-30.025	0	DGOC	-35.037	0	RMV	-15.502	0
888	-22.191	0	JD.	-36.44	0	DIGS	-33.362	0	RNK	-33.177	0
AAF	-37.319	0	JDW	-35.758	0	DLG	-30.998	0	ROR	-14.952	0
AAL	-26.129	0	JEO	-30.377	0	DLN	-29.149	0	RR.	-11.167	0
ABF	-28.011	0	JESC	-34.724	0	DNLM	-44.291	0	RSA	-35.456	0
ACI	-46.254	0	JET	-11.841	0	DOM	-37.711	0	RSW	-26.419	0
ADM	-36.249	0	JFJ	-35.024	0	DPH	-36.395	0	RTO	-13.363	0
AGK	-40.689	0	JLEN	-37.672	0	DPLM	-37.885	0	SAFE	-36.574	0
AGR	-35.911	0	JLG	-33.401	0	DRX	-30.629	0	SAIN	-39.034	0
AGT	-34.328	0	JMAT	-39.778	0	ECM	-22.822	0	SBRE	-37.863	0
AHT	-37.154	0	JMG	-35.607	0	EDIN	-37.269	0	SBRY	-14.524	0
AJB	-17.589	0	JUP	-17.726	0	EMG	-37.221	0	SCIN	-40.757	0
AML	-34.258	0	JUST	-21.782	0	ENOG	-19.07	0	SCT	-17.749	0
ANTO	-37.904	0	KAZ	-36.934	0	ERM	-36.169	0	SDP	-13.552	0
AO.	-13.243	0	KGF	-41.891	0	ESNT	-35.182	0	SDR	-31.952	0
APAX	-33.679	0	KNOS	-35.396	0	EVR	-11.354	0	SEQI	-38.531	0
ASCL	-34.823	0	LAND	-14.698	0	EWI	-37.175	0	SGE	-31.521	0
ASHM	-37.565	0	LGEN	-37.268	0	EXPN	-33.98	0	SGRO	-5.7935	0
ASL	-36.804	0	LIO	-32.901	0	EZJ	-36.72	0	SHB	-17.12	0
ATST	-37.859	0	LLOY	-34.118	0	FCIT	-37.151	0	SIG	-24.518	0
ATT	-36.343	0	LMP	-41.368	0	FCSS	-36.874	0	SKG	-33.946	0
AUTO	-34.55	0	LRE	-30.415	0	FDM	-35.082	0	SLA	-23.439	0
AV.	-35.369	0	LSE	-31.226	0	FERG	-22.993	0	SMDS	-42.055	0
AVON	-14.849	0	LWDB	-37.099	0	FEV	-36.263	0	SMIN	-32.764	0
AVST	-21.012	0	LXI	-40.358	0	FGP	-43.199	0	SMP	-23.251	0
AVV	-38.002	0	MAB	-12.258	0	FGT	-24.036	0	SMT	-36.153	0
AZN	-44.758	0	MCRO	-37.927	0	FLTR	-38.522	0	SMWH	-31.404	0
BA.	-35.073	0	MDC	-32.601	0	FOUR	-34.296	0	SN.	-34.088	0
BAB	-34.422	0	MGAM	-37.467	0	FRAS	-14.644	0	SNN	-35.235	0
BARC	-43.978	0	MGGT	-63.959	0	FRES	-8.9802	0	SOI	-34.923	0
BATS	-37.181	0	MGNS	-35.807	0	FSFL	-29.763	0	SONC	-38.196	0
BBGI	-37.551	0	MKS	-18.95	0	FSJ	-36.713	0	SONG	-13.26	0
BBH	-34.157	0	MNDI	-14.811	0	FSV	-36.699	0	SPT	-11.746	0
BBOX	-27.079	0	MNG	-33.957	0	FUTR	-36.061	0	SPX	-28.577	0
BBY	-37.556	0	MNKS	-37.801	0	FXPO	-36.38	0	SRE	-20.247	0
BCPT	-37.29	0	MONY	-36.263	0	GAW	-22.092	0	SRP	-35.666	0
BDEV	-11.367	0	MRC	-14.001	0	GCP	-40.192	0	SSE	-15.502	0
BEZ	-40.81	0	MRO	-23.251	0	GFS	-37.251	0	SSON	-33.177	0
BGFD	-35.334	0	MRW	-35.666	0	GFTU	-37.435	0	SSPG	-11.167	0
BGS	-36.093	0	MSLH	-24.136	0	GLEN	-36.528	0	STAN	-35.456	0
BGSC	-35.947	0	MYI	-13.878	0	GLO	-38.365	0	STJ	-26.419	0
BHP	-36.804	0	N91	-6.8698	0	GNC	-37.74	0	SVS	-13.363	0

Table B- 11 Unit root test- UK – continued (1)											
Code	t-Stat	Prob.	Code	t-Stat	Prob.	Code	t-Stat	Prob.	Code	t-Stat	Prob.
BIFF	-37.183	0	NESF	-31.235	0	GNS	-37.07	0	SVT	-36.574	0
BKG	-34.573	0	NETW	-22.191	0	GPOR	-34.539	0	SXS	-39.034	0
BLND	-34.832	0	NEX	-34.258	0	GRG	-37.246	0	SYNC	-37.863	0
BME	-34.267	0	NG.	-14.001	0	GRI	-34.062	0	SYNT	-14.524	0
BNKR	-36.565	0	NWG	-17.792	0	GSK	-37.89	0	TALK	-24.136	0
BNZL	-42.578	0	NXT	-14.849	0	GSS	-14.489	0	TATE	-40.757	0
BOY	-37.137	0	OCDO	-37.556	0	GVC	-31.997	0	TBCG	-17.749	0
BP.	-17.32	0	OSB	-34.267	0	GYS	-37.136	0	TCAP	-31.952	0
BRBY	-33.134	0	OXB	-39.034	0	HAS	-36.498	0	TEM	-38.531	0
BRSC	-28.153	0	OXIG	-31.587	0	HFG	-3.3708	0	TEP	-31.521	0
BRW	-10.99	0	PAG	-37.951	0	HGT	-11.691	0	TIFS	-5.7935	0
BRWM	-39.8	0	PAGE	-33.362	0	HICL	-39.937	0	TPK	-17.12	0
BT.A	-19.011	0	PCT	-19.07	0	HIK	-5.5805	0	TRIG	-24.518	0
BVIC	-30.483	0	PETS	-43.199	0	HILS	-34.595	0	TRN	-30.599	0
BWY	-39.034	0	PFC	-22.092	0	HL.	-24.068	0	TRY	-37.749	0
BYG	-9.2602	0	PFD	-37.523	0	HLMA	-36.273	0	TSCO	-13.878	0
CAPC	-14.536	0	PFG	-37.89	0	HOC	-37.909	0	TUI	-5.4179	0
CBG	-0.9488	0	PHNX	-36.273	0	HRI	-31.165	0	TW.	-35.652	0
CCC	-15.884	0	PHP	-9.1329	0	HSBA	-31.802	0	UDG	-47.055	0
CCH	-23.303	0	PIN	-21.546	0	HSL	-12.979	0	UKCM	-34.467	0
CCL	-38.943	0	PLI	-36.44	0	HSTG	-24.336	0	UKW	-32.498	0
CCR	-35.159	0	PLP	-21.782	0	HSV	-22.405	0	ULE	-29.648	0
CEY	-45.415	0	PLUS	-37.099	0	HSX	-35.455	0	ULVR	-37.445	0
CHG	-4.5359	0	PNL	-37.801	0	HTWS	-33.587	0	USA	-42.45	0
CINE	-20.675	0	PNN	-17.792	0	HVPE	-12.193	0	UTG	-37.389	0
CKN	-31.587	0	POG	-37.523	0	HWDN	-15.784	0	UU.	-11.208	0
CLDN	-34.771	0	POLY	-28.18	0	IAG	-9.1329	0	VCT	-6.8698	0
CLI	-22.138	0	PRTC	-28.18	0	IBST	-42.946	0	VEC	-11.25	0
CLSN	-33.922	0	PRU	-9.898	0	ICGT	-38.663	0	VEIL	2.9085	1
CMCX	-33.352	0	PSH	-14.952	0	ICP	-34.382	0	VMUK	-32.099	0
CAN	-4.5359	0	PSN	-13.552	0	IEM	-38.121	0	VOD	-24.215	0
CNE	-21.987	0	PSON	-33.946	0	IGG	-38.097	0	VOF	-41.691	0
COA	-36.552	0	PTEC	-23.439	0	IHG	-36.7	0	VSVS	-37.773	0
CPG	-38.809	0	PZC	-42.055	0	IHP	-33.367	0	VTY	-38.832	0
CPI	-36.936	0	QLT	-32.764	0	III	-36.455	0	VVO	-33.634	0
CRDA	-13.35	0	QQ.	-36.153	0	IMB	-37.051	0	WEIR	-17.941	0
CRH	-37.951	0	RAT	-31.404	0	IMI	-36.808	0	WG.	-21.139	0
CRST	-36.842	0	RB.	-9.898	0	INCH	-21.546	0	WIZZ	-31.235	0
CSH	-13.323	0	RCP	-34.088	0	INDV	-27.25	0	WKP	-19.597	0
CSP	-39.132	0	RDSA	-35.235	0	INF	-36.485	0	WMH	-40.402	0
CTEC	-29.772	0	RDSB	-34.923	0	INPP	-28.91	0	WOSG	-34.74	0
CTY	-12.93	0	RDW	-38.196	0	INVP	-36.753	0	WPP	-36.35	0
CWK	-37.318	0	REL	-13.26	0	IPO	-40.15	0	WTAN	-36.108	0
DC.	-16.313	0	RHIM	-11.746	0	ITRK	-11.26	0	WTB	-33.247	0

Table B- 11 Unit root test- UK – continued (2)											
Code	t-Stat	Prob.	Code	t-Stat	Prob.	Code	t-Stat	Prob.	Code	t-Stat	Prob.
DCC	-26.28	0	RIO	-28.577	0	ITV	-38.097	0	WWH	-20.819	0
DGE	-14.593	0	RMG	-20.247	0	IWG	-37.52	0	XPP	-37.288	0

Table B- 12 Unit root test - US

Code	t-Stat	Prob.	Code	t-Stat	Prob.	Code	t-Stat	Prob.	Code	t-Stat	Prob.
ATVI	-112.15	0	MTD	-104.11	0	DVN	-93.57	0	IBM	-109.97	0
GOOGL	-81.43	0	MYL	-92.94	0	FANG	-69.21	0	INTU	-108.48	0
GOOG	-95.27	0	PKI	-117.45	0	EOG	-81.82	0	IPGP	-90.17	0
T	-88.60	0	PRGO	-36.57	0	XOM	-24.13	0	JKHY	-104.36	0
CTL	-115.93	0	PFE	-106.22	0	HAL	-11.80	0	JNPR	-23.27	0
CHTR	-96.13	0	DGX	-63.06	0	HES	-84.16	0	KEYS	-54.63	0
CMCSA	-85.03	0	REGN	-55.72	0	HFC	-85.44	0	KLAC	-16.70	0
DISCA	-51.68	0	RMD	-110.28	0	KMI	-87.69	0	LRCX	-108.86	0
DISCK	-9.02	0	STE	-71.58	0	MRO	-76.90	0	LDOS	-53.91	0
DISH	-74.44	0	SYK	-74.60	0	MPC	-87.19	0	MA	-89.83	0
EA	-61.15	0	TFX	-78.06	0	NOV	-60.48	0	MXIM	-58.75	0
FB	-107.64	0	COO	-60.18	0	NBL	-114.57	0	MCHP	-51.11	0
FOXA	-63.05	0	TMO	-47.23	0	OXY	-107.86	0	MU	-68.35	0
FOX	-81.48	0	UNH	-109.00	0	OKE	-113.05	0	MSFT	-90.87	0
IPG	-70.42	0	UHS	-38.79	0	PSX	-111.20	0	MSI	-90.37	0
LYV	-51.06	0	VAR	-81.58	0	PXD	-51.66	0	NTAP	-95.13	0
NFLX	-112.85	0	VRTX	-55.38	0	SLB	-33.03	0	NLOK	-82.13	0
NWSA	-50.04	0	WAT	-4.97	0	FTI	-53.83	0	NVDA	-86.05	0
NWS	-110.65	0	WST	-111.67	0	VLO	-80.85	0	ORCL	-53.63	0
OMC	-53.10	0	ZBH	-66.78	0	WMB	-52.80	0	PAYX	-34.78	0
TMUS	-82.59	0	ZTS	-110.58	0	AFL	-24.16	0	PAYC	-84.64	0
TTWO	-110.71	0	MMM	-95.44	0	ALL	-81.71	0	PYPL	-84.45	0
DIS	-84.42	0	AOS	-32.36	0	AXP	-65.03	0	QRVO	-95.00	0
TWTR	-65.75	0	ALK	-26.43	0	AIG	-80.90	0	QCOM	-111.86	0
VZ	-77.02	0	ALLE	-73.99	0	AMP	-17.63	0	CRM	-78.83	0
VIAC	-106.81	0	AAL	-61.74	0	AON	-111.53	0	STX	-48.54	0
AAP	-11.75	0	AME	-91.18	0	AJG	-58.11	0	NOW	-117.17	0
AMZN	-73.47	0	BA	-68.06	0	AIZ	-115.43	0	SWKS	-108.61	0
APTV	-35.36	0	CHRW	-67.74	0	BAC	-113.66	0	SNPS	-97.55	0
AZO	-66.92	0	CARR	-80.20	0	BRK.B	-110.41	0	TEL	-74.94	0
BBY	-92.63	0	CAT	-82.02	0	BLK	-26.92	0	TXN	-111.61	0
BKNG	-109.14	0	CTAS	-40.59	0	COF	-109.99	0	TYL	-106.58	0
BWA	-112.46	0	CPRT	-10.90	0	CBOE	-84.27	0	VRSN	-81.06	0
KMX	-81.34	0	CSX	-113.70	0	SCHW	-67.59	0	V	-106.89	0
CCL	-108.23	0	CMI	-72.14	0	CB	-56.01	0	WDC	-72.62	0
CMG	-116.87	0	DE	-49.66	0	CINF	-51.59	0	WU	-81.82	0
DHI	-71.59	0	DAL	-71.75	0	C	-16.79	0	XRX	-53.95	0
DRI	-72.25	0	DOV	-110.49	0	CFG	-63.62	0	XLNX	-42.06	0
DG	-108.18	0	ETN	-113.30	0	CME	-94.18	0	ZBRA	-108.19	0
DLTR	-51.68	0	EMR	-66.09	0	CMA	-70.24	0	APD	-107.75	0
DPZ	-95.84	0	EFX	-60.78	0	DFS	-110.01	0	ALB	-50.83	0

Table B- 12 Unit root test – US – continued (1)

Code	t-Stat	Prob.	Code	t-Stat	Prob.	Code	t-Stat	Prob.	Code	t-Stat	Prob.
EBAY	-67.74	0	EXPD	-74.29	0	ETFC	-110.66	0	AMCR	-16.62	0
EXPE	-56.17	0	FAST	-41.82	0	RE	-4.54	0	AVY	-111.73	0
F	-37.61	0	FDX	-65.41	0	FITB	-60.61	0	BLL	-110.67	0
GPS	-57.68	0	FLS	-113.67	0	FRC	-81.84	0	CE	-24.09	0
GRMN	-67.24	0	FTV	-43.92	0	BEN	-115.14	0	CF	-25.32	0
GM	-24.77	0	FBHS	-110.37	0	GL	-68.56	0	CTVA	-53.86	0
GPC	-53.65	0	GD	-83.21	0	GS	-109.22	0	DOW	-60.21	0
HRB	-43.95	0	GE	-110.81	0	HIG	-69.76	0	DD	-32.10	0
HBI	-75.86	0	GWW	-76.30	0	HBAN	-51.88	0	EMN	-111.92	0
HAS	-37.04	0	HON	-83.34	0	ICE	-28.16	0	ECL	-52.53	0
HLT	-77.13	0	HWM	-69.73	0	IVZ	-112.09	0	FMC	-19.47	0
HD	-41.47	0	HII	-64.01	0	JPM	-74.26	0	FCX	-67.96	0
KSS	-56.34	0	IEX	-69.28	0	KEY	-83.62	0	IFF	-83.44	0
LB	-109.33	0	INFO	-92.26	0	LNC	-36.70	0	IP	-54.69	0
LVS	-12.63	0	ITW	-110.30	0	L	-73.25	0	LIN	-69.41	0
LEG	-119.49	0	IR	-32.88	0	MTB	-75.24	0	LYB	-66.67	0
LEN	-78.36	0	JBHT	-32.84	0	MKTX	-14.42	0	MLM	-29.68	0
LKQ	-115.51	0	J	-86.18	0	MMC	-110.31	0	NEM	-60.42	0
LOW	-19.77	0	JCI	-65.87	0	MET	-99.37	0	NUE	-31.55	0
MAR	-18.46	0	KSU	-22.89	0	MCO	-107.79	0	PKG	-83.64	0
MCD	-113.83	0	LHX	-62.21	0	MS	-90.36	0	PPG	-59.84	0
MGM	-74.93	0	LMT	-75.77	0	MSCI	-93.33	0	SEE	-85.01	0
MHK	-71.02	0	MAS	-113.52	0	NDAQ	-9.33	0	SHW	-84.48	0
NWL	-108.71	0	NLSN	-112.07	0	NTRS	-10.33	0	MOS	-89.49	0
NKE	-33.77	0	NSC	-119.10	0	PBCT	-30.50	0	VMC	-48.82	0
NCLH	-63.19	0	NOC	-82.16	0	PNC	-106.59	0	WRK	-155.41	0
NVR	-79.10	0	ODFL	-87.14	0	PFG	-47.33	0	ARE	-78.62	0
ORLY	-65.14	0	OTIS	-74.05	0	PGR	-105.59	0	AMT	-67.48	0
PHM	-82.41	0	PCAR	-111.41	0	PRU	-80.67	0	AIV	-61.27	0
PVH	-117.16	0	PH	-77.78	0	RJF	-59.77	0	AVB	-65.00	0
RL	-83.81	0	PNR	-59.81	0	RF	-75.33	0	BXP	-111.16	0
ROST	-65.64	0	PWR	-36.38	0	SPGI	-53.42	0	CBRE	-52.55	0
RCL	-83.56	0	RTX	-82.65	0	STT	-56.75	0	CCI	-60.67	0
SBUX	-78.24	0	RSG	-60.25	0	SIVB	-74.86	0	DLR	-81.33	0
TPR	-68.57	0	RHI	-107.76	0	SYF	-70.43	0	DRE	-60.87	0
TGT	-71.02	0	ROK	-59.32	0	TROW	-112.95	0	EQIX	-65.57	0
TIF	-117.64	0	ROL	-38.68	0	BK	-104.62	0	EQR	-91.97	0
TJX	-69.54	0	ROP	-59.31	0	TRV	-40.65	0	ESS	-62.16	0
TSCO	-119.90	0	SNA	-34.05	0	TFC	-115.08	0	EXR	-66.55	0
ULTA	-117.23	0	LUV	-70.62	0	USB	-83.96	0	FRT	-90.91	0
UAA	-53.66	0	SWK	-100.37	0	UNM	-40.39	0	PEAK	-108.69	0

Table B- 12 Unit root test – US – continued (2)

Code	t-Stat	Prob.	Code	t-Stat	Prob.	Code	t-Stat	Prob.	Code	t-Stat	Prob.
UA	-95.49	0	TDY	-109.78	0	WRB	-37.04	0	HST	-68.84	0
VFC	-57.33	0	TXT	-12.11	0	WFC	-67.92	0	IRM	-72.81	0
WHR	-61.50	0	TT	-110.34	0	WLTW	-110.60	0	KIM	-45.80	0
WYNN	-68.20	0	TDG	-61.15	0	ZION	-30.10	0	MAA	-46.44	0
YUM	-82.79	0	UNP	-111.15	0	ABT	-72.62	0	PLD	-113.43	0
MO	-50.51	0	UAL	-112.73	0	ABBV	-108.19	0	PSA	-75.91	0
ADM	-92.32	0	UPS	-82.36	0	ABMD	-53.09	0	O	-82.50	0
BF.B	-77.76	0	URI	-115.64	0	A	-91.71	0	REG	-86.69	0
CPB	-59.07	0	VRSK	-79.67	0	ALXN	-108.88	0	SBAC	-112.87	0
CHD	-36.01	0	WAB	-91.27	0	ALGN	-111.81	0	SPG	-58.38	0
KO	-83.17	0	WM	-65.09	0	ABC	-71.24	0	SLG	-45.94	0
CL	-113.00	0	XYL	-74.20	0	AMGN	-78.74	0	UDR	-88.01	0
CAG	-113.16	0	ACN	-17.09	0	ANTM	-109.30	0	VTR	-69.29	0
STZ	-75.63	0	ADBE	-49.35	0	BAX	-70.44	0	VNO	-27.95	0
COST	-43.67	0	AMD	-109.45	0	BDX	-59.29	0	WELL	-7.14	0
COTY	-10.57	0	AKAM	-52.33	0	BIO	-110.48	0	WY	-107.42	0
EL	-33.77	0	APH	-86.53	0	BIIB	-65.99	0	Symbol	-20.64	0
GIS	-10.34	0	ADI	-76.39	0	BSX	-81.08	0	AES	-23.79	0
HRL	-65.39	0	ANSS	-64.52	0	BMY	-59.65	0	LNT	-18.12	0
SJM	-10.16	0	AAPL	-80.86	0	CAH	-90.56	0	AEE	-54.80	0
K	-108.51	0	AMAT	-45.47	0	CNC	-86.79	0	AEP	-110.76	0
KMB	-76.86	0	ANET	-13.05	0	CERN	-34.95	0	AWK	-63.41	0
KHC	-98.15	0	ADSK	-56.78	0	CI	-76.88	0	ATO	-57.29	0
KR	-63.08	0	ADP	-70.36	0	CVS	-90.25	0	CNP	-5.88	0
LW	-81.94	0	AVGO	-105.72	0	DHR	-53.59	0	CMS	-93.86	0
MKC	-103.42	0	BR	-67.37	0	DVA	-95.46	0	ED	-57.17	0
TAP	-112.24	0	CDNS	-110.20	0	XRAY	-68.11	0	D	-88.62	0
MDLZ	-66.98	0	CDW	-116.16	0	DXCM	-68.30	0	DTE	-37.18	0
MNST	-37.09	0	CSCO	-59.57	0	EW	-40.18	0	DUK	-113.94	0
PEP	-85.22	0	CTXS	-58.11	0	GILD	-59.23	0	EIX	-50.89	0
PM	-15.60	0	CTSH	-82.37	0	HCA	-51.26	0	ETR	-74.91	0
PG	-112.30	0	GLW	-85.10	0	HSIC	-104.04	0	EVRG	-35.94	0
SYY	-60.85	0	DXC	-109.19	0	HOLX	-58.91	0	ES	-68.13	0
CLX	-61.30	0	FFIV	-87.33	0	HUM	-73.68	0	EXC	-98.53	0
HSY	-77.13	0	FIS	-81.10	0	IDXX	-78.63	0	FE	-72.35	0
TSN	-68.88	0	FISV	-104.96	0	ILMN	-63.10	0	NEE	-83.02	0
WBA	-107.28	0	FLT	-82.63	0	INCY	-107.52	0	NI	-57.23	0
WMT	-111.86	0	FLIR	-109.05	0	ISRG	-24.37	0	NRG	-69.46	0
APA	-108.21	0	FTNT	-76.87	0	IQV	-81.65	0	PNW	-26.79	0
BKR	-49.76	0	IT	-80.08	0	JNJ	-28.52	0	PPL	-37.55	0
COG	-16.90	0	GPN	-23.98	0	LH	-28.49	0	PEG	-67.21	0
CVX	-116.09	0	HPE	-124.69	0	LLY	-111.48	0	SRE	-104.66	0

Table B- 12 Unit root test – US – continued (3)

Code	t-Stat	Prob.	Code	t-Stat	Prob.	Code	t-Stat	Prob.	Code	t-Stat	Prob.
CXO	-112.27	0	HPQ	-37.62	0	MCK	-22.65	0	SO	-48.96	0
COP	-35.85	0	INTC	-88.08	0	MDT	-89.22	0	WEC	-27.68	0
						MRK	-117.60	0	XEL	-43.88	0

Table B- 13 Unit root test- China

Code	t-Stat	Prob.	Code	t-Stat	Prob.
600000	-61.83	0	600895	-55.89	0
600004	-12.04	0	600900	-45.09	0
600009	-23.52	0	600909	-47.12	0
600010	-31.01	0	600919	-61.59	0
600011	-12.37	0	600926	-46.41	0
600015	-39.47	0	600928	-62.63	0
600016	-32.89	0	600958	-54.25	0
600018	-29.13	0	600968	-60.19	0
600019	-48.15	0	600977	-57.39	0
600025	-28.44	0	600989	-61.05	0
600028	-43.79	0	600999	-60.72	0
600029	-36.96	0	601006	-54.31	0
600030	-57.78	0	601009	-56.16	0
600031	-38.97	0	601012	-31.09	0
600036	-44.32	0	601021	-59.11	0
600038	-41.73	0	601066	-43.32	0
600048	-40.46	0	601077	-57.32	0
600050	-29.68	0	601088	-58.58	0
600061	-48.12	0	601099	-54.86	0
600066	-73.79	0	601100	-55.85	0
600068	-38.48	0	601108	-60.15	0
600085	-49.68	0	601111	-57.31	0
600089	-36.60	0	601138	-57.43	0
600104	-54.42	0	601155	-56.14	0
600109	-2.59	0	601162	-41.78	0
600111	-38.58	0	601166	-56.28	0
600115	-33.16	0	601169	-58.06	0
600118	-40.16	0	601186	-61.70	0
600150	-9.65	0	601198	-59.69	0
600155	-41.31	0	601211	-77.00	0
600176	-33.29	0	601225	-47.19	0
600177	-33.83	0	601229	-47.79	0
600183	-4.22	0	601233	-79.25	0
600196	-33.29	0	601236	-78.32	0
600201	-58.30	0	601238	-76.25	0
600208	-41.08	0	601288	-52.00	0
600271	-10.08	0	601318	-60.31	0
600276	-50.51	0	601319	-62.46	0
600298	-30.42	0	601328	-28.12	0
600309	-18.95	0	601336	-49.26	0
600332	-20.68	0	601377	-20.16	0
600340	-42.61	0	601390	-13.72	0

Table B- 13 Unit root test- China – continued (1)					
Code	t-Stat	Prob.	Code	t-Stat	Prob.
600346	-44.48	0	601398	-8.05	0
600352	-37.22	0	601519	-27.60	0
600362	-4.53	0	601555	-25.45	0
600383	-40.66	0	601601	-5.51	0
600406	-38.22	0	601607	-15.96	0
600436	-41.12	0	601618	-60.28	0
600438	-33.16	0	601628	-7.74	0
600487	-44.01	0	601633	-40.30	0
600489	-40.03	0	601658	-36.79	0
600516	-15.60	0	601668	-47.54	0
600519	-47.47	0	601669	-35.76	0
600521	-28.73	0	601688	-25.89	0
600522	-21.65	0	601698	-31.75	0
600536	-13.75	0	601766	-36.17	0
600547	-57.17	0	601788	-45.70	0
600570	-27.44	0	601800	-49.97	0
600572	-31.05	0	601816	-45.18	0
600585	-21.72	0	601818	-40.01	0
600588	-20.33	0	601857	-17.16	0
600598	-25.56	0	601860	-48.45	0
600600	-28.21	0	601872	-14.42	0
600604	-18.15	0	601877	-55.30	0
600606	-8.60	0	601878	-12.00	0
600621	-22.95	0	601881	-47.55	0
600637	-37.17	0	601888	-46.52	0
600660	-65.87	0	601899	-44.76	0
600690	-51.94	0	601901	-26.36	0
600699	-58.49	0	601916	-36.45	0
600703	-67.50	0	601933	-45.67	0
600705	-43.23	0	601939	-56.37	0
600733	-43.51	0	601985	-99.34	0
600737	-66.65	0	601988	-75.67	0
600741	-49.51	0	601989	-22.40	0
600745	-71.08	0	601990	-66.10	0
600760	-52.10	0	601998	-22.70	0
600763	-71.29	0	603019	-23.60	0
600779	-71.15	0	603160	-77.24	0
600795	-63.51	0	603259	-37.45	0
600801	-67.30	0	603288	-38.54	0
600809	-65.96	0	603369	-36.79	0
600837	-50.31	0	603501	-13.79	0
600848	-61.09	0	603517	-8.96	0
600867	-48.90	0	603589	-9.97	0
600872	-65.39	0	603799	-10.57	0

Table B- 13 Unit root test- China – continued (2)					
Code	t-Stat	Prob.	Code	t-Stat	Prob.
600875	-50.36	0	603833	-19.67	0
600886	-67.12	0	603983	-53.64	0
600887	-65.36	0	603986	-55.21	0
600893	-63.84	0	603993	-30.39	0

Table B- 14 Unit root test - Japan

Code	t-Stat	Prob.	Code	t-Stat	Prob.
4503	-83.12	0.0001	1605	-113.80	0.0001
4519	-28.12	0	3401	-49.83	0.0001
4568	-39.12	0	3402	-82.48	0.0001
4506	-39.65	0	3101	-96.97	0.0001
4523	-5.26	0	3103	-114.04	0.0001
4151	-70.37	0.0001	3863	-83.26	0.0001
4578	-67.86	0.0001	3861	-112.63	0.0001
4507	-113.02	0.0001	3407	-67.17	0.0001
4502	-113.29	0.0001	4061	-84.44	0.0001
6857	-67.88	0.0001	4631	-53.58	0.0001
6770	-57.75	0.0001	4901	-114.08	0.0001
7751	-68.20	0.0001	4452	-113.15	0.0001
6952	-68.96	0.0001	3405	-82.62	0.0001
7735	-103.88	0.0001	4188	-48.57	0.0001
6902	-50.31	0.0001	4183	-83.31	0.0001
6954	-116.26	0.0001	4021	-68.64	0.0001
6504	-20.86	0	6988	-84.79	0.0001
6702	-78.16	0.0001	4063	-85.35	0.0001
6674	-81.02	0.0001	4911	-49.12	0.0001
6501	-57.22	0.0001	4004	-47.41	0.0001
6971	-113.28	0.0001	4005	-83.35	0.0001
6479	-82.17	0.0001	4043	-119.26	0.0001
6503	-81.80	0.0001	4042	-68.25	0.0001
6701	-68.34	0.0001	4208	-112.44	0.0001
3105	-81.80	0.0001	5020	-80.25	0.0001
6703	-81.56	0.0001	5019	-68.19	0.0001
6645	-82.76	0.0001	5108	-68.88	0.0001
6752	-82.37	0.0001	5101	-48.48	0.0001
7752	-115.05	0.0001	5201	-82.99	0.0001
6724	-83.32	0.0001	5333	-70.14	0.0001
6758	-114.77	0.0001	5214	-84.81	0.0001
6976	-68.13	0.0001	5202	-88.81	0.0001
6762	-118.27	0.0001	5232	-40.89	0
8035	-111.17	0.0001	5233	-82.49	0.0001
6506	-36.88	0	5301	-117.65	0.0001
6841	-82.81	0.0001	5332	-83.84	0.0001
7205	-115.49	0.0001	5411	-99.31	0.0001
7267	-112.66	0.0001	5406	-83.22	0.0001
7202	-112.02	0.0001	5401	-111.48	0.0001
7261	-84.23	0.0001	5541	-117.65	0.0001
7211	-111.09	0.0001	5714	-114.47	0.0001
7201	-69.94	0.0001	5803	-110.40	0.0001

Table B- 14 Unit root test – Japan – continued (1)					
Code	t-Stat	Prob.	Code	t-Stat	Prob.
7270	-111.69	0.0001	5801	-99.85	0.0001
7269	-83.36	0.0001	5711	-82.79	0.0001
7203	-118.88	0.0001	5706	-81.91	0.0001
7272	-69.63	0.0001	5703	-108.19	0.0001
7762	-84.02	0.0001	3436	-85.00	0.0001
4902	-112.86	0.0001	5802	-82.79	0.0001
7731	-67.02	0.0001	5713	-82.60	0.0001
7733	-57.31	0.0001	5707	-110.82	0.0001
4543	-106.87	0.0001	5901	-115.22	0.0001
9433	-31.86	0	8001	-113.86	0.0001
9432	-68.67	0.0001	8002	-57.99	0.0001
9613	-36.76	0	8058	-66.80	0.0001
9437	-56.27	0.0001	8031	-80.96	0.0001
9412	-58.03	0.0001	2768	-81.41	0.0001
9434	-82.63	0.0001	8053	-69.98	0.0001
9984	-86.60	0.0001	8015	-109.84	0.0001
8304	-23.40	0	1721	-84.56	0.0001
8331	-112.42	0.0001	1925	-82.25	0.0001
7186	-112.48	0.0001	1808	-84.21	0.0001
8309	-85.53	0.0001	1963	-8.95	0
8354	-69.69	0.0001	1812	-96.61	0.0001
8306	-73.07	0.0001	1802	-110.53	0.0001
8411	-87.03	0.0001	1928	-117.96	0.0001
8308	-35.41	0	1803	-67.80	0.0001
8303	-36.44	0	1801	-117.40	0.0001
8355	-86.74	0.0001	6113	-118.10	0.0001
8316	-85.92	0.0001	6367	-59.49	0.0001
8253	-117.08	0.0001	6367	-81.88	0.0001
8697	-89.14	0.0001	6305	-111.71	0.0001
8601	-85.23	0.0001	7004	-80.91	0.0001
8628	-118.94	0.0001	7013	-32.32	0
8604	-82.73	0.0001	5631	-85.63	0.0001
8750	-119.59	0.0001	6473	-81.93	0.0001
8725	-85.16	0.0001	6301	-114.46	0.0001
8630	-117.30	0.0001	6326	-82.55	0.0001
8795	-68.00	0.0001	7011	-88.00	0.0001
8766	-117.22	0.0001	6471	-68.23	0.0001
1332	-68.07	0.0001	6472	-115.79	0.0001
1333	-67.26	0.0001	6103	-119.04	0.0001
2802	-109.03	0.0001	6302	-82.06	0.0001
2502	-93.72	0.0001	7012	-82.58	0.0001
2914	-60.86	0.0001	7003	-84.23	0.0001
2801	-81.48	0.0001	7832	-33.26	0
2503	-72.43	0.0001	7912	-25.82	0

Table B- 14 Unit root test – Japan – continued (2)					
Code	t-Stat	Prob.	Code	t-Stat	Prob.
2269	-109.73	0.0001	7911	-81.20	0.0001
2871	-114.27	0.0001	7951	-112.45	0.0001
2282	-83.18	0.0001	8802	-68.87	0.0001
2002	-52.01	0.0001	8801	-113.28	0.0001
2501	-55.63	0.0001	8830	-82.09	0.0001
2531	-68.50	0.0001	8804	-110.51	0.0001
8267	-63.98	0.0001	3289	-114.50	0.0001
8028	-43.39	0	9022	-82.06	0.0001
9983	-88.11	0.0001	9020	-69.05	0.0001
3099	-87.02	0.0001	9009	-71.80	0.0001
3086	-84.35	0.0001	9007	-54.42	0.0001
8252	-113.36	0.0001	9001	-113.76	0.0001
3382	-69.98	0.0001	9005	-113.96	0.0001
8233	-67.72	0.0001	9021	-84.04	0.0001
4751	-110.35	0.0001	9062	-84.96	0.0001
2432	-55.35	0.0001	9064	-78.25	0.0001
4324	-60.93	0.0001	9107	-74.08	0.0001
6178	-17.50	0	9104	-83.72	0.0001
9766	-80.36	0.0001	9101	-71.41	0.0001
2413	-46.89	0.0001	9302	-79.32	0.0001
4755	-63.48	0.0001	9301	-32.56	0.0001
6098	-25.97	0	9502	-65.20	0.0001
9735	-96.37	0.0001	9503	-77.13	0.0001
9602	-83.83	0.0001	9501	-34.36	0.0001
4704	-67.52	0.0001	9532	-59.87	0.0001
4689	-116.24	0.0001	9531	-69.31	0.0001

Table B- 15 Unit root test - India

Code	t-Stat	Prob.
532215	-67.736	0.0001
532977	-87.451	0.0001
500034	-65.578	0.0001
532978	-67.653	0.0001
532454	-72.81	0.0001
532281	-88.873	0.0001
500010	-76.91	0.0001
500180	-64.498	0.0001
500696	-85.09	0.0001
532174	-53.861	0.0001
532187	-95.205	0.0001
500209	-67.494	0.0001
500875	-51.474	0.0001
500247	-69.892	0.0001
500510	-58.645	0.0001
500520	-85.41	0.0001
532500	-34.996	0
500790	-50.974	0.0001
532555	-86.987	0.0001
500312	-51.018	0.0001
532898	-51.447	0.0001
500325	-88.873	0.0001
500112	-40.33	0
524715	-51.788	0.0001
500470	-74.748	0.0001
532540	-41.348	0
532755	-62.321	0.0001
500114	-64.5	0.0001
532538	-52.493	0.0001

Table B- 16 Wald Test Results (p-value for t-statistics) for Gold, T-bill, SONIA in UK

Code	Gold	T-bill	SONIA	Code	Gold	T-bill	SONIA
3IN	0.45	0.00*	0.00*	JAM	0.68	0.00*	0.00*
888	0.77	0.00*	0.00*	JD.	0.54	0.00*	0.00*
AAF	0.42	0.00*	0.00*	JDW	0.62	0.00*	0.00*
AAL	0.5	0.00*	0.38	JEO	0.79	0.00*	0.00*
ABF	0.83	0.00*	0.00*	JESC	0.32	0.00*	0.00*
ACI	0.62	0.00*	0.00*	JET	0.03*	0.00*	0.00*
ADM	0.24	0.00*	0.00*	JFJ	0.22	0.00*	0.00*
AGK	0.74	0.00*	0.00*	JLEN	0.37	0.00*	0.00*
AGR	0.16	0.00*	0.00*	JLG	0.56	0.00*	0.00*
AGT	0.11	0.00*	0.00*	JMAT	0.63	0.00*	0.00*
AHT	0.64	0.00*	0.00*	JMG	0.28	0.00*	0.00*
AJB	0.01*	0.57	0.00*	JUP	0.26	0.00*	0.00*
AML	0.95	0.00*	0.00*	JUST	0.66	0.00*	0.00*
ANTO	0.91	0.00*	0.00*	KAZ	0.13	0.00*	0.00*
AO.	0.9	0.00*	0.00*	KGF	0.83	0.00*	0.00*
APAX	0.88	0.00*	0.00*	KNOS	0.71	0.00*	0.00*
ASCL	0.55	0.00*	0.00*	LAND	0.1	0.00*	0.00*
ASHM	0.69	0.00*	0.00*	LGEN	0.11	0.00*	0.00*
ASL	0.37	0.00*	0.00*	LIO	0.11	0.00*	0.00*
ATST	0.69	0.00*	0.00*	LLOY	0.28	0.00*	0.00*
ATT	0.47	0.00*	0.00*	LMP	0.83	0.00*	0.00*
AUTO	0.89	0.00*	0.00*	LRE	0.15	0.00*	0.00*
AV.	0.84	0.00*	0.00*	LSE	0.46	0.00*	0.00*
AVON	0.77	0.00*	0.00*	LWDB	0.7	0.00*	0.00*
AVST	0.97	0.00*	0.94	LXI	0.14	0.00*	0.00*
AVV	0.6	0.00*	0.00*	MAB	0.2	0.00*	0.00*
AZN	0.42	0.00*	0.00*	MCRO	0.44	0.00*	0.00*
BA.	0.68	0.00*	0.00*	MDC	0.54	0.00*	0.00*
BAB	0.09	0.00*	0.00*	MGAM	0.66	0.00*	0.00*
BARC	0.85	0.00*	0.00*	MGGT	0.24	0.00*	0.00*
BATS	0.49	0.00*	0.00*	MGNS	0.77	0.00*	0.00*
BBGI	0.39	0.00*	0.00*	MKS	0.97	0.00*	0.00*
BBH	0.63	0.00*	0.00*	MNDI	0.9	0.00*	0.00*
BBOX	0.34	0.00*	0.00*	MNG	0.82	0.00*	0.00*
BBY	0.67	0.00*	0.00*	MNKS	0.7	0.00*	0.00*
BCPT	0.59	0.00*	0.00*	MONY	0.68	0.00*	0.00*
BDEV	0.11	0.00*	0.00*	MRC	0.13	0.00*	0.00*
BEZ	0.63	0.00*	0.00*	MRO	0.43	0.00*	0.00*
BGFD	0.29	0.00*	0.00*	MRW	0.58	0.00*	0.00*
BGS	0.57	0.00*	0.00*	MSLH	0.27	0.00*	0.00*
BGSC	0.09	0.00*	0.00*	MYI	0.34	0.00*	0.00*
BHP	0.48	0.00*	0.00*	N91	0.48	0.00*	0.00*
BIFF	0.34	0.00*	0.00*	NESF	0.92	0.00*	0.00*
BKG	0.01*	0.00*	0.00*	NETW	0.43	0.00*	0.00*

Table B- 16 Wald Test Results (p-value for t-statistics) for Gold, T-bill, SONIA in UK – continued (1)							
Code	Gold	T-bill	SONIA	Code	Gold	T-bill	SONIA
BLND	0.53	0.00*	0.00*	NEX	0.14	0.00*	0.00*
BME	0.86	0.00*	0.00*	NG.	0.15	0.00*	0.00*
BNKR	0.29	0.00*	0.00*	NWG	0.47	0.00*	0.00*
BNZL	0.21	0.00*	0.00*	NXT	0.82	0.00*	0.00*
BOY	0.07	0.00*	0.00*	OCDO	0.66	0.00*	0.00*
BP.	0.77	0.00*	0.00*	OSB	0.96	0.00*	0.00*
BRBY	0.65	0.00*	0.00*	OXB	0.96	0.00*	0.00*
BRSC	0.83	0.00*	0.00*	OXIG	0.97	0.00*	0.00*
BRW	0.17	0.98	0.00*	PAG	0.86	0.00*	0.00*
BRWM	0.45	0.00*	0.00*	PAGE	0.9	0.00*	0.00*
BT.A	0.15	0.00*	0.00*	PCT	0.4	0.00*	0.00*
BVIC	0.22	0.00*	0.00*	PETS	0.35	0.00*	0.00*
BWY	0.67	0.00*	0.00*	PFC	0.6	0.00*	0.00*
BYG	0.8	0.00*	0.00*	PFD	0.76	0.00*	0.00*
CAPC	0.45	0.00*	0.00*	PFG	0.95	0.00*	0.00*
CBG	0.15	0.00*	0.00*	PHNX	0.29	0.27	0.00*
CCC	0.22	0.00*	0.00*	PHP	0.59	0.00*	0.00*
CCH	0.67	0.00*	0.87	PIN	0.97	0.00*	0.00*
CCL	0.79	0.00*	0.00*	PLI	0.72	0.00*	0.00*
CCR	0.39	0.00*	0.00*	PLP	0.01*	0.00*	0.00*
CEY	0.32	0.00*	0.00*	PLUS	0.32	0.00*	0.00*
CHG	0.34	0.00*	0.00*	PNL	0.66	0.00*	0.55
CINE	0.38	0.00*	0.00*	PNN	0.47	0.00*	0.00*
CKN	0.56	0.00*	0.00*	POG	0.35	0.00*	0.00*
CLDN	0.78	0.00*	0.00*	POLY	0.53	0.00*	0.00*
CLI	0.32	0.00*	0.00*	PRTC	0.81	0.00*	0.00*
CLSN	0.68	0.00*	0.00*	PRU	0.21	0.00*	0.00*
CMCX	0.15	0.00*	0.00*	PSH	0.2	0.00*	0.00*
CAN	0.57	0.00*	0.00*	PSN	0.75	0.00*	0.00*
CNE	0.00*	0.00*	0.00*	PSON	0.07	0.00*	0.00*
COA	0.75	0.00*	0.00*	PTEC	0.53	0.00*	0.00*
CPG	0.06	0.00*	0.00*	PZC	0.69	0.00*	0.00*
CPI	0.32	0.00*	0.00*	QLT	0.22	0.00*	0.00*
CRDA	0.37	0.00*	0.00*	QQ.	0.38	0.00*	0.00*
CRH	0.77	0.00*	0.00*	RAT	0.86	0.00*	0.00*
CRST	0.16	0.00*	0.00*	RB.	0.82	0.00*	0.00*
CSH	0.88	0.00*	0.00*	RCP	0.45	0.00*	0.00*
CSP	0.47	0.00*	0.00*	RDSA	0.67	0.00*	0.00*
CTEC	0.54	0.00*	0.00*	RDSB	0.67	0.00*	0.00*
CTY	0.36	0.00*	0.00*	RDW	0.23	0.00*	0.00*
CWK	0.47	0.00*	0.00*	REL	0.78	0.00*	0.00*
DC.	0.36	0.00*	0.00*	RHIM	0.24	0.00*	0.00*
DCC	0.87	0.00*	0.00*	RIO	0.45	0.00*	0.00*
DGE	0.68	0.00*	0.00*	RMG	0.8	0.00*	0.00*

Table B- 16 Wald Test Results (p-value for t-statistics) for Gold, T-bill, SONIA in UK – continued (2)							
Code	Gold	T-bill	SONIA	Code	Gold	T-bill	SONIA
DGOC	0.19	0.00*	0.00*	RMV	0.63	0.00*	0.00*
DIGS	0.68	0.00*	0.00*	RNK	0.26	0.38	0.00*
DLG	0.37	0.00*	0.00*	ROR	0.39	0.00*	0.00*
DLN	0.48	0.00*	0.00*	RR.	0.14	0.00*	0.00*
DNLM	0.67	0.00*	0.00*	RSA	0.81	0.00*	0.00*
DOM	0.22	0.00*	0.00*	RSW	0.62	0.00*	0.00*
DPH	0.97	0.00*	0.00*	RTO	0.57	0.00*	0.00*
DPLM	0.34	0.00*	0.00*	SAFE	0.25	0.00*	0.00*
DRX	0.68	0.00*	0.00*	SAIN	0.39	0.00*	0.00*
ECM	0.37	0.00*	0.00*	SBRE	0.36	0.00*	0.00*
EDIN	0.98	0.00*	0.00*	SBRY	0.98	0.00*	0.00*
EMG	0.25	0.00*	0.00*	SCIN	0.32	0.00*	0.00*
ENOG	0.07	0.00*	0.00*	SCT	0.37	0.00*	0.00*
ERM	0.67	0.00*	0.00*	SDP	0.19	0.00*	0.67
ESNT	0.62	0.00*	0.00*	SDR	0.69	0.00*	0.00*
EVR	0.34	0.00*	0.00*	SEQI	0.86	0.00*	0.00*
EWI	0.29	0.00*	0.00*	SGE	0.99	0.00*	0.00*
EXPN	0.79	0.00*	0.00*	SGRO	0.17	0.00*	0.00*
EZJ	0.31	0.00*	0.00*	SHB	0.81	0.00*	0.00*
FCIT	0.1	0.00*	0.00*	SIG	0.22	0.00*	0.00*
FCSS	0.92	0.00*	0.00*	SKG	0.24	0.00*	0.00*
FDM	0.45	0.00*	0.00*	SLA	0.61	0.00*	0.00*
FERG	0.21	0.00*	0.00*	SMDS	0.24	0.00*	0.00*
FEV	0.37	0.00*	0.00*	SMIN	0.68	0.00*	0.00*
FGP	0.19	0.00*	0.00*	SMP	0.01*	0.00*	0.00*
FGT	0.67	0.00*	0.00*	SMT	0.99	0.00*	0.00*
FLTR	0.59	0.00*	0.00*	SMWH	0.31	0.00*	0.00*
FOUR	0.66	0.00*	0.00*	SN.	0.31	0.00*	0.00*
FRAS	0.37	0.00*	0.00*	SNN	0.67	0.00*	0.00*
FRES	0.24	0.00*	0.00*	SOI	0.99	0.00*	0.00*
FSFL	0.59	0.00*	0.00*	SONC	0.11	0.00*	0.00*
FSJ	0.99	0.00*	0.00*	SONG	0.89	0.00*	0.00*
FSV	0.77	0.00*	0.00*	SPT	0.55	0.00*	0.00*
FUTR	0.01*	0.00*	0.00*	SPX	0.42	0.00*	0.00*
FXPO	0.65	0.00*	0.00*	SRE	0.2	0.00*	0.00*
GAW	0.52	0.00*	0.00*	SRP	0.84	0.00*	0.00*
GCP	0.48	0.00*	0.00*	SSE	0.87	0.00*	0.00*
GFS	0.97	0.00*	0.00*	SSON	0.88	0.00*	0.98
GFTU	0.66	0.00*	0.00*	SSPG	0.94	0.00*	0.00*
GLEN	0.72	0.00*	0.00*	STAN	0.37	0.00*	0.00*
GLO	0.59	0.00*	0.00*	STJ	0.25	0.00*	0.00*
GNC	0.78	0.00*	0.00*	SVS	0.99	0.00*	0.00*
GNS	0.14	0.00*	0.00*	SVT	0.2	0.00*	0.00*
GPOR	0.82	0.00*	0.00*	SXS	0.54	0.00*	0.00*

Table B- 16 Wald Test Results (p-value for t-statistics) for Gold, T-bill, SONIA in UK – continued (3)							
Code	Gold	T-bill	SONIA	Code	Gold	T-bill	SONIA
GRG	0.59	0.00*	0.00*	SYNC	0.96	0.00*	0.00*
GRI	0.75	0.00*	0.00*	SYNT	0.29	0.00*	0.00*
GSK	0.69	0.00*	0.00*	TALK	0.61	0.00*	0.00*
GSS	0.95	0.00*	0.00*	TATE	0.37	0.00*	0.00*
GVC	0.58	0.00*	0.00*	TBCG	0.83	0.00*	0.00*
GYS	0.58	0.00*	0.00*	TCAP	0.58	0.00*	0.00*
HAS	0.01*	0.00*	0.00*	TEM	0.48	0.00*	0.00*
HFG	0.78	0.00*	0.00*	TEP	0.3	0.00*	0.00*
HGT	0.56	0.00*	0.00*	TIFS	0.42	0.00*	0.00*
HICL	0.46	0.00*	0.00*	TPK	0.81	0.00*	0.00*
HIK	0.16	0.00*	0.00*	TRIG	0.96	0.00*	0.00*
HILS	0.13	0.00*	0.00*	TRN	0.65	0.00*	0.00*
HL.	0.52	0.00*	0.00*	TRY	0.16	0.00*	0.00*
HLMA	0.42	0.00*	0.00*	TSCO	0.45	0.00*	0.00*
HOC	0.17	0.00*	0.00*	TUI	0.71	0.00*	0.00*
HRI	0.61	0.00*	0.00*	TW.	0.59	0.00*	0.00*
HSBA	0.86	0.00*	0.00*	UDG	0.68	0.00*	0.00*
HSL	0.75	0.00*	0.00*	UKCM	0.74	0.00*	0.00*
HSTG	0.94	0.00*	0.00*	UKW	0.17	0.00*	0.00*
HSV	0.25	0.00*	0.00*	ULE	0.27	0.00*	0.00*
HSX	0.6	0.00*	0.00*	ULVR	0.4	0.00*	0.00*
HTWS	0.7	0.00*	0.00*	USA	0.23	0.00*	0.00*
HVPE	0.81	0.00*	0.00*	UTG	0.15	0.00*	0.00*
HWDN	0.76	0.00*	0.00*	UU.	0.1	0.00*	0.00*
IAG	0.17	0.00*	0.00*	VCT	0.95	0.00*	0.00*
IBST	0.57	0.00*	0.00*	VEC	0.59	0.00*	0.00*
ICGT	0.83	0.00*	0.00*	VEIL	0.17	0.00*	0.00*
ICP	0.98	0.00*	0.00*	VMUK	0.92	0.00*	0.00*
IEM	0.01*	0.00*	0.00*	VOD	0.26	0.00*	0.00*
IGG	0.76	0.00*	0.00*	VOF	0.49	0.00*	0.00*
IHG	0.19	0.00*	0.00*	VSVS	0.97	0.00*	0.00*
IHP	0.93	0.00*	0.00*	VTY	0.01*	0.00*	0.00*
III	0.16	0.00*	0.00*	VVO	0.68	0.00*	0.00*
IMB	0.44	0.00*	0.00*	WEIR	0.75	0.00*	0.00*
IMI	0.71	0.00*	0.00*	WG.	0.23	0.00*	0.00*
INCH	0.01*	0.00*	0.00*	WIZZ	0.22	0.00*	0.00*
INDV	0.61	0.00*	0.00*	WKP	0.78	0.00*	0.00*
INF	0.27	0.00*	0.00*	WMH	0.33	0.00*	0.00*
INPP	0.87	0.00*	0.00*	WOSG	0.58	0.00*	0.00*
INVP	0.21	0.00*	0.00*	WPP	0.66	0.00*	0.00*
IPO	0.01*	0.00*	0.00*	WTAN	0.53	0.00*	0.00*
ITRK	0.3	0.00*	0.00*	WTB	0.01*	0.00*	0.00*
ITV	0.64	0.00*	0.00*	WWH	0.32	0.00*	0.00*
IWG	0.77	0.00*	0.00*	XPP	0.84	0.00*	0.00*
Note: * represent the statistical significance at the 5% level.							

Table B- 17 Wald Test Results (p-value for t-statistics) for Gold, T-bill, SOFR in US

Code	Gold	T-bill	SOFR	Code	Gold	T-bill	SOFR
ATVI	0.45	0.00*	0.00*	MTD	0.85	0.00*	0.00*
GOOGL	0.52	0.00*	0.71	MYL	0.79	0.00*	0.00*
GOOG	0.52	0.16	0.00*	PKI	0.46	0.00*	0.00*
T	0.9	0.00*	0.00*	PRGO	0.04*	0.00*	0.16
CTL	0.01*	0.00*	0.00*	PFE	0.13	0.39	0.00*
CHTR	0.96	0.00*	0.00*	DGX	0.00*	0.00*	0.68
CMCSA	0.38	0.34	0.54	REGN	0.01*	0.00*	0.00*
DISCA	0.02*	0.00*	0.00*	RMD	0.91	0.00*	0.00*
DISCK	0.24	0.00*	0.00*	STE	0.2	0.00*	0.00*
DISH	0.24	0.00*	0.00*	SYK	0.4	0.00*	0.00*
EA	0.18	0.00*	0.00*	TFX	0.16	0.00*	0.00*
FB	0.69	0.41	0.75	COO	0.00*	0.79	0.76
FOXA	0.00*	0.00*	0.00*	TMO	0.12	0.00*	0.00*
FOX	0.96	0.00*	0.00*	UNH	0.54	0.00*	0.00*
IPG	0.57	0.00*	0.00*	UHS	0.79	0.00*	0.00*
LYV	0.28	0.00*	0.88	VAR	0.75	0.00*	0.00*
NFLX	0.69	0.00*	0.00*	VRTX	0.43	0.00*	0.00*
NWSA	0.34	0.76	0.00*	WAT	0.23	0.00*	0.00*
NWS	0.19	0.00*	0.00*	WST	0.01*	0.62	0.00*
OMC	0.41	0.00*	0.00*	ZBH	0.18	0.00*	0.00*
TMUS	0.91	0.00*	0.00*	ZTS	0.00*	0.00*	0.33
TTWO	0.47	0.00*	0.00*	MMM	0.54	0.00*	0.00*
DIS	0.36	0.68	0.00*	AOS	0.45	0.00*	0.00*
TWTR	0.01*	0.00*	0.00*	ALK	0.62	0.00*	0.00*
VZ	0.76	0.00*	0.89	ALLE	0.98	0.00*	0.00*
VIAC	0.33	0.00*	0.00*	AAL	0.01*	0.00*	0.00*
AAP	0.56	0.00*	0.00*	AME	0.17	0.00*	0.00*
AMZN	0.67	0.00*	0.00*	BA	0.27	0.00*	0.00*
APTV	0.00*	0.00*	0.00*	CHRW	0.95	0.00*	0.00*
AZO	0.79	0.00*	0.00*	CARR	0.39	0.00*	0.00*
BBY	0.16	0.52	0.00*	CAT	0.12	0.16	0.26
BKNG	0.63	0.00*	0.00*	CTAS	0.79	0.00*	0.00*
BWA	0.7	0.00*	0.00*	CPRT	0.33	0.00*	0.00*
KMX	0.68	0.00*	0.36	CSX	0.91	0.00*	0.00*
CCL	0.18	0.00*	0.00*	CMI	0.00*	0.00*	0.00*
CMG	0.32	0.00*	0.00*	DE	0.52	0.00*	0.00*
DHI	0.82	0.00*	0.00*	DAL	0.03*	0.00*	0.00*
DRI	0.4	0.00*	0.00*	DOV	0.46	0.00*	0.00*
DG	0.00*	0.09	0.00*	ETN	0.09	0.00*	0.51
DLTR	0.64	0.00*	0.53	EMR	0.47	0.00*	0.00*
DPZ	0.1	0.00*	0.00*	EFX	0.8	0.00*	0.00*

Table B- 17 Wald Test Results (p-value for t-statistics) for Gold, T-bill, SOFR in US – continued (1)							
Code	Gold	T-bill	SOFR	Code	Gold	T-bill	SOFR
EBAY	0.43	0.00*	0.00*	EXPD	0.1	0.00*	0.00*
EXPE	0.22	0.24	0.00*	FAST	0.27	0.00*	0.00*
F	0.73	0.00*	0.00*	FDX	0.16	0.00*	0.00*
GPS	0.91	0.00*	0.00*	FLS	0.78	0.00*	0.00*
GRMN	0.66	0.00*	0.00*	FTV	0.01*	0.63	0.00*
GM	0.63	0.49	0.00*	FBHS	0.26	0.00*	0.00*
GPC	0.28	0.00*	0.00*	GD	0.47	0.00*	0.00*
HRB	0.32	0.00*	0.00*	GE	0.67	0.00*	0.00*
HBI	0.00*	0.00*	0.00*	GWW	0.89	0.00*	0.00*
HAS	0.07	0.00*	0.00*	HON	0.00*	0.00*	0.00*
HLT	0.63	0.00*	0.00*	HWM	0.7	0.00*	0.00*
HD	0.92	0.00*	0.00*	HII	0.53	0.00*	0.00*
KSS	0.37	0.00*	0.00*	IEX	0.21	0.00*	0.00*
LB	0.00*	0.08	0.94	INFO	0.47	0.00*	0.00*
LVS	0.31	0.00*	0.00*	ITW	0.00*	0.00*	0.00*
LEG	0.34	0.00*	0.00*	IR	0.72	0.00*	0.05
LEN	0.77	0.00*	0.00*	JBHT	0.17	0.00*	0.00*
LKQ	0.84	0.00*	0.00*	J	0.27	0.00*	0.00*
LOW	0.83	0.00*	0.00*	JCI	0.84	0.00*	0.00*
MAR	0.28	0.00*	0.00*	KSU	0.02*	0.49	0.00*
MCD	0.86	0.00*	0.00*	LHX	0.55	0.00*	0.00*
MGM	0.28	0.00*	0.00*	LMT	0.85	0.00*	0.00*
MHK	0.29	0.00*	0.00*	MAS	0.73	0.00*	0.00*
NWL	0.18	0.00*	0.00*	NLSN	0.19	0.00*	0.00*
NKE	0.01*	0.00*	0.00*	NSC	0.07	0.00*	0.00*
NCLH	0.63	0.95	0.22	NOC	0.00*	0.00*	0.00*
NVR	0.78	0.00*	0.00*	ODFL	0.33	0.00*	0.00*
ORLY	0.22	0.00*	0.00*	OTIS	0.31	0.00*	0.00*
PHM	0.88	0.00*	0.00*	PCAR	0.01*	0.00*	0.00*
PVH	0.52	0.00*	0.00*	PH	0.2	0.00*	0.00*
RL	0.46	0.00*	0.00*	PNR	0.00*	0.00*	0.89
ROST	0.00*	0.00*	0.24	PWR	0.19	0.00*	0.00*
RCL	0.16	0.00*	0.00*	RTX	0.75	0.00*	0.00*
SBUX	0.94	0.00*	0.00*	RSG	0.29	0.00*	0.65
TPR	0.73	0.58	0.24	RHI	0.83	0.81	0.00*
TGT	0.91	0.00*	0.00*	ROK	0.4	0.00*	0.00*
TIF	0.15	0.00*	0.00*	ROL	0.11	0.00*	0.00*
TJX	0.67	0.00*	0.00*	ROP	0.1	0.00*	0.00*
TSCO	0.06	0.00*	0.00*	SNA	0.00*	0.00*	0.00*
ULTA	0.1	0.00*	0.00*	LUV	0.89	0.00*	0.00*
UAA	0.27	0.00*	0.42	SWK	0.57	0.00*	0.00*
UA	0.16	0.00*	0.00*	TDY	0.45	0.00*	0.00*
VFC	0.77	0.00*	0.00*	TXT	0.2	0.00*	0.00*
WHR	0.4	0.29	0.00*	TT	0.39	0.00*	0.00*

Table B- 17 Wald Test Results (p-value for t-statistics) for Gold, T-bill, SOFR in US – continued (2)							
Code	Gold	T-bill	SOFR	Code	Gold	T-bill	SOFR
WYNN	0.45	0.00*	0.00*	TDG	0.8	0.00*	0.00*
YUM	0.26	0.00*	0.00*	UNP	0.21	0.00*	0.00*
MO	0.23	0.00*	0.00*	UAL	0.27	0.00*	0.41
ADM	0.68	0.00*	0.00*	UPS	0.74	0.00*	0.00*
BF.B	0.01*	0.00*	0.00*	URI	0.68	0.00*	0.00*
CPB	0.83	0.00*	0.00*	VRSK	0.8	0.59	0.00*
CHD	0.64	0.00*	0.00*	WAB	0.01*	0.00*	0.00*
KO	0.29	0.00*	0.00*	WM	0.87	0.00*	0.37
CL	0.61	0.73	0.00*	XYL	0.32	0.00*	0.00*
CAG	0.62	0.00*	0.00*	ACN	0.26	0.00*	0.00*
STZ	0.00*	0.00*	0.00*	ADBE	0.00*	0.00*	0.00*
COST	0.18	0.00*	0.07	AMD	0.11	0.00*	0.00*
COTY	0.68	0.00*	0.00*	AKAM	0.24	0.00*	0.00*
EL	0.44	0.00*	0.00*	APH	0.71	0.00*	0.00*
GIS	0.69	0.41	0.00*	ADI	0.55	0.00*	0.00*
HRL	0.65	0.00*	0.00*	ANSS	0.00*	0.00*	0.61
SJM	0.89	0.00*	0.00*	AAPL	0.61	0.00*	0.00*
K	0.73	0.00*	0.00*	AMAT	0.63	0.00*	0.00*
KMB	0.75	0.00*	0.00*	ANET	0.89	0.00*	0.23
KHC	0.72	0.00*	0.00*	ADSK	0.97	0.00*	0.00*
KR	0.42	0.9	0.00*	ADP	0.78	0.51	0.00*
LW	0.49	0.00*	0.00*	AVGO	0.32	0.00*	0.00*
MKC	0.77	0.00*	0.00*	BR	0.99	0.00*	0.85
TAP	0.22	0.00*	0.00*	CDNS	0.89	0.00*	0.00*
MDLZ	0.23	0.00*	0.00*	CDW	0.87	0.00*	0.00*
MNST	0.00*	0.00*	0.00*	CSCO	0.4	0.00*	0.00*
PEP	0.81	0.00*	0.00*	CTXS	0.77	0.00*	0.00*
PM	0.79	0.00*	0.00*	CTSH	0.28	0.00*	0.00*
PG	0.36	0.00*	0.00*	GLW	0.7	0.00*	0.00*
SYY	0.92	0.52	0.24	DXC	0.34	0.00*	0.00*
CLX	0.66	0.00*	0.00*	FFIV	0.75	0.00*	0.00*
HSY	0.54	0.00*	0.00*	FIS	0.1	0.00*	0.00*
TSN	0.32	0.00*	0.00*	FISV	0.85	0.00*	0.00*
WBA	0.88	0.00*	0.00*	FLT	0.00*	0.00*	0.72
WMT	0.85	0.00*	0.00*	FLIR	0.17	0.00*	0.00*
APA	0.72	0.54	0.00*	FTNT	0.54	0.00*	0.00*
BKR	0.35	0.00*	0.00*	IT	0.78	0.00*	0.00*
COG	0.81	0.00*	0.00*	GPN	0.94	0.00*	0.00*
CVX	0.63	0.00*	0.00*	HPE	0.21	0.48	0.00*
CXO	0.00*	0.00*	0.00*	HPQ	0.00*	0.00*	0.92
COP	0.68	0.81	0.00*	INTC	0.96	0.00*	0.00*
DVN	0.23	0.00*	0.00*	IBM	0.38	0.00*	0.00*
FANG	0.74	0.00*	0.00*	INTU	0.61	0.00*	0.00*
EOG	0.41	0.00*	0.00*	IPGP	0.37	0.00*	0.00*

Table B- 17 Wald Test Results (p-value for t-statistics) for Gold, T-bill, SOFR in US – continued (3)							
Code	Gold	T-bill	SOFR	Code	Gold	T-bill	SOFR
XOM	0.45	0.00*	0.00*	JKHY	0.68	0.00*	0.00*
HAL	0.78	0.00*	0.00*	JNPR	0.00*	0.00*	0.00*
HES	0.01*	0.00*	0.00*	KEYS	0.6	0.00*	0.00*
HFC	0.62	0.66	0.00*	KLAC	0.76	0.00*	0.00*
KMI	0.87	0.00*	0.00*	LRCX	0.15	0.00*	0.00*
MRO	0.78	0.00*	0.00*	LDOS	0.94	0.00*	0.00*
MPC	0.94	0.00*	0.92	MA	0.00*	0.48	0.00*
NOV	0.22	0.00*	0.00*	MXIM	0.4	0.00*	0.76
NBL	0.24	0.00*	0.00*	MCHP	0.25	0.00*	0.00*
OXY	0.99	0.85	0.00*	MU	0.09	0.00*	0.00*
OKE	0.33	0.00*	0.00*	MSFT	0.27	0.00*	0.00*
PSX	0.00*	0.00*	0.00*	MSI	0.00*	0.00*	0.00*
PXD	0.52	0.00*	0.00*	NTAP	0.85	0.00*	0.00*
SLB	0.63	0.00*	0.00*	NLOK	0.89	0.00*	0.00*
FTI	0.42	0.00*	0.00*	NVDA	0.68	0.00*	0.00*
VLO	0.62	0.00*	0.00*	ORCL	0.44	0.00*	0.00*
WMB	0.16	0.00*	0.00*	PAYX	0.07	0.00*	0.00*
AFL	0.53	0.00*	0.00*	PAYC	0.42	0.00*	0.00*
ALL	0.47	0.00*	0.00*	PYPL	0.00*	0.18	0.00*
AXP	0.48	0.00*	0.00*	QRVO	0.25	0.00*	0.19
AIG	0.49	0.00*	0.00*	QCOM	0.65	0.00*	0.00*
AMP	0.85	0.00*	0.6	CRM	0.61	0.00*	0.00*
AON	0.57	0.00*	0.00*	STX	0.13	0.00*	0.91
AJG	0.00*	0.00*	0.00*	NOW	0.63	0.00*	0.00*
AIZ	0.55	0.45	0.00*	SWKS	0.18	0.00*	0.00*
BAC	0.32	0.00*	0.00*	SNPS	0.00*	0.00*	0.00*
BRK.B	0.54	0.00*	0.00*	TEL	0.28	0.00*	0.00*
BLK	0.18	0.00*	0.9	TXN	0.57	0.00*	0.00*
COF	0.19	0.00*	0.00*	TYL	0.59	0.00*	0.00*
CBOE	0.88	0.00*	0.00*	VRSN	0.32	0.00*	0.00*
SCHW	0.39	0.00*	0.00*	V	0.37	0.00*	0.00*
CB	0.94	0.00*	0.00*	WDC	0.82	0.00*	0.00*
CINF	0.00*	0.00*	0.00*	WU	0.18	0.00*	0.00*
C	0.84	0.00*	0.00*	XRX	0.00*	0.82	0.00*
CFG	0.94	0.00*	0.00*	XLNX	0.55	0.00*	0.00*
CME	0.98	0.00*	0.00*	ZBRA	0.06	0.00*	0.00*
CMA	0.96	0.00*	0.92	APD	0.27	0.00*	0.00*
DFS	0.00*	0.00*	0.00*	ALB	0.04*	0.00*	0.00*
ETFC	0.63	0.00*	0.00*	AMCR	0.88	0.00*	0.00*
RE	0.22	0.00*	0.00*	AVY	0.14	0.00*	0.00*
FITB	0.3	0.00*	0.00*	BLL	0.86	0.00*	0.95
FRC	0.96	0.00*	0.00*	CE	0.76	0.00*	0.00*
BEN	0.47	0.44	0.00*	CF	0.96	0.00*	0.00*
GL	0.57	0.00*	0.00*	CTVA	0.00*	0.00*	0.00*

Table B- 17 Wald Test Results (p-value for t-statistics) for Gold, T-bill, SOFR in US – continued (4)							
Code	Gold	T-bill	SOFR	Code	Gold	T-bill	SOFR
GS	0.7	0.00*	0.00*	DOW	0.54	0.00*	0.00*
HIG	0.42	0.00*	0.00*	DD	0.84	0.08	0.99
HBAN	0.9	0.00*	0.00*	EMN	0.06	0.00*	0.00*
ICE	0.45	0.00*	0.00*	ECL	0.46	0.00*	0.00*
IVZ	0.5	0.00*	0.4	FMC	0.43	0.00*	0.00*
JPM	0.94	0.00*	0.00*	FCX	0.00*	0.00*	0.00*
KEY	0.48	0.00*	0.00*	IFF	0.55	0.00*	0.00*
LNC	0.00*	0.00*	0.00*	IP	0.44	0.00*	0.00*
L	0.65	0.00*	0.00*	LIN	0.01*	0.00*	0.00*
MTB	0.85	0.00*	0.5	LYB	0.06	0.00*	0.00*
MKTX	0.93	0.00*	0.00*	MLM	0.83	0.00*	0.00*
MMC	0.01*	0.00*	0.00*	NEM	0.93	0.00*	0.8
MET	0.32	0.00*	0.00*	NUE	0.36	0.00*	0.00*
MCO	0.64	0.00*	0.00*	PKG	0.00*	0.00*	0.00*
MS	0.46	0.00*	0.00*	PPG	0.34	0.00*	0.00*
MSCI	0.54	0.00*	0.00*	SEE	0.77	0.00*	0.00*
NDAQ	0.67	0.00*	0.36	SHW	0.94	0.00*	0.00*
NTRS	0.81	0.00*	0.00*	MOS	0.85	0.00*	0.00*
PBCT	0.07	0.00*	0.00*	VMC	0.27	0.00*	0.00*
PNC	0.00*	0.00*	0.00*	WRK	0.96	0.00*	0.00*
PFG	0.69	0.00*	0.00*	ARE	0.00*	0.00*	0.00*
PGR	0.22	0.00*	0.00*	AMT	0.96	0.00*	0.00*
PRU	0.65	0.00*	0.00*	AIV	0.00*	0.00*	0.00*
RJF	0.14	0.00*	0.00*	AVB	0.91	0.00*	0.00*
RF	0.32	0.00*	0.00*	BXP	0.44	0.00*	0.00*
SPGI	0.00*	0.00*	0.00*	CBRE	0.66	0.00*	0.00*
STT	0.07	0.00*	0.00*	CCI	0.00*	0.00*	0.00*
SIVB	0.27	0.00*	0.00*	DLR	0.35	0.00*	0.00*
SYF	0.14	0.00*	0.00*	DRE	0.23	0.00*	0.00*
TROW	0.83	0.00*	0.00*	EQIX	0.85	0.00*	0.53
BK	0.28	0.00*	0.00*	EQR	0.18	0.00*	0.00*
TRV	0.88	0.00*	0.00*	ESS	0.86	0.00*	0.00*
TFC	0.29	0.00*	0.00*	EXR	0.00*	0.00*	0.00*
USB	0.13	0.00*	0.00*	FRT	0.08	0.00*	0.00*
UNM	0.89	0.00*	0.3	PEAK	0.33	0.00*	0.00*
WRB	0.1	0.00*	0.00*	HST	0.82	0.00*	0.00*
WFC	0.83	0.00*	0.00*	IRM	0.00*	0.00*	0.00*
WLTW	0.00*	0.00*	0.00*	KIM	0.98	0.00*	0.00*
ZION	0.61	0.00*	0.00*	MAA	0.22	0.00*	0.00*
ABT	0.23	0.00*	0.00*	PLD	0.93	0.00*	0.00*
ABBV	0.91	0.00*	0.00*	PSA	0.7	0.00*	0.00*
ABMD	0.1	0.00*	0.00*	O	0.47	0.00*	0.00*
A	0.82	0.00*	0.00*	REG	0.17	0.00*	0.00*
ALXN	0.45	0.00*	0.00*	SBAC	0.00*	0.00*	0.00*

Table B- 17 Wald Test Results (p-value for t-statistics) for Gold, T-bill, SOFR in US – continued (5)							
Code	Gold	T-bill	SOFR	Code	Gold	T-bill	SOFR
ALGN	0.98	0.00*	0.00*	SPG	0.64	0.00*	0.00*
ABC	0.00*	0.00*	0.00*	SLG	0.68	0.00*	0.00*
AMGN	0.27	0.00*	0.00*	UDR	0.93	0.00*	0.00*
ANTM	0.01*	0.37	0.00*	VTR	0.36	0.00*	0.89
BAX	0.37	0.00*	0.00*	VNO	0.37	0.00*	0.00*
BDX	0.8	0.00*	0.41	WELL	0.00*	0.08	0.00*
BIO	0.59	0.00*	0.00*	WY	0.77	0.00*	0.00*
BIIB	0.00*	0.00*	0.00*	Symbol	0.00*	0.00*	0.00*
BSX	0.81	0.00*	0.00*	AES	0.29	0.00*	0.00*
BMY	0.23	0.00*	0.00*	LNT	0.6	0.00*	0.00*
CAH	0.56	0.00*	0.00*	AEE	0.01*	0.00*	0.00*
CNC	0.91	0.00*	0.00*	AEP	0.86	0.00*	0.00*
CERN	0.83	0.00*	0.00*	AWK	0.82	0.18	0.00*
CI	0.74	0.00*	0.00*	ATO	0.72	0.00*	0.00*
CVS	0.00*	0.00*	0.00*	CNP	0.00*	0.00*	0.00*
DHR	0.49	0.00*	0.00*	CMS	0.9	0.00*	0.00*
DVA	0.56	0.00*	0.00*	ED	0.17	0.00*	0.00*
XRAY	0.01*	0.00*	0.37	D	0.81	0.00*	0.00*
DXCM	0.7	0.00*	0.00*	DTE	0.99	0.00*	0.00*
EW	0.62	0.00*	0.00*	DUK	0.23	0.00*	0.00*
GILD	0.9	0.00*	0.00*	EIX	0.33	0.00*	0.00*
HCA	0.77	0.00*	0.00*	ETR	0.57	0.00*	0.06
HSIC	0.00*	0.00*	0.00*	EVRG	0.00*	0.00*	0.00*
HOLX	0.62	0.00*	0.00*	ES	0.76	0.00*	0.00*
HUM	0.14	0.00*	0.00*	EXC	0.16	0.00*	0.00*
IDXX	0.56	0.00*	0.00*	FE	0.85	0.00*	0.00*
ILMN	0.00*	0.00*	0.00*	NEE	0.00*	0.00*	0.00*
INCY	0.97	0.00*	0.00*	NI	0.79	0.84	0.00*
ISRG	0.07	0.2	0.00*	NRG	0.83	0.00*	0.00*
IQV	0.8	0.00*	0.00*	PNW	0.87	0.00*	0.00*
JNJ	0.46	0.00*	0.00*	PPL	0.01*	0.00*	0.00*
LH	0.47	0.00*	0.00*	PEG	0.77	0.00*	0.00*
LLY	0.00*	0.00*	0.57	SRE	0.00*	0.67	0.00*
MCK	0.67	0.38	0.00*	SO	0.22	0.00*	0.42
MDT	0.27	0.00*	0.00*	WEC	0.00*	0.00*	0.00*
MRK	0.47	0.00*	0.00*	XEL	0.14	0.00*	0.00*
Note: * represent the statistical significance at the 5% level.							

Table B- 18 Wald Test Results (p-value for t-statistics) for Gold, T-bill, IBOR in China

Code	Gold	T-bill	IBOR	Code	Gold	T-bill	IBOR
600000	0.08	0.00*	0.99	600895	0.15	0.00*	0.99
600004	0.7	0.00*	0.71	600900	0.48	0.00*	0.17
600009	0.77	0.00*	0.13	600909	0.24	0.00*	0.39
600010	0.89	0.16	0.39	600919	0.29	0.00*	0.91
600011	0.59	0.00*	0.31	600926	0.75	0.00*	0.2
600015	0.49	0.00*	0.08	600928	0.63	0.00*	0.3
600016	0.64	0.00*	0.76	600958	0.12	0.00*	0.77
600018	0.56	0.00*	0.01*	600968	0.36	0.00*	0.8
600019	0.41	0.00*	0.92	600977	0.94	0.00*	0.01*
600025	0.87	0.00*	0.53	600989	0.27	0.00*	0.49
600028	0.66	0.21	0.33	600999	0.43	0.00*	0.16
600029	0.63	0.00*	0.41	601006	0.1	0.00*	0.43
600030	0.1	0.00*	0.52	601009	0.18	0.79	0.81
600031	0.83	0.00*	0.3	601012	0.73	0.00*	0.28
600036	0.51	0.45	0.68	601021	0.42	0.00*	0.16
600038	0.42	0.00*	0.46	601066	0.66	0.00*	0.34
600048	0.46	0.00*	0.15	601077	0.85	0.00*	0.63
600050	0.54	0.00*	0.22	601088	0.68	0.00*	0.88
600061	0.96	0.14	0.14	601099	0.42	0.00*	0.23
600066	0.45	0.00*	0.41	601100	0.62	0.00*	0.17
600068	0.83	0.00*	0.42	601108	0.75	0.00*	0.84
600085	0.19	0.00*	0.75	601111	0.53	0.00*	0.66
600089	0.78	0.00*	0.11	601138	0.26	0.00*	0.32
600104	0.59	0.00*	0.33	601155	0.19	0.00*	0.99
600109	0.98	0.00*	0.02*	601162	0.84	0.00*	0.2
600111	0.18	0.00*	0.65	601166	0.78	0.00*	0.2
600115	0.73	0.00*	0.18	601169	0.83	0.00*	0.04*
600118	0.01*	0.00*	0.26	601186	0.83	0.00*	0.24
600150	0.82	0.00*	0.54	601198	0.11	0.00*	0.35
600155	0.96	0.00*	0.74	601211	0.84	0.00*	0.97
600176	0.23	0.00*	0.36	601225	0.24	0.00*	0.36
600177	0.11	0.00*	0.39	601229	0.54	0.00*	0.17
600183	0.15	0.00*	0.54	601233	0.15	0.00*	0.23
600196	0.82	0.00*	0.2	601236	0.4	0.00*	0.68
600201	0.36	0.00*	0.3	601238	0.6	0.57	0.73
600208	0.48	0.00*	0.2	601288	0.15	0.00*	0.39
600271	0.51	0.17	0.64	601318	0.31	0.00*	0.95
600276	0.28	0.00*	0.61	601319	0.02*	0.00*	0.2
600298	0.45	0.00*	0.99	601328	0.64	0.00*	0.87
600309	0.57	0.00*	0.48	601336	0.96	0.00*	0.41
600332	0.29	0.00*	0.48	601377	0.86	0.00*	0.95

Table B- 18 Wald Test Results (p-value for t-statistics) for Gold, T-bill, IBOR in China – continued (1)							
Code	Gold	T-bill	IBOR	Code	Gold	T-bill	IBOR
600340	0.94	0.00*	0.99	601390	0.1	0.00*	0.92
600346	0.44	0.00*	0.88	601398	0.46	0.00*	0.76
600352	0.51	0.00*	0.84	601519	0.98	0.00*	0.78
600362	0.1	0.00*	0.88	601555	0.28	0.00*	0.69
600383	0.59	0.00*	0.41	601601	0.43	0.00*	0.12
600406	0.15	0.00*	0.3	601607	0.49	0.00*	0.16
600436	0.58	0.00*	0.67	601618	0.35	0.00*	0.77
600438	0.65	0.49	0.89	601628	0.82	0.00*	0.92
600487	0.61	0.00*	0.64	601633	0.06	0.38	0.79
600489	0.57	0.00*	0.68	601658	0.22	0.00*	0.83
600516	0.87	0.00*	0.47	601668	0.99	0.00*	0.41
600519	0.07	0.00*	0.53	601669	0.64	0.00*	0.72
600521	0.39	0.00*	0.02*	601688	0.55	0.00*	0.68
600522	0.47	0.00*	0.57	601698	0.91	0.00*	0.79
600536	0.95	0.00*	0.73	601766	0.78	0.00*	0.58
600547	0.44	0.00*	0.08	601788	0.53	0.00*	0.52
600570	0.11	0.00*	0.92	601800	0.49	0.00*	0.23
600572	0.8	0.00*	0.95	601816	0.51	0.00*	0.49
600585	0.37	0.00*	0.06	601818	0.57	0.00*	0.25
600588	0.77	0.00*	0.81	601857	0.47	0.00*	0.19
600598	0.97	0.00*	0.13	601860	0.29	0.00*	0.01*
600600	0.17	0.00*	0.84	601872	0.51	0.00*	0.97
600604	0.57	0.72	0.84	601877	0.63	0.00*	0.6
600606	0.14	0.00*	0.58	601878	0.72	0.00*	0.87
600621	0.98	0.00*	0.04*	601881	0.65	0.00*	0.22
600637	0.97	0.00*	0.46	601888	0.89	0.00*	0.85
600660	0.28	0.00*	0.26	601899	0.18	0.92	0.33
600690	0.12	0.00*	0.23	601901	0.65	0.00*	0.63
600699	0.79	0.00*	0.76	601916	0.11	0.00*	0.37
600703	0.83	0.00*	0.09	601933	0.07	0.00*	0.18
600705	0.79	0.00*	0.64	601939	0.83	0.00*	0.88
600733	0.62	0.00*	0.43	601985	0.04*	0.00*	0.76
600737	0.5	0.00*	0.6	601988	0.49	0.00*	0.1
600741	0.52	0.00*	0.34	601989	0.66	0.00*	0.08
600745	0.12	0.64	0.96	601990	0.4	0.00*	0.96
600760	0.01*	0.00*	0.6	601998	0.09	0.00*	0.24
600763	0.19	0.00*	0.76	603019	0.32	0.00*	0.32
600779	0.22	0.00*	0.98	603160	0.62	0.00*	0.39
600795	0.85	0.00*	0.18	603259	0.79	0.00*	0.65
600801	0.12	0.00*	0.83	603288	0.65	0.00*	0.01*
600809	0.79	0.00*	0.97	603369	0.39	0.00*	0.98
600837	0.11	0.00*	0.85	603501	0.59	0.17	0.64
600848	0.9	0.00*	0.81	603517	0.8	0.23	0.67

Table B- 18 Wald Test Results (p-value for t-statistics) for Gold, T-bill, IBOR in China – continued (2)							
Code	Gold	T-bill	IBOR	Code	Gold	T-bill	IBOR
600867	0.58	0.00*	0.89	603589	0.6	0.00*	0.16
600872	0.73	0.00*	0.12	603799	0.09	0.00*	0.08
600875	0.37	0.00*	0.06	603833	0.45	0.00*	0.86
600886	0.1	0.61	0.23	603983	0.32	0.00*	0.96
600887	0.68	0.00*	0.9	603986	0.82	0.00*	0.22
600893	0.57	0.00*	0.09	603993	0.61	0.53	0.91
Note: * represent the statistical significance at the 5% level.							

Table B- 19 Wald Test Results (p-value for t-statistics) for Gold, T-bill, TONA in Japan

Code	Gold	T-bill	TONA	Code	Gold	T-bill	TONA
4503	0.61	0.52	0.00*	1605	0.16	0.08	0.00*
4519	0.82	0.49	0.00*	3401	0.59	0.64	0.00*
4568	0.27	0.02*	0.49	3402	0.29	0.65	0.88
4506	0.23	0.45	0.00*	3101	0.75	0.68	0.00*
4523	0.15	0.56	0.00*	3103	0.54	0.35	0.00*
4151	0.01*	0.07	0.00*	3863	0.09	0.12	0.00*
4578	0.23	0.13	0.00*	3861	0.63	0.02*	0.00*
4507	0.5	0.93	0.7	3407	0.98	0.19	0.00*
4502	0.16	0.57	0.00*	4061	0.4	0.48	0.00*
6857	0.56	0.79	0.00*	4631	0.48	0.33	0.29
6770	0.12	0.04*	0.00*	4901	0.04*	0.59	0.00*
7751	0.56	0.67	0.87	4452	0.98	0.74	0.00*
6952	0.33	0.52	0.00*	3405	0.14	0.29	0.00*
7735	0.75	0.02*	0.00*	4188	0.72	0.4	0.00*
6902	0.12	0.47	0.00*	4183	0.56	0.34	0.00*
6954	0.24	0.45	0.71	4021	0.84	0.68	0.35
6504	0.5	0.16	0.00*	6988	0.63	0.97	0.00*
6702	0.59	0.23	0.00*	4063	0.7	0.63	0.00*
6674	0.24	0.64	0.00*	4911	0.01*	0.55	0.00*
6501	0.98	0.77	0.00*	4004	0.17	0.11	0.00*
6971	0.99	0.21	0.00*	4005	0.72	0.33	0.00*
6479	0.02*	0.76	0.63	4043	0.6	0.02*	0.00*
6503	0.52	0.27	0.00*	4042	0.74	0.2	0.14
6701	0.11	0.55	0.00*	4208	0.58	0.56	0.00*
3105	0.74	0.86	0.00*	5020	0.8	0.88	0.00*
6703	0.8	0.47	0.00*	5019	0.39	0.87	0.00*
6645	0.37	0.68	0.00*	5108	0.4	0.04*	0.00*
6752	0.16	0.23	0.41	5101	0.51	0.86	0.00*
7752	0.41	0.99	0.00*	5201	0.3	0.97	0.00*
6724	0.79	0.33	0.00*	5333	0.77	0.27	0.00*
6758	0.07	0.14	0.00*	5214	0.48	0.25	0.00*
6976	0.18	0.77	0.00*	5202	0.65	0.45	0.00*
6762	0.98	0.03*	0.00*	5232	0.19	0.74	0.00*
8035	0.58	0.27	0.00*	5233	0.44	0.24	0.00*
6506	0.33	0.91	0.00*	5301	0.96	0.26	0.00*
6841	0.46	0.56	0.00*	5332	0.86	0.75	0.00*
7205	0.69	0.19	0.15	5411	0.98	0.79	0.00*
7267	0.68	0.52	0.00*	5406	0.01*	0.16	0.00*
7202	0.93	0.89	0.00*	5401	0.43	0.9	0.00*
7261	0.33	0.15	0.00*	5541	0.81	0.17	0.00*
7211	0.87	0.17	0.00*	5714	0.07	0.02*	0.15
7201	0.39	0.78	0.00*	5803	0.45	0.31	0.00*
7270	0.14	0.15	0.71	5801	0.72	0.4	0.00*

Table B- 19 Wald Test Results (p-value for t-statistics) for Gold, T-bill, TONA in Japan – continued (1)							
Code	Gold	T-bill	TONA	Code	Gold	T-bill	TONA
7269	0.17	0.41	0.00*	5711	0.84	0.71	0.00*
7203	0.38	0.04*	0.00*	5706	0.79	0.79	0.00*
7272	0.2	0.65	0.00*	5703	0.37	0.44	0.00*
7762	0.81	0.91	0.00*	3436	0.36	0.62	0.00*
4902	0.46	0.6	0.00*	5802	0.00*	0.32	0.00*
7731	0.01*	0.73	0.00*	5713	0.64	0.22	0.00*
7733	0.18	0.83	0.00*	5707	0.5	0.39	0.00*
4543	0.44	0.47	0.00*	5901	0.62	0.99	0.00*
9433	0.74	0.19	0.73	8001	0.16	0.92	0.00*
9432	0.99	0.68	0.00*	8002	0.07	0.79	0.00*
9613	0.89	0.75	0.00*	8058	0.57	0.48	0.00*
9437	0.37	0.37	0.00*	8031	0.36	0.8	0.00*
9412	0.4	0.56	0.00*	2768	0.68	0.53	0.00*
9434	0.74	0.76	0.00*	8053	0.02*	0.55	0.00*
9984	0.97	0.46	0.00*	8015	0.58	0.19	0.00*
8304	0.59	0.92	0.00*	1721	0.97	0.87	0.83
8331	0.64	0.73	0.00*	1925	0.7	0.16	0.00*
7186	0.73	0.81	0.00*	1808	0.27	0.47	0.00*
8309	0.85	0.35	0.00*	1963	0.15	0.16	0.00*
8354	0.09	0.93	0.00*	1812	0.69	0.22	0.00*
8306	0.97	0.84	0.27	1802	0.25	0.96	0.00*
8411	0.21	0.37	0.00*	1928	0.54	0.17	0.00*
8308	0.89	0.55	0.00*	1803	0.21	0.27	0.00*
8303	0.69	0.45	0.00*	1801	0.31	0.89	0.00*
8355	0.61	0.19	0.00*	6113	0.02*	0.87	0.00*
8316	0.51	0.94	0.00*	6367	0.96	0.99	0.00*
8253	0.95	0.47	0.00*	6367	0.41	0.62	0.00*
8697	0.95	0.87	0.00*	6305	0.52	0.2	0.00*
8601	0.04*	0.52	0.00*	7004	0.83	0.93	0.00*
8628	0.92	0.7	0.00*	7013	0.81	0.6	0.00*
8604	0.63	0.57	0.00*	5631	0.43	0.81	0.00*
8750	0.49	0.59	0.00*	6473	0.22	0.98	0.00*
8725	0.17	0.4	0.00*	6301	0.83	0.61	0.00*
8630	0.77	0.75	0.00*	6326	0.44	0.12	0.00*
8795	0.78	0.47	0.00*	7011	0.74	0.76	0.05
8766	0.01*	0.95	0.00*	6471	0.7	0.47	0.00*
1332	0.25	0.38	0.00*	6472	0.49	0.21	0.00*
1333	0.97	0.33	0.00*	6103	0.08	0.74	0.00*
2802	0.63	0.94	0.00*	6302	0.65	0.06	0.00*
2502	0.96	0.26	0.12	7012	0.26	0.2	0.00*
2914	0.43	0.25	0.00*	7003	0.31	0.31	0.00*
2801	0.03*	0.96	0.00*	7832	0.67	0.58	0.00*
2503	0.19	0.49	0.00*	7912	0.41	0.61	0.00*
2269	0.83	0.84	0.00*	7911	0.85	0.16	0.00*

Table B- 19 Wald Test Results (p-value for t-statistics) for Gold, T-bill, TONA in Japan – continued (2)							
Code	Gold	T-bill	TONA	Code	Gold	T-bill	TONA
2871	0.75	0.81	0.00*	7951	0.9	0.56	0.00*
2282	0.87	0.34	0.00*	8802	0.22	0.75	0.00*
2002	0.94	0.74	0.00*	8801	0.61	0.8	0.00*
2501	0.35	0.37	0.00*	8830	0.21	0.73	0.00*
2531	0.38	0.54	0.00*	8804	0.28	0.62	0.00*
8267	0.06	0.19	0.00*	3289	0.05*	0.61	0.00*
8028	0.27	0.89	0.00*	9022	0.34	0.65	0.00*
9983	0.03*	0.43	0.00*	9020	0.07	0.24	0.00*
3099	0.49	0.87	0.00*	9008	0.3	0.57	0.38
3086	0.83	0.92	0.00*	9009	0.99	0.46	0.00*
8252	0.7	0.33	0.00*	9007	0.69	0.38	0.00*
3382	0.24	0.06	0.00*	9001	0.32	0.43	0.00*
8233	0.47	0.44	0.00*	9005	0.97	0.76	0.00*
4751	0.11	0.75	0.00*	9021	0.77	0.85	0.00*
2432	0.55	0.27	0.00*	9062	0.33	0.37	0.00*
4324	0.32	0.75	0.00*	9064	0.13	0.13	0.00*
6178	0.01*	0.85	0.18	9107	0.02*	0.46	0.00*
9766	0.11	0.89	0.00*	9104	0.17	0.65	0.00*
2413	0.44	0.9	0.00*	9101	0.21	0.07	0.00*
4755	0.28	0.44	0.00*	9302	0.79	0.55	0.00*
6098	0.09	0.7	0.00*	9301	0.06	0.39	0.00*
9735	0.78	0.54	0.00*	9502	0.55	0.06	0.00*
9602	0.67	0.67	0.00*	9503	0.86	0.91	0.36
4704	0.13	0.16	0.00*	9501	0.65	0.87	0.00*
4689	0.48	0.86	0.00*	9532	0.56	0.44	0.00*
				9531	0.88	0.74	0.00*
Note: * represent the statistical significance at the 5% level.							

Table B- 20 Wald Test Results (p-value for t-statistics) for Gold, T-bill, IBOR in India

Code	Gold	T-bill	IBOR
500820	0.01*	0.01*	0.00*
532215	0.09	0.00*	0.00*
532977	0.75	0.00*	0.00*
500034	0.1	0.00*	0.01*
532978	0.52	0.75	0.03*
532454	0.45	0.00*	0.04*
532281	0.63	0.00*	0.00*
500010	0.08	0.00*	0.00*
500180	0.6	0.00*	0.00*
500696	0.07	0.00*	0.00*
532174	0.25	0.00*	0.00*
532187	0.38	0.66	0.00*
500209	0.01*	0.00*	0.00*
500875	0.05*	0.00*	0.00*
500247	0.13	0.00*	0.00*
500510	0.2	0.00*	0.00*
500520	0.23	0.00*	0.02*
532500	0.29	0.31	0.00*
500790	0.04*	0.00*	0.17
532555	0.39	0.00*	0.01*
500312	0.53	0.00*	0.54
532898	0.86	0.00*	0.00*
500325	0.07	0.00*	0.00*
500112	0.16	0.00*	0.00*
524715	0.95	0.00*	0.02*
500470	0.99	0.00*	0.00*
532540	0.52	0.00*	0.00*
532755	0.62	0.00*	0.00*
500114	0.02*	0.00*	0.00*
532538	0.57	0.00*	0.00*
Note: * represent the statistical significance at the 5% level.			

Appendix C

Table C- 1 Wald Test results for Portfolio 1,2,3 in the UK

Code	P1	P2	P3	Code	P1	P2	P3
3IN	0.00*	0.62	0.28	JAM	0.00*	0.25	0.07
888	0.00*	0.9	0.52	JD.	0.00*	0.97	0.91
AAF	0.00*	0.33	0.91	JDW	0.00*	0.27	0.17
AAL	0.00*	0.88	0.89	JEO	0.00*	0.54	0.76
ABF	0.00*	0.62	0.33	JESC	0.00*	0.68	0.56
ACI	0.75	0.08	0.9	JET	0.00*	0.15	0.62
ADM	0.00*	0.99	0.32	JFJ	0.00*	0.25	0.48
AGK	0.00*	0.27	0.01*	JLEN	0.00*	0.42	0.56
AGR	0.00*	0.24	0.67	JLG	0.00*	0.4	0.08
AGT	0.00*	0.39	0.54	JMAT	0.00*	0.74	0.83
AHT	0.00*	0.02*	0.42	JMG	0.57	0.89	0.26
AJB	0.00*	0.7	0.64	JUP	0.00*	0.87	0.21
AML	0.00*	0.36	0.06	JUST	0.00*	0.07	0.46
ANTO	0.00*	0.41	0.15	KAZ	0.00*	0.63	0.94
AO.	0.00*	0.66	0.95	KGF	0.00*	0.32	0.88
APAX	0.00*	0.45	0.79	KNOS	0.00*	0.57	0.59
ASCL	0.00*	0.16	0.15	LAND	0.00*	0.9	0.89
ASHM	0.69	0.32	0.2	LGEN	0.00*	0.31	0.04*
ASL	0.00*	0.62	0.21	LIO	0.00*	0.1	0.54
ATST	0.00*	0.37	0.23	LLOY	0.00*	0.69	0.37
ATT	0.00*	0.15	0.31	LMP	0.00*	0.95	0.71
AUTO	0.00*	0.51	0.33	LRE	0.00*	0.45	0.39
AV.	0.00*	0.1	0.18	LSE	0.00*	0.89	0.4
AVON	0.00*	0.23	0.5	LWDB	0.00*	0.22	0.62
AVST	0.00*	0.02*	0.79	LXI	0.00*	0.29	0.69
AVV	0.00*	0.22	0.13	MAB	0.00*	0.19	0.7
AZN	0.00*	0.05	0.09	MCRO	0.00*	0.83	0.35
BA.	0.00*	0.06	0.13	MDC	0.00*	0.31	0.47
BAB	0.00*	0.51	0.13	MGAM	0.00*	0.05	0.89
BARC	0.00*	0.22	0.51	MGGT	0.00*	0.99	0.63
BATS	0.00*	0.88	0.85	MGNS	0.00*	0.17	0.9
BBGI	0.00*	0.82	0.77	MKS	0.00*	0.35	0.27
BBH	0.00*	0.71	0.25	MNDI	0.00*	0.55	0.65
BBOX	0.00*	0.91	0.84	MNG	0.00*	0.14	0.72
BBY	0.00*	0.68	0.71	MNKS	0.00*	0.03*	0.06
BCPT	0.00*	0.19	0.27	MONY	0.00*	0.05	0.77
BDEV	0.00*	0.11	0.06	MRC	0.00*	0.29	0.08
BEZ	0.00*	0.61	0.21	MRO	0.00*	0.67	0.63
BGFD	0.00*	0.83	0.89	MRW	0.00*	0.32	0.61
BGS	0.00*	0.64	0.79	MSLH	0.00*	0.84	0.39
BGSC	0.00*	0.7	0.46	MYI	0.00*	0.98	0.08
BHP	0.00*	0.8	0.85	N91	0.00*	0.72	0.41

Table C- 1 Wald Test results for Portfolio 1,2,3 in the UK – continued (1)							
Code	P1	P2	P3	Code	P1	P2	P3
BIFF	0.00*	0.94	0.19	NESF	0.00*	0.19	0.04*
BKG	0.00*	0.4	0.87	NETW	0.00*	0.91	0.78
BLND	0.00*	0.16	0.5	NEX	0.00*	0.59	0.75
BME	0.00*	0.12	0.59	NG.	0.00*	0.11	0.97
BNKR	0.00*	0.1	0.24	NWG	0.00*	0.33	0.85
BNZL	0.00*	0.02*	0.29	NXT	0.00*	0.38	0.7
BOY	0.00*	0.45	0.9	OCDO	0.00*	0.63	0.82
BP.	0.00*	0.72	0.23	OSB	0.00*	0.25	0.41
BRBY	0.00*	0.84	0.97	OXB	0.00*	0.08	0.66
BRSC	0.00*	0.82	0.62	OXIG	0.00*	0.17	0.51
BRW	0.00*	0.35	0.15	PAG	0.00*	0.14	0.92
BRWM	0.00*	0.81	0.21	PAGE	0.00*	0.9	0.74
BT.A	0.00*	0.91	0.64	PCT	0.00*	0.11	0.91
BVIC	0.00*	0.32	0.11	PETS	0.00*	0.7	0.86
BWY	0.00*	0.36	0.29	PFC	0.00*	0.15	0.49
BYG	0.00*	0.89	0.45	PFD	0.00*	0.23	0.11
CAPC	0.00*	0.32	0.75	PFG	0.00*	0.98	0.85
CBG	0.00*	0.97	0.58	PHNX	0.00*	0.83	0.05
CCC	0.00*	0.02*	0.13	PHP	0.00*	0.15	0.42
CCH	0.00*	0.73	0.93	PIN	0.00*	0.39	0.31
CCL	0.00*	0.91	0.82	PLI	0.00*	0.85	0.65
CCR	0.00*	0.11	0.36	PLP	0.00*	0.16	0.71
CEY	0.00*	0.06	0.05	PLUS	0.00*	0.33	0.16
CHG	0.00*	0.1	0.6	PNL	0.00*	0.99	0.17
CINE	0.00*	0.48	0.65	PNN	0.00*	0.8	0.23
CKN	0.00*	0.11	0.57	POG	0.00*	0.49	0.95
CLDN	0.00*	0.61	0.72	POLY	0.00*	0.85	0.57
CLI	0.00*	0.42	0.97	PRTC	0.00*	0.59	0.64
CLSN	0.00*	0.98	0.67	PRU	0.00*	0.05	0.14
CMCX	0.00*	0.53	0.59	PSH	0.00*	0.81	0.2
CAN	0.00*	0.25	0.02*	PSN	0.00*	0.46	0.56
CNE	0.00*	0.6	0.14	PSON	0.00*	0.58	0.98
COA	0.00*	0.4	0.68	PTEC	0.00*	0.46	0.64
CPG	0.00*	0.42	0.82	PZC	0.00*	0.11	0.23
CPI	0.00*	0.93	0.99	QLT	0.00*	0.65	0.72
CRDA	0.00*	0.79	0.32	QQ.	0.00*	0.36	0.39
CRH	0.00*	0.3	0.9	RAT	0.00*	0.27	0.03*
CRST	0.00*	0.03*	0.16	RB.	0.00*	0.21	0.54
CSH	0.00*	0.26	0.77	RCP	0.00*	0.78	0.63
CSP	0.00*	0.94	0.81	RDSA	0.00*	0.74	0.94
CTEC	0.00*	0.96	0.09	RDSB	0.00*	0.64	0.67
CTY	0.00*	0.51	0.7	RDW	0.00*	0.8	0.6
CWK	0.00*	0.21	0.13	REL	0.00*	0.01*	0.43
DC.	0.00*	0.3	0.61	RHIM	0.00*	0.09	0.31

Table C- 1 Wald Test results for Portfolio 1,2,3 in the UK – continued (2)							
Code	P1	P2	P3	Code	P1	P2	P3
DCC	0.00*	0.7	0.71	RIO	0.00*	0.25	0.61
DGE	0.00*	0.6	0.53	RMG	0.00*	0.73	0.59
DGOC	0.00*	0.2	0.88	RMV	0.00*	0.36	0.92
DIGS	0.00*	0.88	0.54	RNK	0.00*	0.76	0.48
DLG	0.00*	0.39	0.15	ROR	0.00*	0.78	0.88
DLN	0.00*	0.31	0.34	RR.	0.00*	0.05	0.82
DNLM	0.00*	0.84	0.88	RSA	0.00*	0.38	0.93
DOM	0.00*	0.57	0.76	RSW	0.00*	0.63	0.38
DPH	0.00*	0.49	0.27	RTO	0.00*	0.94	0.15
DPLM	0.00*	0.03*	0.13	SAFE	0.00*	0.51	0.83
DRX	0.00*	0.62	0.63	SAIN	0.00*	0.02*	0.35
ECM	0.00*	0.36	0.5	SBRE	0.00*	0.75	0.15
EDIN	0.00*	0.16	0.71	SBRY	0.00*	0.47	0.06
EMG	0.00*	0.45	0.81	SCIN	0.00*	0.87	0.25
ENOG	0.00*	0.2	0.13	SCT	0.00*	0.8	0.1
ERM	0.00*	0.74	0.43	SDP	0.00*	0.26	0.28
ESNT	0.00*	0.68	0.05	SDR	0.00*	0.96	0.38
EVR	0.00*	0.76	0.47	SEQI	0.00*	0.51	0.03*
EWI	0.00*	0.75	0.96	SGE	0.00*	0.61	0.62
EXPN	0.00*	0.44	0.13	SGRO	0.00*	0.6	0.95
EZJ	0.00*	0.9	0.57	SHB	0.00*	0.32	0.72
FCIT	0.00*	0.8	0.08	SIG	0.00*	0.65	0.43
FCSS	0.00*	0.26	0.37	SKG	0.00*	0.13	0.66
FDM	0.00*	0.04*	0.89	SLA	0.00*	0.59	0.36
FERG	0.00*	0.48	0.11	SMDS	0.00*	0.86	0.52
FEV	0.00*	0.97	0.07	SMIN	0.00*	0.55	0.99
FGP	0.00*	0.91	0.89	SMP	0.00*	0.06	0.63
FGT	0.00*	0.87	0.6	SMT	0.00*	0.38	0.98
FLTR	0.00*	0.28	0.73	SMWH	0.00*	0.27	0.36
FOUR	0.00*	0.08	0.5	SN.	0.00*	0.51	0.98
FRAS	0.00*	0.33	0.06	SNN	0.00*	0.48	0.43
FRES	0.00*	0.71	0.77	SOI	0.00*	0.71	0.84
FSFL	0.00*	0.99	0.88	SONC	0.00*	0.59	0.29
FSJ	0.00*	0.34	0.73	SONG	0.00*	0.45	0.51
FSV	0.00*	0.79	0.15	SPT	0.00*	0.53	0.3
FUTR	0.00*	0.56	0.03*	SPX	0.00*	0.9	0.28
FXPO	0.00*	0.31	0.58	SRE	0.00*	0.62	0.83
GAW	0.00*	0.64	0.62	SRP	0.00*	0.2	0.16
GCP	0.00*	0.21	0.97	SSE	0.00*	0.9	0.09
GFS	0.00*	0.19	0.58	SSON	0.00*	0.11	0.99
GFTU	0.00*	0.84	0.89	SSPG	0.00*	0.49	0.13
GLEN	0.00*	0.07	0.67	STAN	0.00*	0.42	0.98
GLO	0.00*	0.54	0.23	STJ	0.00*	0.48	0.72
GNC	0.00*	0.86	0.26	SVS	0.00*	0.43	0.17

Table C- 1 Wald Test results for Portfolio 1,2,3 in the UK – continued (3)							
Code	P1	P2	P3	Code	P1	P2	P3
GNS	0.00*	0.41	0.32	SVT	0.00*	0.05*	0.59
GPOR	0.00*	0.36	0.45	SXS	0.00*	0.86	0.7
GRG	0.00*	0.78	0.76	SYNC	0.00*	0.47	0.83
GRI	0.00*	0.07	0.47	SYNT	0.00*	0.88	0.44
GSK	0.00*	0.51	0.09	TALK	0.00*	0.17	0.81
GSS	0.00*	0.74	0.94	TATE	0.00*	0.96	0.69
GVC	0.00*	0.93	0.22	TBCG	0.00*	0.52	0.35
GYS	0.00*	0.75	0.05	TCAP	0.00*	0.81	0.67
HAS	0.00*	0.91	0.86	TEM	0.00*	0.6	0.93
HFG	0.00*	0.49	0.52	TEP	0.00*	0.31	0.03*
HGT	0.00*	0.98	0.33	TIFS	0.00*	0.16	0.9
HICL	0.00*	0.85	0.22	TPK	0.00*	0.09	0.38
HIK	0.00*	0.88	0.66	TRIG	0.00*	0.48	0.95
HILS	0.00*	0.52	0.23	TRN	0.00*	0.96	0.87
HL.	0.00*	0.9	0.74	TRY	0.00*	0.3	0.1
HLMA	0.00*	0.76	0.36	TSCO	0.00*	0.42	0.39
HOC	0.00*	0.67	0.74	TUI	0.00*	0.39	0.47
HRI	0.00*	0.11	0.29	TW.	0.00*	0.39	0.11
HSBA	0.00*	0.16	0.54	UDG	0.00*	0.23	0.98
HSL	0.00*	0.02*	0.87	UKCM	0.00*	0.33	0.64
HSTG	0.00*	0.53	0.89	UKW	0.00*	0.29	0.36
HSV	0.00*	0.16	0.61	ULE	0.00*	0.38	0.69
HSX	0.00*	0.68	0.56	ULVR	0.00*	0.63	0.93
HTWS	0.00*	0.93	0.2	USA	0.00*	0.32	0.66
HVPE	0.00*	0.46	0.5	UTG	0.00*	0.06	0.6
HWDN	0.00*	0.42	0.04*	UU.	0.00*	0.16	0.7
IAG	0.00*	0.96	0.66	VCT	0.00*	0.1	0.33
IBST	0.00*	0.4	0.32	VEC	0.00*	0.4	0.63
ICGT	0.00*	0.89	0.96	VEIL	0.00*	0.7	0.74
ICP	0.00*	0.88	0.2	VMUK	0.00*	0.5	0.53
IEM	0.00*	0.85	0.07	VOD	0.00*	0.42	0.53
IGG	0.00*	0.27	0.56	VOF	0.00*	0.02*	0.28
IHG	0.00*	0.05*	0.82	VSVS	0.00*	0.91	0.64
IHP	0.00*	0.55	0.78	VTY	0.00*	0.86	0.8
III	0.00*	0.99	0.87	VVO	0.00*	0.26	0.04*
IMB	0.00*	0.64	0.41	WEIR	0.00*	0.24	0.46
IMI	0.00*	0.12	0.68	WG.	0.00*	0.45	0.66
INCH	0.00*	0.8	0.02*	WIZZ	0.00*	0.02*	0.34
INDV	0.00*	0.61	0.29	WKP	0.00*	0.84	0.6
INF	0.00*	0.38	0.92	WMH	0.00*	0.69	0.99
INPP	0.00*	0.71	0.08	WOSG	0.00*	0.71	0.57
INVP	0.00*	0.73	0.85	WPP	0.00*	0.18	0.77
IPO	0.00*	0.89	0.35	WTAN	0.00*	0.05	0.54
ITRK	0.00*	0.08	0.78	WTB	0.00*	0.07	0.51

Table C- 1 Wald Test results for Portfolio 1,2,3 in the UK – continued (4)							
Code	P1	P2	P3	Code	P1	P2	P3
ITV	0.00*	0.69	0.55	WWH	0.00*	0.34	0.49
IWG	0.00*	0.31	0.5	XPP	0.00*	0.25	0.14
Note: * represent the statistical significance at the 5% level.							

Table C- 2 Wald Test results for Portfolio 4, 5, 6 in the UK

Code	P4	P5	P6	Code	P4	P5	P6
3IN	0.00*	0.56	0.21	JAM	0.00*	0.9	0.75
888	0.00*	0.84	0.55	JD.	0.00*	0.84	0.24
AAF	0.00*	0.91	0.24	JDW	0.00*	0.04*	0.16
AAL	0.00*	0.7	0.26	JEO	0.00*	0.96	0.06
ABF	0.52	0.58	0.88	JESC	0.00*	0.18	0.08
ACI	0.00*	0.28	0.64	JET	0.00*	0.62	0.87
ADM	0.00*	0.38	0.39	JFJ	0.00*	0.92	0.59
AGK	0.00*	0.13	0.01*	JLEN	0.00*	0.71	0.91
AGR	0.00*	0.11	0.57	JLG	0.00*	0.75	0.32
AGT	0.00*	0.96	0.34	JMAT	0.00*	0.47	0.42
AHT	0.00*	0.68	0.79	JMG	0.00*	0.12	0.25
AJB	0.00*	0.54	0.48	JUP	0.00*	0.13	0.84
AML	0.00*	0.99	0.72	JUST	0.00*	0.96	0.45
ANTO	0.00*	0.18	0.6	KAZ	0.00*	0.24	0.86
AO.	0.69	0.63	0.01*	KGF	0.00*	0.65	0.11
APAX	0.00*	0.48	0.55	KNOS	0.00*	0.67	0.88
ASCL	0.00*	0.3	0.31	LAND	0.00*	0.55	0.3
ASHM	0.00*	0.84	0.95	LGEN	0.00*	0.58	0.58
ASL	0.00*	0.42	0.98	LIO	0.00*	0.65	0.81
ATST	0.00*	0.68	0.24	LLOY	0.00*	0.31	0.1
ATT	0.00*	0.16	0.37	LMP	0.00*	0.73	0.57
AUTO	0.00*	0.5	0.77	LRE	0.00*	0.76	0.15
AV.	0.00*	0.32	0.39	LSE	0.00*	0.29	0.73
AVON	0.00*	0.09	0.64	LWDB	0.00*	0.84	0.7
AVST	0.00*	0.8	0.07	LXI	0.00*	0.62	0.05
AVV	0.00*	0.85	0.89	MAB	0.00*	0.56	0.89
AZN	0.00*	0.84	0.13	MCRO	0.00*	0.5	0.28
BA.	0.43	0.78	0.07	MDC	0.00*	0.28	0.97
BAB	0.00*	0.33	0.62	MGAM	0.00*	0.8	0.83
BARC	0.00*	0.91	0.99	MGGT	0.00*	0.66	0.09
BATS	0.00*	0.91	0.37	MGNS	0.00*	0.7	0.89
BBGI	0.00*	0.44	0.72	MKS	0.00*	0.87	0.34
BBH	0.00*	0.26	0.89	MNDI	0.00*	0.28	0.91
BBOX	0.00*	0.85	0.75	MNG	0.00*	0.94	0.63
BBY	0.00*	0.3	0.48	MNKS	0.92	0.24	0.67
BCPT	0.00*	0.72	0.6	MONY	0.00*	0.37	0.65
BDEV	0.00*	0.57	0.91	MRC	0.00*	0.41	0.57
BEZ	0.00*	0.74	0.36	MRO	0.00*	0.75	0.64
BGFD	0.00*	0.03*	0.32	MRW	0.00*	0.98	0.65
BGS	0.00*	0.82	0.82	MSLH	0.00*	0.72	0.19
BGSC	0.00*	0.34	0.37	MYI	0.00*	0.83	0.61
BHP	0.00*	0.35	0.74	N91	0.00*	0.54	0.69
BIFF	0.00*	0.39	0.94	NESF	0.00*	0.81	0.69
BKG	0.00*	0.83	0.61	NETW	0.00*	0.64	0.54

Table C- 2 Wald Test results for Portfolio 4, 5, 6 in the UK – continued (1)

Code	P4	P5	P6	Code	P4	P5	P6
BLND	0.00*	0.33	0.39	NEX	0.00*	0.94	0.47
BME	0.00*	0.37	0.09	NG.	0.00*	0.86	0.01*
BNKR	0.00*	0.33	0.46	NWG	0.00*	0.48	0.24
BNZL	0.59	0.51	0.53	NXT	0.00*	0.4	0.48
BOY	0.00*	0.61	0.68	OCDO	0.00*	0.42	0.32
BP.	0.00*	0.86	0.14	OSB	0.00*	0.88	0.36
BRBY	0.00*	0.28	0.54	OXB	0.00*	0.42	0.17
BRSC	0.00*	0.59	0.3	OXIG	0.00*	0.52	0.68
BRW	0.00*	0.36	0.54	PAG	0.00*	0.12	0.33
BRWM	0.00*	0.95	0.96	PAGE	0.99	0.84	0.51
BT.A	0.00*	0.44	0.12	PCT	0.00*	0.55	0.5
BVIC	0.00*	0.86	0.86	PETS	0.00*	0.63	0.22
BWY	0.00*	0.55	0.08	PFC	0.00*	0.11	0.68
BYG	0.00*	0.48	0.46	PFD	0.00*	0.74	0.9
CAPC	0.00*	0.39	0.61	PFG	0.00*	0.09	0.43
CBG	0.00*	0.92	0.57	PHNX	0.00*	0.43	0.77
CCC	0.00*	0.2	0.53	PHP	0.00*	0.83	0.48
CCH	0.00*	0.28	0.67	PIN	0.00*	0.84	0.05
CCL	0.00*	0.42	0.25	PLI	0.00*	0.13	0.14
CCR	0.00*	0.1	0.96	PLP	0.00*	0.99	0.9
CEY	0.00*	0.07	0.93	PLUS	0.00*	0.73	0.1
CHG	0.00*	0.9	0.76	PNL	0.00*	0.8	0.1
CINE	0.00*	0.15	0.34	PNN	0.00*	0.9	0.97
CKN	0.00*	0.37	0.48	POG	0.00*	0.31	0.99
CLDN	0.00*	0.75	0.46	POLY	0.00*	0.45	0.32
CLI	0.5	0.3	0.31	PRTC	0.00*	0.28	0.96
CLSN	0.00*	0.93	0.67	PRU	0.00*	0.64	0.43
CMCX	0.00*	0.05	0.41	PSH	0.00*	0.76	0.78
CAN	0.00*	0.59	0.5	PSN	0.00*	0.51	0.63
CNE	0.00*	0.92	0.47	PSON	0.00*	0.14	0.19
COA	0.00*	0.54	0.78	PTEC	0.00*	0.89	0.05
CPG	0.00*	0.93	0.79	PZC	0.00*	0.33	0.75
CPI	0.00*	0.12	0.46	QLT	0.00*	0.34	0.15
CRDA	0.00*	0.29	0.51	QQ.	0.00*	0.42	0.51
CRH	0.00*	0.3	0.18	RAT	0.77	0.98	0.69
CRST	0.00*	0.25	0.88	RB.	0.00*	0.65	0.09
CSH	0.00*	0.48	0.14	RCP	0.00*	0.64	0.23
CSP	0.00*	0.29	0.76	RDSA	0.00*	0.68	0.87
CTEC	0.00*	0.52	0.74	RDSB	0.00*	0.69	0.23
CTY	0.00*	0.72	0.66	RDW	0.00*	0.91	0.36
CWK	0.00*	0.67	0.34	REL	0.00*	0.45	0.33
DC.	0.00*	0.25	0.32	RHIM	0.00*	0.75	0.43
DCC	0.00*	0.2	0.17	RIO	0.00*	0.15	0.3
DGE	0.00*	0.79	0.65	RMG	0.00*	0.61	0.79

Table C- 2 Wald Test results for Portfolio 4, 5, 6 in the UK – continued (2)							
Code	P4	P5	P6	Code	P4	P5	P6
DGOC	0.00*	0.15	0.64	RMV	0.00*	0.54	0.1
DIGS	0.00*	0.28	0.64	RNK	0.00*	0.56	0.56
DLG	0.00*	0.47	0.38	ROR	0.00*	0.85	0.49
DLN	0.00*	0.89	0.06	RR.	0.00*	0.81	0.9
DNLM	0.00*	0.28	0.26	RSA	0.00*	0.4	0.65
DOM	0.00*	0.39	0.41	RSW	0.00*	0.05	0.43
DPH	0.00*	0.8	0.94	RTO	0.00*	0.34	0.8
DPLM	0.00*	0.56	0.84	SAFE	0.00*	0.63	0.23
DRX	0.00*	0.08	0.25	SAIN	0.00*	0.41	0.36
ECM	0.00*	0.73	0.39	SBRE	0.00*	0.58	0.09
EDIN	0.00*	0.65	0.47	SBRY	0.00*	0.32	0.75
EMG	0.00*	0.74	0.79	SCIN	0.00*	0.32	0.46
ENOG	0.00*	0.14	0.18	SCT	0.00*	0.59	0.82
ERM	0.00*	0.45	0.23	SDP	0.00*	0.99	0.92
ESNT	0.00*	0.41	0.27	SDR	0.00*	0.06	0.91
EVR	0.00*	0.93	0.86	SEQI	0.00*	0.55	0.06
EWI	0.00*	0.27	0.09	SGE	0.00*	0.05	0.11
EXPN	0.00*	0.46	0.39	SGRO	0.00*	0.55	0.23
EZJ	0.00*	0.85	0.4	SHB	0.00*	0.88	0.72
FCIT	0.00*	0.65	0.13	SIG	0.00*	0.09	0.45
FCSS	0.00*	0.14	0.96	SKG	0.00*	0.24	0.84
FDM	0.00*	0.38	0.82	SLA	0.00*	0.83	0.27
FERG	0.00*	0.19	0.51	SMDS	0.00*	0.09	0.91
FEV	0.00*	0.28	0.33	SMIN	0.00*	0.61	0.67
FGP	0.00*	0.52	0.73	SMP	0.00*	0.7	0.91
FGT	0.00*	0.36	0.18	SMT	0.00*	0.31	0.28
FLTR	0.00*	0.18	0.24	SMWH	0.00*	0.46	0.47
FOUR	0.00*	0.78	0.37	SN.	0.00*	0.83	0.69
FRAS	0.00*	0.23	0.53	SNN	0.00*	0.32	0.25
FRES	0.00*	0.85	0.55	SOI	0.00*	0.17	0.15
FSFL	0.00*	0.46	0.3	SONC	0.00*	0.14	0.67
FSJ	0.00*	0.51	0.22	SONG	0.00*	0.31	0.6
FSV	0.00*	0.16	0.89	SPT	0.00*	0.78	0.39
FUTR	0.00*	0.56	0.96	SPX	0.00*	0.24	0.94
FXPO	0.00*	0.38	0.47	SRE	0.00*	0.25	0.98
GAW	0.00*	0.71	0.31	SRP	0.00*	0.42	0.99
GCP	0.00*	0.08	0.67	SSE	0.00*	0.8	0.28
GFS	0.00*	0.09	0.22	SSON	0.00*	0.48	0.25
GFTU	0.00*	0.22	0.38	SSPG	0.00*	0.73	0.25
GLEN	0.00*	0.25	0.61	STAN	0.00*	0.81	0.89
GLO	0.00*	0.7	0.56	STJ	0.00*	0.08	0.9
GNC	0.00*	0.7	0.65	SVS	0.00*	0.14	0.74
GNS	0.00*	0.13	0.43	SVT	0.00*	0.66	0.42
GPOR	0.00*	0.09	0.32	SXS	0.00*	0.74	0.82

Table C- 2 Wald Test results for Portfolio 4, 5, 6 in the UK – continued (3)							
Code	P4	P5	P6	Code	P4	P5	P6
GRG	0.00*	0.71	0.33	SYNC	0.00*	0.72	0.65
GRI	0.00*	0.74	0.93	SYNT	0.00*	0.79	0.66
GSK	0.00*	0.41	0.92	TALK	0.00*	0.63	0.84
GSS	0.00*	0.73	0.32	TATE	0.00*	0.15	0.7
GVC	0.00*	0.18	0.12	TBCG	0.00*	0.8	0.28
GYS	0.00*	0.73	0.18	TCAP	0.00*	0.65	0.89
HAS	0.00*	0.8	0.56	TEM	0.00*	0.67	0.28
HFG	0.00*	0.42	0.85	TEP	0.00*	0.18	0.94
HGT	0.00*	0.66	0.87	TIFS	0.00*	0.63	0.78
HICL	0.00*	0.56	0.39	TPK	0.00*	0.25	0.44
HIK	0.00*	0.75	0.51	TRIG	0.00*	0.93	0.48
HILS	0.00*	0.23	0.28	TRN	0.00*	0.31	0.06
HL.	0.00*	0.57	0.58	TRY	0.00*	0.6	0.98
HLMA	0.00*	0.65	0.82	TSCO	0.00*	0.51	0.19
HOC	0.00*	0.55	0.49	TUI	0.00*	0.18	0.16
HRI	0.00*	0.62	0.16	TW.	0.00*	0.48	0.3
HSBA	0.00*	0.26	0.82	UDG	0.00*	0.16	0.09
HSL	0.00*	0.07	0.78	UKCM	0.00*	0.35	0.58
HSTG	0.00*	0.13	0.58	UKW	0.00*	0.45	0.92
HSV	0.00*	0.43	0.81	ULE	0.00*	0.87	0.22
HSX	0.00*	0.99	0.17	ULVR	0.00*	0.83	0.52
HTWS	0.00*	0.31	0.14	USA	0.00*	0.48	0.29
HVPE	0.00*	0.91	0.62	UTG	0.00*	0.95	0.16
HWDN	0.00*	0.07	0.42	UU.	0.00*	0.62	0.6
IAG	0.00*	0.32	0.29	VCT	0.00*	0.71	0.75
IBST	0.00*	0.95	0.7	VEC	0.00*	0.71	0.68
ICGT	0.00*	0.11	0.51	VEIL	0.00*	0.83	0.48
ICP	0.00*	0.94	0.84	VMUK	0.00*	0.98	0.28
IEM	0.00*	0.83	0.28	VOD	0.00*	0.68	0.83
IGG	0.00*	0.82	0.5	VOF	0.00*	0.34	0.74
IHG	0.00*	0.55	0.47	VSVS	0.00*	0.35	0.18
IHP	0.00*	0.79	0.09	VTY	0.00*	0.77	0.37
III	0.00*	0.5	0.47	VVO	0.00*	0.71	0.35
IMB	0.00*	0.13	0.21	WEIR	0.00*	0.27	0.43
IMI	0.00*	0.15	0.87	WG.	0.00*	0.73	0.68
INCH	0.00*	0.57	0.92	WIZZ	0.00*	0.93	0.56
INDV	0.00*	0.17	0.98	WKP	0.00*	0.6	0.84
INF	0.00*	0.5	0.54	WMH	0.00*	0.94	0.48
INPP	0.00*	0.05	0.87	WOSG	0.00*	0.9	0.69
INVP	0.00*	0.93	0.83	WPP	0.00*	0.56	0.63
IPO	0.00*	0.42	0.87	WTAN	0.00*	0.39	0.94
ITRK	0.00*	0.41	0.3	WTB	0.00*	0.15	0.95
ITV	0.00*	0.34	0.15	WWH	0.00*	0.43	0.32
IWG	0.00*	0.78	0.46	XPP	0.00*	0.19	0.3
Note: * represent the statistical significance at the 5% level.							

Table C- 3 Wald Test results for Portfolio 7, 8, 9 in the UK

Code	P7	P8	P9	Code	P7	P8	P9
3IN	0.00*	0.81	0.46	JAM	0.00*	0.88	0.35
888	0.00*	0.38	0.07	JD.	0.00*	0.92	0.87
AAF	0.00*	0.84	0.05	JDW	0.00*	0.52	0.34
AAL	0.00*	0.48	0.24	JEO	0.00*	0.49	0.49
ABF	0.00*	0.12	0.81	JESC	0.00*	0.21	0.76
ACI	0.00*	0.8	0.38	JET	0.00*	0.1	0.05
ADM	0.00*	0.22	0.4	JFJ	0.00*	0.41	0.49
AGK	0.00*	0.28	0.3	JLEN	0.00*	0.26	0.33
AGR	0.00*	0.79	0.02*	JLG	0.00*	0.92	0.58
AGT	0.00*	0.8	0.85	JMAT	0.00*	0.44	0.55
AHT	0.00*	0.87	0.54	JMG	0.00*	0.82	0.95
AJB	0.00*	0.9	0.29	JUP	0.00*	0.2	0.35
AML	0.00*	0.28	0.96	JUST	0.00*	0.36	0.26
ANTO	0.00*	0.88	0.84	KAZ	0.00*	0.41	0.24
AO.	0.00*	0.56	0.33	KGF	0.00*	0.47	0.77
APAX	0.00*	0.99	0.48	KNOS	0.00*	0.86	0.71
ASCL	0.00*	0.55	0.23	LAND	0.00*	0.1	0.32
ASHM	0.00*	0.01*	0.26	LGEN	0.00*	0.61	0.87
ASL	0.00*	0.98	0.23	LIO	0.00*	0.92	0.24
ATST	0.00*	0.31	0.89	LLOY	0.00*	0.66	0.93
ATT	0.00*	0.86	0.25	LMP	0.00*	0.16	0.93
AUTO	0.00*	0.97	0.67	LRE	0.00*	0.36	0.43
AV.	0.00*	0.63	0.96	LSE	0.00*	0.75	0.79
AVON	0.00*	0.4	0.23	LWDB	0.00*	0.85	0.19
AVST	0.00*	0.47	0.78	LXI	0.00*	0.65	0.62
AVV	0.87	0.16	0.44	MAB	0.00*	0.57	0.64
AZN	0.00*	0.56	0.39	MCRO	0.00*	0.96	0.75
BA.	0.00*	0.92	0.72	MDC	0.00*	0.86	0.09
BAB	0.00*	0.27	0.88	MGAM	0.00*	0.96	0.44
BARC	0.00*	0.18	0.1	MGGT	0.00*	0.98	0.62
BATS	0.00*	0.81	0.92	MGNS	0.00*	0.47	0.95
BBGI	0.00*	0.1	0.47	MKS	0.00*	0.19	0.86
BBH	0.00*	0.74	0.74	MNDI	0.00*	0.98	0.73
BBOX	0.00*	0.03*	0.51	MNG	0.00*	0.17	0.71
BBY	0.00*	0.09	0.49	MNKS	0.00*	0.38	0.35
BCPT	0.00*	0.64	0.65	MONY	0.00*	0.2	0.93
BDEV	0.00*	0.6	0.25	MRC	0.00*	0.72	0.27
BEZ	0.00*	0.87	0.97	MRO	0.00*	0.96	0.34
BGFD	0.00*	0.53	0.71	MRW	0.00*	0.55	0.03*
BGS	0.00*	0.86	0.67	MSLH	0.00*	0.33	0.29
BGSC	0.00*	0.51	0.78	MYI	0.00*	0.29	0.23
BHP	0.00*	0.75	0.16	N91	0.00*	0.05	0.31

Table C- 3 Wald Test results for Portfolio 7, 8, 9 in the UK – continued (1)							
Code	P7	P8	P9	Code	P7	P8	P9
BIFF	0.00*	0.65	0.16	NESF	0.00*	0.85	0.54
BKG	0.00*	0.37	0.74	NETW	0.00*	0.57	0.19
BLND	0.00*	0.53	0.21	NEX	0.00*	0.54	0.14
BME	0.00*	0.2	0.32	NG.	0.00*	0.05	0.29
BNKR	0.00*	0.55	0.55	NWG	0.00*	0.82	0.53
BNZL	0.00*	0.02*	0.62	NXT	0.00*	0.8	0.9
BOY	0.00*	0.81	0.77	OCDO	0.00*	0.97	0.2
BP.	0.00*	0.34	0.01*	OSB	0.00*	0.35	0.54
BRBY	0.00*	0.16	0.55	OXB	0.92	0.66	0.61
BRSC	0.00*	0.87	0.9	OXIG	0.00*	0.07	0.63
BRW	0.00*	0.64	0.29	PAG	0.00*	0.83	0.52
BRWM	0.00*	0.47	0.18	PAGE	0.00*	0.06	0.69
BT.A	0.00*	0.17	0.82	PCT	0.00*	0.62	0.97
BVIC	0.00*	0.07	0.09	PETS	0.00*	0.15	0.03*
BWY	0.00*	0.91	0.69	PFC	0.00*	0.63	0.65
BYG	0.00*	0.74	0.79	PFD	0.00*	0.41	0.52
CAPC	0.00*	0.48	0.17	PFG	0.00*	0.33	0.76
CBG	0.00*	0.63	0.86	PHNX	0.00*	0.9	0.92
CCC	0.00*	0.85	0.13	PHP	0.00*	0.32	0.64
CCH	0.00*	0.65	0.62	PIN	0.00*	0.28	0.13
CCL	0.00*	0.02*	0.69	PLI	0.00*	0.27	0.67
CCR	0.00*	0.58	0.45	PLP	0.00*	0.66	0.48
CEY	0.00*	0.39	0.39	PLUS	0.00*	0.69	0.97
CHG	0.00*	0.17	0.78	PNL	0.00*	0.32	0.97
CINE	0.00*	0.13	0.33	PNN	0.00*	0.39	0.71
CKN	0.00*	0.48	0.19	POG	0.00*	0.48	0.15
CLDN	0.00*	0.65	0.77	POLY	0.00*	0.57	0.67
CLI	0.00*	0.64	0.53	PRTC	0.00*	0.25	0.01*
CLSN	0.00*	0.31	0.28	PRU	0.00*	0.23	0.12
CMCX	0.00*	0.37	0.47	PSH	0.00*	0.67	0.61
CAN	0.00*	0.96	0.53	PSN	0.00*	0.19	0.78
CNE	0.00*	0.3	0.78	PSON	0.00*	0.47	0.65
COA	0.00*	0.12	0.63	PTEC	0.00*	0.16	0.91
CPG	0.00*	0.93	0.52	PZC	0.00*	0.25	0.1
CPI	0.00*	0.76	0.91	QLT	0.00*	0.25	0.99
CRDA	0.00*	0.71	0.28	QQ.	0.00*	0.79	0.37
CRH	0.00*	0.11	0.53	RAT	0.00*	0.09	0.09
CRST	0.00*	0.72	0.12	RB.	0.00*	0.12	0.95
CSH	0.00*	0.12	0.11	RCP	0.00*	0.97	0.15
CSP	0.00*	0.81	0.64	RDSA	0.00*	0.85	0.52
CTEC	0.00*	0.2	0.55	RDSB	0.00*	0.51	0.25
CTY	0.00*	0.59	0.13	RDW	0.00*	0.74	0.35
CWK	0.00*	0.52	0.18	REL	0.00*	0.45	0.14
DC.	0.00*	0.62	0.41	RHIM	0.00*	0.38	0.28

Table C- 3 Wald Test results for Portfolio 7, 8, 9 in the UK – continued (2)							
Code	P7	P8	P9	Code	P7	P8	P9
DCC	0.00*	0.16	0.96	RIO	0.00*	0.55	0.57
DGE	0.00*	0.32	0.4	RMG	0.00*	0.51	0.6
DGOC	0.00*	0.02*	0.08	RMV	0.00*	0.28	0.82
DIGS	0.00*	0.79	0.57	RNK	0.00*	0.79	0.25
DLG	0.00*	0.63	0.12	ROR	0.00*	0.59	0.83
DLN	0.00*	0.07	0.91	RR.	0.00*	0.21	0.39
DNLM	0.00*	0.21	0.15	RSA	0.00*	0.34	0.25
DOM	0.00*	0.54	0.02*	RSW	0.00*	0.03*	0.67
DPH	0.00*	0.4	0.64	RTO	0.00*	0.28	0.25
DPLM	0.00*	0.19	0.31	SAFE	0.00*	0.87	0.74
DRX	0.00*	0.06	0.17	SAIN	0.00*	0.45	0.16
ECM	0.00*	0.37	0.66	SBRE	0.00*	0.56	0.38
EDIN	0.00*	0.75	0.44	SBRY	0.00*	0.3	0.24
EMG	0.00*	0.72	0.1	SCIN	0.00*	0.77	0.45
ENOG	0.00*	0.56	0.62	SCT	0.00*	0.51	0.93
ERM	0.00*	0.88	0.46	SDP	0.00*	0.68	0.74
ESNT	0.00*	0.46	0.52	SDR	0.00*	0.74	0.97
EVR	0.00*	0.44	0.55	SEQI	0.00*	0.68	0.8
EWI	0.00*	0.21	0.34	SGE	0.00*	0.44	0.87
EXPN	0.00*	0.41	0.55	SGRO	0.00*	0.01*	0.84
EZJ	0.00*	0.87	0.87	SHB	0.00*	0.52	0.4
FCIT	0.00*	0.41	0.86	SIG	0.00*	0.51	0.95
FCSS	0.00*	0.75	0.89	SKG	0.00*	0.29	0.44
FDM	0.00*	0.07	0.5	SLA	0.00*	0.06	0.37
FERG	0.00*	0.67	0.29	SMDS	0.00*	0.83	0.28
FEV	0.00*	0.16	0.81	SMIN	0.00*	0.64	0.89
FGP	0.00*	0.05	0.74	SMP	0.00*	0.61	0.99
FGT	0.00*	0.56	0.97	SMT	0.00*	0.79	0.19
FLTR	0.00*	0.25	0.71	SMWH	0.00*	0.99	0.85
FOUR	0.00*	0.15	0.77	SN.	0.00*	0.69	0.55
FRAS	0.00*	0.72	0.52	SNN	0.00*	0.68	0.55
FRES	0.00*	0.87	0.84	SOI	0.00*	0.6	0.71
FSFL	0.00*	0.28	0.62	SONC	0.00*	0.75	0.16
FSJ	0.00*	0.84	0.14	SONG	0.00*	0.93	0.45
FSV	0.00*	0.66	0.34	SPT	0.00*	0.72	0.71
FUTR	0.00*	0.14	0.18	SPX	0.00*	0.37	0.86
FXPO	0.00*	0.02*	0.68	SRE	0.00*	0.57	0.46
GAW	0.00*	0.25	0.11	SRP	0.00*	0.42	0.88
GCP	0.00*	0.97	0.53	SSE	0.00*	0.94	0.89
GFS	0.00*	0.7	0.95	SSON	0.00*	0.23	0.8
GFTU	0.00*	0.16	0.58	SSPG	0.00*	0.73	0.63
GLEN	0.00*	0.23	0.78	STAN	0.00*	0.08	0.71
GLO	0.00*	0.4	0.23	STJ	0.00*	0.86	0.44
GNC	0.00*	0.97	0.64	SVS	0.00*	0.46	0.21

Table C- 3 Wald Test results for Portfolio 7, 8, 9 in the UK – continued (3)							
Code	P7	P8	P9	Code	P7	P8	P9
GNS	0.00*	0.8	0.65	SVT	0.00*	0.65	0.13
GPOR	0.00*	0.69	0.07	SXS	0.00*	0.24	0.95
GRG	0.00*	0.28	0.56	SYNC	0.00*	0.25	0.55
GRI	0.00*	0.89	0.39	SYNT	0.00*	0.13	0.8
GSK	0.00*	0.07	0.19	TALK	0.00*	0.81	0.37
GSS	0.00*	0.33	0.36	TATE	0.00*	0.01*	0.46
GVC	0.00*	0.35	0.14	TBCG	0.00*	0.18	0.26
GYS	0.00*	0.34	0.21	TCAP	0.00*	0.96	0.66
HAS	0.00*	0.69	0.16	TEM	0.00*	0.91	0.48
HFG	0.00*	0.66	0.64	TEP	0.00*	0.28	0.63
HGT	0.00*	0.04*	0.28	TIFS	0.00*	0.89	0.2
HICL	0.00*	0.11	0.22	TPK	0.00*	0.86	0.19
HIK	0.00*	0.38	0.67	TRIG	0.00*	0.87	0.24
HILS	0.00*	0.29	0.74	TRN	0.00*	0.89	0.56
HL.	0.00*	0.59	0.92	TRY	0.00*	0.4	0.95
HLMA	0.00*	0.63	0.32	TSCO	0.00*	0.49	0.11
HOC	0.00*	0.47	0.91	TUI	0.00*	0.19	0.02*
HRI	0.00*	0.32	0.12	TW.	0.00*	0.43	0.22
HSBA	0.00*	0.7	0.62	UDG	0.00*	0.36	0.96
HSL	0.00*	0.25	0.97	UKCM	0.00*	0.86	0.82
HSTG	0.00*	0.05	0.55	UKW	0.00*	0.22	0.51
HSV	0.00*	0.43	0.83	ULE	0.00*	0.14	0.39
HSX	0.00*	0.13	0.64	ULVR	0.00*	0.05	0.79
HTWS	0.00*	0.51	0.76	USA	0.00*	0.59	0.36
HVPE	0.00*	0.29	0.12	UTG	0.00*	0.71	0.63
HWDN	0.00*	0.62	0.33	UU.	0.00*	0.63	0.31
IAG	0.00*	0.24	0.78	VCT	0.00*	0.53	0.44
IBST	0.00*	0.19	0.07	VEC	0.00*	0.59	0.49
ICGT	0.00*	0.3	0.64	VEIL	0.00*	0.57	0.75
ICP	0.00*	0.94	0.1	VMUK	0.00*	0.61	0.85
IEM	0.00*	0.84	0.78	VOD	0.00*	0.15	0.37
IGG	0.00*	0.98	0.9	VOF	0.00*	0.13	0.54
IHG	0.00*	0.18	0.62	VSVS	0.00*	0.3	0.7
IHP	0.00*	0.73	0.8	VTY	0.00*	0.65	0.47
III	0.00*	0.68	0.12	VVO	0.00*	0.61	0.21
IMB	0.00*	0.05*	0.7	WEIR	0.00*	0.78	0.8
IMI	0.00*	0.27	0.7	WG.	0.00*	0.12	0.68
INCH	0.00*	0.4	0.73	WIZZ	0.00*	0.85	0.44
INDV	0.00*	0.18	0.46	WKP	0.00*	0.67	0.32
INF	0.00*	0.29	0.6	WMH	0.00*	0.97	0.16
INPP	0.00*	0.69	0.49	WOSG	0.00*	0.38	0.98
INVP	0.00*	0.55	0.59	WPP	0.00*	0.03*	0.8
IPO	0.00*	0.52	0.82	WTAN	0.00*	0.6	0.72
ITRK	0.00*	0.16	0.01*	WTB	0.00*	0.24	0.76

Table C- 3 Wald Test results for Portfolio 7, 8, 9 in the UK – continued (4)							
Code	P7	P8	P9	Code	P7	P8	P9
ITV	0.00*	0.13	0.9	WWH	0.00*	0.14	0.91
IWG	0.00*	0.94	0.45	XPP	0.00*	0.19	0.43
Note: * represent the statistical significance at the 5% level.							

Table C- 4 Wald Test results for Portfolio 10, 11, 12 in the UK

Code	P10	P11	P12	Code	P10	P11	P12
3IN	0.44	0.00*	0.00*	JAM	0.83	0.00*	0.00*
888	0.31	0.00*	0.00*	JD.	0.55	0.00*	0.00*
AAF	0.88	0.00*	0.00*	JDW	0.92	0.00*	0.00*
AAL	0.2	0.00*	0.00*	JEO	0.6	0.00*	0.00*
ABF	0.36	0.00*	0.00*	JESC	0.56	0.00*	0.00*
ACI	0.43	0.00*	0.00*	JET	0.75	0.00*	0.00*
ADM	0.02*	0.00*	0.00*	JFJ	0.87	0.00*	0.00*
AGK	0.12	0.00*	0.00*	JLEN	0.91	0.00*	0.00*
AGR	0.81	0.00*	0.00*	JLG	0.25	0.00*	0.00*
AGT	0.38	0.00*	0.00*	JMAT	0.08	0.00*	0.00*
AHT	0.55	0.00*	0.00*	JMG	0.38	0.00*	0.00*
AJB	0.81	0.67	0.00*	JUP	0.6	0.00*	0.00*
AML	0.18	0.00*	0.00*	JUST	0.22	0.00*	0.00*
ANTO	0.34	0.00*	0.00*	KAZ	0.11	0.00*	0.00*
AO.	0.19	0.00*	0.00*	KGF	0.92	0.00*	0.00*
APAX	0.93	0.00*	0.00*	KNOS	0.26	0.00*	0.00*
ASCL	0.58	0.00*	0.00*	LAND	0.86	0.00*	0.00*
ASHM	0.72	0.00*	0.00*	LGEN	0.49	0.00*	0.00*
ASL	0.46	0.00*	0.00*	LIO	0.17	0.00*	0.00*
ATST	0.81	0.00*	0.00*	LLOY	0.92	0.00*	0.00*
ATT	0.61	0.00*	0.00*	LMP	0.49	0.00*	0.00*
AUTO	0.57	0.00*	0.00*	LRE	0.79	0.00*	0.00*
AV.	0.33	0.00*	0.00*	LSE	0.15	0.00*	0.00*
AVON	0.64	0.00*	0.00*	LWDB	0.42	0.00*	0.00*
AVST	0.14	0.00*	0.00*	LXI	0.72	0.00*	0.00*
AVV	0.85	0.00*	0.00*	MAB	0.06	0.00*	0.00*
AZN	0.24	0.00*	0.00*	MCRO	0.61	0.00*	0.00*
BA.	0.66	0.00*	0.00*	MDC	0.42	0.00*	0.00*
BAB	0.97	0.00*	0.00*	MGAM	0.26	0.00*	0.00*
BARC	0.05	0.00*	0.00*	MGGT	0.07	0.00*	0.00*
BATS	0.42	0.00*	0.00*	MGNS	0.88	0.00*	0.00*
BBGI	0.3	0.00*	0.00*	MKS	0.4	0.00*	0.00*
BBH	0.98	0.00*	0.00*	MNDI	0.41	0.00*	0.00*
BBOX	0.55	0.00*	0.00*	MNG	0.59	0.00*	0.00*
BBY	0.94	0.00*	0.00*	MNKS	0.46	0.00*	0.00*
BCPT	0.24	0.00*	0.00*	MONY	0.3	0.00*	0.00*
BDEV	0.28	0.00*	0.00*	MRC	0.27	0.00*	0.00*
BEZ	0.92	0.00*	0.00*	MRO	0.44	0.00*	0.00*
BGFD	0.67	0.00*	0.00*	MRW	0.4	0.00*	0.00*
BGS	0.32	0.00*	0.00*	MSLH	0.55	0.00*	0.00*
BGSC	0.38	0.00*	0.00*	MYI	0.3	0.00*	0.00*
BHP	0.19	0.00*	0.00*	N91	0.55	0.00*	0.00*
BIFF	0.19	0.00*	0.00*	NESF	0.15	0.00*	0.00*
BKG	0.99	0.00*	0.00*	NETW	0.14	0.00*	0.00*

Table C- 4 Wald Test results for Portfolio 10, 11, 12 in the UK – continued (1)							
Code	P10	P11	P12	Code	P10	P11	P12
BLND	0.7	0.00*	0.00*	NEX	0.14	0.00*	0.00*
BME	0.04*	0.00*	0.00*	NG.	0.44	0.00*	0.00*
BNKR	0.8	0.00*	0.00*	NWG	0.71	0.00*	0.00*
BNZL	0.86	0.00*	0.00*	NXT	0.61	0.00*	0.00*
BOY	0.58	0.00*	0.00*	OCDO	0.62	0.00*	0.00*
BP.	0.62	0.00*	0.00*	OSB	0.55	0.00*	0.00*
BRBY	0.23	0.00*	0.00*	OXB	0.73	0.00*	0.00*
BRSC	0.6	0.00*	0.00*	OXIG	0.96	0.00*	0.00*
BRW	0.45	0.00*	0.00*	PAG	0.52	0.00*	0.00*
BRWM	0.34	0.00*	0.00*	PAGE	0.89	0.00*	0.00*
BT.A	0.55	0.00*	0.00*	PCT	0.66	0.00*	0.00*
BVIC	0.31	0.00*	0.00*	PETS	0.86	0.00*	0.00*
BWY	0.83	0.06	0.00*	PFC	0.74	0.00*	0.00*
BYG	0.73	0.00*	0.00*	PFD	0.11	0.00*	0.00*
CAPC	0.85	0.00*	0.00*	PFG	0.95	0.00*	0.00*
CBG	0.11	0.00*	0.00*	PHNX	0.79	0.00*	0.00*
CCC	0.6	0.00*	0.00*	PHP	0.87	0.00*	0.00*
CCH	0.72	0.00*	0.00*	PIN	0.21	0.1	0.00*
CCL	0.02*	0.00*	0.00*	PLI	0.36	0.00*	0.00*
CCR	0.18	0.00*	0.00*	PLP	0.27	0.00*	0.00*
CEY	0.55	0.00*	0.00*	PLUS	0.21	0.00*	0.00*
CHG	0.32	0.00*	0.00*	PNL	0.33	0.00*	0.00*
CINE	0.57	0.00*	0.00*	PNN	0.54	0.00*	0.00*
CKN	0.52	0.00*	0.00*	POG	0.45	0.00*	0.00*
CLDN	0.36	0.00*	0.00*	POLY	0.68	0.00*	0.00*
CLI	0.27	0.00*	0.00*	PRTC	0.89	0.00*	0.00*
CLSN	0.74	0.00*	0.00*	PRU	0.36	0.00*	0.00*
CMCX	0.22	0.00*	0.00*	PSH	0.97	0.00*	0.00*
CAN	0.13	0.00*	0.00*	PSN	0.68	0.00*	0.00*
CNE	0.48	0.00*	0.00*	PSON	0.46	0.00*	0.00*
COA	0.85	0.00*	0.00*	PTEC	0.01*	0.00*	0.00*
CPG	0.73	0.00*	0.00*	PZC	0.13	0.00*	0.00*
CPI	0.18	0.00*	0.41	QLT	0.06	0.00*	0.00*
CRDA	0.4	0.00*	0.00*	QQ.	0.68	0.00*	0.00*
CRH	0.27	0.00*	0.00*	RAT	0.41	0.00*	0.00*
CRST	0.98	0.00*	0.00*	RB.	0.92	0.00*	0.00*
CSH	0.89	0.00*	0.00*	RCP	0.91	0.00*	0.00*
CSP	0.77	0.00*	0.00*	RDSA	0.72	0.00*	0.00*
CTEC	0.37	0.00*	0.00*	RDSB	0.4	0.00*	0.00*
CTY	0.08	0.00*	0.00*	RDW	0.73	0.00*	0.00*
CWK	0.01*	0.00*	0.00*	REL	0.9	0.00*	0.00*
DC.	0.64	0.00*	0.00*	RHIM	0.36	0.00*	0.00*
DCC	0.32	0.00*	0.00*	RIO	0.64	0.00*	0.00*
DGE	0.9	0.00*	0.00*	RMG	0.26	0.00*	0.00*

Table C- 4 Wald Test results for Portfolio 10, 11, 12 in the UK – continued (2)							
Code	P10	P11	P12	Code	P10	P11	P12
DGOC	0.73	0.00*	0.00*	RMV	0.64	0.00*	0.00*
DIGS	0.17	0.00*	0.00*	RNK	0.56	0.00*	0.00*
DLG	0.74	0.00*	0.00*	ROR	0.78	0.00*	0.00*
DLN	0.9	0.00*	0.00*	RR.	0.68	0.00*	0.00*
DNLM	0.85	0.00*	0.00*	RSA	0.41	0.00*	0.00*
DOM	0.11	0.00*	0.00*	RSW	0.03*	0.00*	0.00*
DPH	0.16	0.00*	0.00*	RTO	0.66	0.00*	0.00*
DPLM	0.23	0.00*	0.00*	SAFE	0.41	0.00*	0.00*
DRX	0.85	0.00*	0.00*	SAIN	0.09	0.00*	0.00*
ECM	0.53	0.00*	0.00*	SBRE	0.53	0.00*	0.00*
EDIN	0.62	0.00*	0.00*	SBRY	0.35	0.00*	0.00*
EMG	0.74	0.00*	0.00*	SCIN	0.32	0.00*	0.00*
ENOG	0.67	0.00*	0.00*	SCT	0.72	0.00*	0.00*
ERM	0.99	0.00*	0.00*	SDP	0.71	0.00*	0.00*
ESNT	0.61	0.00*	0.00*	SDR	0.43	0.00*	0.00*
EVR	0.5	0.00*	0.00*	SEQI	0.31	0.00*	0.00*
EWI	0.19	0.00*	0.00*	SGE	0.35	0.00*	0.00*
EXPN	0.53	0.00*	0.00*	SGRO	0.34	0.00*	0.00*
EZJ	0.93	0.00*	0.15	SHB	0.53	0.00*	0.00*
FCIT	0.67	0.00*	0.00*	SIG	0.24	0.00*	0.00*
FCSS	0.58	0.00*	0.00*	SKG	0.32	0.15	0.00*
FDM	0.07	0.00*	0.00*	SLA	0.35	0.00*	0.00*
FERG	0.48	0.00*	0.00*	SMDS	0.77	0.00*	0.00*
FEV	0.74	0.00*	0.00*	SMIN	0.46	0.00*	0.00*
FGP	0.02*	0.00*	0.00*	SMP	0.54	0.00*	0.00*
FGT	0.87	0.00*	0.00*	SMT	0.07	0.00*	0.00*
FLTR	0.86	0.00*	0.00*	SMWH	0.32	0.00*	0.00*
FOUR	0.91	0.00*	0.00*	SN.	0.69	0.00*	0.00*
FRAS	0.11	0.00*	0.00*	SNN	0.19	0.00*	0.00*
FRES	0.86	0.00*	0.00*	SOI	0.55	0.00*	0.00*
FSFL	0.81	0.00*	0.00*	SONC	0.98	0.00*	0.00*
FSJ	0.17	0.00*	0.00*	SONG	0.86	0.00*	0.00*
FSV	0.15	0.00*	0.00*	SPT	0.57	0.00*	0.00*
FUTR	0.25	0.00*	0.00*	SPX	0.75	0.00*	0.00*
FXPO	0.6	0.00*	0.00*	SRE	0.94	0.00*	0.00*
GAW	0.12	0.00*	0.00*	SRP	0.44	0.00*	0.00*
GCP	0.75	0.00*	0.00*	SSE	0.33	0.00*	0.00*
GFS	0.91	0.00*	0.00*	SSON	0.18	0.00*	0.00*
GFTU	0.89	0.00*	0.00*	SSPG	0.21	0.00*	0.00*
GLEN	0.16	0.00*	0.00*	STAN	0.62	0.00*	0.00*
GLO	0.15	0.00*	0.00*	STJ	0.34	0.00*	0.00*
GNC	0.94	0.00*	0.00*	SVS	0.19	0.00*	0.00*
GNS	0.35	0.00*	0.00*	SVT	0.31	0.00*	0.00*
GPOR	0.96	0.00*	0.00*	SXS	0.57	0.00*	0.00*

Table C- 4 Wald Test results for Portfolio 10, 11, 12 in the UK – continued (3)							
Code	P10	P11	P12	Code	P10	P11	P12
GRG	0.64	0.00*	0.00*	SYNC	0.49	0.00*	0.00*
GRI	0.6	0.00*	0.00*	SYNT	0.73	0.00*	0.00*
GSK	0.99	0.00*	0.00*	TALK	0.17	0.00*	0.00*
GSS	0.3	0.00*	0.00*	TATE	0.22	0.00*	0.00*
GVC	0.82	0.00*	0.00*	TBCG	0.35	0.00*	0.00*
GYS	0.68	0.00*	0.00*	TCAP	0.52	0.00*	0.00*
HAS	0.53	0.00*	0.00*	TEM	0.72	0.00*	0.00*
HFG	0.76	0.00*	0.00*	TEP	0.42	0.00*	0.00*
HGT	0.86	0.00*	0.00*	TIFS	0.3	0.00*	0.00*
HICL	0.26	0.00*	0.00*	TPK	0.98	0.00*	0.00*
HIK	0.2	0.00*	0.00*	TRIG	0.06	0.00*	0.00*
HILS	0.25	0.00*	0.00*	TRN	0.93	0.00*	0.00*
HL.	0.67	0.00*	0.00*	TRY	0.87	0.00*	0.00*
HLMA	0.3	0.00*	0.00*	TSCO	0.99	0.00*	0.00*
HOC	0.55	0.00*	0.00*	TUI	0.3	0.00*	0.00*
HRI	0.04*	0.00*	0.00*	TW.	0.48	0.00*	0.00*
HSBA	0.32	0.00*	0.00*	UDG	0.27	0.00*	0.00*
HSL	0.28	0.00*	0.00*	UKCM	0.38	0.00*	0.00*
HSTG	0.98	0.00*	0.58	UKW	0.12	0.00*	0.00*
HSV	0.2	0.00*	0.00*	ULE	0.32	0.00*	0.00*
HSX	0.55	0.00*	0.00*	ULVR	0.73	0.00*	0.00*
HTWS	0.72	0.00*	0.00*	USA	0.64	0.00*	0.64
HVPE	0.72	0.00*	0.00*	UTG	0.78	0.00*	0.00*
HWDN	0.96	0.00*	0.00*	UU.	0.97	0.00*	0.00*
IAG	0.97	0.00*	0.00*	VCT	0.99	0.00*	0.00*
IBST	0.83	0.00*	0.00*	VEC	0.34	0.00*	0.00*
ICGT	0.57	0.00*	0.00*	VEIL	0.38	0.00*	0.00*
ICP	0.7	0.00*	0.00*	VMUK	0.22	0.00*	0.00*
IEM	0.75	0.00*	0.00*	VOD	0.35	0.00*	0.00*
IGG	0.44	0.00*	0.00*	VOF	0.19	0.00*	0.00*
IHG	0.54	0.00*	0.00*	VSVS	0.9	0.00*	0.00*
IHP	0.15	0.00*	0.00*	VTY	0.92	0.00*	0.00*
III	0.11	0.00*	0.00*	VVO	0.45	0.00*	0.00*
IMB	0.59	0.00*	0.00*	WEIR	0.84	0.00*	0.00*
IMI	0.11	0.00*	0.00*	WG.	0.76	0.00*	0.00*
INCH	0.92	0.00*	0.00*	WIZZ	0.52	0.00*	0.00*
INDV	0.79	0.00*	0.00*	WKP	0.02*	0.00*	0.00*
INF	0.28	0.00*	0.00*	WMH	0.18	0.00*	0.00*
INPP	0.88	0.00*	0.00*	WOSG	0.06	0.00*	0.00*
INVP	0.97	0.00*	0.00*	WPP	0.82	0.00*	0.00*
IPO	0.86	0.00*	0.00*	WTAN	0.24	0.00*	0.85
ITRK	0.68	0.00*	0.00*	WTB	0.92	0.00*	0.00*
ITV	0.13	0.00*	0.00*	WWH	0.68	0.00*	0.00*
IWG	0.01*	0.00*	0.00*	XPP	0.79	0.00*	0.00*
Note: * represent the statistical significance at the 5% level.							

Table C- 5 Wald Test results for Portfolio 13, 14, 15 in the UK

Code	P13	P14	P15	Code	P13	P14	P15
3IN	0.00*	0.84	0.99	JAM	0.00*	0.31	0.85
888	0.00*	0.2	0.21	JD.	0.00*	0.13	0.95
AAF	0.00*	0.51	0.86	JDW	0.00*	0.29	0.28
AAL	0.00*	0.15	0.59	JEO	0.00*	0.29	0.29
ABF	0.00*	0.11	0.91	JESC	0.00*	0.93	0.41
ACI	0.00*	0.95	0.46	JET	0.00*	0.22	0.67
ADM	0.00*	0.27	0.07	JFJ	0.00*	0.07	0.23
AGK	0.00*	0.15	0.92	JLEN	0.00*	0.4	0.15
AGR	0.00*	0.42	0.23	JLG	0.00*	0.46	0.57
AGT	0.00*	0.59	0.74	JMAT	0.00*	0.78	0.13
AHT	0.00*	0.78	0.84	JMG	0.00*	0.69	0.7
AJB	0.1	0.86	0.29	JUP	0.00*	0.95	0.79
AML	0.00*	0.96	0.31	JUST	0.00*	0.1	0.91
ANTO	0.00*	0.65	0.6	KAZ	0.00*	0.93	0.89
AO.	0.00*	0.92	0.65	KGF	0.00*	0.21	0.32
APAX	0.00*	0.84	0.31	KNOS	0.00*	0.87	0.48
ASCL	0.00*	0.00*	0.83	LAND	0.00*	0.18	0.47
ASHM	0.00*	0.2	0.62	LGEN	0.00*	0.3	0.29
ASL	0.00*	0.53	0.08	LIO	0.00*	0.87	0.43
ATST	0.00*	0.59	0.73	LLOY	0.00*	0.11	0.4
ATT	0.00*	0.73	0.96	LMP	0.00*	0.83	0.46
AUTO	0.00*	0.08	0.06	LRE	0.00*	0.92	0.93
AV.	0.00*	0.15	0.95	LSE	0.23	0.59	0.98
AVON	0.00*	0.05	0.37	LWDB	0.00*	0.37	0.69
AVST	0.00*	0.29	0.86	LXI	0.00*	0.57	0.33
AVV	0.00*	0.51	0.29	MAB	0.00*	0.7	0.11
AZN	0.00*	0.79	0.2	MCRO	0.00*	0.72	0.44
BA.	0.00*	0.37	0.12	MDC	0.00*	0.91	0.6
BAB	0.00*	0.22	0.71	MGAM	0.00*	0.97	0.35
BARC	0.00*	0.25	0.48	MGGT	0.00*	0.44	0.57
BATS	0.00*	0.79	0.65	MGNS	0.00*	0.6	0.87
BBGI	0.00*	0.08	0.3	MKS	0.00*	0.94	0.87
BBH	0.00*	0.2	0.99	MNDI	0.00*	0.33	0.73
BBOX	0.00*	0.96	0.91	MNG	0.00*	0.6	0.72
BBY	0.00*	0.3	0.7	MNKS	0.00*	0.28	0.42
BCPT	0.00*	0.07	0.34	MONY	0.00*	0.69	0.77
BDEV	0.00*	0.81	0.99	MRC	0.00*	0.39	0.66
BEZ	0.00*	0.12	0.84	MRO	0.00*	0.91	0.17
BGFD	0.00*	0.23	0.62	MRW	0.00*	0.67	0.35
BGS	0.00*	0.61	0.62	MSLH	0.00*	0.57	0.61
BGSC	0.00*	0.48	0.72	MYI	0.00*	0.55	0.69
BHP	0.00*	0.52	0.99	N91	0.00*	0.65	0.93

Table C- 5 Wald Test results for Portfolio 13, 14, 15 in the UK – continued (1)

Code	P13	P14	P15	Code	P13	P14	P15
BIFF	0.00*	0.39	0.08	NESF	0.00*	0.72	0.95
BKG	0.00*	0.52	0.68	NETW	0.00*	0.11	0.76
BLND	0.00*	0.48	0.2	NEX	0.00*	0.24	0.11
BME	0.00*	0.78	0.11	NG.	0.00*	0.41	0.36
BNKR	0.00*	0.44	0.59	NWG	0.00*	0.9	0.16
BNZL	0.00*	0.88	0.8	NXT	0.00*	0.16	0.39
BOY	0.00*	0.19	0.96	OCDO	0.00*	0.23	0.15
BP.	0.00*	0.29	0.93	OSB	0.00*	0.97	0.66
BRBY	0.00*	0.17	0.89	OXB	0.00*	0.84	0.92
BRSC	0.00*	0.54	0.39	OXIG	0.00*	0.74	0.51
BRW	0.00*	0.65	0.08	PAG	0.00*	0.69	0.1
BRWM	0.00*	0.32	0.28	PAGE	0.00*	0.38	0.3
BT.A	0.00*	0.28	0.98	PCT	0.00*	0.09	0.48
BVIC	0.00*	0.77	0.55	PETS	0.00*	0.83	0.26
BWY	0.00*	0.59	0.99	PFC	0.00*	0.8	0.23
BYG	0.00*	0.38	0.99	PFD	0.00*	0.6	0.95
CAPC	0.00*	0.00*	0.64	PFG	0.00*	0.65	0.58
CBG	0.00*	0.84	0.21	PHNX	0.00*	0.92	0.53
CCC	0.00*	0.72	0.62	PHP	0.00*	0.72	0.31
CCH	0.00*	0.06	0.8	PIN	0.00*	0.00*	0.37
CCL	0.00*	0.75	0.92	PLI	0.00*	0.78	0.9
CCR	0.00*	0.9	0.11	PLP	0.00*	0.93	0.42
CEY	0.00*	0.68	0.00*	PLUS	0.00*	0.92	0.86
CHG	0.00*	0.99	0.15	PNL	0.00*	0.1	0.56
CINE	0.00*	0.7	0.59	PNN	0.00*	0.96	0.76
CKN	0.00*	0.91	0.62	POG	0.00*	0.29	0.35
CLDN	0.00*	0.59	0.51	POLY	0.00*	0.31	0.85
CLI	0.00*	0.55	0.51	PRTC	0.00*	0.77	0.49
CLSN	0.00*	0.44	0.8	PRU	0.00*	0.43	0.21
CMCX	0.00*	0.4	0.14	PSH	0.00*	0.34	0.07
CAN	0.00*	0.94	0.34	PSN	0.00*	0.23	0.73
CNE	0.00*	0.37	0.07	PSON	0.00*	0.57	0.67
COA	0.00*	0.06	0.58	PTEC	0.00*	0.9	0.19
CPG	0.00*	0.4	0.64	PZC	0.00*	0.75	0.35
CPI	0.00*	0.78	0.2	QLT	0.00*	0.71	0.89
CRDA	0.00*	0.4	0.83	QQ.	0.00*	0.17	0.52
CRH	0.00*	0.11	0.46	RAT	0.00*	0.44	0.24
CRST	0.00*	0.12	0.93	RB.	0.00*	0.78	0.09
CSH	0.00*	0.97	0.96	RCP	0.00*	0.63	0.56
CSP	0.00*	0.13	0.39	RDSA	0.08	0.89	0.96
CTEC	0.00*	0.16	0.81	RDSB	0.00*	0.32	0.05
CTY	0.00*	0.87	0.47	RDW	0.00*	0.44	0.33
CWK	0.00*	0.16	0.64	REL	0.00*	0.57	0.00*
DC.	0.00*	0.86	0.22	RHIM	0.00*	0.67	0.42

Table C- 5 Wald Test results for Portfolio 13, 14, 15 in the UK – continued (2)							
Code	P13	P14	P15	Code	P13	P14	P15
DCC	0.00*	0.27	0.51	RIO	0.00*	0.82	0.96
DGE	0.00*	0.44	0.95	RMG	0.00*	0.1	0.33
DGOC	0.00*	0.53	0.19	RMV	0.00*	0.31	0.78
DIGS	0.00*	0.43	0.36	RNK	0.00*	0.71	0.77
DLG	0.00*	0.49	0.93	ROR	0.00*	0.26	0.28
DLN	0.00*	0.69	0.13	RR.	0.00*	0.92	0.22
DNLM	0.00*	0.63	0.93	RSA	0.00*	0.06	0.77
DOM	0.00*	0.41	0.75	RSW	0.00*	0.82	0.16
DPH	0.00*	0.39	0.75	RTO	0.00*	0.9	0.54
DPLM	0.00*	0.59	0.44	SAFE	0.00*	0.9	0.17
DRX	0.00*	0.59	0.07	SAIN	0.00*	0.77	0.35
ECM	0.00*	0.56	0.47	SBRE	0.00*	0.54	0.89
EDIN	0.00*	0.45	0.92	SBRY	0.00*	0.65	0.39
EMG	0.00*	0.92	0.68	SCIN	0.00*	0.55	0.7
ENOG	0.00*	0.63	0.64	SCT	0.00*	0.21	0.42
ERM	0.00*	0.87	0.74	SDP	0.00*	0.79	0.87
ESNT	0.00*	0.39	0.41	SDR	0.00*	0.95	0.37
EVR	0.00*	0.72	0.48	SEQI	0.00*	0.00*	0.3
EWI	0.00*	0.16	0.92	SGE	0.00*	0.38	0.81
EXPN	0.00*	0.85	0.18	SGRO	0.00*	0.28	0.58
EZJ	0.00*	0.24	0.54	SHB	0.00*	0.47	0.85
FCIT	0.00*	0.82	0.00*	SIG	0.00*	0.46	0.17
FCSS	0.00*	0.72	0.94	SKG	0.00*	0.5	0.28
FDM	0.00*	0.28	0.1	SLA	0.00*	0.6	0.56
FERG	0.00*	0.8	0.61	SMDS	0.00*	0.47	0.71
FEV	0.00*	0.16	0.15	SMIN	0.00*	0.32	0.69
FGP	0.00*	0.86	0.54	SMP	0.00*	0.56	0.7
FGT	0.00*	0.34	0.72	SMT	0.00*	0.93	0.55
FLTR	0.00*	0.57	0.87	SMWH	0.00*	0.66	0.15
FOUR	0.00*	0.73	0.54	SN.	0.00*	0.93	0.98
FRAS	0.00*	0.9	0.62	SNN	0.00*	0.63	0.2
FRES	0.00*	0.59	0.77	SOI	0.00*	0.45	0.08
FSFL	0.00*	0.75	0.92	SONC	0.00*	0.59	0.96
FSJ	0.00*	0.87	0.3	SONG	0.00*	0.43	0.5
FSV	0.00*	0.44	0.51	SPT	0.00*	0.85	0.56
FUTR	0.00*	0.26	0.1	SPX	0.00*	0.53	0.68
FXPO	0.00*	0.66	0.45	SRE	0.00*	0.38	0.58
GAW	0.00*	0.66	0.89	SRP	0.00*	0.6	0.37
GCP	0.00*	0.93	0.71	SSE	0.00*	0.89	0.53
GFS	0.00*	0.28	0.61	SSON	0.00*	0.85	0.78
GFTU	0.00*	0.92	0.76	SSPG	0.00*	0.58	0.7
GLEN	0.00*	0.52	0.05	STAN	0.00*	0.65	0.41
GLO	0.00*	0.78	0.83	STJ	0.00*	0.63	0.00*
GNC	0.00*	0.71	0.58	SVS	0.00*	0.19	0.36

Table C- 5 Wald Test results for Portfolio 13, 14, 15 in the UK – continued (3)							
Code	P13	P14	P15	Code	P13	P14	P15
GNS	0.00*	0.54	0.09	SVT	0.00*	0.88	0.95
GPOR	0.00*	0.38	0.65	SXS	0.00*	0.7	0.31
GRG	0.00*	0.78	0.09	SYNC	0.00*	0.42	0.69
GRI	0.00*	0.35	0.12	SYNT	0.00*	0.46	0.29
GSK	0.00*	0.99	0.3	TALK	0.00*	0.49	0.29
GSS	0.00*	0.64	0.72	TATE	0.00*	0.73	0.55
GVC	0.00*	0.87	0.05	TBCG	0.00*	0.16	0.52
GYS	0.00*	0.26	0.93	TCAP	0.00*	0.2	0.45
HAS	0.00*	0.26	0.17	TEM	0.00*	0.73	0.09
HFG	0.00*	0.17	0.96	TEP	0.00*	0.45	0.22
HGT	0.00*	0.72	0.52	TIFS	0.00*	0.83	0.17
HICL	0.00*	0.48	0.35	TPK	0.00*	0.41	0.72
HIK	0.00*	0.45	0.07	TRIG	0.00*	0.8	0.46
HILS	0.00*	0.22	0.73	TRN	0.00*	0.12	0.96
HL.	0.00*	0.67	0.29	TRY	0.00*	0.69	0.96
HLMA	0.00*	0.74	0.6	TSCO	0.00*	0.41	0.45
HOC	0.00*	0.46	0.4	TUI	0.00*	0.16	0.86
HRI	0.00*	0.13	0.48	TW.	0.00*	0.45	0.19
HSBA	0.00*	0.67	0.55	UDG	0.00*	0.46	0.73
HSL	0.00*	0.98	0.09	UKCM	0.00*	0.99	0.05
HSTG	0.00*	0.29	0.13	UKW	0.00*	0.45	0.91
HSV	0.00*	0.53	0.64	ULE	0.00*	0.17	0.93
HSX	0.00*	0.12	0.26	ULVR	0.00*	0.5	0.59
HTWS	0.00*	0.08	0.11	USA	0.00*	0.41	0.07
HVPE	0.00*	0.33	0.4	UTG	0.00*	0.29	0.49
HWDN	0.00*	0.49	0.84	UU.	0.00*	0.82	0.47
IAG	0.00*	0.46	0.1	VCT	0.00*	0.07	0.08
IBST	0.00*	0.44	0.47	VEC	0.00*	0.66	0.44
ICGT	0.00*	0.76	0.54	VEIL	0.00*	0.31	0.24
ICP	0.00*	0.8	0.4	VMUK	0.00*	0.56	0.05
IEM	0.00*	0.97	0.32	VOD	0.00*	0.12	0.68
IGG	0.00*	0.95	0.8	VOF	0.00*	0.42	0.06
IHG	0.00*	0.16	0.51	VSVS	0.00*	0.44	0.21
IHP	0.00*	0.31	0.3	VTY	0.00*	0.92	0.7
III	0.00*	0.39	0.00*	VVO	0.00*	0.24	0.96
IMB	0.00*	0.25	0.76	WEIR	0.00*	0.73	0.68
IMI	0.00*	0.33	0.3	WG.	0.00*	0.41	0.87
INCH	0.00*	0.6	0.66	WIZZ	0.00*	0.06	0.61
INDV	0.00*	0.83	0.27	WKP	0.00*	0.78	0.77
INF	0.00*	0.53	0.71	WMH	0.00*	0.2	0.48
INPP	0.00*	0.96	0.27	WOSG	0.00*	0.59	0.38
INVP	0.00*	0.39	0.99	WPP	0.00*	0.83	0.00*
IPO	0.00*	0.9	0.62	WTAN	0.00*	0.76	0.18
ITRK	0.00*	0.48	0.55	WTB	0.00*	0.42	0.86

Table C- 5 Wald Test results for Portfolio 13, 14, 15 in the UK – continued (4)							
Code	P13	P14	P15	Code	P13	P14	P15
ITV	0.00*	0.00*	0.7	WWH	0.00*	0.18	0.73
IWG	0.00*	0.2	0.5	XPP	0.00*	0.37	0.65
Note: * represent the statistical significance at the 5% level.							

Table C- 6 Wald Test results for Portfolio 16, 17, 18 in the UK

Code	P16	P17	P18	Code	P16	P17	P18
3IN	0.07	0.00*	0.00*	JAM	0.85	0.00*	0.00*
888	0.85	0.00*	0.00*	JD.	0.5	0.00*	0.00*
AAF	0.83	0.00*	0.00*	JDW	0.41	0.00*	0.00*
AAL	0.41	0.00*	0.00*	JEO	0.85	0.00*	0.00*
ABF	0.59	0.00*	0.00*	JESC	0.53	0.00*	0.00*
ACI	0.65	0.00*	0.00*	JET	0.77	0.00*	0.00*
ADM	0.51	0.00*	0.00*	JFJ	0.8	0.00*	0.00*
AGK	0.34	0.47	0.00*	JLEN	0.83	0.00*	0.00*
AGR	0.67	0.00*	0.32	JLG	0.1	0.00*	0.00*
AGT	0.27	0.00*	0.00*	JMAT	0.18	0.00*	0.00*
AHT	0.00*	0.00*	0.00*	JMG	0.65	0.00*	0.00*
AJB	0.45	0.00*	0.00*	JUP	0.25	0.00*	0.00*
AML	0.94	0.00*	0.00*	JUST	0.42	0.00*	0.00*
ANTO	0.19	0.00*	0.00*	KAZ	0.07	0.00*	0.00*
AO.	0.48	0.00*	0.00*	KGF	0.62	0.00*	0.00*
APAX	0.52	0.00*	0.00*	KNOS	0.86	0.00*	0.00*
ASCL	0.58	0.00*	0.00*	LAND	0.65	0.00*	0.39
ASHM	0.35	0.00*	0.00*	LGEN	0.38	0.00*	0.00*
ASL	0.72	0.00*	0.00*	LIO	0.65	0.21	0.00*
ATST	0.54	0.00*	0.00*	LLOY	0.2	0.00*	0.00*
ATT	0.39	0.00*	0.00*	LMP	0.28	0.00*	0.00*
AUTO	0.95	0.00*	0.00*	LRE	0.41	0.00*	0.00*
AV.	0.99	0.00*	0.00*	LSE	0.37	0.00*	0.00*
AVON	0.42	0.00*	0.00*	LWDB	0.26	0.00*	0.00*
AVST	0.42	0.00*	0.00*	LXI	0.95	0.00*	0.00*
AVV	0.78	0.00*	0.00*	MAB	0.84	0.00*	0.00*
AZN	0.63	0.00*	0.00*	MCRO	0.29	0.00*	0.00*
BA.	0.17	0.00*	0.00*	MDC	0.75	0.00*	0.00*
BAB	0.08	0.00*	0.00*	MGAM	0.64	0.00*	0.00*
BARC	0.48	0.00*	0.00*	MGGT	0.17	0.00*	0.00*
BATS	0.52	0.00*	0.00*	MGNS	0.69	0.00*	0.00*
BBGI	0.00*	0.00*	0.00*	MKS	0.29	0.00*	0.00*
BBH	0.72	0.00*	0.00*	MNDI	0.42	0.00*	0.00*
BBOX	0.43	0.00*	0.00*	MNG	0.86	0.00*	0.00*
BBY	0.97	0.00*	0.00*	MNKS	0.76	0.00*	0.00*
BCPT	0.95	0.00*	0.00*	MONY	0.99	0.00*	0.00*
BDEV	0.84	0.00*	0.00*	MRC	0.24	0.00*	0.00*
BEZ	0.65	0.00*	0.00*	MRO	0.63	0.00*	0.00*
BGFD	0.36	0.00*	0.00*	MRW	0.49	0.00*	0.00*
BGS	0.81	0.00*	0.00*	MSLH	0.69	0.00*	0.00*
BGSC	0.46	0.00*	0.00*	MYI	0.00*	0.00*	0.00*
BHP	0.09	0.00*	0.00*	N91	0.98	0.00*	0.00*
BIFF	0.4	0.00*	0.00*	NESF	0.32	0.00*	0.00*
BKG	0.18	0.00*	0.00*	NETW	0.58	0.00*	0.00*

Table C- 6 Wald Test results for Portfolio 16, 17, 18 in the UK – continued (1)							
Code	P16	P17	P18	Code	P16	P17	P18
BLND	0.08	0.00*	0.00*	NEX	0.27	0.00*	0.00*
BME	0.83	0.00*	0.00*	NG.	0.8	0.00*	0.7
BNKR	0.82	0.00*	0.11	NWG	0.45	0.00*	0.00*
BNZL	0.8	0.00*	0.00*	NXT	0.65	0.00*	0.00*
BOY	0.32	0.00*	0.00*	OCDO	0.8	0.00*	0.00*
BP.	0.28	0.00*	0.00*	OSB	0.55	0.00*	0.00*
BRBY	0.56	0.00*	0.00*	OXB	0.39	0.00*	0.00*
BRSC	0.69	0.00*	0.00*	OXIG	0.13	0.00*	0.00*
BRW	0.63	0.00*	0.00*	PAG	0.74	0.00*	0.00*
BRWM	0.05	0.00*	0.00*	PAGE	0.64	0.00*	0.00*
BT.A	0.63	0.00*	0.00*	PCT	0.3	0.00*	0.00*
BVIC	0.86	0.00*	0.00*	PETS	0.58	0.00*	0.00*
BWY	0.54	0.00*	0.00*	PFC	0.34	0.00*	0.00*
BYG	0.74	0.00*	0.00*	PFD	0.36	0.00*	0.00*
CAPC	0.96	0.00*	0.00*	PFG	0.64	0.00*	0.00*
CBG	0.59	0.00*	0.00*	PHNX	0.67	0.00*	0.00*
CCC	0.67	0.00*	0.00*	PHP	0.76	0.00*	0.00*
CCH	0.75	0.00*	0.00*	PIN	0.32	0.00*	0.00*
CCL	0.1	0.00*	0.00*	PLI	0.24	0.00*	0.00*
CCR	0.09	0.00*	0.00*	PLP	0.1	0.00*	0.00*
CEY	0.7	0.00*	0.00*	PLUS	0.09	0.00*	0.00*
CHG	0.36	0.00*	0.00*	PNL	0.52	0.00*	0.00*
CINE	0.24	0.00*	0.00*	PNN	0.36	0.00*	0.00*
CKN	0.26	0.00*	0.00*	POG	0.48	0.00*	0.00*
CLDN	0.21	0.00*	0.00*	POLY	0.76	0.00*	0.00*
CLI	0.08	0.00*	0.00*	PRTC	0.2	0.92	0.00*
CLSN	0.51	0.00*	0.00*	PRU	0.78	0.00*	0.00*
CMCX	0.45	0.00*	0.00*	PSH	0.8	0.00*	0.00*
CAN	0.32	0.00*	0.00*	PSN	0.91	0.00*	0.00*
CNE	0.43	0.00*	0.00*	PSON	0.31	0.00*	0.00*
COA	0.78	0.00*	0.00*	PTEC	0.75	0.00*	0.00*
CPG	0.29	0.00*	0.00*	PZC	0.94	0.00*	0.00*
CPI	0.65	0.00*	0.00*	QLT	0.46	0.00*	0.00*
CRDA	0.77	0.00*	0.00*	QQ.	0.47	0.00*	0.00*
CRH	0.59	0.00*	0.00*	RAT	0.8	0.00*	0.00*
CRST	0.14	0.00*	0.00*	RB.	0.98	0.00*	0.00*
CSH	0.49	0.00*	0.00*	RCP	0.45	0.00*	0.00*
CSP	0.89	0.00*	0.00*	RDSA	0.59	0.00*	0.00*
CTEC	0.64	0.00*	0.00*	RDSB	0.7	0.00*	0.07
CTY	0.72	0.00*	0.00*	RDW	0.89	0.00*	0.00*
CWK	0.12	0.00*	0.00*	REL	0.68	0.00*	0.00*
DC.	0.00*	0.00*	0.00*	RHIM	0.46	0.00*	0.00*
DCC	0.52	0.00*	0.00*	RIO	0.07	0.00*	0.00*
DGE	0.33	0.00*	0.35	RMG	0.67	0.00*	0.00*

Table C- 6 Wald Test results for Portfolio 16, 17, 18 in the UK – continued (2)							
Code	P16	P17	P18	Code	P16	P17	P18
DGOC	0.37	0.00*	0.00*	RMV	0.53	0.00*	0.00*
DIGS	0.78	0.00*	0.00*	RNK	0.68	0.00*	0.00*
DLG	0.85	0.00*	0.00*	ROR	0.64	0.00*	0.00*
DLN	0.24	0.00*	0.00*	RR.	0.00*	0.00*	0.00*
DNLM	0.52	0.00*	0.00*	RSA	0.78	0.00*	0.00*
DOM	0.74	0.00*	0.00*	RSW	0.53	0.00*	0.00*
DPH	0.45	0.00*	0.00*	RTO	0.13	0.00*	0.00*
DPLM	0.27	0.00*	0.00*	SAFE	0.38	0.00*	0.00*
DRX	0.39	0.00*	0.00*	SAIN	0.19	0.00*	0.00*
ECM	0.17	0.00*	0.00*	SBRE	0.63	0.00*	0.00*
EDIN	0.34	0.00*	0.00*	SBRY	0.6	0.00*	0.00*
EMG	0.69	0.00*	0.00*	SCIN	0.14	0.00*	0.00*
ENOG	0.88	0.00*	0.00*	SCT	0.6	0.00*	0.00*
ERM	0.75	0.00*	0.00*	SDP	0.33	0.00*	0.00*
ESNT	0.24	0.00*	0.00*	SDR	0.34	0.00*	0.00*
EVR	0.27	0.00*	0.00*	SEQI	0.84	0.00*	0.00*
EWI	0.84	0.00*	0.00*	SGE	0.67	0.00*	0.00*
EXPN	0.29	0.00*	0.00*	SGRO	0.86	0.00*	0.00*
EZJ	0.52	0.00*	0.00*	SHB	0.7	0.00*	0.00*
FCIT	0.94	0.00*	0.00*	SIG	0.37	0.00*	0.00*
FCSS	0.14	0.00*	0.00*	SKG	0.24	0.00*	0.00*
FDM	0.83	0.00*	0.00*	SLA	0.16	0.00*	0.00*
FERG	0.23	0.00*	0.00*	SMDS	0.32	0.00*	0.00*
FEV	0.24	0.72	0.00*	SMIN	0.64	0.00*	0.00*
FGP	0.78	0.00*	0.00*	SMP	0.14	0.00*	0.00*
FGT	0.07	0.00*	0.00*	SMT	0.1	0.00*	0.00*
FLTR	0.46	0.00*	0.00*	SMWH	0.07	0.00*	0.00*
FOUR	0.47	0.00*	0.00*	SN.	0.1	0.00*	0.99
FRAS	0.55	0.00*	0.00*	SNN	0.35	0.00*	0.00*
FRES	0.74	0.00*	0.00*	SOI	0.35	0.00*	0.00*
FSFL	0.26	0.00*	0.00*	SONC	0.23	0.00*	0.00*
FSJ	0.24	0.00*	0.00*	SONG	0.34	0.00*	0.00*
FSV	0.44	0.00*	0.00*	SPT	0.23	0.00*	0.00*
FUTR	0.75	0.00*	0.00*	SPX	0.91	0.00*	0.00*
FXPO	0.74	0.00*	0.00*	SRE	0.16	0.00*	0.00*
GAW	0.89	0.00*	0.00*	SRP	0.44	0.00*	0.00*
GCP	0.75	0.00*	0.00*	SSE	0.83	0.00*	0.00*
GFS	0.58	0.00*	0.00*	SSON	0.35	0.00*	0.00*
GFTU	0.25	0.00*	0.00*	SSPG	0.15	0.00*	0.00*
GLEN	0.44	0.00*	0.00*	STAN	0.11	0.00*	0.00*
GLO	0.16	0.00*	0.00*	STJ	0.77	0.00*	0.00*
GNC	0.11	0.00*	0.00*	SVS	0.81	0.00*	0.00*
GNS	0.19	0.00*	0.00*	SVT	0.34	0.00*	0.00*
GPOR	0.65	0.00*	0.00*	SXS	0.57	0.00*	0.00*

Table C- 6 Wald Test results for Portfolio 16, 17, 18 in the UK – continued (3)							
Code	P16	P17	P18	Code	P16	P17	P18
GRG	0.77	0.00*	0.00*	SYNC	0.22	0.00*	0.00*
GRI	0.3	0.00*	0.00*	SYNT	0.3	0.00*	0.00*
GSK	0.65	0.00*	0.00*	TALK	0.55	0.00*	0.00*
GSS	0.95	0.00*	0.00*	TATE	0.16	0.00*	0.00*
GVC	0.68	0.00*	0.00*	TBCG	0.92	0.00*	0.00*
GYS	0.43	0.00*	0.00*	TCAP	0.76	0.00*	0.00*
HAS	0.28	0.00*	0.00*	TEM	0.19	0.00*	0.00*
HFG	0.99	0.00*	0.00*	TEP	0.66	0.00*	0.00*
HGT	0.06	0.00*	0.00*	TIFS	0.24	0.00*	0.00*
HICL	0.56	0.00*	0.00*	TPK	0.29	0.00*	0.00*
HIK	0.09	0.00*	0.00*	TRIG	0.51	0.00*	0.00*
HILS	0.42	0.00*	0.00*	TRN	0.35	0.00*	0.00*
HL.	0.62	0.00*	0.00*	TRY	0.1	0.00*	0.00*
HLMA	0.52	0.00*	0.00*	TSCO	0.81	0.00*	0.00*
HOC	0.14	0.00*	0.00*	TUI	0.37	0.00*	0.00*
HRI	0.7	0.00*	0.00*	TW.	0.55	0.00*	0.00*
HSBA	0.95	0.00*	0.00*	UDG	0.53	0.00*	0.00*
HSL	0.61	0.00*	0.00*	UKCM	0.08	0.00*	0.00*
HSTG	0.17	0.00*	0.00*	UKW	0.28	0.00*	0.00*
HSV	0.12	0.00*	0.00*	ULE	0.09	0.00*	0.00*
HSX	0.93	0.00*	0.00*	ULVR	0.93	0.00*	0.00*
HTWS	0.85	0.00*	0.00*	USA	0.34	0.00*	0.00*
HVPE	0.83	0.00*	0.00*	UTG	0.36	0.00*	0.00*
HWDN	0.13	0.00*	0.00*	UU.	0.22	0.00*	0.00*
IAG	0.09	0.00*	0.00*	VCT	0.18	0.00*	0.00*
IBST	0.56	0.00*	0.00*	VEC	0.82	0.00*	0.00*
ICGT	0.29	0.00*	0.00*	VEIL	0.3	0.00*	0.00*
ICP	0.19	0.00*	0.00*	VMUK	0.73	0.00*	0.00*
IEM	0.81	0.00*	0.00*	VOD	0.24	0.00*	0.00*
IGG	0.22	0.00*	0.00*	VOF	0.96	0.00*	0.00*
IHG	0.08	0.00*	0.00*	VSVS	0.3	0.00*	0.00*
IHP	0.35	0.00*	0.00*	VTY	0.71	0.00*	0.00*
III	0.77	0.00*	0.00*	VVO	0.76	0.00*	0.00*
IMB	0.24	0.00*	0.00*	WEIR	0.8	0.00*	0.00*
IMI	0.25	0.00*	0.00*	WG.	0.22	0.00*	0.00*
INCH	0.4	0.00*	0.00*	WIZZ	0.65	0.00*	0.00*
INDV	0.19	0.00*	0.00*	WKP	0.65	0.00*	0.00*
INF	0.65	0.00*	0.00*	WMH	0.18	0.00*	0.00*
INPP	0.52	0.00*	0.00*	WOSG	0.05	0.00*	0.00*
INVP	0.00*	0.00*	0.00*	WPP	0.98	0.00*	0.00*
IPO	0.78	0.00*	0.00*	WTAN	0.19	0.00*	0.00*
ITRK	0.88	0.00*	0.00*	WTB	0.00*	0.00*	0.00*
ITV	0.5	0.00*	0.00*	WWH	0.89	0.00*	0.00*
IWG	0.86	0.00*	0.00*	XPP	0.36	0.00*	0.00*
Note: * represent the statistical significance at the 5% level.							

Table C- 7 Wald Test results for Portfolio 19, 20, 21 in the UK

Code	P19	P20	P21	Code	P19	P20	P21
3IN	0.00*	0.39	0.00*	JAM	0.00*	0.08	0.00*
888	0.00*	0.85	0.00*	JD.	0.00*	0.75	0.00*
AAF	0.00*	0.62	0.00*	JDW	0.00*	0.24	0.00*
AAL	0.00*	0.05	0.00*	JEO	0.00*	0.37	0.00*
ABF	0.45	0.86	0.00*	JESC	0.00*	0.7	0.00*
ACI	0.00*	0.13	0.00*	JET	0.00*	0.8	0.81
ADM	0.00*	0.00*	0.00*	JFJ	0.00*	0.63	0.00*
AGK	0.00*	0.68	0.00*	JLEN	0.00*	0.44	0.00*
AGR	0.00*	0.32	0.00*	JLG	0.00*	0.16	0.00*
AGT	0.00*	0.31	0.00*	JMAT	0.00*	0.17	0.00*
AHT	0.00*	0.94	0.00*	JMG	0.00*	0.67	0.00*
AJB	0.00*	0.27	0.00*	JUP	0.00*	0.32	0.00*
AML	0.00*	0.52	0.00*	JUST	0.00*	0.45	0.00*
ANTO	0.00*	0.13	0.00*	KAZ	0.00*	0.36	0.00*
AO.	0.00*	0.13	0.00*	KGF	0.00*	0.33	0.00*
APAX	0.00*	0.14	0.00*	KNOS	0.00*	0.16	0.00*
ASCL	0.00*	0.16	0.00*	LAND	0.00*	0.87	0.00*
ASHM	0.00*	0.94	0.00*	LGEN	0.00*	0.41	0.00*
ASL	0.00*	0.31	0.00*	LIO	0.00*	0.26	0.00*
ATST	0.00*	0.32	0.00*	LLOY	0.00*	0.49	0.00*
ATT	0.00*	0.56	0.00*	LMP	0.00*	0.59	0.00*
AUTO	0.00*	0.41	0.00*	LRE	0.00*	0.1	0.00*
AV.	0.00*	0.47	0.00*	LSE	0.00*	0.65	0.00*
AVON	0.00*	0.41	0.00*	LWDB	0.00*	0.1	0.00*
AVST	0.00*	0.63	0.00*	LXI	0.00*	0.87	0.00*
AVV	0.00*	0.12	0.00*	MAB	0.00*	0.54	0.00*
AZN	0.00*	0.91	0.00*	MCRO	0.00*	0.25	0.00*
BA.	0.00*	0.42	0.00*	MDC	0.00*	0.95	0.00*
BAB	0.00*	0.71	0.00*	MGAM	0.00*	0.99	0.00*
BARC	0.00*	0.57	0.00*	MGGT	0.00*	0.78	0.00*
BATS	0.62	0.34	0.00*	MGNS	0.00*	0.17	0.00*
BBGI	0.00*	0.77	0.00*	MKS	0.00*	0.68	0.00*
BBH	0.00*	0.96	0.00*	MNDI	0.00*	0.13	0.00*
BBOX	0.00*	0.11	0.00*	MNG	0.00*	0.35	0.00*
BBY	0.00*	0.22	0.00*	MNKS	0.00*	0.96	0.00*
BCPT	0.00*	0.00*	0.00*	MONY	0.00*	0.5	0.00*
BDEV	0.00*	0.09	0.00*	MRC	0.00*	0.91	0.00*
BEZ	0.00*	0.75	0.00*	MRO	0.00*	0.94	0.00*
BGFD	0.00*	0.77	0.00*	MRW	0.00*	0.68	0.00*
BGS	0.00*	0.93	0.00*	MSLH	0.00*	0.86	0.00*
BGSC	0.00*	0.31	0.00*	MYI	0.00*	0.24	0.00*
BHP	0.00*	0.94	0.00*	N91	0.00*	0.47	0.00*

Table C- 7 Wald Test results for Portfolio 19, 20, 21 in the UK – continued (1)							
Code	P19	P20	P21	Code	P19	P20	P21
BIFF	0.00*	0.86	0.00*	NESF	0.00*	0.67	0.00*
BKG	0.00*	0.37	0.00*	NETW	0.00*	0.71	0.00*
BLND	0.00*	0.76	0.00*	NEX	0.00*	0.9	0.00*
BME	0.00*	0.87	0.00*	NG.	0.00*	0.51	0.00*
BNKR	0.00*	0.81	0.00*	NWG	0.00*	0.55	0.00*
BNZL	0.00*	0.97	0.00*	NXT	0.00*	0.5	0.00*
BOY	0.00*	0.89	0.00*	OCDO	0.00*	0.44	0.00*
BP.	0.00*	0.47	0.00*	OSB	0.00*	0.97	0.00*
BRBY	0.00*	0.24	0.00*	OXB	0.00*	0.00*	0.00*
BRSC	0.00*	0.26	0.00*	OXIG	0.00*	0.33	0.00*
BRW	0.00*	0.56	0.00*	PAG	0.00*	0.67	0.61
BRWM	0.00*	0.51	0.00*	PAGE	0.00*	0.36	0.00*
BT.A	0.00*	0.28	0.00*	PCT	0.00*	0.54	0.00*
BVIC	0.00*	0.00*	0.82	PETS	0.00*	0.45	0.00*
BWY	0.00*	0.6	0.00*	PFC	0.00*	0.67	0.00*
BYG	0.14	0.76	0.00*	PFD	0.00*	0.92	0.00*
CAPC	0.00*	0.96	0.00*	PFG	0.00*	0.58	0.00*
CBG	0.00*	0.95	0.00*	PHNX	0.00*	0.32	0.00*
CCC	0.00*	0.97	0.00*	PHP	0.00*	0.71	0.00*
CCH	0.00*	0.53	0.00*	PIN	0.00*	0.77	0.00*
CCL	0.00*	0.69	0.00*	PLI	0.00*	0.14	0.00*
CCR	0.00*	0.49	0.00*	PLP	0.00*	0.05	0.00*
CEY	0.00*	0.36	0.00*	PLUS	0.00*	0.7	0.00*
CHG	0.00*	0.11	0.00*	PNL	0.00*	0.7	0.00*
CINE	0.00*	0.83	0.00*	PNN	0.00*	0.78	0.00*
CKN	0.00*	0.97	0.00*	POG	0.00*	0.96	0.00*
CLDN	0.00*	0.84	0.00*	POLY	0.00*	0.71	0.00*
CLI	0.00*	0.53	0.00*	PRTC	0.00*	0.28	0.00*
CLSN	0.00*	0.32	0.00*	PRU	0.00*	0.08	0.00*
CMCX	0.00*	0.71	0.00*	PSH	0.00*	0.25	0.00*
CAN	0.00*	0.87	0.00*	PSN	0.00*	0.62	0.00*
CNE	0.00*	0.05	0.00*	PSON	0.00*	0.44	0.00*
COA	0.00*	0.96	0.00*	PTEC	0.00*	0.18	0.58
CPG	0.00*	0.72	0.00*	PZC	0.00*	0.31	0.00*
CPI	0.00*	0.98	0.00*	QLT	0.00*	0.19	0.00*
CRDA	0.00*	0.87	0.00*	QQ.	0.00*	0.46	0.00*
CRH	0.00*	0.69	0.00*	RAT	0.00*	0.64	0.00*
CRST	0.00*	0.56	0.00*	RB.	0.00*	0.61	0.00*
CSH	0.00*	0.33	0.00*	RCP	0.00*	0.37	0.00*
CSP	0.00*	0.52	0.00*	RDSA	0.00*	0.07	0.00*
CTEC	0.00*	0.27	0.00*	RDSB	0.00*	0.82	0.00*
CTY	0.00*	0.94	0.00*	RDW	0.00*	0.29	0.00*
CWK	0.00*	0.95	0.00*	REL	0.00*	0.41	0.00*
DC.	0.00*	0.33	0.00*	RHIM	0.00*	0.69	0.00*

Table C- 7 Wald Test results for Portfolio 19, 20, 21 in the UK – continued (2)							
Code	P19	P20	P21	Code	P19	P20	P21
DCC	0.00*	0.27	0.00*	RIO	0.00*	0.12	0.00*
DGE	0.00*	0.94	0.00*	RMG	0.00*	0.34	0.00*
DGOC	0.00*	0.98	0.00*	RMV	0.00*	0.34	0.00*
DIGS	0.00*	0.45	0.00*	RNK	0.00*	0.92	0.00*
DLG	0.00*	0.23	0.00*	ROR	0.00*	0.47	0.00*
DLN	0.00*	0.06	0.00*	RR.	0.00*	0.67	0.00*
DNLM	0.00*	0.12	0.00*	RSA	0.00*	0.8	0.00*
DOM	0.00*	0.17	0.00*	RSW	0.47	0.53	0.00*
DPH	0.00*	0.08	0.00*	RTO	0.00*	0.24	0.00*
DPLM	0.00*	0.34	0.00*	SAFE	0.00*	0.00*	0.00*
DRX	0.12	0.95	0.00*	SAIN	0.00*	0.62	0.00*
ECM	0.00*	0.95	0.51	SBRE	0.00*	0.83	0.00*
EDIN	0.00*	0.34	0.00*	SBRY	0.00*	0.38	0.00*
EMG	0.00*	0.13	0.00*	SCIN	0.00*	0.27	0.00*
ENOG	0.00*	0.98	0.00*	SCT	0.00*	0.99	0.00*
ERM	0.00*	0.84	0.00*	SDP	0.00*	0.32	0.00*
ESNT	0.00*	0.26	0.00*	SDR	0.00*	0.65	0.00*
EVR	0.00*	0.32	0.00*	SEQI	0.00*	0.8	0.00*
EWI	0.00*	0.83	0.00*	SGE	0.00*	0.56	0.00*
EXPN	0.00*	0.48	0.00*	SGRO	0.00*	0.35	0.00*
EZJ	0.00*	0.32	0.00*	SHB	0.00*	0.33	0.00*
FCIT	0.00*	0.78	0.00*	SIG	0.00*	0.57	0.00*
FCSS	0.00*	0.07	0.00*	SKG	0.00*	0.97	0.00*
FDM	0.00*	0.96	0.00*	SLA	0.00*	0.34	0.00*
FERG	0.00*	0.52	0.00*	SMDS	0.00*	0.94	0.00*
FEV	0.00*	0.79	0.00*	SMIN	0.00*	0.21	0.00*
FGP	0.00*	0.61	0.00*	SMP	0.00*	0.23	0.00*
FGT	0.00*	0.52	0.00*	SMT	0.00*	0.71	0.00*
FLTR	0.00*	0.99	0.00*	SMWH	0.00*	0.1	0.00*
FOUR	0.00*	0.62	0.00*	SN.	0.00*	0.3	0.00*
FRAS	0.00*	0.23	0.00*	SNN	0.00*	0.72	0.00*
FRES	0.00*	0.13	0.00*	SOI	0.54	0.4	0.00*
FSFL	0.00*	0.84	0.00*	SONC	0.00*	0.1	0.00*
FSJ	0.00*	0.08	0.00*	SONG	0.00*	0.7	0.00*
FSV	0.00*	0.07	0.00*	SPT	0.00*	0.78	0.00*
FUTR	0.00*	0.93	0.66	SPX	0.00*	0.3	0.00*
FXPO	0.00*	0.58	0.00*	SRE	0.00*	0.76	0.00*
GAW	0.00*	0.53	0.00*	SRP	0.00*	0.06	0.00*
GCP	0.00*	0.79	0.00*	SSE	0.00*	0.39	0.61
GFS	0.00*	0.71	0.00*	SSON	0.00*	0.22	0.00*
GFTU	0.00*	0.34	0.00*	SSPG	0.00*	0.84	0.00*
GLEN	0.00*	0.9	0.00*	STAN	0.00*	0.24	0.00*
GLO	0.00*	0.13	0.00*	STJ	0.00*	0.22	0.00*
GNC	0.00*	0.7	0.00*	SVS	0.00*	0.52	0.00*

Table C- 7 Wald Test results for Portfolio 19, 20, 21 in the UK – continued (3)							
Code	P19	P20	P21	Code	P19	P20	P21
GNS	0.00*	0.33	0.00*	SVT	0.00*	0.85	0.00*
GPOR	0.00*	0.23	0.00*	SXS	0.00*	0.25	0.00*
GRG	0.00*	0.79	0.00*	SYNC	0.00*	0.3	0.00*
GRI	0.00*	0.57	0.00*	SYNT	0.00*	0.52	0.00*
GSK	0.00*	0.51	0.00*	TALK	0.00*	0.13	0.00*
GSS	0.00*	0.09	0.00*	TATE	0.00*	0.61	0.00*
GVC	0.00*	0.44	0.00*	TBCG	0.00*	0.34	0.00*
GYS	0.00*	0.16	0.00*	TCAP	0.00*	0.7	0.00*
HAS	0.00*	0.87	0.00*	TEM	0.00*	0.69	0.00*
HFG	0.00*	0.6	0.00*	TEP	0.00*	0.49	0.00*
HGT	0.00*	0.12	0.00*	TIFS	0.00*	0.32	0.00*
HICL	0.00*	0.67	0.00*	TPK	0.24	0.57	0.00*
HIK	0.00*	0.72	0.00*	TRIG	0.00*	0.61	0.00*
HILS	0.00*	0.05	0.00*	TRN	0.00*	0.67	0.00*
HL.	0.00*	0.92	0.00*	TRY	0.00*	0.52	0.00*
HLMA	0.00*	0.62	0.00*	TSCO	0.00*	0.4	0.00*
HOC	0.00*	0.28	0.00*	TUI	0.00*	0.65	0.00*
HRI	0.00*	0.53	0.00*	TW.	0.00*	0.82	0.00*
HSBA	0.00*	0.94	0.00*	UDG	0.00*	0.13	0.00*
HSL	0.00*	0.55	0.00*	UKCM	0.00*	0.92	0.00*
HSTG	0.00*	0.8	0.00*	UKW	0.00*	0.42	0.00*
HSV	0.00*	0.23	0.21	ULE	0.00*	0.34	0.00*
HSX	0.00*	0.8	0.00*	ULVR	0.00*	0.54	0.00*
HTWS	0.00*	0.96	0.00*	USA	0.00*	0.97	0.00*
HVPE	0.00*	0.64	0.00*	UTG	0.00*	0.26	0.00*
HWDN	0.00*	0.96	0.00*	UU.	0.00*	0.86	0.00*
IAG	0.00*	0.73	0.00*	VCT	0.00*	0.73	0.00*
IBST	0.00*	0.29	0.00*	VEC	0.00*	0.17	0.00*
ICGT	0.00*	0.93	0.00*	VEIL	0.00*	0.55	0.00*
ICP	0.00*	0.21	0.00*	VMUK	0.00*	0.56	0.00*
IEM	0.23	0.74	0.00*	VOD	0.00*	0.48	0.00*
IGG	0.00*	0.47	0.00*	VOF	0.00*	0.7	0.00*
IHG	0.00*	0.76	0.00*	VSVS	0.00*	0.32	0.00*
IHP	0.00*	0.2	0.00*	VTY	0.8	0.24	0.00*
III	0.00*	0.18	0.00*	VVO	0.00*	0.93	0.00*
IMB	0.00*	0.96	0.00*	WEIR	0.00*	0.88	0.00*
IMI	0.00*	0.29	0.00*	WG.	0.00*	0.61	0.00*
INCH	0.00*	0.57	0.00*	WIZZ	0.00*	0.09	0.00*
INDV	0.00*	0.84	0.00*	WKP	0.00*	0.28	0.00*
INF	0.00*	0.06	0.00*	WMH	0.00*	0.77	0.39
INPP	0.00*	0.98	0.00*	WOSG	0.00*	0.1	0.00*
INVP	0.00*	0.27	0.00*	WPP	0.00*	0.51	0.00*
IPO	0.00*	0.97	0.00*	WTAN	0.00*	0.51	0.00*
ITRK	0.14	0.52	0.52	WTB	0.00*	0.69	0.00*

Table C- 7 Wald Test results for Portfolio 19, 20, 21 in the UK – continued (4)							
Code	P19	P20	P21	Code	P19	P20	P21
ITV	0.00*	0.37	0.00*	WWH	0.00*	0.06	0.00*
IWG	0.00*	0.44	0.00*	XPP	0.00*	0.99	0.00*
Note: * represent the statistical significance at the 5% level.							

Table C- 8 Wald Test results for Portfolio 22, 23, 24 in the UK

Code	P22	P23	P24	Code	P22	P23	P24
3IN	0.00*	0.00*	0.66	JAM	0.00*	0.00*	0.17
888	0.00*	0.00*	0.19	JD.	0.00*	0.00*	0.58
AAF	0.00*	0.00*	0.32	JDW	0.00*	0.00*	0.28
AAL	0.00*	0.47	0.7	JEO	0.00*	0.3	0.57
ABF	0.00*	0.00*	0.38	JESC	0.00*	0.00*	0.72
ACI	0.00*	0.00*	0.42	JET	0.00*	0.00*	0.52
ADM	0.87	0.00*	0.71	JFJ	0.00*	0.00*	0.95
AGK	0.00*	0.00*	0.25	JLEN	0.00*	0.00*	0.22
AGR	0.00*	0.00*	0.19	JLG	0.00*	0.00*	0.37
AGT	0.00*	0.00*	0.93	JMAT	0.00*	0.00*	0.57
AHT	0.00*	0.00*	0.00*	JMG	0.00*	0.00*	0.42
AJB	0.00*	0.00*	0.74	JUP	0.00*	0.59	0.37
AML	0.00*	0.00*	0.3	JUST	0.00*	0.00*	0.32
ANTO	0.00*	0.00*	0.41	KAZ	0.00*	0.00*	0.18
AO.	0.00*	0.00*	0.27	KGF	0.19	0.00*	0.61
APAX	0.00*	0.00*	0.79	KNOS	0.00*	0.00*	0.1
ASCL	0.00*	0.00*	0.39	LAND	0.00*	0.00*	0.43
ASHM	0.95	0.00*	0.34	LGEN	0.00*	0.00*	0.87
ASL	0.00*	0.00*	0.91	LIO	0.00*	0.00*	0.36
ATST	0.00*	0.00*	0.6	LLOY	0.00*	0.00*	0.68
ATT	0.00*	0.00*	0.9	LMP	0.00*	0.00*	0.79
AUTO	0.00*	0.00*	0.5	LRE	0.00*	0.00*	0.48
AV.	0.00*	0.00*	0.7	LSE	0.00*	0.00*	0.87
AVON	0.00*	0.00*	0.29	LWDB	0.00*	0.00*	0.24
AVST	0.00*	0.00*	0.61	LXI	0.00*	0.00*	0.23
AVV	0.00*	0.00*	0.26	MAB	0.00*	0.00*	0.89
AZN	0.00*	0.00*	0.71	MCRO	0.00*	0.00*	0.62
BA.	0.00*	0.2	0.23	MDC	0.00*	0.00*	0.74
BAB	0.00*	0.00*	0.46	MGAM	0.00*	0.00*	0.62
BARC	0.00*	0.00*	0.06	MGGT	0.00*	0.94	0.66
BATS	0.00*	0.00*	0.34	MGNS	0.00*	0.00*	0.57
BBGI	0.00*	0.00*	0.27	MKS	0.00*	0.00*	0.83
BBH	0.00*	0.00*	0.35	MNDI	0.00*	0.00*	0.68
BBOX	0.00*	0.00*	0.47	MNG	0.00*	0.00*	0.8
BBY	0.00*	0.00*	0.56	MNKS	0.00*	0.00*	0.71
BCPT	0.00*	0.00*	0.29	MONY	0.00*	0.00*	0.6
BDEV	0.00*	0.00*	0.86	MRC	0.00*	0.00*	0.78
BEZ	0.00*	0.00*	0.21	MRO	0.00*	0.00*	0.44
BGFD	0.96	0.00*	0.78	MRW	0.12	0.00*	0.37
BGS	0.00*	0.00*	0.00*	MSLH	0.00*	0.00*	0.49
BGSC	0.00*	0.00*	0.73	MYI	0.00*	0.00*	0.73
BHP	0.00*	0.00*	0.11	N91	0.00*	0.00*	0.12
BIFF	0.00*	0.00*	0.33	NESF	0.00*	0.00*	0.08
BKG	0.00*	0.00*	0.58	NETW	0.00*	0.00*	0.91

Table C- 8 Wald Test results for Portfolio 22, 23, 24 in the UK – continued (1)							
Code	P22	P23	P24	Code	P22	P23	P24
BLND	0.00*	0.00*	0.52	NEX	0.00*	0.00*	0.85
BME	0.00*	0.00*	0.05	NG.	0.00*	0.00*	0.27
BNKR	0.00*	0.00*	0.91	NWG	0.00*	0.00*	0.2
BNZL	0.00*	0.00*	0.88	NXT	0.00*	0.00*	0.56
BOY	0.00*	0.88	0.82	OCDO	0.00*	0.00*	0.36
BP.	0.00*	0.00*	0.17	OSB	0.00*	0.00*	0.92
BRBY	0.00*	0.00*	0.88	OXB	0.00*	0.00*	0.77
BRSC	0.00*	0.00*	0.06	OXIG	0.00*	0.00*	0.11
BRW	0.00*	0.00*	0.87	PAG	0.00*	0.00*	0.31
BRWM	0.00*	0.00*	0.17	PAGE	0.00*	0.00*	0.82
BT.A	0.00*	0.00*	0.7	PCT	0.00*	0.00*	0.7
BVIC	0.00*	0.00*	0.87	PETS	0.00*	0.00*	0.78
BWY	0.00*	0.00*	0.52	PFC	0.00*	0.00*	0.7
BYG	0.00*	0.00*	0.45	PFD	0.00*	0.00*	0.55
CAPC	0.00*	0.00*	0.62	PFG	0.00*	0.00*	0.59
CBG	0.00*	0.00*	0.92	PHNX	0.00*	0.00*	0.83
CCC	0.00*	0.00*	0.00*	PHP	0.00*	0.00*	0.61
CCH	0.00*	0.00*	0.51	PIN	0.00*	0.00*	0.91
CCL	0.00*	0.00*	0.51	PLI	0.00*	0.00*	0.00*
CCR	0.00*	0.00*	0.23	PLP	0.00*	0.00*	0.95
CEY	0.00*	0.00*	0.92	PLUS	0.00*	0.00*	0.6
CHG	0.00*	0.00*	0.05	PNL	0.00*	0.00*	0.98
CINE	0.00*	0.00*	0.88	PNN	0.00*	0.00*	0.82
CKN	0.00*	0.00*	0.99	POG	0.00*	0.00*	0.16
CLDN	0.00*	0.00*	0.09	POLY	0.00*	0.00*	0.65
CLI	0.00*	0.00*	0.8	PRTC	0.00*	0.00*	0.21
CLSN	0.00*	0.00*	0.07	PRU	0.00*	0.00*	0.94
CMCX	0.00*	0.00*	0.07	PSH	0.00*	0.00*	0.67
CAN	0.00*	0.92	0.82	PSN	0.00*	0.00*	0.53
CNE	0.00*	0.00*	0.92	PSON	0.00*	0.00*	0.33
COA	0.00*	0.00*	0.5	PTEC	0.00*	0.00*	0.83
CPG	0.00*	0.00*	0.6	PZC	0.00*	0.00*	0.33
CPI	0.00*	0.00*	0.89	QLT	0.00*	0.00*	0.51
CRDA	0.00*	0.00*	0.23	QQ.	0.31	0.00*	0.12
CRH	0.00*	0.00*	0.43	RAT	0.00*	0.00*	0.2
CRST	0.00*	0.00*	0.98	RB.	0.00*	0.00*	0.55
CSH	0.00*	0.00*	0.31	RCP	0.00*	0.88	0.23
CSP	0.00*	0.00*	0.39	RDSA	0.00*	0.00*	0.18
CTEC	0.00*	0.00*	0.72	RDSB	0.00*	0.00*	0.39
CTY	0.88	0.00*	0.82	RDW	0.00*	0.00*	0.53
CWK	0.00*	0.00*	0.66	REL	0.00*	0.00*	0.98
DC.	0.00*	0.00*	0.51	RHIM	0.00*	0.00*	0.17
DCC	0.00*	0.00*	0.83	RIO	0.00*	0.00*	0.24
DGE	0.00*	0.00*	0.21	RMG	0.00*	0.00*	0.11

Table C- 8 Wald Test results for Portfolio 22, 23, 24 in the UK – continued (2)							
Code	P22	P23	P24	Code	P22	P23	P24
DGOC	0.00*	0.00*	0.93	RMV	0.00*	0.00*	0.4
DIGS	0.00*	0.00*	0.11	RNK	0.00*	0.00*	0.63
DLG	0.00*	0.00*	0.33	ROR	0.00*	0.00*	0.94
DLN	0.00*	0.00*	0.32	RR.	0.00*	0.00*	0.34
DNLM	0.00*	0.00*	0.23	RSA	0.00*	0.00*	0.26
DOM	0.00*	0.94	0.21	RSW	0.00*	0.00*	0.55
DPH	0.00*	0.00*	0.3	RTO	0.00*	0.00*	0.18
DPLM	0.00*	0.00*	0.08	SAFE	0.00*	0.00*	0.13
DRX	0.00*	0.00*	0.89	SAIN	0.00*	0.00*	0.51
ECM	0.00*	0.00*	0.94	SBRE	0.00*	0.00*	0.2
EDIN	0.00*	0.00*	0.17	SBRY	0.00*	0.00*	0.1
EMG	0.00*	0.00*	0.43	SCIN	0.00*	0.00*	0.00*
ENOG	0.00*	0.00*	0.18	SCT	0.00*	0.00*	0.18
ERM	0.00*	0.00*	0.54	SDP	0.00*	0.00*	0.19
ESNT	0.00*	0.00*	0.46	SDR	0.00*	0.00*	0.55
EVR	0.00*	0.00*	0.08	SEQI	0.00*	0.00*	0.64
EWI	0.00*	0.00*	0.05	SGE	0.71	0.18	0.74
EXPN	0.00*	0.00*	0.08	SGRO	0.00*	0.00*	0.72
EZJ	0.00*	0.00*	0.89	SHB	0.00*	0.00*	0.52
FCIT	0.09	0.00*	0.19	SIG	0.00*	0.00*	0.68
FCSS	0.00*	0.00*	0.39	SKG	0.00*	0.00*	0.51
FDM	0.00*	0.00*	0.42	SLA	0.00*	0.00*	0.28
FERG	0.00*	0.00*	0.69	SMDS	0.00*	0.00*	0.69
FEV	0.00*	0.00*	0.6	SMIN	0.00*	0.00*	0.2
FGP	0.00*	0.00*	0.19	SMP	0.00*	0.00*	0.79
FGT	0.00*	0.00*	0.95	SMT	0.00*	0.00*	0.5
FLTR	0.00*	0.00*	0.48	SMWH	0.00*	0.00*	0.53
FOUR	0.00*	0.00*	0.64	SN.	0.00*	0.00*	0.51
FRAS	0.00*	0.00*	0.98	SNN	0.00*	0.00*	0.59
FRES	0.00*	0.41	0.66	SOI	0.00*	0.00*	0.9
FSFL	0.00*	0.00*	0.42	SONC	0.00*	0.00*	0.33
FSJ	0.00*	0.00*	0.53	SONG	0.00*	0.00*	0.82
FSV	0.00*	0.00*	0.36	SPT	0.00*	0.00*	0.72
FUTR	0.00*	0.00*	0.72	SPX	0.00*	0.00*	0.35
FXPO	0.00*	0.00*	0.81	SRE	0.00*	0.00*	0.94
GAW	0.00*	0.00*	0.22	SRP	0.00*	0.00*	0.89
GCP	0.00*	0.00*	0.47	SSE	0.00*	0.00*	0.51
GFS	0.00*	0.00*	0.35	SSON	0.00*	0.00*	0.79
GFTU	0.00*	0.00*	0.44	SSPG	0.00*	0.00*	0.78
GLEN	0.00*	0.00*	0.12	STAN	0.00*	0.00*	0.09
GLO	0.00*	0.00*	0.31	STJ	0.00*	0.24	0.86
GNC	0.00*	0.00*	0.1	SVS	0.00*	0.00*	0.48
GNS	0.00*	0.00*	0.95	SVT	0.00*	0.00*	0.62
GPOR	0.00*	0.00*	0.16	SXS	0.00*	0.00*	0.12

Table C- 8 Wald Test results for Portfolio 22, 23, 24 in the UK – continued (3)							
Code	P22	P23	P24	Code	P22	P23	P24
GRG	0.00*	0.00*	0.54	SYNC	0.00*	0.00*	0.77
GRI	0.00*	0.00*	0.08	SYNT	0.00*	0.00*	0.79
GSK	0.00*	0.00*	0.78	TALK	0.00*	0.00*	0.12
GSS	0.00*	0.00*	0.1	TATE	0.00*	0.00*	0.42
GVC	0.00*	0.00*	0.26	TBCG	0.00*	0.00*	0.62
GYS	0.00*	0.00*	0.31	TCAP	0.00*	0.00*	0.42
HAS	0.00*	0.00*	0.57	TEM	0.00*	0.00*	0.6
HFG	0.00*	0.00*	0.72	TEP	0.00*	0.00*	0.61
HGT	0.00*	0.00*	0.37	TIFS	0.00*	0.00*	0.63
HICL	0.00*	0.00*	0.12	TPK	0.00*	0.00*	0.09
HIK	0.00*	0.00*	0.46	TRIG	0.00*	0.00*	0.91
HILS	0.00*	0.00*	0.47	TRN	0.00*	0.00*	0.94
HL.	0.00*	0.00*	0.18	TRY	0.00*	0.00*	0.41
HLMA	0.00*	0.00*	0.12	TSCO	0.00*	0.00*	0.87
HOC	0.00*	0.00*	0.76	TUI	0.75	0.00*	0.3
HRI	0.00*	0.00*	0.57	TW.	0.00*	0.00*	0.91
HSBA	0.00*	0.00*	0.38	UDG	0.00*	0.00*	0.29
HSL	0.00*	0.00*	0.74	UKCM	0.00*	0.99	0.00*
HSTG	0.00*	0.00*	0.98	UKW	0.00*	0.00*	0.71
HSV	0.14	0.00*	0.39	ULE	0.00*	0.00*	0.96
HSX	0.00*	0.00*	0.64	ULVR	0.00*	0.00*	0.37
HTWS	0.00*	0.00*	0.32	USA	0.00*	0.00*	0.62
HVPE	0.00*	0.00*	0.41	UTG	0.00*	0.00*	0.46
HWDN	0.00*	0.00*	0.07	UU.	0.00*	0.00*	0.41
IAG	0.00*	0.00*	0.37	VCT	0.00*	0.00*	0.43
IBST	0.00*	0.00*	0.75	VEC	0.00*	0.00*	0.39
ICGT	0.00*	0.00*	0.82	VEIL	0.00*	0.00*	0.29
ICP	0.00*	0.00*	0.96	VMUK	0.00*	0.00*	0.86
IEM	0.00*	0.00*	0.53	VOD	0.00*	0.00*	0.83
IGG	0.00*	0.00*	0.39	VOF	0.00*	0.00*	0.38
IHG	0.00*	0.12	0.43	VSVS	0.00*	0.00*	0.67
IHP	0.00*	0.00*	0.24	VTY	0.00*	0.00*	0.08
III	0.00*	0.00*	0.57	VVO	0.00*	0.00*	0.89
IMB	0.00*	0.00*	0.46	WEIR	0.00*	0.00*	0.81
IMI	0.00*	0.00*	0.89	WG.	0.00*	0.00*	0.48
INCH	0.00*	0.00*	0.88	WIZZ	0.00*	0.00*	0.29
INDV	0.00*	0.00*	0.67	WKP	0.00*	0.00*	0.2
INF	0.00*	0.00*	0.42	WMH	0.00*	0.00*	0.94
INPP	0.00*	0.00*	0.27	WOSG	0.00*	0.00*	0.82
INVP	0.00*	0.00*	0.26	WPP	0.00*	0.00*	0.73
IPO	0.00*	0.00*	0.99	WTAN	0.00*	0.00*	0.53
ITRK	0.00*	0.00*	0.45	WTB	0.54	0.00*	0.69
ITV	0.00*	0.00*	0.87	WWH	0.00*	0.35	0.58
IWG	0.00*	0.00*	0.16	XPP	0.00*	0.00*	0.13
Note: * represent the statistical significance at the 5% level.							

Table C- 9 Wald Test results for Portfolio 25, 26 in the UK

Code	P25	P26	Code	P25	P26
3IN	0.00*	0.00*	JAM	0.00*	0.00*
888	0.00*	0.00*	JD.	0.00*	0.00*
AAF	0.00*	0.00*	JDW	0.00*	0.00*
AAL	0.64	0.00*	JEO	0.00*	0.00*
ABF	0.00*	0.51	JESC	0.00*	0.00*
ACI	0.00*	0.00*	JET	0.00*	0.00*
ADM	0.00*	0.00*	JFJ	0.00*	0.00*
AGK	0.00*	0.00*	JLEN	0.00*	0.00*
AGR	0.00*	0.00*	JLG	0.00*	0.11
AGT	0.00*	0.00*	JMAT	0.00*	0.00*
AHT	0.00*	0.00*	JMG	0.00*	0.00*
AJB	0.00*	0.00*	JUP	0.00*	0.00*
AML	0.00*	0.00*	JUST	0.00*	0.00*
ANTO	0.00*	0.00*	KAZ	0.00*	0.00*
AO.	0.00*	0.00*	KGF	0.00*	0.00*
APAX	0.00*	0.00*	KNOS	0.00*	0.00*
ASCL	0.00*	0.00*	LAND	0.00*	0.00*
ASHM	0.00*	0.00*	LGEN	0.00*	0.00*
ASL	0.00*	0.00*	LIO	0.00*	0.00*
ATST	0.00*	0.00*	LLOY	0.00*	0.00*
ATT	0.00*	0.00*	LMP	0.00*	0.00*
AUTO	0.00*	0.00*	LRE	0.00*	0.00*
AV.	0.00*	0.00*	LSE	0.85	0.00*
AVON	0.00*	0.28	LWDB	0.00*	0.00*
AVST	0.00*	0.00*	LXI	0.00*	0.00*
AVV	0.00*	0.00*	MAB	0.00*	0.00*
AZN	0.00*	0.00*	MCRO	0.00*	0.00*
BA.	0.00*	0.00*	MDC	0.00*	0.00*
BAB	0.00*	0.00*	MGAM	0.00*	0.00*
BARC	0.00*	0.00*	MGGT	0.00*	0.00*
BATS	0.00*	0.00*	MGNS	0.00*	0.00*
BBGI	0.00*	0.00*	MKS	0.00*	0.00*
BBH	0.25	0.00*	MNDI	0.00*	0.00*
BBOX	0.00*	0.00*	MNG	0.00*	0.00*
BBY	0.00*	0.00*	MNKS	0.00*	0.00*
BCPT	0.00*	0.00*	MONY	0.00*	0.00*
BDEV	0.00*	0.00*	MRC	0.00*	0.00*
BEZ	0.00*	0.00*	MRO	0.00*	0.00*
BGFD	0.00*	0.00*	MRW	0.00*	0.00*
BGS	0.00*	0.00*	MSLH	0.00*	0.00*
BGSC	0.00*	0.00*	MYI	0.00*	0.00*
BHP	0.00*	0.00*	N91	0.00*	0.00*

Table C- 9 Wald Test results for Portfolio 25, 26 in the UK – continued (1)					
Code	P25	P26	Code	P25	P26
BIFF	0.00*	0.00*	NESF	0.00*	0.00*
BKG	0.00*	0.00*	NETW	0.00*	0.00*
BLND	0.00*	0.24	NEX	0.00*	0.00*
BME	0.00*	0.00*	NG.	0.78	0.00*
BNKR	0.00*	0.00*	NWG	0.00*	0.00*
BNZL	0.00*	0.00*	NXT	0.00*	0.00*
BOY	0.00*	0.00*	OCDO	0.00*	0.00*
BP.	0.00*	0.00*	OSB	0.00*	0.00*
BRBY	0.00*	0.00*	OXB	0.00*	0.00*
BRSC	0.00*	0.00*	OXIG	0.00*	0.00*
BRW	0.00*	0.00*	PAG	0.00*	0.00*
BRWM	0.00*	0.00*	PAGE	0.00*	0.00*
BT.A	0.00*	0.00*	PCT	0.00*	0.00*
BVIC	0.00*	0.00*	PETS	0.00*	0.00*
BWY	0.86	0.00*	PFC	0.00*	0.00*
BYG	0.00*	0.00*	PFD	0.00*	0.00*
CAPC	0.00*	0.00*	PFG	0.00*	0.00*
CBG	0.00*	0.00*	PHNX	0.00*	0.00*
CCC	0.00*	0.00*	PHP	0.00*	0.00*
CCH	0.00*	0.00*	PIN	0.00*	0.00*
CCL	0.00*	0.00*	PLI	0.00*	0.00*
CCR	0.00*	0.00*	PLP	0.00*	0.00*
CEY	0.00*	0.00*	PLUS	0.00*	0.00*
CHG	0.00*	0.00*	PNL	0.00*	0.00*
CINE	0.00*	0.00*	PNN	0.00*	0.00*
CKN	0.00*	0.00*	POG	0.00*	0.00*
CLDN	0.00*	0.51	POLY	0.00*	0.00*
CLI	0.00*	0.00*	PRTC	0.00*	0.00*
CLSN	0.00*	0.00*	PRU	0.00*	0.00*
CMCX	0.00*	0.00*	PSH	0.00*	0.00*
CAN	0.00*	0.00*	PSN	0.00*	0.00*
CNE	0.00*	0.00*	PSON	0.00*	0.00*
COA	0.00*	0.00*	PTEC	0.00*	0.00*
CPG	0.00*	0.00*	PZC	0.00*	0.00*
CPI	0.00*	0.00*	QLT	0.00*	0.00*
CRDA	0.00*	0.00*	QQ.	0.00*	0.00*
CRH	0.00*	0.00*	RAT	0.00*	0.00*
CRST	0.00*	0.00*	RB.	0.00*	0.00*
CSH	0.00*	0.00*	RCP	0.00*	0.00*
CSP	0.00*	0.00*	RDSA	0.00*	0.00*
CTEC	0.00*	0.00*	RDSB	0.00*	0.00*
CTY	0.00*	0.00*	RDW	0.00*	0.00*
CWK	0.00*	0.00*	REL	0.00*	0.00*
DC.	0.00*	0.00*	RHIM	0.00*	0.00*

Table C- 9 Wald Test results for Portfolio 25, 26 in the UK – continued (2)					
Code	P25	P26	Code	P25	P26
DCC	0.00*	0.00*	RIO	0.00*	0.00*
DGE	0.00*	0.00*	RMG	0.66	0.00*
DGOC	0.00*	0.00*	RMV	0.00*	0.00*
DIGS	0.00*	0.73	RNK	0.00*	0.00*
DLG	0.00*	0.00*	ROR	0.00*	0.00*
DLN	0.00*	0.00*	RR.	0.00*	0.00*
DNLM	0.00*	0.00*	RSA	0.00*	0.00*
DOM	0.00*	0.00*	RSW	0.00*	0.00*
DPH	0.00*	0.00*	RTO	0.00*	0.00*
DPLM	0.00*	0.00*	SAFE	0.00*	0.00*
DRX	0.00*	0.00*	SAIN	0.00*	0.00*
ECM	0.00*	0.00*	SBRE	0.00*	0.00*
EDIN	0.5	0.00*	SBRY	0.00*	0.00*
EMG	0.00*	0.00*	SCIN	0.00*	0.00*
ENOG	0.00*	0.00*	SCT	0.00*	0.00*
ERM	0.00*	0.00*	SDP	0.00*	0.00*
ESNT	0.00*	0.00*	SDR	0.00*	0.00*
EVR	0.00*	0.00*	SEQI	0.00*	0.00*
EWI	0.00*	0.00*	SGE	0.00*	0.00*
EXPN	0.00*	0.00*	SGRO	0.00*	0.00*
EZJ	0.00*	0.00*	SHB	0.00*	0.00*
FCIT	0.00*	0.00*	SIG	0.00*	0.00*
FCSS	0.00*	0.00*	SKG	0.00*	0.00*
FDM	0.00*	0.00*	SLA	0.00*	0.00*
FERG	0.00*	0.00*	SMDS	0.00*	0.00*
FEV	0.00*	0.00*	SMIN	0.00*	0.00*
FGP	0.00*	0.00*	SMP	0.00*	0.00*
FGT	0.00*	0.00*	SMT	0.00*	0.00*
FLTR	0.00*	0.00*	SMWH	0.00*	0.00*
FOUR	0.00*	0.00*	SN.	0.00*	0.00*
FRAS	0.00*	0.00*	SNN	0.00*	0.00*
FRES	0.00*	0.00*	SOI	0.00*	0.00*
FSFL	0.00*	0.00*	SONC	0.00*	0.00*
FSJ	0.00*	0.00*	SONG	0.00*	0.00*
FSV	0.00*	0.00*	SPT	0.00*	0.00*
FUTR	0.00*	0.00*	SPX	0.00*	0.00*
FXPO	0.00*	0.00*	SRE	0.00*	0.00*
GAW	0.00*	0.98	SRP	0.00*	0.88
GCP	0.00*	0.00*	SSE	0.00*	0.00*
GFS	0.00*	0.00*	SSON	0.00*	0.00*
GFTU	0.00*	0.00*	SSPG	0.3	0.00*
GLEN	0.00*	0.00*	STAN	0.00*	0.00*
GLO	0.00*	0.00*	STJ	0.00*	0.00*
GNC	0.00*	0.00*	SVS	0.00*	0.00*

Table C- 9 Wald Test results for Portfolio 25, 26 in the UK – continued (3)					
Code	P25	P26	Code	P25	P26
GNS	0.00*	0.00*	SVT	0.00*	0.00*
GPOR	0.00*	0.00*	SXS	0.00*	0.00*
GRG	0.00*	0.00*	SYNC	0.00*	0.00*
GRI	0.00*	0.00*	SYNT	0.00*	0.00*
GSK	0.00*	0.00*	TALK	0.00*	0.00*
GSS	0.00*	0.00*	TATE	0.00*	0.00*
GVC	0.00*	0.00*	TBCG	0.00*	0.00*
GYS	0.53	0.00*	TCAP	0.00*	0.00*
HAS	0.00*	0.00*	TEM	0.00*	0.00*
HFG	0.00*	0.00*	TEP	0.00*	0.00*
HGT	0.00*	0.00*	TIFS	0.00*	0.00*
HICL	0.00*	0.00*	TPK	0.00*	0.00*
HIK	0.00*	0.00*	TRIG	0.00*	0.00*
HILS	0.00*	0.00*	TRN	0.00*	0.00*
HL.	0.00*	0.00*	TRY	0.00*	0.34
HLMA	0.00*	0.00*	TSCO	0.00*	0.00*
HOC	0.00*	0.00*	TUI	0.00*	0.00*
HRI	0.00*	0.00*	TW.	0.00*	0.00*
HSBA	0.00*	0.00*	UDG	0.00*	0.00*
HSL	0.00*	0.00*	UKCM	0.00*	0.00*
HSTG	0.00*	0.00*	UKW	0.00*	0.00*
HSV	0.00*	0.00*	ULE	0.00*	0.00*
HSX	0.00*	0.00*	ULVR	0.00*	0.00*
HTWS	0.00*	0.00*	USA	0.00*	0.00*
HVPE	0.00*	0.00*	UTG	0.00*	0.00*
HWDN	0.00*	0.00*	UU.	0.00*	0.00*
IAG	0.00*	0.00*	VCT	0.00*	0.00*
IBST	0.00*	0.00*	VEC	0.00*	0.00*
ICGT	0.00*	0.00*	VEIL	0.00*	0.00*
ICP	0.00*	0.00*	VMUK	0.00*	0.00*
IEM	0.00*	0.00*	VOD	0.76	0.00*
IGG	0.00*	0.00*	VOF	0.00*	0.00*
IHG	0.00*	0.00*	VSVS	0.00*	0.00*
IHP	0.00*	0.00*	VTY	0.00*	0.00*
III	0.00*	0.00*	VVO	0.00*	0.00*
IMB	0.00*	0.00*	WEIR	0.00*	0.00*
IMI	0.00*	0.00*	WG.	0.00*	0.00*
INCH	0.00*	0.00*	WIZZ	0.00*	0.00*
INDV	0.00*	0.00*	WKP	0.00*	0.95
INF	0.00*	0.00*	WMH	0.00*	0.00*
INPP	0.00*	0.00*	WOSG	0.00*	0.00*
INVP	0.00*	0.00*	WPP	0.00*	0.00*
IPO	0.00*	0.00*	WTAN	0.00*	0.00*
ITRK	0.00*	0.00*	WTB	0.62	0.00*

Table C- 9 Wald Test results for Portfolio 25, 26 in the UK – continued (4)					
Code	P25	P26	Code	P25	P26
ITV	0.00*	0.00*	WWH	0.00*	0.00*
IWG	0.00*	0.00*	XPP	0.00*	0.00*
Note: * represent the statistical significance at the 5% level.					

Table C- 10 Wald Test results for Portfolio 1,2,3 in the US

Code	P1	P2	P3	Code	P1	P2	P3
ATVI	0.00*	0.00*	0.00*	MTD	0.00*	0.00*	0.00*
GOOGL	0.00*	0.00*	0.00*	MYL	0.00*	0.00*	0.00*
GOOG	0.00*	0.00*	0.00*	PKI	0.00*	0.00*	0.00*
T	0.00*	0.00*	0.39	PRGO	0.00*	0.00*	0.00*
CTL	0.29	0.00*	0.00*	PFE	0.00*	0.00*	0.00*
CHTR	0.00*	0.00*	0.00*	DGX	0.00*	0.00*	0.00*
CMCSA	0.00*	0.00*	0.00*	REGN	0.00*	0.00*	0.00*
DISCA	0.00*	0.00*	0.00*	RMD	0.00*	0.00*	0.00*
DISCK	0.00*	0.45	0.00*	STE	0.00*	0.00*	0.00*
DISH	0.00*	0.00*	0.00*	SYK	0.00*	0.00*	0.00*
EA	0.00*	0.00*	0.00*	TFX	0.00*	0.00*	0.00*
FB	0.00*	0.00*	0.00*	COO	0.00*	0.00*	0.00*
FOXA	0.00*	0.00*	0.00*	TMO	0.00*	0.00*	0.00*
FOX	0.00*	0.00*	0.00*	UNH	0.00*	0.00*	0.00*
IPG	0.00*	0.00*	0.00*	UHS	0.00*	0.00*	0.00*
LYV	0.32	0.00*	0.00*	VAR	0.00*	0.00*	0.00*
NFLX	0.00*	0.00*	0.00*	VRTX	0.00*	0.00*	0.00*
NWSA	0.00*	0.00*	0.00*	WAT	0.00*	0.00*	0.00*
NWS	0.00*	0.00*	0.00*	WST	0.00*	0.00*	0.00*
OMC	0.00*	0.00*	0.00*	ZBH	0.00*	0.00*	0.00*
TMUS	0.00*	0.00*	0.00*	ZTS	0.00*	0.00*	0.00*
TTWO	0.00*	0.00*	0.00*	MMM	0.00*	0.00*	0.00*
DIS	0.00*	0.00*	0.00*	AOS	0.00*	0.00*	0.00*
TWTR	0.00*	0.00*	0.00*	ALK	0.00*	0.00*	0.00*
VZ	0.00*	0.00*	0.00*	ALLE	0.00*	0.00*	0.00*
VIAC	0.00*	0.00*	0.00*	AAL	0.00*	0.00*	0.00*
AAP	0.00*	0.00*	0.00*	AME	0.00*	0.00*	0.00*
AMZN	0.00*	0.00*	0.00*	BA	0.00*	0.00*	0.00*
APTV	0.00*	0.00*	0.00*	CHRW	0.00*	0.00*	0.00*
AZO	0.00*	0.92	0.00*	CARR	0.00*	0.00*	0.00*
BBY	0.00*	0.00*	0.00*	CAT	0.00*	0.00*	0.00*
BKNG	0.00*	0.00*	0.00*	CTAS	0.00*	0.00*	0.00*
BWA	0.00*	0.00*	0.29	CPRT	0.00*	0.00*	0.00*
KMX	0.00*	0.00*	0.00*	CSX	0.00*	0.00*	0.00*
CCL	0.00*	0.00*	0.00*	CMI	0.00*	0.00*	0.00*
CMG	0.54	0.00*	0.00*	DE	0.00*	0.00*	0.00*
DHI	0.00*	0.00*	0.00*	DAL	0.00*	0.00*	0.00*
DRI	0.00*	0.00*	0.00*	DOV	0.00*	0.00*	0.00*
DG	0.00*	0.00*	0.00*	ETN	0.00*	0.00*	0.00*
DLTR	0.00*	0.00*	0.00*	EMR	0.00*	0.00*	0.00*
DPZ	0.00*	0.00*	0.00*	EFX	0.00*	0.00*	0.00*
EBAY	0.00*	0.00*	0.00*	EXPD	0.00*	0.00*	0.00*
EXPE	0.00*	0.00*	0.00*	FAST	0.00*	0.00*	0.00*
F	0.00*	0.00*	0.00*	FDX	0.00*	0.00*	0.00*

Table C- 10 Wald Test results for Portfolio 1,2,3 in the US – continued (1)							
Code	P1	P2	P3	Code	P1	P2	P3
GPS	0.00*	0.00*	0.00*	FLS	0.00*	0.00*	0.00*
GRMN	0.00*	0.00*	0.00*	FTV	0.69	0.00*	0.00*
GM	0.00*	0.00*	0.00*	FBHS	0.00*	0.52	0.00*
GPC	0.00*	0.87	0.00*	GD	0.00*	0.00*	0.00*
HRB	0.00*	0.00*	0.00*	GE	0.00*	0.00*	0.00*
HBI	0.00*	0.00*	0.00*	GWW	0.00*	0.00*	0.00*
HAS	0.00*	0.00*	0.54	HON	0.00*	0.00*	0.00*
HLT	0.00*	0.00*	0.00*	HWM	0.00*	0.00*	0.00*
HD	0.00*	0.00*	0.00*	HII	0.00*	0.00*	0.00*
KSS	0.00*	0.00*	0.00*	IEX	0.00*	0.00*	0.00*
LB	0.00*	0.00*	0.00*	INFO	0.00*	0.00*	0.00*
LVS	0.00*	0.00*	0.00*	ITW	0.00*	0.00*	0.00*
LEG	0.00*	0.00*	0.00*	IR	0.00*	0.00*	0.00*
LEN	0.00*	0.00*	0.00*	JBHT	0.00*	0.00*	0.00*
LKQ	0.00*	0.00*	0.00*	J	0.00*	0.00*	0.00*
LOW	0.56	0.00*	0.00*	JCI	0.00*	0.00*	0.00*
MAR	0.00*	0.00*	0.00*	KSU	0.00*	0.00*	0.00*
MCD	0.00*	0.00*	0.00*	LHX	0.00*	0.00*	0.00*
MGM	0.00*	0.00*	0.00*	LMT	0.00*	0.00*	0.00*
MHK	0.00*	0.00*	0.00*	MAS	0.00*	0.00*	0.00*
NWL	0.00*	0.00*	0.00*	NLSN	0.00*	0.00*	0.00*
NKE	0.00*	0.00*	0.00*	NSC	0.00*	0.00*	0.00*
NCLH	0.00*	0.00*	0.00*	NOC	0.00*	0.00*	0.00*
NVR	0.00*	0.00*	0.00*	ODFL	0.00*	0.00*	0.00*
ORLY	0.00*	0.67	0.00*	OTIS	0.00*	0.00*	0.00*
PHM	0.00*	0.00*	0.00*	PCAR	0.00*	0.00*	0.00*
PVH	0.00*	0.00*	0.00*	PH	0.00*	0.00*	0.00*
RL	0.00*	0.00*	0.1	PNR	0.00*	0.00*	0.00*
ROST	0.00*	0.00*	0.00*	PWR	0.00*	0.00*	0.00*
RCL	0.00*	0.00*	0.00*	RTX	0.00*	0.00*	0.00*
SBUX	0.49	0.00*	0.00*	RSG	0.00*	0.00*	0.00*
TPR	0.00*	0.00*	0.00*	RHI	0.00*	0.00*	0.00*
TGT	0.00*	0.00*	0.00*	ROK	0.00*	0.00*	0.00*
TIF	0.00*	0.00*	0.00*	ROL	0.00*	0.00*	0.00*
TJX	0.00*	0.00*	0.00*	ROP	0.00*	0.00*	0.00*
TSCO	0.00*	0.00*	0.00*	SNA	0.00*	0.00*	0.00*
ULTA	0.00*	0.00*	0.00*	LUV	0.00*	0.00*	0.00*
UAA	0.00*	0.00*	0.00*	SWK	0.00*	0.00*	0.00*
UA	0.00*	0.00*	0.00*	TDY	0.00*	0.00*	0.00*
VFC	0.00*	0.00*	0.00*	TXT	0.00*	0.00*	0.00*
WHR	0.00*	0.00*	0.00*	TT	0.00*	0.00*	0.00*
WYNN	0.00*	0.00*	0.00*	TDG	0.00*	0.00*	0.00*
YUM	0.00*	0.24	0.00*	UNP	0.00*	0.00*	0.00*
MO	0.00*	0.00*	0.00*	UAL	0.00*	0.00*	0.00*

Table C- 10 Wald Test results for Portfolio 1,2,3 in the US – continued (2)							
Code	P1	P2	P3	Code	P1	P2	P3
ADM	0.00*	0.00*	0.00*	UPS	0.00*	0.00*	0.00*
BF.B	0.00*	0.00*	0.00*	URI	0.00*	0.00*	0.00*
CPB	0.00*	0.00*	0.00*	VRSK	0.00*	0.00*	0.00*
CHD	0.00*	0.00*	0.00*	WAB	0.00*	0.00*	0.00*
KO	0.00*	0.00*	0.00*	WM	0.00*	0.00*	0.00*
CL	0.00*	0.00*	0.00*	XYL	0.00*	0.00*	0.00*
CAG	0.00*	0.00*	0.00*	ACN	0.00*	0.00*	0.00*
STZ	0.5	0.00*	0.31	ADBE	0.00*	0.00*	0.00*
COST	0.00*	0.00*	0.00*	AMD	0.00*	0.00*	0.00*
COTY	0.00*	0.00*	0.00*	AKAM	0.00*	0.00*	0.00*
EL	0.00*	0.00*	0.00*	APH	0.00*	0.00*	0.00*
GIS	0.00*	0.00*	0.00*	ADI	0.64	0.00*	0.00*
HRL	0.00*	0.00*	0.00*	ANSS	0.00*	0.00*	0.00*
SJM	0.00*	0.00*	0.00*	AAPL	0.00*	0.00*	0.00*
K	0.00*	0.00*	0.00*	AMAT	0.00*	0.00*	0.00*
KMB	0.00*	0.00*	0.00*	ANET	0.00*	0.00*	0.00*
KHC	0.00*	0.76	0.00*	ADSK	0.00*	0.00*	0.00*
KR	0.00*	0.00*	0.00*	ADP	0.00*	0.00*	0.00*
LW	0.99	0.00*	0.00*	AVGO	0.00*	0.00*	0.00*
MKC	0.00*	0.00*	0.00*	BR	0.00*	0.00*	0.00*
TAP	0.00*	0.00*	0.00*	CDNS	0.00*	0.00*	0.00*
MDLZ	0.00*	0.00*	0.00*	CDW	0.00*	0.54	0.00*
MNST	0.00*	0.00*	0.00*	CSCO	0.00*	0.00*	0.00*
PEP	0.00*	0.00*	0.00*	CTXS	0.00*	0.00*	0.00*
PM	0.00*	0.00*	0.00*	CTSH	0.00*	0.00*	0.00*
PG	0.00*	0.00*	0.00*	GLW	0.00*	0.00*	0.00*
SYY	0.00*	0.00*	0.00*	DXC	0.00*	0.00*	0.00*
CLX	0.66	0.00*	0.00*	FFIV	0.00*	0.00*	0.00*
HSY	0.00*	0.00*	0.65	FIS	0.00*	0.00*	0.00*
TSN	0.00*	0.00*	0.00*	FISV	0.00*	0.00*	0.00*
WBA	0.00*	0.00*	0.00*	FLT	0.00*	0.00*	0.00*
WMT	0.00*	0.00*	0.00*	FLIR	0.00*	0.00*	0.00*
APA	0.00*	0.00*	0.00*	FTNT	0.85	0.00*	0.00*
BKR	0.00*	0.00*	0.00*	IT	0.00*	0.00*	0.00*
COG	0.00*	0.17	0.00*	GPN	0.00*	0.00*	0.00*
CVX	0.00*	0.00*	0.00*	HPE	0.00*	0.00*	0.00*
CXO	0.00*	0.00*	0.00*	HPQ	0.00*	0.00*	0.00*
COP	0.00*	0.00*	0.00*	INTC	0.00*	0.00*	0.00*
DVN	0.00*	0.00*	0.00*	IBM	0.00*	0.00*	0.00*
FANG	0.54	0.00*	0.00*	INTU	0.00*	0.00*	0.61
EOG	0.00*	0.00*	0.00*	IPGP	0.00*	0.00*	0.00*
XOM	0.00*	0.00*	0.00*	JKHY	0.00*	0.00*	0.00*
HAL	0.00*	0.00*	0.00*	JNPR	0.00*	0.93	0.00*
HES	0.00*	0.00*	0.00*	KEYS	0.00*	0.00*	0.00*

Table C- 10 Wald Test results for Portfolio 1,2,3 in the US – continued (3)							
Code	P1	P2	P3	Code	P1	P2	P3
HFC	0.00*	0.00*	0.00*	KLAC	0.00*	0.00*	0.00*
KMI	0.00*	0.00*	0.00*	LRCX	0.00*	0.00*	0.00*
MRO	0.00*	0.00*	0.00*	LDOS	0.00*	0.00*	0.00*
MPC	0.00*	0.00*	0.00*	MA	0.00*	0.00*	0.00*
NOV	0.00*	0.00*	0.00*	MXIM	0.00*	0.00*	0.00*
NBL	0.00*	0.00*	0.00*	MCHP	0.00*	0.00*	0.00*
OXY	0.00*	0.00*	0.00*	MU	0.36	0.00*	0.00*
OKE	0.64	0.00*	0.00*	MSFT	0.00*	0.00*	0.00*
PSX	0.00*	0.61	0.00*	MSI	0.00*	0.00*	0.00*
PXD	0.00*	0.00*	0.00*	NTAP	0.00*	0.00*	0.00*
SLB	0.00*	0.00*	0.00*	NLOK	0.00*	0.00*	0.00*
FTI	0.00*	0.00*	0.00*	NVDA	0.00*	0.00*	0.00*
VLO	0.00*	0.00*	0.00*	ORCL	0.00*	0.00*	0.00*
WMB	0.00*	0.00*	0.00*	PAYX	0.00*	0.00*	0.00*
AFL	0.00*	0.00*	0.00*	PAYC	0.00*	0.00*	0.00*
ALL	0.00*	0.00*	0.00*	PYPL	0.00*	0.00*	0.00*
AXP	0.00*	0.00*	0.00*	QRVO	0.00*	0.00*	0.91
AIG	0.00*	0.00*	0.00*	QCOM	0.00*	0.00*	0.00*
AMP	0.00*	0.00*	0.00*	CRM	0.00*	0.00*	0.00*
AON	0.85	0.00*	0.00*	STX	0.00*	0.00*	0.00*
AJG	0.00*	0.00*	0.00*	NOW	0.00*	0.00*	0.00*
AIZ	0.00*	0.00*	0.00*	SWKS	0.00*	0.00*	0.00*
BAC	0.00*	0.00*	0.00*	SNPS	0.00*	0.5	0.00*
BRK.B	0.00*	0.96	0.12	TEL	0.00*	0.00*	0.00*
BLK	0.00*	0.00*	0.00*	TXN	0.00*	0.00*	0.00*
COF	0.00*	0.00*	0.00*	TYL	0.00*	0.00*	0.00*
CBOE	0.00*	0.00*	0.00*	VRSN	0.00*	0.00*	0.00*
SCHW	0.00*	0.00*	0.00*	V	0.63	0.00*	0.00*
CB	0.00*	0.00*	0.00*	WDC	0.00*	0.00*	0.00*
CINF	0.00*	0.00*	0.00*	WU	0.00*	0.00*	0.00*
C	0.00*	0.00*	0.00*	XRX	0.00*	0.00*	0.00*
CFG	0.00*	0.00*	0.00*	XLNX	0.00*	0.00*	0.00*
CME	0.00*	0.00*	0.00*	ZBRA	0.00*	0.00*	0.00*
CMA	0.00*	0.00*	0.00*	APD	0.00*	0.00*	0.00*
DFS	0.1	0.00*	0.00*	ALB	0.00*	0.00*	0.41
ETFC	0.00*	0.00*	0.00*	AMCR	0.00*	0.00*	0.00*
RE	0.00*	0.00*	0.00*	AVY	0.00*	0.00*	0.00*
FITB	0.00*	0.00*	0.00*	BLL	0.00*	0.00*	0.00*
FRC	0.00*	0.58	0.00*	CE	0.00*	0.00*	0.00*
BEN	0.00*	0.00*	0.00*	CF	0.00*	0.00*	0.00*
GL	0.00*	0.00*	0.00*	CTVA	0.00*	0.00*	0.00*
GS	0.00*	0.00*	0.00*	DOW	0.00*	0.00*	0.00*
HIG	0.00*	0.00*	0.00*	DD	0.00*	0.00*	0.00*
HBAN	0.00*	0.00*	0.00*	EMN	0.00*	0.00*	0.00*

Table C- 10 Wald Test results for Portfolio 1,2,3 in the US – continued (4)							
Code	P1	P2	P3	Code	P1	P2	P3
ICE	0.00*	0.00*	0.28	ECL	0.00*	0.00*	0.00*
IVZ	0.00*	0.00*	0.00*	FMC	0.96	0.00*	0.00*
JPM	0.00*	0.00*	0.00*	FCX	0.00*	0.9	0.00*
KEY	0.00*	0.00*	0.00*	IFF	0.00*	0.00*	0.00*
LNC	0.00*	0.00*	0.00*	IP	0.00*	0.00*	0.00*
L	0.13	0.00*	0.00*	LIN	0.00*	0.00*	0.00*
MTB	0.00*	0.00*	0.00*	LYB	0.00*	0.00*	0.00*
MKTX	0.00*	0.00*	0.00*	MLM	0.00*	0.00*	0.00*
MMC	0.00*	0.00*	0.00*	NEM	0.00*	0.00*	0.76
MET	0.00*	0.00*	0.00*	NUE	0.00*	0.00*	0.00*
MCO	0.00*	0.00*	0.00*	PKG	0.00*	0.00*	0.00*
MS	0.00*	0.00*	0.00*	PPG	0.00*	0.00*	0.00*
MSCI	0.00*	0.00*	0.00*	SEE	0.00*	0.00*	0.00*
NDAQ	0.00*	0.00*	0.00*	SHW	0.00*	0.00*	0.00*
NTRS	0.00*	0.00*	0.00*	MOS	0.00*	0.00*	0.00*
PBCT	0.00*	0.00*	0.00*	VMC	0.00*	0.00*	0.00*
PNC	0.00*	0.00*	0.00*	WRK	0.00*	0.00*	0.00*
PFG	0.00*	0.00*	0.00*	ARE	0.00*	0.00*	0.00*
PGR	0.00*	0.00*	0.36	AMT	0.00*	0.00*	0.00*
PRU	0.00*	0.00*	0.00*	AIV	0.00*	0.00*	0.00*
RJF	0.74	0.00*	0.00*	AVB	0.00*	0.00*	0.00*
RF	0.00*	0.00*	0.00*	BXP	0.00*	0.00*	0.00*
SPGI	0.00*	0.00*	0.00*	CBRE	0.00*	0.00*	0.00*
STT	0.00*	0.00*	0.00*	CCI	0.00*	0.00*	0.00*
SIVB	0.00*	0.00*	0.00*	DLR	0.00*	0.00*	0.00*
SYF	0.00*	0.00*	0.00*	DRE	0.06	0.00*	0.00*
TROW	0.00*	0.00*	0.00*	EQIX	0.00*	0.86	0.00*
BK	0.00*	0.44	0.00*	EQR	0.00*	0.00*	0.00*
TRV	0.00*	0.00*	0.00*	ESS	0.00*	0.00*	0.00*
TFC	0.00*	0.00*	0.00*	EXR	0.00*	0.00*	0.44
USB	0.00*	0.00*	0.00*	FRT	0.00*	0.00*	0.00*
UNM	0.00*	0.00*	0.00*	PEAK	0.00*	0.00*	0.00*
WRB	0.00*	0.00*	0.00*	HST	0.00*	0.00*	0.00*
WFC	0.00*	0.00*	0.00*	IRM	0.00*	0.00*	0.00*
WLTW	0.00*	0.00*	0.00*	KIM	0.00*	0.00*	0.00*
ZION	0.72	0.00*	0.00*	MAA	0.00*	0.00*	0.00*
ABT	0.00*	0.00*	0.00*	PLD	0.00*	0.00*	0.00*
ABBV	0.00*	0.00*	0.00*	PSA	0.00*	0.00*	0.00*
ABMD	0.00*	0.00*	0.00*	O	0.00*	0.00*	0.00*
A	0.00*	0.00*	0.71	REG	0.00*	0.00*	0.00*
ALXN	0.00*	0.00*	0.00*	SBAC	0.00*	0.00*	0.00*
ALGN	0.00*	0.00*	0.00*	SPG	0.00*	0.00*	0.00*
ABC	0.00*	0.00*	0.00*	SLG	0.00*	0.00*	0.00*
AMGN	0.00*	0.00*	0.00*	UDR	0.65	0.00*	0.00*

Table C- 10 Wald Test results for Portfolio 1,2,3 in the US – continued (5)							
Code	P1	P2	P3	Code	P1	P2	P3
ANTM	0.00*	0.00*	0.00*	VTR	0.00*	0.00*	0.00*
BAX	0.00*	0.85	0.00*	VNO	0.00*	0.00*	0.00*
BDX	0.00*	0.00*	0.00*	WELL	0.00*	0.00*	0.00*
BIO	0.13	0.00*	0.00*	WY	0.00*	0.6	0.00*
BIIB	0.00*	0.00*	0.00*	Symbol	0.00*	0.00*	0.00*
BSX	0.00*	0.00*	0.00*	AES	0.00*	0.00*	0.00*
BMY	0.00*	0.00*	0.00*	LNT	0.00*	0.00*	0.61
CAH	0.00*	0.00*	0.00*	AEE	0.00*	0.00*	0.00*
CNC	0.00*	0.00*	0.00*	AEP	0.00*	0.00*	0.00*
CERN	0.00*	0.00*	0.00*	AWK	0.00*	0.00*	0.00*
CI	0.00*	0.00*	0.00*	ATO	0.00*	0.00*	0.00*
CVS	0.00*	0.00*	0.00*	CNP	0.00*	0.00*	0.00*
DHR	0.00*	0.00*	0.00*	CMS	0.00*	0.00*	0.00*
DVA	0.00*	0.00*	0.00*	ED	0.00*	0.00*	0.00*
XRAY	0.00*	0.00*	0.00*	D	0.00*	0.00*	0.00*
DXCM	0.00*	0.00*	0.00*	DTE	0.00*	0.00*	0.00*
EW	0.00*	0.00*	0.11	DUK	0.00*	0.00*	0.00*
GILD	0.00*	0.00*	0.00*	EIX	0.00*	0.00*	0.00*
HCA	0.00*	0.00*	0.00*	ETR	0.00*	0.00*	0.00*
HSIC	0.00*	0.00*	0.00*	EVRG	0.00*	0.00*	0.00*
HOLX	0.00*	0.00*	0.00*	ES	0.35	0.00*	0.00*
HUM	0.87	0.00*	0.00*	EXC	0.00*	0.00*	0.00*
IDXX	0.47	0.00*	0.00*	FE	0.00*	0.00*	0.00*
ILMN	0.00*	0.00*	0.00*	NEE	0.00*	0.00*	0.00*
INCY	0.00*	0.00*	0.00*	NI	0.00*	0.00*	0.00*
ISRG	0.00*	0.00*	0.00*	NRG	0.00*	0.00*	0.00*
IQV	0.00*	0.00*	0.00*	PNW	0.00*	0.00*	0.00*
JNJ	0.00*	0.00*	0.00*	PPL	0.00*	0.00*	0.00*
LH	0.00*	0.00*	0.00*	PEG	0.24	0.13	0.00*
LLY	0.00*	0.00*	0.00*	SRE	0.00*	0.00*	0.00*
MCK	0.00*	0.00*	0.00*	SO	0.00*	0.00*	0.00*
MDT	0.00*	0.00*	0.00*	WEC	0.00*	0.00*	0.88
MRK	0.00*	0.00*	0.00*	XEL	0.00*	0.00*	0.00*
Note: * represent the statistical significance at the 5% level.							

Table C- 11 Wald Test results for Portfolio 4, 5, 6 in the US

Code	P4	P5	P6	Code	P4	P5	P6
ATVI	0.00*	0.00*	0.00*	MTD	0.00*	0.00*	0.00*
GOOGL	0.00*	0.00*	0.00*	MYL	0.00*	0.00*	0.00*
GOOG	0.00*	0.00*	0.00*	PKI	0.00*	0.00*	0.00*
T	0.00*	0.00*	0.18	PRGO	0.00*	0.59	0.00*
CTL	0.77	0.00*	0.00*	PFE	0.00*	0.00*	0.00*
CHTR	0.00*	0.35	0.00*	DGX	0.00*	0.00*	0.00*
CMCSA	0.00*	0.00*	0.00*	REGN	0.00*	0.00*	0.00*
DISCA	0.00*	0.00*	0.00*	RMD	0.00*	0.00*	0.00*
DISCK	0.00*	0.00*	0.00*	STE	0.00*	0.00*	0.00*
DISH	0.00*	0.00*	0.00*	SYK	0.00*	0.00*	0.00*
EA	0.00*	0.00*	0.00*	TFX	0.00*	0.00*	0.00*
FB	0.00*	0.00*	0.00*	COO	0.00*	0.00*	0.00*
FOXA	0.00*	0.00*	0.00*	TMO	0.00*	0.00*	0.00*
FOX	0.00*	0.4	0.00*	UNH	0.00*	0.64	0.00*
IPG	0.00*	0.00*	0.00*	UHS	0.00*	0.00*	0.00*
LYV	0.00*	0.00*	0.00*	VAR	0.00*	0.00*	0.00*
NFLX	0.00*	0.00*	0.00*	VRTX	0.00*	0.00*	0.00*
NWSA	0.00*	0.00*	0.00*	WAT	0.00*	0.00*	0.00*
NWS	0.00*	0.00*	0.00*	WST	0.00*	0.00*	0.00*
OMC	0.00*	0.18	0.00*	ZBH	0.00*	0.00*	0.00*
TMUS	0.00*	0.00*	0.52	ZTS	0.00*	0.00*	0.00*
TTWO	0.00*	0.00*	0.00*	MMM	0.00*	0.31	0.00*
DIS	0.00*	0.00*	0.00*	AOS	0.00*	0.00*	0.00*
TWTR	0.00*	0.41	0.00*	ALK	0.00*	0.00*	0.00*
VZ	0.00*	0.00*	0.00*	ALLE	0.00*	0.00*	0.00*
VIAC	0.00*	0.00*	0.00*	AAL	0.00*	0.00*	0.00*
AAP	0.00*	0.00*	0.00*	AME	0.00*	0.00*	0.00*
AMZN	0.00*	0.00*	0.00*	BA	0.00*	0.00*	0.00*
APTV	0.52	0.00*	0.00*	CHRW	0.00*	0.00*	0.00*
AZO	0.00*	0.00*	0.00*	CARR	0.00*	0.00*	0.00*
BBY	0.00*	0.00*	0.00*	CAT	0.00*	0.00*	0.00*
BKNG	0.00*	0.00*	0.00*	CTAS	0.00*	0.00*	0.00*
BWA	0.00*	0.00*	0.49	CPRT	0.00*	0.00*	0.00*
KMX	0.00*	0.00*	0.00*	CSX	0.00*	0.00*	0.00*
CCL	0.00*	0.00*	0.00*	CMI	0.00*	0.00*	0.00*
CMG	0.00*	0.00*	0.00*	DE	0.00*	0.00*	0.00*
DHI	0.00*	0.00*	0.00*	DAL	0.00*	0.24	0.00*
DRI	0.00*	0.00*	0.00*	DOV	0.00*	0.00*	0.00*
DG	0.00*	0.00*	0.00*	ETN	0.00*	0.00*	0.00*
DLTR	0.00*	0.00*	0.00*	EMR	0.00*	0.00*	0.00*
DPZ	0.00*	0.00*	0.00*	EFX	0.00*	0.00*	0.00*
EBAY	0.00*	0.00*	0.00*	EXPD	0.00*	0.00*	0.00*
EXPE	0.00*	0.00*	0.00*	FAST	0.00*	0.00*	0.00*
F	0.35	0.00*	0.00*	FDX	0.00*	0.00*	0.00*

Table C- 11 Wald Test results for Portfolio 4, 5, 6 in the US – continued (1)							
Code	P4	P5	P6	Code	P4	P5	P6
GPS	0.00*	0.39	0.08	FLS	0.00*	0.00*	0.00*
GRMN	0.00*	0.00*	0.00*	FTV	0.00*	0.00*	0.00*
GM	0.00*	0.00*	0.00*	FBHS	0.00*	0.00*	0.00*
GPC	0.00*	0.00*	0.00*	GD	0.00*	0.00*	0.00*
HRB	0.00*	0.00*	0.00*	GE	0.00*	0.00*	0.00*
HBI	0.00*	0.00*	0.00*	GWW	0.00*	0.00*	0.00*
HAS	0.00*	0.00*	0.00*	HON	0.00*	0.00*	0.00*
HLT	0.00*	0.00*	0.00*	HWM	0.00*	0.00*	0.00*
HD	0.00*	0.00*	0.00*	HII	0.00*	0.00*	0.00*
KSS	0.00*	0.00*	0.83	IEX	0.00*	0.00*	0.00*
LB	0.00*	0.00*	0.00*	INFO	0.00*	0.93	0.00*
LVS	0.00*	0.00*	0.00*	ITW	0.00*	0.00*	0.00*
LEG	0.00*	0.00*	0.00*	IR	0.00*	0.00*	0.00*
LEN	0.00*	0.00*	0.00*	JBHT	0.00*	0.00*	0.00*
LKQ	0.00*	0.00*	0.00*	J	0.00*	0.00*	0.00*
LOW	0.00*	0.94	0.00*	JCI	0.00*	0.00*	0.00*
MAR	0.00*	0.00*	0.00*	KSU	0.00*	0.00*	0.00*
MCD	0.29	0.00*	0.00*	LHX	0.00*	0.00*	0.00*
MGM	0.00*	0.00*	0.00*	LMT	0.00*	0.00*	0.00*
MHK	0.00*	0.00*	0.00*	MAS	0.00*	0.00*	0.00*
NWL	0.00*	0.00*	0.00*	NLSN	0.00*	0.00*	0.00*
NKE	0.00*	0.00*	0.43	NSC	0.00*	0.00*	0.00*
NCLH	0.00*	0.00*	0.00*	NOC	0.00*	0.00*	0.00*
NVR	0.00*	0.00*	0.00*	ODFL	0.00*	0.00*	0.00*
ORLY	0.00*	0.00*	0.00*	OTIS	0.00*	0.00*	0.00*
PHM	0.00*	0.00*	0.00*	PCAR	0.00*	0.24	0.00*
PVH	0.00*	0.00*	0.00*	PH	0.00*	0.00*	0.99
RL	0.00*	0.00*	0.00*	PNR	0.00*	0.00*	0.00*
ROST	0.00*	0.00*	0.00*	PWR	0.00*	0.00*	0.00*
RCL	0.00*	0.00*	0.00*	RTX	0.00*	0.00*	0.00*
SBUX	0.00*	0.58	0.00*	RSG	0.00*	0.00*	0.00*
TPR	0.00*	0.00*	0.00*	RHI	0.00*	0.00*	0.00*
TGT	0.00*	0.00*	0.00*	ROK	0.00*	0.00*	0.00*
TIF	0.00*	0.00*	0.3	ROL	0.00*	0.00*	0.00*
TJX	0.00*	0.00*	0.00*	ROP	0.00*	0.00*	0.00*
TSCO	0.81	0.00*	0.00*	SNA	0.42	0.00*	0.00*
ULTA	0.00*	0.00*	0.00*	LUV	0.00*	0.00*	0.00*
UAA	0.00*	0.00*	0.00*	SWK	0.00*	0.00*	0.00*
UA	0.00*	0.00*	0.00*	TDY	0.00*	0.00*	0.00*
VFC	0.00*	0.00*	0.00*	TXT	0.00*	0.00*	0.00*
WHR	0.00*	0.00*	0.00*	TT	0.00*	0.3	0.00*
WYNN	0.00*	0.00*	0.00*	TDG	0.00*	0.00*	0.00*
YUM	0.00*	0.00*	0.49	UNP	0.00*	0.00*	0.00*
MO	0.00*	0.00*	0.00*	UAL	0.00*	0.00*	0.00*

Table C- 11 Wald Test results for Portfolio 4, 5, 6 in the US – continued (2)							
Code	P4	P5	P6	Code	P4	P5	P6
ADM	0.00*	0.00*	0.00*	UPS	0.00*	0.00*	0.00*
BF.B	0.00*	0.00*	0.00*	URI	0.00*	0.00*	0.00*
CPB	0.00*	0.00*	0.00*	VRSK	0.00*	0.00*	0.00*
CHD	0.00*	0.00*	0.00*	WAB	0.00*	0.00*	0.00*
KO	0.00*	0.00*	0.00*	WM	0.00*	0.00*	0.71
CL	0.00*	0.00*	0.00*	XYL	0.00*	0.00*	0.00*
CAG	0.45	0.00*	0.00*	ACN	0.00*	0.00*	0.00*
STZ	0.00*	0.17	0.00*	ADBE	0.00*	0.00*	0.00*
COST	0.00*	0.00*	0.00*	AMD	0.00*	0.00*	0.00*
COTY	0.00*	0.00*	0.00*	AKAM	0.00*	0.00*	0.00*
EL	0.00*	0.00*	0.61	APH	0.00*	0.00*	0.00*
GIS	0.00*	0.00*	0.00*	ADI	0.00*	0.00*	0.00*
HRL	0.00*	0.00*	0.00*	ANSS	0.00*	0.00*	0.00*
SJM	0.00*	0.00*	0.00*	AAPL	0.00*	0.00*	0.00*
K	0.00*	0.00*	0.00*	AMAT	0.00*	0.9	0.00*
KMB	0.00*	0.00*	0.00*	ANET	0.00*	0.00*	0.00*
KHC	0.00*	0.00*	0.00*	ADSK	0.00*	0.00*	0.00*
KR	0.00*	0.00*	0.00*	ADP	0.00*	0.00*	0.00*
LW	0.87	0.00*	0.00*	AVGO	0.00*	0.00*	0.00*
MKC	0.00*	0.00*	0.00*	BR	0.00*	0.00*	0.73
TAP	0.00*	0.00*	0.00*	CDNS	0.00*	0.00*	0.00*
MDLZ	0.00*	0.00*	0.00*	CDW	0.00*	0.00*	0.00*
MNST	0.00*	0.00*	0.58	CSCO	0.00*	0.00*	0.00*
PEP	0.00*	0.00*	0.00*	CTXS	0.00*	0.00*	0.00*
PM	0.00*	0.00*	0.00*	CTSH	0.00*	0.00*	0.00*
PG	0.00*	0.52	0.00*	GLW	0.00*	0.00*	0.00*
SYY	0.00*	0.00*	0.00*	DXC	0.00*	0.00*	0.00*
CLX	0.00*	0.00*	0.00*	FFIV	0.00*	0.00*	0.00*
HSY	0.00*	0.00*	0.00*	FIS	0.00*	0.00*	0.00*
TSN	0.00*	0.00*	0.00*	FISV	0.00*	0.00*	0.00*
WBA	0.00*	0.00*	0.00*	FLT	0.00*	0.00*	0.00*
WMT	0.00*	0.00*	0.05	FLIR	0.67	0.00*	0.00*
APA	0.00*	0.00*	0.00*	FTNT	0.00*	0.81	0.00*
BKR	0.00*	0.00*	0.00*	IT	0.00*	0.00*	0.00*
COG	0.00*	0.00*	0.00*	GPN	0.00*	0.00*	0.8
CVX	0.00*	0.00*	0.00*	HPE	0.00*	0.00*	0.00*
CXO	0.08	0.00*	0.00*	HPQ	0.00*	0.00*	0.00*
COP	0.00*	0.00*	0.08	INTC	0.00*	0.00*	0.00*
DVN	0.00*	0.00*	0.00*	IBM	0.00*	0.00*	0.00*
FANG	0.00*	0.00*	0.00*	INTU	0.00*	0.00*	0.00*
EOG	0.00*	0.49	0.00*	IPGP	0.00*	0.00*	0.00*
XOM	0.00*	0.00*	0.00*	JKHY	0.00*	0.00*	0.00*
HAL	0.00*	0.00*	0.51	JNPR	0.00*	0.00*	0.00*
HES	0.00*	0.00*	0.00*	KEYS	0.00*	0.00*	0.00*

Table C- 11 Wald Test results for Portfolio 4, 5, 6 in the US – continued (3)							
Code	P4	P5	P6	Code	P4	P5	P6
HFC	0.00*	0.00*	0.00*	KLAC	0.00*	0.00*	0.00*
KMI	0.00*	0.00*	0.00*	LRCX	0.00*	0.00*	0.00*
MRO	0.00*	0.00*	0.00*	LDOS	0.00*	0.00*	0.00*
MPC	0.00*	0.00*	0.00*	MA	0.00*	0.45	0.00*
NOV	0.00*	0.00*	0.00*	MXIM	0.00*	0.00*	0.00*
NBL	0.00*	0.00*	0.00*	MCHP	0.00*	0.00*	0.00*
OXY	0.00*	0.00*	0.00*	MU	0.00*	0.00*	0.00*
OKE	0.82	0.00*	0.00*	MSFT	0.00*	0.00*	0.00*
PSX	0.00*	0.00*	0.00*	MSI	0.52	0.00*	0.00*
PXD	0.00*	0.00*	0.00*	NTAP	0.00*	0.00*	0.00*
SLB	0.00*	0.00*	0.00*	NLOK	0.00*	0.00*	0.00*
FTI	0.00*	0.09	0.00*	NVDA	0.00*	0.00*	0.00*
VLO	0.00*	0.00*	0.00*	ORCL	0.00*	0.00*	0.4
WMB	0.00*	0.00*	0.00*	PAYX	0.00*	0.00*	0.00*
AFL	0.00*	0.00*	0.00*	PAYC	0.00*	0.00*	0.00*
ALL	0.00*	0.00*	0.00*	PYPL	0.00*	0.00*	0.00*
AXP	0.00*	0.00*	0.00*	QRVO	0.00*	0.00*	0.00*
AIG	0.00*	0.00*	0.00*	QCOM	0.00*	0.00*	0.00*
AMP	0.00*	0.00*	0.72	CRM	0.00*	0.00*	0.00*
AON	0.00*	0.00*	0.00*	STX	0.00*	0.00*	0.00*
AJG	0.00*	0.00*	0.00*	NOW	0.00*	0.00*	0.00*
AIZ	0.00*	0.00*	0.00*	SWKS	0.00*	0.22	0.00*
BAC	0.59	0.00*	0.00*	SNPS	0.00*	0.00*	0.00*
BRK.B	0.00*	0.00*	0.00*	TEL	0.00*	0.00*	0.00*
BLK	0.00*	0.00*	0.00*	TXN	0.00*	0.00*	0.00*
COF	0.00*	0.00*	0.00*	TYL	0.00*	0.00*	0.00*
CBOE	0.00*	0.33	0.00*	VRSN	0.74	0.00*	0.00*
SCHW	0.00*	0.00*	0.00*	V	0.00*	0.00*	0.00*
CB	0.00*	0.00*	0.00*	WDC	0.00*	0.00*	0.00*
CINF	0.00*	0.00*	0.00*	WU	0.00*	0.00*	0.00*
C	0.00*	0.00*	0.67	XRX	0.00*	0.00*	0.00*
CFG	0.00*	0.00*	0.00*	XLNX	0.00*	0.00*	0.00*
CME	0.00*	0.00*	0.00*	ZBRA	0.00*	0.00*	0.31
CMA	0.00*	0.00*	0.00*	APD	0.00*	0.00*	0.00*
DFS	0.00*	0.00*	0.00*	ALB	0.00*	0.00*	0.00*
ETFC	0.00*	0.00*	0.00*	AMCR	0.00*	0.00*	0.00*
RE	0.00*	0.00*	0.00*	AVY	0.00*	0.53	0.00*
FITB	0.19	0.00*	0.00*	BLL	0.00*	0.00*	0.00*
FRC	0.00*	0.00*	0.00*	CE	0.00*	0.00*	0.00*
BEN	0.00*	0.00*	0.00*	CF	0.00*	0.00*	0.00*
GL	0.00*	0.00*	0.00*	CTVA	0.00*	0.00*	0.00*
GS	0.00*	0.27	0.00*	DOW	0.00*	0.00*	0.00*
HIG	0.00*	0.00*	0.44	DD	0.00*	0.00*	0.00*
HBAN	0.00*	0.00*	0.00*	EMN	0.00*	0.00*	0.00*

Table C- 11 Wald Test results for Portfolio 4, 5, 6 in the US – continued (4)							
Code	P4	P5	P6	Code	P4	P5	P6
ICE	0.00*	0.00*	0.00*	ECL	0.00*	0.00*	0.00*
IVZ	0.00*	0.00*	0.00*	FMC	0.00*	0.00*	0.00*
JPM	0.00*	0.00*	0.00*	FCX	0.00*	0.00*	0.00*
KEY	0.00*	0.00*	0.00*	IFF	0.41	0.00*	0.00*
LNC	0.00*	0.00*	0.15	IP	0.00*	0.00*	0.00*
L	0.83	0.00*	0.00*	LIN	0.00*	0.00*	0.00*
MTB	0.00*	0.00*	0.00*	LYB	0.00*	0.00*	0.57
MKTX	0.00*	0.00*	0.00*	MLM	0.00*	0.76	0.00*
MMC	0.00*	0.00*	0.00*	NEM	0.00*	0.00*	0.00*
MET	0.00*	0.00*	0.00*	NUE	0.00*	0.00*	0.00*
MCO	0.00*	0.00*	0.00*	PKG	0.00*	0.00*	0.00*
MS	0.00*	0.00*	0.00*	PPG	0.00*	0.00*	0.00*
MSCI	0.00*	0.6	0.00*	SEE	0.00*	0.00*	0.00*
NDAQ	0.00*	0.00*	0.00*	SHW	0.00*	0.00*	0.00*
NTRS	0.00*	0.00*	0.00*	MOS	0.00*	0.00*	0.00*
PBCT	0.00*	0.00*	0.00*	VMC	0.00*	0.00*	0.00*
PNC	0.00*	0.00*	0.74	WRK	0.00*	0.00*	0.00*
PFG	0.00*	0.00*	0.00*	ARE	0.00*	0.00*	0.00*
PGR	0.00*	0.00*	0.00*	AMT	0.00*	0.00*	0.00*
PRU	0.00*	0.00*	0.00*	AIV	0.00*	0.00*	0.00*
RJF	0.66	0.00*	0.00*	AVB	0.00*	0.00*	0.00*
RF	0.00*	0.00*	0.00*	BXP	0.00*	0.00*	0.36
SPGI	0.00*	0.00*	0.00*	CBRE	0.00*	0.78	0.00*
STT	0.00*	0.00*	0.00*	CCI	0.00*	0.00*	0.00*
SIVB	0.00*	0.00*	0.00*	DLR	0.32	0.00*	0.00*
SYF	0.00*	0.00*	0.00*	DRE	0.00*	0.00*	0.00*
TROW	0.00*	0.00*	0.00*	EQIX	0.00*	0.00*	0.00*
BK	0.00*	0.00*	0.00*	EQR	0.00*	0.00*	0.00*
TRV	0.00*	0.00*	0.77	ESS	0.00*	0.00*	0.00*
TFC	0.00*	0.00*	0.00*	EXR	0.00*	0.00*	0.00*
USB	0.00*	0.39	0.00*	FRT	0.00*	0.00*	0.00*
UNM	0.00*	0.00*	0.00*	PEAK	0.00*	0.00*	0.00*
WRB	0.00*	0.00*	0.00*	HST	0.00*	0.00*	0.00*
WFC	0.00*	0.00*	0.00*	IRM	0.00*	0.00*	0.22
WLTW	0.00*	0.00*	0.00*	KIM	0.00*	0.00*	0.00*
ZION	0.00*	0.00*	0.00*	MAA	0.00*	0.00*	0.00*
ABT	0.00*	0.00*	0.00*	PLD	0.00*	0.00*	0.00*
ABBV	0.00*	0.00*	0.00*	PSA	0.00*	0.00*	0.00*
ABMD	0.46	0.00*	0.00*	O	0.00*	0.8	0.00*
A	0.00*	0.00*	0.00*	REG	0.00*	0.00*	0.00*
ALXN	0.00*	0.00*	0.00*	SBAC	0.00*	0.00*	0.00*
ALGN	0.00*	0.00*	0.00*	SPG	0.00*	0.00*	0.00*
ABC	0.00*	0.00*	0.00*	SLG	0.48	0.00*	0.00*
AMGN	0.00*	0.00*	0.25	UDR	0.00*	0.00*	0.00*

Table C- 11 Wald Test results for Portfolio 4, 5, 6 in the US – continued (5)							
Code	P4	P5	P6	Code	P4	P5	P6
ANTM	0.00*	0.00*	0.00*	VTR	0.00*	0.00*	0.00*
BAX	0.00*	0.00*	0.00*	VNO	0.00*	0.00*	0.00*
BDX	0.00*	0.00*	0.00*	WELL	0.00*	0.00*	0.00*
BIO	0.00*	0.00*	0.00*	WY	0.00*	0.00*	0.00*
BIIB	0.00*	0.99	0.00*	Symbol	0.00*	0.00*	0.7
BSX	0.00*	0.00*	0.00*	AES	0.00*	0.00*	0.00*
BMY	0.00*	0.00*	0.00*	LNT	0.00*	0.00*	0.00*
CAH	0.00*	0.00*	0.00*	AEE	0.00*	0.00*	0.00*
CNC	0.00*	0.00*	0.00*	AEP	0.00*	0.00*	0.00*
CERN	0.00*	0.00*	0.00*	AWK	0.00*	0.00*	0.00*
CI	0.00*	0.00*	0.00*	ATO	0.00*	0.00*	0.00*
CVS	0.00*	0.00*	0.00*	CNP	0.00*	0.00*	0.00*
DHR	0.00*	0.00*	0.00*	CMS	0.00*	0.88	0.00*
DVA	0.00*	0.00*	0.00*	ED	0.00*	0.00*	0.00*
XRAY	0.00*	0.00*	0.00*	D	0.00*	0.00*	0.00*
DXCM	0.41	0.00*	0.00*	DTE	0.00*	0.00*	0.00*
EW	0.00*	0.00*	0.00*	DUK	0.00*	0.00*	0.00*
GILD	0.00*	0.00*	0.00*	EIX	0.00*	0.00*	0.00*
HCA	0.00*	0.00*	0.00*	ETR	0.00*	0.00*	0.00*
HSIC	0.00*	0.12	0.00*	EVRG	0.00*	0.00*	0.00*
HOLX	0.00*	0.00*	0.00*	ES	0.00*	0.00*	0.00*
HUM	0.00*	0.00*	0.00*	EXC	0.00*	0.00*	0.00*
IDXX	0.00*	0.00*	0.00*	FE	0.00*	0.00*	0.00*
ILMN	0.00*	0.00*	0.00*	NEE	0.00*	0.00*	0.00*
INCY	0.00*	0.00*	0.00*	NI	0.07	0.00*	0.00*
ISRG	0.00*	0.00*	0.00*	NRG	0.00*	0.00*	0.00*
IQV	0.00*	0.00*	0.00*	PNW	0.00*	0.00*	0.00*
JNJ	0.00*	0.00*	0.00*	PPL	0.00*	0.00*	0.00*
LH	0.00*	0.00*	0.00*	PEG	0.00*	0.00*	0.00*
LLY	0.00*	0.00*	0.00*	SRE	0.00*	0.00*	0.00*
MCK	0.00*	0.00*	0.00*	SO	0.00*	0.00*	0.00*
MDT	0.00*	0.11	0.00*	WEC	0.00*	0.00*	0.00*
MRK	0.00*	0.00*	0.00*	XEL	0.00*	0.19	0.00*
Note: * represent the statistical significance at the 5% level.							

Table C- 12 Wald Test results for Portfolio 7, 8, 9 in the US

Code	P7	P8	P9	Code	P7	P8	P9
ATVI	0.00*	0.27	0.18	MTD	0.00*	0.27	0.44
GOOGL	0.6	0.36	0.5	MYL	0.00*	0.71	0.61
GOOG	0.00*	0.09	0.1	PKI	0.00*	0.78	0.8
T	0.00*	0.00*	0.5	PRGO	0.00*	0.99	0.71
CTL	0.00*	0.45	0.38	PFE	0.00*	0.00*	0.72
CHTR	0.00*	0.24	0.00*	DGX	0.12	0.78	0.63
CMCSA	0.00*	0.33	0.75	REGN	0.00*	0.00*	0.59
DISCA	0.00*	0.00*	0.49	RMD	0.00*	0.53	0.77
DISCK	0.00*	0.91	0.05	STE	0.00*	0.61	0.25
DISH	0.00*	0.15	0.97	SYK	0.00*	0.00*	0.68
EA	0.00*	0.36	0.41	TFX	0.00*	0.84	0.43
FB	0.35	0.00*	0.07	COO	0.48	0.24	0.24
FOXA	0.00*	0.76	0.12	TMO	0.00*	0.00*	0.94
FOX	0.00*	0.69	0.42	UNH	0.00*	0.13	0.99
IPG	0.00*	0.00*	0.12	UHS	0.00*	0.64	0.96
LYV	0.00*	0.44	0.96	VAR	0.00*	0.86	0.59
NFLX	0.00*	0.7	0.97	VRTX	0.00*	0.73	0.8
NWSA	0.00*	0.5	0.05	WAT	0.00*	0.09	0.86
NWS	0.00*	0.55	0.00*	WST	0.00*	0.00*	0.47
OMC	0.00*	0.83	0.63	ZBH	0.00*	0.72	0.41
TMUS	0.00*	0.08	0.74	ZTS	0.00*	0.66	0.86
TTWO	0.00*	0.00*	0.97	MMM	0.00*	0.00*	0.19
DIS	0.00*	0.26	0.96	AOS	0.00*	0.23	0.14
TWTR	0.05	0.28	0.65	ALK	0.00*	0.39	0.44
VZ	0.00*	0.35	0.32	ALLE	0.00*	0.92	0.4
VIAC	0.00*	0.3	0.73	AAL	0.00*	0.57	0.49
AAP	0.00*	0.17	0.21	AME	0.00*	0.45	0.45
AMZN	0.00*	0.93	0.1	BA	0.00*	0.18	0.26
APTV	0.00*	0.3	0.19	CHRW	0.00*	0.00*	0.35
AZO	0.00*	0.77	0.39	CARR	0.00*	0.75	0.77
BBY	0.00*	0.65	0.99	CAT	0.00*	0.00*	0.07
BKNG	0.00*	0.00*	0.65	CTAS	0.63	0.16	0.14
BWA	0.00*	0.28	0.41	CPRT	0.00*	0.33	0.49
KMX	0.00*	0.55	0.00*	CSX	0.00*	0.78	0.89
CCL	0.00*	0.37	0.85	CMI	0.00*	0.9	0.54
CMG	0.00*	0.41	0.83	DE	0.00*	0.54	0.57
DHI	0.00*	0.98	0.68	DAL	0.00*	0.34	0.7
DRI	0.00*	0.09	0.42	DOV	0.00*	0.61	0.22
DG	0.11	0.95	0.51	ETN	0.00*	0.00*	0.45
DLTR	0.00*	0.00*	0.17	EMR	0.00*	0.21	0.42
DPZ	0.00*	0.71	0.18	EFX	0.00*	0.44	0.92
EBAY	0.00*	0.2	0.95	EXPD	0.00*	0.16	0.15
EXPE	0.00*	0.12	0.35	FAST	0.00*	0.00*	0.38
F	0.00*	0.41	0.51	FDX	0.00*	0.67	0.63

Table C- 12 Wald Test results for Portfolio 7, 8, 9 in the US – continued (1)							
Code	P7	P8	P9	Code	P7	P8	P9
GPS	0.00*	0.98	0.54	FLS	0.00*	0.84	0.64
GRMN	0.00*	0.22	0.00*	FTV	0.00*	0.3	0.37
GM	0.00*	0.5	0.6	FBHS	0.2	0.48	0.54
GPC	0.00*	0.00*	0.9	GD	0.00*	0.74	0.91
HRB	0.00*	0.15	0.24	GE	0.00*	0.48	0.25
HBI	0.00*	0.24	0.81	GWW	0.00*	0.67	0.87
HAS	0.00*	0.16	0.88	HON	0.00*	0.89	0.56
HLT	0.00*	0.86	0.88	HWM	0.00*	0.53	0.62
HD	0.00*	0.38	0.53	HII	0.00*	0.00*	0.91
KSS	0.74	0.9	0.54	IEX	0.00*	0.64	0.35
LB	0.00*	0.00*	0.72	INFO	0.00*	0.00*	0.31
LVS	0.00*	0.28	0.1	ITW	0.00*	0.59	0.77
LEG	0.00*	0.95	0.76	IR	0.00*	0.49	0.65
LEN	0.00*	0.21	0.48	JBHT	0.00*	0.43	0.62
LKQ	0.00*	0.75	0.63	J	0.00*	0.73	0.66
LOW	0.00*	0.44	0.56	JCI	0.00*	0.7	0.06
MAR	0.00*	0.53	0.00*	KSU	0.00*	0.33	0.82
MCD	0.00*	0.05	0.37	LHX	0.00*	0.53	0.91
MGM	0.00*	0.33	0.72	LMT	0.00*	0.61	0.53
MHK	0.00*	0.79	0.5	MAS	0.00*	0.08	0.77
NWL	0.00*	0.8	0.41	NLSN	0.98	0.00*	0.26
NKE	0.00*	0.13	0.21	NSC	0.00*	0.26	0.11
NCLH	0.00*	0.00*	0.95	NOC	0.00*	0.15	0.16
NVR	0.00*	0.66	0.93	ODFL	0.00*	0.28	0.4
ORLY	0.13	0.00*	0.28	OTIS	0.00*	0.5	0.36
PHM	0.00*	0.84	0.11	PCAR	0.00*	0.00*	0.17
PVH	0.00*	0.56	0.49	PH	0.00*	0.65	0.44
RL	0.00*	0.88	0.9	PNR	0.00*	0.64	0.57
ROST	0.00*	0.58	0.25	PWR	0.00*	0.96	0.74
RCL	0.00*	0.89	0.62	RTX	0.00*	0.68	0.93
SBUX	0.00*	0.36	0.73	RSG	0.00*	0.91	0.31
TPR	0.00*	0.15	0.00*	RHI	0.00*	0.74	0.32
TGT	0.00*	0.22	0.06	ROK	0.00*	0.4	0.05
TIF	0.00*	0.83	0.31	ROL	0.00*	0.57	0.63
TJX	0.00*	0.52	0.32	ROP	0.00*	0.32	0.33
TSCO	0.00*	0.88	0.49	SNA	0.00*	0.00*	0.83
ULTA	0.00*	0.63	0.7	LUV	0.00*	0.41	0.34
UAA	0.00*	0.00*	0.1	SWK	0.00*	0.00*	0.29
UA	0.00*	0.39	0.47	TDY	0.00*	0.86	0.55
VFC	0.65	0.00*	0.63	TXT	0.00*	0.22	0.95
WHR	0.00*	0.49	0.48	TT	0.00*	0.84	0.45
WYNN	0.00*	0.41	0.25	TDG	0.8	0.68	0.8
YUM	0.00*	0.31	0.34	UNP	0.00*	0.66	0.31
MO	0.00*	0.53	0.8	UAL	0.00*	0.2	0.23

Table C- 12 Wald Test results for Portfolio 7, 8, 9 in the US – continued (2)							
Code	P7	P8	P9	Code	P7	P8	P9
ADM	0.00*	0.96	0.6	UPS	0.00*	0.54	0.53
BF.B	0.00*	0.17	0.58	URI	0.00*	0.97	0.43
CPB	0.00*	0.79	0.7	VRSK	0.00*	0.33	0.08
CHD	0.00*	0.12	0.23	WAB	0.00*	0.00*	0.66
KO	0.00*	0.62	0.33	WM	0.00*	0.91	0.88
CL	0.00*	0.00*	0.00*	XYL	0.00*	0.89	0.34
CAG	0.00*	0.89	0.23	ACN	0.00*	0.84	0.97
STZ	0.31	0.17	0.93	ADBE	0.00*	0.32	0.09
COST	0.00*	0.00*	0.41	AMD	0.00*	0.00*	0.61
COTY	0.00*	0.9	0.66	AKAM	0.00*	0.73	0.57
EL	0.00*	0.61	0.73	APH	0.00*	0.11	0.57
GIS	0.00*	0.6	0.45	ADI	0.00*	0.45	0.38
HRL	0.00*	0.05	0.07	ANSS	0.00*	0.66	0.58
SJM	0.00*	0.31	0.08	AAPL	0.00*	0.85	0.79
K	0.00*	0.88	0.44	AMAT	0.00*	0.00*	0.86
KMB	0.00*	0.66	0.72	ANET	0.12	0.57	0.23
KHC	0.00*	0.19	0.25	ADSK	0.00*	0.55	0.65
KR	0.00*	0.5	0.45	ADP	0.00*	0.64	0.97
LW	0.00*	0.33	0.63	AVGO	0.00*	0.00*	0.06
MKC	0.93	0.88	0.51	BR	0.00*	0.85	0.48
TAP	0.00*	0.00*	0.00*	CDNS	0.00*	0.48	0.78
MDLZ	0.00*	0.62	0.64	CDW	0.00*	0.41	0.77
MNST	0.00*	0.64	0.12	CSCO	0.00*	0.4	0.22
PEP	0.00*	0.12	0.7	CTXS	0.00*	0.32	0.72
PM	0.00*	0.34	0.46	CTSH	0.00*	0.00*	0.63
PG	0.00*	0.77	0.28	GLW	0.00*	0.95	0.89
SYY	0.00*	0.00*	0.67	DXC	0.00*	0.28	0.29
CLX	0.00*	0.51	0.96	FFIV	0.00*	0.94	0.26
HSY	0.00*	0.85	0.17	FIS	0.00*	0.57	0.44
TSN	0.00*	0.46	0.82	FISV	0.00*	0.00*	0.49
WBA	0.00*	0.66	0.7	FLT	0.00*	0.14	0.18
WMT	0.68	0.52	0.88	FLIR	0.00*	0.37	0.17
APA	0.00*	0.00*	0.62	FTNT	0.00*	0.2	0.54
BKR	0.00*	0.41	0.74	IT	0.94	0.77	0.82
COG	0.00*	0.13	0.56	GPN	0.00*	0.00*	0.9
CVX	0.00*	0.34	0.34	HPE	0.00*	0.41	0.54
CXO	0.00*	0.47	0.9	HPQ	0.00*	0.71	0.98
COP	0.00*	0.22	0.18	INTC	0.00*	0.21	0.52
DVN	0.00*	0.9	0.00*	IBM	0.00*	0.66	0.79
FANG	0.00*	0.34	0.22	INTU	0.00*	0.24	0.81
EOG	0.00*	0.42	0.08	IPGP	0.00*	0.67	0.12
XOM	0.00*	0.19	0.58	JKHY	0.00*	0.59	0.24
HAL	0.00*	0.7	0.89	JNPR	0.00*	0.00*	0.89
HES	0.05	0.14	0.29	KEYS	0.00*	0.09	0.43

Table C- 12 Wald Test results for Portfolio 7, 8, 9 in the US – continued (3)							
Code	P7	P8	P9	Code	P7	P8	P9
HFC	0.00*	0.00*	0.58	KLAC	0.00*	0.00*	0.21
KMI	0.00*	0.91	0.8	LRCX	0.00*	0.76	0.15
MRO	0.00*	0.53	0.73	LDOS	0.00*	0.09	0.96
MPC	0.00*	0.27	0.5	MA	0.00*	0.98	0.46
NOV	0.00*	0.00*	0.62	MXIM	0.00*	0.84	0.29
NBL	0.00*	0.77	0.42	MCHP	0.00*	0.44	0.75
OXY	0.00*	0.68	0.39	MU	0.00*	0.39	0.84
OKE	0.00*	0.97	0.48	MSFT	0.81	0.46	0.63
PSX	0.00*	0.14	0.67	MSI	0.00*	0.78	0.32
PXD	0.00*	0.00*	0.00*	NTAP	0.00*	0.00*	0.64
SLB	0.00*	0.25	0.49	NLOK	0.00*	0.08	0.27
FTI	0.45	0.31	0.2	NVDA	0.00*	0.46	0.09
VLO	0.00*	0.73	0.85	ORCL	0.00*	0.00*	0.69
WMB	0.00*	0.31	0.29	PAYX	0.00*	0.1	0.83
AFL	0.00*	0.43	0.68	PAYC	0.00*	0.11	0.69
ALL	0.00*	0.43	0.98	PYPL	0.00*	0.93	0.71
AXP	0.00*	0.00*	0.98	QRVO	0.00*	0.44	0.34
AIG	0.00*	0.92	0.87	QCOM	0.00*	0.28	0.36
AMP	0.00*	0.00*	0.49	CRM	0.00*	0.35	0.00*
AON	0.00*	0.44	0.1	STX	0.00*	0.06	0.4
AJG	0.00*	0.73	0.36	NOW	0.00*	0.24	0.6
AIZ	0.00*	0.19	0.59	SWKS	0.00*	0.00*	0.36
BAC	0.00*	0.16	0.26	SNPS	0.00*	0.17	0.65
BRK.B	0.00*	0.21	0.31	TEL	0.00*	0.63	0.26
BLK	0.00*	0.47	0.09	TXN	0.00*	0.00*	0.99
COF	0.00*	0.29	0.72	TYL	0.00*	0.87	0.35
CBOE	0.00*	0.69	0.86	VRSN	0.00*	0.91	0.46
SCHW	0.00*	0.00*	0.57	V	0.00*	0.79	0.72
CB	0.00*	0.79	0.66	WDC	0.00*	0.93	0.34
CINF	0.64	0.18	0.54	WU	0.00*	0.92	0.37
C	0.00*	0.00*	0.08	XRX	0.00*	0.00*	0.00*
CFG	0.00*	0.39	0.05	XLNX	0.00*	0.38	0.55
CME	0.00*	0.11	0.12	ZBRA	0.00*	0.1	0.78
CMA	0.00*	0.24	0.55	APD	0.00*	0.57	0.64
DFS	0.00*	0.7	0.08	ALB	0.00*	0.99	0.32
ETFC	0.00*	0.18	0.32	AMCR	0.00*	0.63	0.87
RE	0.00*	0.00*	0.45	AVY	0.00*	0.00*	0.57
FITB	0.00*	0.6	0.49	BLL	0.00*	0.52	0.57
FRC	0.00*	0.15	0.83	CE	0.00*	0.36	0.59
BEN	0.00*	0.75	0.72	CF	0.00*	0.1	0.21
GL	0.00*	0.06	0.72	CTVA	0.00*	0.11	0.21
GS	0.00*	0.42	0.17	DOW	0.00*	0.77	0.27
HIG	0.00*	0.00*	0.14	DD	0.00*	0.14	0.00*
HBAN	0.00*	0.63	0.42	EMN	0.00*	0.00*	0.75

Table C- 12 Wald Test results for Portfolio 7, 8, 9 in the US – continued (4)							
Code	P7	P8	P9	Code	P7	P8	P9
ICE	0.00*	0.54	0.09	ECL	0.00*	0.46	0.71
IVZ	0.00*	0.63	0.29	FMC	0.00*	0.25	0.63
JPM	0.00*	0.72	0.99	FCX	0.00*	0.59	0.2
KEY	0.00*	0.43	0.27	IFF	0.00*	0.97	0.25
LNC	0.88	0.4	0.62	IP	0.00*	0.00*	0.82
L	0.00*	0.42	0.16	LIN	0.00*	0.25	0.55
MTB	0.00*	0.24	0.92	LYB	0.00*	0.36	0.38
MKTX	0.00*	0.00*	0.83	MLM	0.00*	0.94	0.46
MMC	0.00*	0.74	0.45	NEM	0.00*	0.97	0.19
MET	0.77	0.79	0.56	NUE	0.00*	0.69	0.52
MCO	0.00*	0.00*	0.39	PKG	0.00*	0.7	0.42
MS	0.00*	0.83	0.86	PPG	0.00*	0.95	0.89
MSCI	0.00*	0.5	0.05	SEE	0.00*	0.34	0.87
NDAQ	0.00*	0.26	0.56	SHW	0.00*	0.11	0.15
NTRS	0.00*	0.29	0.69	MOS	0.00*	0.00*	0.65
PBCT	0.00*	0.1	0.48	VMC	0.00*	0.87	0.7
PNC	0.00*	0.46	0.42	WRK	0.00*	0.00*	0.00*
PFG	0.00*	0.28	0.41	ARE	0.00*	0.61	0.7
PGR	0.00*	0.37	0.67	AMT	0.00*	0.84	0.25
PRU	0.00*	0.44	0.24	AIV	0.00*	0.06	0.96
RJF	0.00*	0.64	0.64	AVB	0.00*	0.23	0.65
RF	0.00*	0.78	0.48	BXP	0.75	0.83	0.54
SPGI	0.00*	0.00*	0.92	CBRE	0.00*	0.28	0.33
STT	0.00*	0.18	0.66	CCI	0.00*	0.43	0.97
SIVB	0.00*	0.00*	0.24	DLR	0.00*	0.00*	0.95
SYF	0.00*	0.08	0.06	DRE	0.00*	0.61	0.44
TROW	0.00*	0.24	0.11	EQIX	0.00*	0.24	0.6
BK	0.00*	0.32	0.44	EQR	0.00*	0.15	0.98
TRV	0.00*	0.57	0.63	ESS	0.00*	0.87	0.88
TFC	0.00*	0.08	0.49	EXR	0.00*	0.00*	0.16
USB	0.00*	0.31	0.37	FRT	0.00*	0.86	0.12
UNM	0.00*	0.1	0.61	PEAK	0.21	0.00*	0.45
WRB	0.00*	0.27	0.35	HST	0.00*	0.41	0.33
WFC	0.00*	0.99	0.87	IRM	0.00*	0.79	0.58
WLTW	0.00*	0.00*	0.16	KIM	0.00*	0.85	0.05
ZION	0.00*	0.47	0.89	MAA	0.00*	0.29	0.28
ABT	0.00*	0.21	0.81	PLD	0.81	0.99	0.74
ABBV	0.00*	0.85	0.3	PSA	0.00*	0.42	0.42
ABMD	0.00*	0.00*	0.46	O	0.00*	0.28	0.27
A	0.00*	0.53	0.7	REG	0.00*	0.78	0.6
ALXN	0.00*	0.6	0.11	SBAC	0.1	0.56	0.5
ALGN	0.00*	0.35	0.98	SPG	0.00*	0.1	0.06
ABC	0.00*	0.42	0.31	SLG	0.00*	0.00*	0.56
AMGN	0.00*	0.97	0.11	UDR	0.00*	0.24	0.24

Table C- 12 Wald Test results for Portfolio 7, 8, 9 in the US – continued (5)							
Code	P7	P8	P9	Code	P7	P8	P9
ANTM	0.00*	0.83	0.37	VTR	0.00*	0.00*	0.53
BAX	0.00*	0.92	0.77	VNO	0.00*	0.54	0.25
BDX	0.00*	0.00*	0.56	WELL	0.00*	0.43	0.98
BIO	0.00*	0.25	0.67	WY	0.00*	0.27	0.4
BIIB	0.00*	0.7	0.25	Symbol	0.00*	0.61	0.33
BSX	0.00*	0.07	0.84	AES	0.00*	0.93	0.92
BMY	0.00*	0.06	0.56	LNT	0.00*	0.09	0.96
CAH	0.00*	0.65	0.19	AEE	0.00*	0.73	0.06
CNC	0.00*	0.00*	0.41	AEP	0.00*	0.63	0.88
CERN	0.00*	0.33	0.39	AWK	0.00*	0.79	0.74
CI	0.00*	0.86	0.17	ATO	0.00*	0.69	0.34
CVS	0.00*	0.08	0.1	CNP	0.5	0.23	0.92
DHR	0.00*	0.08	0.46	CMS	0.00*	0.00*	0.89
DVA	0.00*	0.13	0.63	ED	0.00*	0.66	0.78
XRAY	0.00*	0.00*	0.23	D	0.00*	0.35	0.78
DXCM	0.00*	0.94	0.85	DTE	0.00*	0.00*	0.9
EW	0.00*	0.37	0.71	DUK	0.00*	0.84	0.81
GILD	0.00*	0.91	0.97	EIX	0.00*	0.55	0.63
HCA	0.74	0.41	0.25	ETR	0.00*	0.17	0.52
HSIC	0.00*	0.85	0.32	EVRG	0.00*	0.00*	0.48
HOLX	0.00*	0.85	0.19	ES	0.00*	0.36	0.89
HUM	0.00*	0.4	0.55	EXC	0.00*	0.78	0.21
IDXX	0.00*	0.99	0.26	FE	0.00*	0.97	0.68
ILMN	0.00*	0.00*	0.43	NEE	0.00*	0.05	0.51
INCY	0.00*	0.08	0.45	NI	0.00*	0.53	0.96
ISRG	0.00*	0.88	0.36	NRG	0.00*	0.73	0.61
IQV	0.00*	0.00*	0.12	PNW	0.00*	0.91	0.79
JNJ	0.00*	0.13	0.16	PPL	0.00*	0.61	0.48
LH	0.00*	0.58	0.83	PEG	0.00*	0.78	0.48
LLY	0.00*	0.00*	0.79	SRE	0.00*	0.00*	0.98
MCK	0.17	0.72	0.65	SO	0.00*	0.9	0.51
MDT	0.00*	0.99	0.76	WEC	0.92	0.14	0.26
MRK	0.00*	0.11	0.88	XEL	0.00*	0.00*	0.27
Note: * represent the statistical significance at the 5% level.							

Table C- 13 Wald Test results for Portfolio 10, 11, 12 in the US

Code	P10	P11	P12	Code	P10	P11	P12
ATVI	0.97	0.00*	0.00*	MTD	0.74	0.00*	0.00*
GOOGL	0.24	0.00*	0.00*	MYL	0.97	0.00*	0.00*
GOOG	0.61	0.00*	0.41	PKI	0.47	0.00*	0.00*
T	0.00*	0.00*	0.00*	PRGO	0.27	0.00*	0.37
CTL	0.65	0.11	0.23	PFE	0.39	0.4	0.00*
CHTR	0.62	0.00*	0.00*	DGX	0.55	0.00*	0.00*
CMCSA	0.13	0.00*	0.00*	REGN	0.41	0.97	0.00*
DISCA	0.08	0.00*	0.00*	RMD	0.1	0.00*	0.00*
DISCK	0.48	0.00*	0.00*	STE	0.73	0.00*	0.00*
DISH	0.00*	0.00*	0.00*	SYK	0.34	0.00*	0.00*
EA	0.77	0.00*	0.81	TFX	0.92	0.00*	0.72
FB	0.17	0.00*	0.00*	COO	0.9	0.00*	0.00*
FOXA	0.56	0.00*	0.00*	TMO	0.82	0.00*	0.00*
FOX	0.53	0.00*	0.00*	UNH	0.25	0.91	0.00*
IPG	0.21	0.22	0.39	UHS	0.49	0.00*	0.00*
LYV	0.46	0.00*	0.00*	VAR	0.74	0.00*	0.00*
NFLX	0.96	0.00*	0.00*	VRTX	0.54	0.65	0.00*
NWSA	0.23	0.00*	0.00*	WAT	0.66	0.00*	0.00*
NWS	0.11	0.00*	0.00*	WST	0.00*	0.00*	0.00*
OMC	0.5	0.00*	0.00*	ZBH	0.84	0.00*	0.79
TMUS	0.73	0.00*	0.79	ZTS	0.44	0.00*	0.00*
TTWO	0.45	0.15	0.00*	MMM	0.74	0.00*	0.00*
DIS	0.09	0.00*	0.00*	AOS	0.24	0.00*	0.00*
TWTR	0.24	0.00*	0.00*	ALK	0.26	0.00*	0.00*
VZ	0.00*	0.00*	0.00*	ALLE	0.75	0.00*	0.00*
VIAC	0.83	0.00*	0.00*	AAL	0.45	0.00*	0.00*
AAP	0.46	0.00*	0.00*	AME	0.16	0.00*	0.00*
AMZN	0.88	0.00*	0.00*	BA	0.78	0.00*	0.00*
APTV	0.36	0.00*	0.00*	CHRW	0.83	0.00*	0.00*
AZO	0.09	0.00*	0.00*	CARR	0.97	0.00*	0.00*
BBY	0.47	0.00*	0.00*	CAT	0.19	0.00*	0.00*
BKNG	0.86	0.00*	0.00*	CTAS	0.71	0.00*	0.4
BWA	0.08	0.00*	0.00*	CPRT	0.1	0.00*	0.00*
KMX	0.62	0.49	0.00*	CSX	0.41	0.00*	0.00*
CCL	0.21	0.00*	0.00*	CMI	0.91	0.53	0.00*
CMG	0.94	0.00*	0.52	DE	0.57	0.00*	0.00*
DHI	0.46	0.00*	0.00*	DAL	0.5	0.00*	0.00*
DRI	0.96	0.00*	0.00*	DOV	0.42	0.00*	0.00*
DG	0.41	0.00*	0.00*	ETN	0.26	0.00*	0.00*
DLTR	0.47	0.7	0.00*	EMR	0.67	0.00*	0.00*
DPZ	0.85	0.00*	0.00*	EFX	0.17	0.00*	0.00*
EBAY	0.23	0.00*	0.00*	EXPD	0.51	0.00*	0.00*
EXPE	0.00*	0.00*	0.00*	FAST	0.98	0.00*	0.00*
F	0.31	0.00*	0.00*	FDX	0.38	0.00*	0.00*

Table C- 13 Wald Test results for Portfolio 10, 11, 12 in the US – continued (1)							
Code	P10	P11	P12	Code	P10	P11	P12
GPS	0.17	0.00*	0.00*	FLS	0.62	0.00*	0.00*
GRMN	0.72	0.53	0.00*	FTV	0.18	0.00*	0.00*
GM	0.07	0.00*	0.00*	FBHS	0.91	0.00*	0.00*
GPC	0.25	0.00*	0.00*	GD	0.87	0.00*	0.00*
HRB	0.11	0.00*	0.00*	GE	0.67	0.00*	0.00*
HBI	0.83	0.00*	0.00*	GWW	0.83	0.00*	0.32
HAS	0.91	0.00*	0.00*	HON	0.35	0.00*	0.00*
HLT	0.4	0.00*	0.00*	HWM	0.86	0.00*	0.00*
HD	0.14	0.00*	0.00*	HII	0.6	0.76	0.00*
KSS	0.96	0.00*	0.78	IEX	0.66	0.00*	0.00*
LB	0.00*	0.00*	0.00*	INFO	0.08	0.00*	0.00*
LVS	0.31	0.00*	0.00*	ITW	0.16	0.00*	0.00*
LEG	0.46	0.00*	0.00*	IR	0.62	0.00*	0.00*
LEN	0.33	0.58	0.00*	JBHT	0.91	0.00*	0.00*
LKQ	0.21	0.00*	0.00*	J	0.12	0.00*	0.00*
LOW	0.73	0.00*	0.00*	JCI	0.34	0.00*	0.00*
MAR	0.48	0.54	0.00*	KSU	0.92	0.00*	0.00*
MCD	0.33	0.00*	0.00*	LHX	0.27	0.00*	0.00*
MGM	0.61	0.00*	0.00*	LMT	0.93	0.00*	0.00*
MHK	0.49	0.00*	0.00*	MAS	0.15	0.00*	0.00*
NWL	0.67	0.00*	0.00*	NLSN	0.69	0.00*	0.00*
NKE	0.65	0.00*	0.00*	NSC	0.61	0.00*	0.00*
NCLH	0.88	0.00*	0.00*	NOC	0.51	0.00*	0.00*
NVR	0.06	0.00*	0.00*	ODFL	0.23	0.00*	0.00*
ORLY	0.67	0.00*	0.27	OTIS	0.89	0.00*	0.00*
PHM	0.00*	0.4	0.00*	PCAR	0.88	0.00*	0.00*
PVH	0.85	0.00*	0.00*	PH	0.26	0.33	0.25
RL	0.42	0.00*	0.00*	PNR	0.4	0.00*	0.00*
ROST	0.41	0.00*	0.00*	PWR	0.85	0.00*	0.00*
RCL	0.84	0.00*	0.00*	RTX	0.9	0.00*	0.00*
SBUX	0.44	0.00*	0.00*	RSG	0.89	0.00*	0.00*
TPR	0.21	0.00*	0.00*	RHI	0.55	0.00*	0.00*
TGT	0.92	0.00*	0.00*	ROK	0.07	0.00*	0.00*
TIF	0.86	0.00*	0.00*	ROL	0.11	0.00*	0.00*
TJX	0.89	0.1	0.00*	ROP	0.48	0.00*	0.00*
TSCO	0.09	0.00*	0.00*	SNA	0.82	0.00*	0.00*
ULTA	0.61	0.00*	0.00*	LUV	0.93	0.00*	0.00*
UAA	0.00*	0.00*	0.00*	SWK	0.00*	0.00*	0.00*
UA	0.34	0.00*	0.00*	TDY	0.72	0.00*	0.00*
VFC	0.81	0.00*	0.00*	TXT	0.88	0.00*	0.00*
WHR	0.37	0.00*	0.00*	TT	0.44	0.00*	0.00*
WYNN	0.05	0.00*	0.00*	TDG	0.55	0.00*	0.00*
YUM	0.61	0.00*	0.29	UNP	0.46	0.00*	0.00*
MO	0.15	0.49	0.00*	UAL	0.38	0.00*	0.00*

Table C- 13 Wald Test results for Portfolio 10, 11, 12 in the US – continued (2)							
Code	P10	P11	P12	Code	P10	P11	P12
ADM	0.78	0.00*	0.00*	UPS	0.38	0.52	0.9
BF.B	0.57	0.00*	0.00*	URI	0.22	0.00*	0.00*
CPB	0.43	0.65	0.00*	VRSK	0.44	0.00*	0.00*
CHD	0.23	0.00*	0.00*	WAB	0.76	0.00*	0.00*
KO	0.88	0.00*	0.00*	WM	0.94	0.00*	0.00*
CL	0.52	0.00*	0.00*	XYL	0.74	0.00*	0.00*
CAG	0.68	0.00*	0.00*	ACN	0.68	0.00*	0.00*
STZ	0.84	0.00*	0.00*	ADBE	0.1	0.00*	0.00*
COST	0.00*	0.00*	0.00*	AMD	0.39	0.00*	0.00*
COTY	0.52	0.00*	0.00*	AKAM	0.24	0.00*	0.00*
EL	0.73	0.00*	0.00*	APH	0.28	0.00*	0.00*
GIS	0.13	0.69	0.00*	ADI	0.00*	0.00*	0.00*
HRL	0.65	0.00*	0.00*	ANSS	0.46	0.00*	0.00*
SJM	0.1	0.00*	0.84	AAPL	0.5	0.00*	0.00*
K	0.85	0.00*	0.00*	AMAT	0.65	0.00*	0.00*
KMB	0.68	0.00*	0.00*	ANET	0.29	0.00*	0.82
KHC	0.39	0.00*	0.00*	ADSK	0.44	0.00*	0.00*
KR	0.19	0.00*	0.00*	ADP	0.22	0.00*	0.00*
LW	0.61	0.00*	0.00*	AVGO	0.5	0.00*	0.00*
MKC	0.41	0.00*	0.00*	BR	0.3	0.00*	0.22
TAP	0.00*	0.25	0.00*	CDNS	0.7	0.00*	0.00*
MDLZ	0.42	0.00*	0.00*	CDW	0.49	0.18	0.00*
MNST	0.85	0.00*	0.00*	CSCO	0.2	0.00*	0.00*
PEP	0.18	0.98	0.00*	CTXS	0.35	0.00*	0.00*
PM	0.48	0.00*	0.00*	CTSH	0.21	0.00*	0.00*
PG	0.93	0.00*	0.00*	GLW	0.89	0.00*	0.00*
SYY	0.35	0.00*	0.00*	DXC	0.56	0.00*	0.00*
CLX	0.93	0.00*	0.00*	FFIV	0.38	0.00*	0.00*
HSY	0.08	0.00*	0.46	FIS	0.27	0.00*	0.00*
TSN	0.27	0.00*	0.00*	FISV	0.00*	0.00*	0.00*
WBA	0.92	0.00*	0.00*	FLT	0.82	0.00*	0.00*
WMT	0.44	0.00*	0.00*	FLIR	0.39	0.00*	0.00*
APA	0.00*	0.41	0.00*	FTNT	0.35	0.00*	0.00*
BKR	0.31	0.00*	0.00*	IT	0.56	0.00*	0.00*
COG	0.14	0.00*	0.00*	GPN	0.73	0.00*	0.00*
CVX	0.77	0.00*	0.00*	HPE	0.12	0.00*	0.00*
CXO	0.69	0.00*	0.00*	HPQ	0.62	0.00*	0.00*
COP	0.45	0.00*	0.00*	INTC	0.36	0.00*	0.98
DVN	0.85	0.00*	0.00*	IBM	0.87	0.00*	0.00*
FANG	0.75	0.00*	0.00*	INTU	0.37	0.34	0.00*
EOG	0.51	0.00*	0.72	IPGP	0.78	0.00*	0.00*
XOM	0.71	0.49	0.00*	JKHY	0.56	0.00*	0.00*
HAL	0.16	0.00*	0.00*	JNPR	0.84	0.00*	0.00*
HES	0.39	0.00*	0.00*	KEYS	0.78	0.61	0.00*

Table C- 13 Wald Test results for Portfolio 10, 11, 12 in the US – continued (3)							
Code	P10	P11	P12	Code	P10	P11	P12
HFC	0.58	0.00*	0.00*	KLAC	0.23	0.00*	0.00*
KMI	0.43	0.00*	0.00*	LRCX	0.11	0.00*	0.00*
MRO	0.43	0.00*	0.52	LDOS	0.21	0.00*	0.12
MPC	0.73	0.00*	0.00*	MA	0.74	0.00*	0.00*
NOV	0.69	0.00*	0.00*	MXIM	0.11	0.00*	0.00*
NBL	0.91	0.00*	0.00*	MCHP	0.31	0.00*	0.00*
OXY	0.23	0.00*	0.00*	MU	0.00*	0.00*	0.00*
OKE	0.24	0.00*	0.00*	MSFT	0.57	0.00*	0.00*
PSX	0.88	0.00*	0.00*	MSI	0.72	0.00*	0.00*
PXD	0.08	0.35	0.00*	NTAP	0.47	0.00*	0.00*
SLB	0.34	0.00*	0.00*	NLOK	0.9	0.00*	0.48
FTI	0.74	0.00*	0.25	NVDA	0.3	0.00*	0.00*
VLO	0.58	0.00*	0.00*	ORCL	0.24	0.00*	0.00*
WMB	0.27	0.00*	0.00*	PAYX	0.62	0.00*	0.00*
AFL	0.29	0.00*	0.00*	PAYC	0.07	0.00*	0.74
ALL	0.94	0.00*	0.00*	PYPL	0.23	0.00*	0.00*
AXP	0.77	0.00*	0.00*	QRVO	0.99	0.65	0.00*
AIG	0.3	0.00*	0.00*	QCOM	0.61	0.00*	0.00*
AMP	0.56	0.4	0.00*	CRM	0.68	0.00*	0.00*
AON	0.3	0.00*	0.00*	STX	0.59	0.00*	0.71
AJG	0.36	0.00*	0.00*	NOW	0.19	0.00*	0.00*
AIZ	0.73	0.00*	0.00*	SWKS	0.00*	0.00*	0.00*
BAC	0.89	0.00*	0.00*	SNPS	0.42	0.97	0.00*
BRK.B	0.62	0.00*	0.00*	TEL	0.75	0.00*	0.00*
BLK	0.4	0.00*	0.00*	TXN	0.26	0.00*	0.00*
COF	0.38	0.00*	0.00*	TYL	0.05	0.00*	0.00*
CBOE	0.73	0.00*	0.00*	VRSN	0.8	0.00*	0.00*
SCHW	0.77	0.00*	0.00*	V	0.34	0.00*	0.00*
CB	0.92	0.00*	0.00*	WDC	0.7	0.00*	0.00*
CINF	0.98	0.00*	0.74	WU	0.57	0.00*	0.25
C	0.17	0.00*	0.00*	XRX	0.36	0.00*	0.00*
CFG	0.22	0.00*	0.00*	XLNX	0.85	0.00*	0.00*
CME	0.07	0.00*	0.00*	ZBRA	0.74	0.00*	0.00*
CMA	0.00*	0.7	0.00*	APD	0.65	0.00*	0.00*
DFS	0.19	0.00*	0.00*	ALB	0.42	0.78	0.00*
ETFC	0.39	0.00*	0.13	AMCR	0.48	0.00*	0.94
RE	0.74	0.00*	0.00*	AVY	0.51	0.00*	0.00*
FITB	0.93	0.00*	0.00*	BLL	0.71	0.00*	0.00*
FRC	0.43	0.00*	0.00*	CE	0.28	0.00*	0.00*
BEN	0.08	0.00*	0.00*	CF	0.29	0.00*	0.00*
GL	0.82	0.00*	0.00*	CTVA	0.75	0.00*	0.00*
GS	0.23	0.00*	0.00*	DOW	0.16	0.00*	0.00*
HIG	0.08	0.00*	0.00*	DD	0.00*	0.00*	0.00*
HBAN	0.44	0.00*	0.00*	EMN	0.28	0.00*	0.00*

Table C- 13 Wald Test results for Portfolio 10, 11, 12 in the US – continued (4)							
Code	P10	P11	P12	Code	P10	P11	P12
ICE	0.4	0.00*	0.72	ECL	0.56	0.96	0.42
IVZ	0.39	0.39	0.00*	FMC	0.9	0.00*	0.00*
JPM	0.66	0.00*	0.00*	FCX	0.35	0.00*	0.00*
KEY	0.29	0.00*	0.00*	IFF	0.83	0.00*	0.00*
LNC	0.9	0.00*	0.00*	IP	0.82	0.00*	0.00*
L	0.75	0.00*	0.00*	LIN	0.72	0.00*	0.00*
MTB	0.56	0.00*	0.00*	LYB	0.97	0.00*	0.45
MKTX	0.8	0.00*	0.00*	MLM	0.73	0.00*	0.00*
MMC	0.55	0.00*	0.00*	NEM	0.23	0.00*	0.00*
MET	0.86	0.00*	0.00*	NUE	0.93	0.00*	0.00*
MCO	0.44	0.00*	0.00*	PKG	0.23	0.00*	0.00*
MS	0.76	0.00*	0.00*	PPG	0.48	0.85	0.00*
MSCI	0.84	0.00*	0.00*	SEE	0.79	0.00*	0.6
NDAQ	0.69	0.00*	0.00*	SHW	0.00*	0.00*	0.00*
NTRS	0.48	0.00*	0.00*	MOS	0.05	0.00*	0.00*
PBCT	0.73	0.00*	0.00*	VMC	0.25	0.00*	0.00*
PNC	0.07	0.00*	0.00*	WRK	0.93	0.00*	0.00*
PFG	0.7	0.00*	0.00*	ARE	0.25	0.00*	0.00*
PGR	0.2	0.00*	0.77	AMT	0.42	0.00*	0.00*
PRU	0.49	0.00*	0.00*	AIV	0.24	0.00*	0.00*
RJF	0.6	0.00*	0.00*	AVB	0.8	0.00*	0.00*
RF	0.7	0.00*	0.00*	BXP	0.14	0.00*	0.45
SPGI	0.82	0.13	0.00*	CBRE	0.29	0.31	0.00*
STT	0.76	0.00*	0.00*	CCI	0.25	0.00*	0.00*
SIVB	0.26	0.00*	0.00*	DLR	0.77	0.00*	0.00*
SYF	0.74	0.00*	0.72	DRE	0.72	0.00*	0.00*
TROW	0.45	0.00*	0.00*	EQIX	0.41	0.38	0.00*
BK	0.4	0.00*	0.00*	EQR	0.42	0.00*	0.55
TRV	0.34	0.00*	0.00*	ESS	0.93	0.00*	0.00*
TFC	0.34	0.00*	0.00*	EXR	0.91	0.00*	0.00*
USB	0.99	0.00*	0.00*	FRT	0.27	0.00*	0.00*
UNM	0.53	0.00*	0.00*	PEAK	0.9	0.00*	0.00*
WRB	0.96	0.00*	0.00*	HST	0.63	0.00*	0.00*
WFC	0.57	0.00*	0.97	IRM	0.64	0.00*	0.75
WLTW	0.16	0.00*	0.00*	KIM	0.00*	0.00*	0.00*
ZION	0.8	0.00*	0.00*	MAA	0.19	0.00*	0.00*
ABT	0.93	0.00*	0.00*	PLD	0.34	0.00*	0.00*
ABBV	0.89	0.67	0.00*	PSA	0.58	0.00*	0.00*
ABMD	0.07	0.00*	0.00*	O	0.57	0.00*	0.00*
A	0.64	0.00*	0.00*	REG	0.16	0.00*	0.00*
ALXN	0.35	0.00*	0.00*	SBAC	0.48	0.00*	0.00*
ALGN	0.7	0.00*	0.00*	SPG	0.29	0.00*	0.00*
ABC	0.79	0.00*	0.84	SLG	0.62	0.52	0.08
AMGN	0.24	0.00*	0.00*	UDR	0.21	0.00*	0.00*

Table C- 13 Wald Test results for Portfolio 10, 11, 12 in the US – continued (5)							
Code	P10	P11	P12	Code	P10	P11	P12
ANTM	0.98	0.00*	0.00*	VTR	0.73	0.00*	0.00*
BAX	0.06	0.00*	0.00*	VNO	0.89	0.00*	0.00*
BDX	0.62	0.00*	0.00*	WELL	0.82	0.00*	0.00*
BIO	0.96	0.00*	0.00*	WY	0.74	0.00*	0.00*
BIIB	0.43	0.00*	0.00*	Symbol	0.81	0.66	0.00*
BSX	0.51	0.00*	0.00*	AES	0.19	0.00*	0.00*
BMY	0.26	0.00*	0.00*	LNT	0.36	0.00*	0.00*
CAH	0.91	0.00*	0.65	AEE	0.31	0.00*	0.00*
CNC	0.43	0.56	0.00*	AEP	0.00*	0.00*	0.00*
CERN	0.79	0.00*	0.00*	AWK	0.6	0.00*	0.00*
CI	0.6	0.00*	0.00*	ATO	0.33	0.00*	0.73
CVS	0.00*	0.00*	0.00*	CNP	0.86	0.00*	0.00*
DHR	0.77	0.00*	0.00*	CMS	0.62	0.00*	0.00*
DVA	0.81	0.00*	0.07	ED	0.81	0.00*	0.00*
XRAY	0.88	0.96	0.00*	D	0.33	0.24	0.00*
DXCM	0.58	0.00*	0.00*	DTE	0.65	0.00*	0.00*
EW	0.5	0.00*	0.00*	DUK	0.95	0.00*	0.00*
GILD	0.25	0.00*	0.00*	EIX	0.73	0.00*	0.00*
HCA	0.36	0.00*	0.00*	ETR	0.06	0.00*	0.00*
HSIC	0.13	0.00*	0.84	EVRG	0.18	0.00*	0.2
HOLX	0.09	0.00*	0.00*	ES	0.54	0.00*	0.00*
HUM	0.71	0.00*	0.00*	EXC	0.83	0.00*	0.00*
IDXX	0.99	0.00*	0.00*	FE	0.36	0.00*	0.00*
ILMN	0.96	0.77	0.00*	NEE	0.93	0.00*	0.00*
INCY	0.84	0.00*	0.00*	NI	0.46	0.00*	0.00*
ISRG	0.95	0.00*	0.00*	NRG	0.81	0.00*	0.00*
IQV	0.86	0.00*	0.00*	PNW	0.22	0.00*	0.00*
JNJ	0.91	0.00*	0.00*	PPL	0.24	0.00*	0.00*
LH	0.86	0.36	0.00*	PEG	0.38	0.00*	0.00*
LLY	0.06	0.00*	0.47	SRE	0.00*	0.00*	0.00*
MCK	0.17	0.00*	0.00*	SO	0.77	0.00*	0.72
MDT	0.65	0.00*	0.00*	WEC	0.38	0.00*	0.00*
MRK	0.93	0.00*	0.97	XEL	0.6	0.23	0.00*
Note: * represent the statistical significance at the 5% level.							

Table C- 14 Wald Test results for Portfolio 13, 14, 15 in the US

Code	P13	P14	P15	Code	P13	P14	P15
ATVI	0.00*	0.00*	0.00*	MTD	0.00*	0.00*	0.00*
GOOGL	0.3	0.00*	0.38	MYL	0.00*	0.00*	0.00*
GOOG	0.00*	0.00*	0.00*	PKI	0.00*	0.00*	0.00*
T	0.00*	0.19	0.00*	PRGO	0.36	0.00*	0.00*
CTL	0.00*	0.00*	0.00*	PFE	0.00*	0.00*	0.00*
CHTR	0.00*	0.00*	0.00*	DGX	0.00*	0.00*	0.00*
CMCSA	0.00*	0.00*	0.00*	REGN	0.91	0.00*	0.00*
DISCA	0.00*	0.00*	0.99	RMD	0.00*	0.00*	0.00*
DISCK	0.00*	0.00*	0.00*	STE	0.00*	0.00*	0.00*
DISH	0.00*	0.87	0.00*	SYK	0.00*	0.00*	0.00*
EA	0.81	0.00*	0.00*	TFX	0.69	0.00*	0.00*
FB	0.00*	0.00*	0.00*	COO	0.00*	0.00*	0.00*
FOXA	0.00*	0.00*	0.00*	TMO	0.00*	0.00*	0.00*
FOX	0.00*	0.00*	0.00*	UNH	0.11	0.00*	0.00*
IPG	0.00*	0.2	0.00*	UHS	0.00*	0.00*	0.00*
LYV	0.00*	0.00*	0.00*	VAR	0.00*	0.00*	0.00*
NFLX	0.98	0.00*	0.71	VRTX	0.00*	0.00*	0.00*
NWSA	0.00*	0.00*	0.00*	WAT	0.00*	0.00*	0.00*
NWS	0.00*	0.00*	0.00*	WST	0.00*	0.00*	0.00*
OMC	0.00*	0.00*	0.00*	ZBH	0.51	0.00*	0.00*
TMUS	0.00*	0.19	0.00*	ZTS	0.00*	0.00*	0.00*
TTWO	0.00*	0.00*	0.00*	MMM	0.00*	0.00*	0.00*
DIS	0.00*	0.00*	0.00*	AOS	0.00*	0.00*	0.00*
TWTR	0.00*	0.33	0.00*	ALK	0.00*	0.00*	0.00*
VZ	0.00*	0.00*	0.00*	ALLE	0.00*	0.00*	0.00*
VIAC	0.19	0.00*	0.00*	AAL	0.00*	0.00*	0.00*
AAP	0.00*	0.00*	0.00*	AME	0.00*	0.00*	0.00*
AMZN	0.00*	0.24	0.00*	BA	0.00*	0.00*	0.00*
APTV	0.00*	0.00*	0.00*	CHRW	0.83	0.00*	0.00*
AZO	0.00*	0.00*	0.00*	CARR	0.00*	0.00*	0.00*
BBY	0.00*	0.00*	0.00*	CAT	0.00*	0.00*	0.00*
BKNG	0.00*	0.00*	0.00*	CTAS	0.00*	0.00*	0.00*
BWA	0.00*	0.00*	0.33	CPRT	0.00*	0.00*	0.00*
KMX	0.00*	0.00*	0.00*	CSX	0.00*	0.00*	0.00*
CCL	0.37	0.00*	0.00*	CMI	0.00*	0.00*	0.00*
CMG	0.00*	0.00*	0.00*	DE	0.00*	0.00*	0.00*
DHI	0.00*	0.00*	0.00*	DAL	0.00*	0.00*	0.00*
DRI	0.00*	0.00*	0.00*	DOV	0.00*	0.00*	0.00*
DG	0.00*	0.00*	0.00*	ETN	0.00*	0.00*	0.00*
DLTR	0.00*	0.3	0.00*	EMR	0.00*	0.6	0.00*
DPZ	0.00*	0.00*	0.00*	EFX	0.86	0.00*	0.00*
EBAY	0.00*	0.00*	0.00*	EXPD	0.00*	0.00*	0.00*
EXPE	0.00*	0.00*	0.32	FAST	0.00*	0.00*	0.00*
F	0.91	0.00*	0.00*	FDX	0.00*	0.00*	0.00*

Table C- 14 Wald Test results for Portfolio 13, 14, 15 in the US – continued (1)							
Code	P13	P14	P15	Code	P13	P14	P15
GPS	0.00*	0.00*	0.00*	FLS	0.00*	0.00*	0.00*
GRMN	0.00*	0.00*	0.00*	FTV	0.00*	0.00*	0.00*
GM	0.00*	0.00*	0.00*	FBHS	0.00*	0.00*	0.00*
GPC	0.00*	0.00*	0.00*	GD	0.00*	0.00*	0.00*
HRB	0.00*	0.84	0.00*	GE	0.00*	0.00*	0.00*
HBI	0.00*	0.00*	0.00*	GWW	0.00*	0.00*	0.00*
HAS	0.00*	0.00*	0.00*	HON	0.00*	0.00*	0.00*
HLT	0.00*	0.00*	0.00*	HWM	0.00*	0.19	0.00*
HD	0.44	0.00*	0.00*	HII	0.95	0.00*	0.00*
KSS	0.00*	0.00*	0.00*	IEX	0.00*	0.00*	0.00*
LB	0.00*	0.00*	0.87	INFO	0.00*	0.00*	0.00*
LVS	0.00*	0.00*	0.00*	ITW	0.00*	0.00*	0.00*
LEG	0.00*	0.00*	0.00*	IR	0.00*	0.00*	0.00*
LEN	0.00*	0.00*	0.00*	JBHT	0.00*	0.00*	0.00*
LKQ	0.00*	0.00*	0.00*	J	0.00*	0.00*	0.00*
LOW	0.00*	0.00*	0.00*	JCI	0.00*	0.00*	0.00*
MAR	0.00*	0.43	0.45	KSU	0.00*	0.85	0.00*
MCD	0.00*	0.00*	0.00*	LHX	0.00*	0.00*	0.00*
MGM	0.00*	0.00*	0.00*	LMT	0.00*	0.00*	0.00*
MHK	0.00*	0.00*	0.00*	MAS	0.00*	0.00*	0.00*
NWL	0.95	0.00*	0.00*	NLSN	0.00*	0.00*	0.00*
NKE	0.00*	0.00*	0.00*	NSC	0.00*	0.00*	0.00*
NCLH	0.00*	0.00*	0.00*	NOC	0.00*	0.00*	0.00*
NVR	0.00*	0.00*	0.00*	ODFL	0.33	0.00*	0.00*
ORLY	0.00*	0.00*	0.00*	OTIS	0.00*	0.00*	0.00*
PHM	0.00*	0.63	0.82	PCAR	0.00*	0.89	0.00*
PVH	0.91	0.00*	0.00*	PH	0.00*	0.00*	0.00*
RL	0.00*	0.00*	0.00*	PNR	0.00*	0.00*	0.00*
ROST	0.00*	0.00*	0.00*	PWR	0.00*	0.00*	0.00*
RCL	0.00*	0.00*	0.00*	RTX	0.00*	0.00*	0.00*
SBUX	0.00*	0.00*	0.00*	RSG	0.00*	0.00*	0.00*
TPR	0.00*	0.00*	0.00*	RHI	0.87	0.00*	0.00*
TGT	0.35	0.00*	0.00*	ROK	0.00*	0.00*	0.00*
TIF	0.00*	0.00*	0.00*	ROL	0.00*	0.00*	0.00*
TJX	0.00*	0.00*	0.29	ROP	0.00*	0.27	0.00*
TSCO	0.00*	0.00*	0.00*	SNA	0.00*	0.00*	0.15
ULTA	0.00*	0.00*	0.00*	LUV	0.00*	0.00*	0.00*
UAA	0.00*	0.77	0.00*	SWK	0.00*	0.00*	0.00*
UA	0.00*	0.00*	0.00*	TDY	0.00*	0.00*	0.00*
VFC	0.00*	0.00*	0.00*	TXT	0.00*	0.00*	0.00*
WHR	0.00*	0.00*	0.00*	TT	0.88	0.00*	0.00*
WYNN	0.65	0.00*	0.00*	TDG	0.00*	0.00*	0.00*
YUM	0.00*	0.00*	0.00*	UNP	0.00*	0.00*	0.00*
MO	0.00*	0.00*	0.56	UAL	0.00*	0.00*	0.00*

Table C- 14 Wald Test results for Portfolio 13, 14, 15 in the US – continued (2)							
Code	P13	P14	P15	Code	P13	P14	P15
ADM	0.00*	0.00*	0.00*	UPS	0.00*	0.00*	0.00*
BF.B	0.00*	0.00*	0.00*	URI	0.00*	0.00*	0.00*
CPB	0.00*	0.00*	0.00*	VRSK	0.00*	0.35	0.00*
CHD	0.00*	0.00*	0.00*	WAB	0.00*	0.00*	0.00*
KO	0.00*	0.00*	0.00*	WM	0.00*	0.00*	0.00*
CL	0.00*	0.77	0.00*	XYL	0.00*	0.00*	0.00*
CAG	0.73	0.00*	0.00*	ACN	0.00*	0.00*	0.00*
STZ	0.00*	0.00*	0.00*	ADBE	0.00*	0.00*	0.00*
COST	0.00*	0.00*	0.00*	AMD	0.00*	0.00*	0.00*
COTY	0.00*	0.00*	0.00*	AKAM	0.00*	0.00*	0.00*
EL	0.00*	0.00*	0.00*	APH	0.00*	0.00*	0.00*
GIS	0.00*	0.00*	0.06	ADI	0.64	0.21	0.00*
HRL	0.00*	0.00*	0.00*	ANSS	0.00*	0.00*	0.00*
SJM	0.00*	0.00*	0.00*	AAPL	0.00*	0.00*	0.00*
K	0.00*	0.69	0.00*	AMAT	0.53	0.00*	0.07
KMB	0.28	0.00*	0.00*	ANET	0.00*	0.00*	0.00*
KHC	0.00*	0.00*	0.00*	ADSK	0.00*	0.00*	0.00*
KR	0.00*	0.00*	0.06	ADP	0.00*	0.00*	0.00*
LW	0.00*	0.00*	0.00*	AVGO	0.00*	0.00*	0.00*
MKC	0.00*	0.00*	0.00*	BR	0.00*	0.00*	0.00*
TAP	0.00*	0.00*	0.00*	CDNS	0.00*	0.00*	0.00*
MDLZ	0.00*	0.00*	0.00*	CDW	0.00*	0.00*	0.00*
MNST	0.00*	0.00*	0.00*	CSCO	0.00*	0.00*	0.00*
PEP	0.00*	0.00*	0.00*	CTXS	0.75	0.00*	0.26
PM	0.9	0.00*	0.00*	CTSH	0.00*	0.00*	0.00*
PG	0.00*	0.00*	0.00*	GLW	0.00*	0.00*	0.00*
SYY	0.00*	0.63	0.92	DXC	0.00*	0.29	0.00*
CLX	0.00*	0.00*	0.00*	FFIV	0.00*	0.00*	0.00*
HSY	0.00*	0.00*	0.00*	FIS	0.00*	0.00*	0.00*
TSN	0.00*	0.00*	0.00*	FISV	0.00*	0.13	0.00*
WBA	0.45	0.00*	0.00*	FLT	0.00*	0.00*	0.00*
WMT	0.00*	0.00*	0.00*	FLIR	0.00*	0.00*	0.00*
APA	0.00*	0.00*	0.00*	FTNT	0.00*	0.00*	0.83
BKR	0.00*	0.00*	0.00*	IT	0.00*	0.00*	0.00*
COG	0.00*	0.00*	0.00*	GPN	0.00*	0.00*	0.00*
CVX	0.00*	0.00*	0.00*	HPE	0.36	0.00*	0.00*
CXO	0.00*	0.00*	0.00*	HPQ	0.00*	0.00*	0.00*
COP	0.00*	0.00*	0.00*	INTC	0.00*	0.00*	0.00*
DVN	0.00*	0.18	0.47	IBM	0.00*	0.00*	0.00*
FANG	0.27	0.00*	0.00*	INTU	0.00*	0.00*	0.00*
EOG	0.00*	0.00*	0.00*	IPGP	0.00*	0.00*	0.00*
XOM	0.00*	0.00*	0.00*	JKHY	0.00*	0.00*	0.00*
HAL	0.00*	0.00*	0.00*	JNPR	0.00*	0.00*	0.00*
HES	0.00*	0.00*	0.00*	KEYS	0.00*	0.00*	0.00*

Table C- 14 Wald Test results for Portfolio 13, 14, 15 in the US – continued (3)							
Code	P13	P14	P15	Code	P13	P14	P15
HFC	0.00*	0.00*	0.00*	KLAC	0.00*	0.00*	0.73
KMI	0.00*	0.00*	0.00*	LRCX	0.00*	0.00*	0.00*
MRO	0.00*	0.00*	0.00*	LDOS	0.00*	0.00*	0.00*
MPC	0.00*	0.00*	0.12	MA	0.54	0.48	0.00*
NOV	0.29	0.00*	0.00*	MXIM	0.00*	0.00*	0.00*
NBL	0.00*	0.00*	0.00*	MCHP	0.00*	0.00*	0.00*
OXY	0.00*	0.58	0.00*	MU	0.00*	0.00*	0.00*
OKE	0.00*	0.00*	0.00*	MSFT	0.00*	0.00*	0.00*
PSX	0.00*	0.00*	0.00*	MSI	0.00*	0.00*	0.00*
PXD	0.00*	0.00*	0.00*	NTAP	0.00*	0.00*	0.34
SLB	0.00*	0.00*	0.00*	NLOK	0.00*	0.00*	0.00*
FTI	0.00*	0.00*	0.00*	NVDA	0.00*	0.00*	0.00*
VLO	0.00*	0.00*	0.00*	ORCL	0.00*	0.6	0.00*
WMB	0.00*	0.00*	0.00*	PAYX	0.00*	0.00*	0.00*
AFL	0.00*	0.00*	0.00*	PAYC	0.00*	0.00*	0.00*
ALL	0.00*	0.00*	0.72	PYPL	0.00*	0.00*	0.00*
AXP	0.8	0.00*	0.00*	QRVO	0.00*	0.00*	0.00*
AIG	0.00*	0.00*	0.00*	QCOM	0.00*	0.00*	0.00*
AMP	0.00*	0.00*	0.00*	CRM	0.26	0.00*	0.00*
AON	0.00*	0.00*	0.00*	STX	0.00*	0.00*	0.00*
AJG	0.00*	0.00*	0.00*	NOW	0.00*	0.00*	0.00*
AIZ	0.00*	0.64	0.00*	SWKS	0.00*	0.00*	0.14
BAC	0.00*	0.00*	0.00*	SNPS	0.00*	0.00*	0.00*
BRK.B	0.00*	0.00*	0.00*	TEL	0.00*	0.00*	0.00*
BLK	0.00*	0.00*	0.00*	TXN	0.00*	0.49	0.00*
COF	0.00*	0.00*	0.00*	TYL	0.00*	0.00*	0.00*
CBOE	0.00*	0.00*	0.00*	VRSN	0.00*	0.00*	0.00*
SCHW	0.00*	0.00*	0.84	V	0.64	0.00*	0.00*
CB	0.22	0.00*	0.00*	WDC	0.00*	0.00*	0.00*
CINF	0.00*	0.00*	0.00*	WU	0.00*	0.00*	0.00*
C	0.00*	0.36	0.00*	XRX	0.00*	0.00*	0.87
CFG	0.00*	0.00*	0.00*	XLNX	0.00*	0.00*	0.00*
CME	0.00*	0.00*	0.00*	ZBRA	0.00*	0.00*	0.00*
CMA	0.00*	0.00*	0.00*	APD	0.00*	0.44	0.00*
DFS	0.00*	0.00*	0.00*	ALB	0.00*	0.00*	0.00*
ETFC	0.00*	0.00*	0.00*	AMCR	0.00*	0.00*	0.00*
RE	0.00*	0.00*	0.00*	AVY	0.15	0.00*	0.00*
FITB	0.99	0.00*	0.00*	BLL	0.00*	0.00*	0.00*
FRC	0.00*	0.00*	0.00*	CE	0.00*	0.00*	0.00*
BEN	0.00*	0.00*	0.58	CF	0.00*	0.00*	0.00*
GL	0.00*	0.00*	0.00*	CTVA	0.00*	0.00*	0.00*
GS	0.00*	0.00*	0.00*	DOW	0.00*	0.00*	0.00*
HIG	0.00*	0.89	0.00*	DD	0.00*	0.25	0.87
HBAN	0.00*	0.00*	0.00*	EMN	0.00*	0.00*	0.00*

Table C- 14 Wald Test results for Portfolio 13, 14, 15 in the US – continued (4)							
Code	P13	P14	P15	Code	P13	P14	P15
ICE	0.00*	0.00*	0.00*	ECL	0.00*	0.00*	0.00*
IVZ	0.00*	0.00*	0.00*	FMC	0.00*	0.00*	0.00*
JPM	0.00*	0.00*	0.00*	FCX	0.00*	0.00*	0.00*
KEY	0.00*	0.00*	0.00*	IFF	0.00*	0.00*	0.00*
LNC	0.00*	0.00*	0.32	IP	0.69	0.00*	0.00*
L	0.75	0.00*	0.00*	LIN	0.00*	0.00*	0.44
MTB	0.00*	0.00*	0.00*	LYB	0.00*	0.00*	0.00*
MKTX	0.00*	0.00*	0.00*	MLM	0.00*	0.00*	0.00*
MMC	0.00*	0.00*	0.00*	NEM	0.00*	0.00*	0.00*
MET	0.00*	0.00*	0.00*	NUE	0.00*	0.00*	0.00*
MCO	0.00*	0.00*	0.00*	PKG	0.00*	0.00*	0.00*
MS	0.00*	0.00*	0.00*	PPG	0.00*	0.23	0.00*
MSCI	0.00*	0.00*	0.00*	SEE	0.00*	0.00*	0.00*
NDAQ	0.00*	0.28	0.00*	SHW	0.00*	0.00*	0.00*
NTRS	0.00*	0.00*	0.00*	MOS	0.00*	0.00*	0.00*
PBCT	0.00*	0.00*	0.00*	VMC	0.00*	0.00*	0.00*
PNC	0.00*	0.00*	0.5	WRK	0.00*	0.00*	0.00*
PFG	0.00*	0.00*	0.00*	ARE	0.00*	0.00*	0.00*
PGR	0.00*	0.00*	0.00*	AMT	0.00*	0.00*	0.00*
PRU	0.00*	0.00*	0.00*	AIV	0.00*	0.00*	0.00*
RJF	0.6	0.00*	0.00*	AVB	0.00*	0.00*	0.29
RF	0.00*	0.00*	0.00*	BXP	0.00*	0.00*	0.00*
SPGI	0.00*	0.00*	0.00*	CBRE	0.73	0.00*	0.00*
STT	0.00*	0.00*	0.00*	CCI	0.00*	0.00*	0.00*
SIVB	0.00*	0.00*	0.00*	DLR	0.00*	0.1	0.00*
SYF	0.00*	0.73	0.00*	DRE	0.00*	0.00*	0.00*
TROW	0.00*	0.00*	0.00*	EQIX	0.00*	0.00*	0.00*
BK	0.00*	0.00*	0.00*	EQR	0.00*	0.00*	0.00*
TRV	0.00*	0.00*	0.00*	ESS	0.29	0.00*	0.00*
TFC	0.00*	0.00*	0.00*	EXR	0.00*	0.00*	0.00*
USB	0.00*	0.00*	0.00*	FRT	0.00*	0.00*	0.00*
UNM	0.00*	0.00*	0.92	PEAK	0.00*	0.00*	0.00*
WRB	0.00*	0.00*	0.00*	HST	0.00*	0.00*	0.00*
WFC	0.00*	0.00*	0.00*	IRM	0.00*	0.00*	0.00*
WLTW	0.00*	0.00*	0.00*	KIM	0.53	0.00*	0.00*
ZION	0.67	0.00*	0.00*	MAA	0.00*	0.00*	0.13
ABT	0.00*	0.00*	0.00*	PLD	0.00*	0.67	0.00*
ABBV	0.00*	0.13	0.00*	PSA	0.00*	0.00*	0.00*
ABMD	0.00*	0.00*	0.00*	O	0.00*	0.00*	0.00*
A	0.00*	0.00*	0.00*	REG	0.99	0.00*	0.00*
ALXN	0.00*	0.00*	0.00*	SBAC	0.00*	0.00*	0.00*
ALGN	0.00*	0.00*	0.00*	SPG	0.00*	0.00*	0.00*
ABC	0.00*	0.00*	0.00*	SLG	0.00*	0.00*	0.00*
AMGN	0.00*	0.00*	0.05	UDR	0.00*	0.00*	0.00*

Table C- 14 Wald Test results for Portfolio 13, 14, 15 in the US – continued (5)							
Code	P13	P14	P15	Code	P13	P14	P15
ANTM	0.00*	0.00*	0.00*	VTR	0.00*	0.00*	0.00*
BAX	0.00*	0.00*	0.00*	VNO	0.00*	0.00*	0.00*
BDX	0.00*	0.00*	0.00*	WELL	0.00*	0.00*	0.00*
BIO	0.32	0.00*	0.00*	WY	0.00*	0.00*	0.00*
BIIB	0.00*	0.00*	0.00*	Symbol	0.00*	0.00*	0.00*
BSX	0.00*	0.46	0.00*	AES	0.00*	0.00*	0.00*
BMY	0.00*	0.00*	0.00*	LNT	0.00*	0.00*	0.45
CAH	0.00*	0.00*	0.00*	AEE	0.34	0.77	0.00*
CNC	0.00*	0.00*	0.00*	AEP	0.00*	0.00*	0.00*
CERN	0.00*	0.00*	0.00*	AWK	0.00*	0.00*	0.00*
CI	0.00*	0.00*	0.00*	ATO	0.00*	0.00*	0.00*
CVS	0.00*	0.00*	0.17	CNP	0.00*	0.00*	0.00*
DHR	0.00*	0.00*	0.00*	CMS	0.00*	0.00*	0.00*
DVA	0.00*	0.00*	0.00*	ED	0.00*	0.00*	0.00*
XRAY	0.00*	0.65	0.00*	D	0.00*	0.00*	0.00*
DXCM	0.74	0.00*	0.00*	DTE	0.00*	0.00*	0.00*
EW	0.00*	0.00*	0.00*	DUK	0.00*	0.00*	0.00*
GILD	0.00*	0.00*	0.00*	EIX	0.00*	0.00*	0.00*
HCA	0.00*	0.00*	0.00*	ETR	0.00*	0.00*	0.00*
HSIC	0.00*	0.00*	0.00*	EVRG	0.51	0.87	0.00*
HOLX	0.00*	0.00*	0.00*	ES	0.00*	0.00*	0.00*
HUM	0.92	0.00*	0.00*	EXC	0.00*	0.00*	0.94
IDXX	0.00*	0.00*	0.00*	FE	0.00*	0.00*	0.00*
ILMN	0.00*	0.00*	0.62	NEE	0.00*	0.00*	0.00*
INCY	0.00*	0.00*	0.00*	NI	0.00*	0.00*	0.00*
ISRG	0.00*	0.00*	0.00*	NRG	0.00*	0.00*	0.00*
IQV	0.00*	0.00*	0.00*	PNW	0.00*	0.00*	0.00*
JNJ	0.00*	0.00*	0.55	PPL	0.00*	0.00*	0.00*
LH	0.09	0.00*	0.00*	PEG	0.00*	0.00*	0.00*
LLY	0.00*	0.48	0.00*	SRE	0.00*	0.00*	0.00*
MCK	0.00*	0.00*	0.00*	SO	0.00*	0.00*	0.29
MDT	0.00*	0.00*	0.00*	WEC	0.84	0.24	0.00*
MRK	0.00*	0.00*	0.00*	XEL	0.00*	0.00*	0.00*
Note: * represent the statistical significance at the 5% level.							

Table C- 15 Wald Test results for Portfolio 16, 17, 18 in the US

Code	P16	P17	P18	Code	P16	P17	P18
ATVI	0.00*	0.77	0.00*	MTD	0.00*	0.00*	0.00*
GOOGL	0.00*	0.00*	0.00*	MYL	0.00*	0.00*	0.00*
GOOG	0.41	0.00*	0.00*	PKI	0.00*	0.00*	0.00*
T	0.00*	0.00*	0.00*	PRGO	0.41	0.00*	0.00*
CTL	0.00*	0.00*	0.00*	PFE	0.00*	0.00*	0.00*
CHTR	0.00*	0.00*	0.84	DGX	0.26	0.00*	0.00*
CMCSA	0.00*	0.00*	0.00*	REGN	0.00*	0.00*	0.24
DISCA	0.00*	0.43	0.00*	RMD	0.00*	0.00*	0.00*
DISCK	0.09	0.00*	0.00*	STE	0.83	0.00*	0.00*
DISH	0.00*	0.00*	0.00*	SYK	0.00*	0.00*	0.00*
EA	0.00*	0.00*	0.00*	TFX	0.00*	0.00*	0.33
FB	0.00*	0.00*	0.00*	COO	0.00*	0.00*	0.00*
FOXA	0.00*	0.00*	0.43	TMO	0.00*	0.00*	0.00*
FOX	0.00*	0.00*	0.00*	UNH	0.00*	0.00*	0.00*
IPG	0.56	0.00*	0.00*	UHS	0.00*	0.00*	0.00*
LYV	0.00*	0.00*	0.00*	VAR	0.00*	0.00*	0.00*
NFLX	0.00*	0.00*	0.23	VRTX	0.00*	0.00*	0.00*
NWSA	0.00*	0.00*	0.00*	WAT	0.00*	0.00*	0.00*
NWS	0.00*	0.00*	0.00*	WST	0.00*	0.00*	0.00*
OMC	0.00*	0.5	0.00*	ZBH	0.00*	0.00*	0.3
TMUS	0.00*	0.00*	0.00*	ZTS	0.00*	0.00*	0.00*
TTWO	0.00*	0.00*	0.00*	MMM	0.57	0.00*	0.00*
DIS	0.00*	0.00*	0.00*	AOS	0.00*	0.00*	0.00*
TWTR	0.68	0.00*	0.59	ALK	0.00*	0.00*	0.00*
VZ	0.00*	0.00*	0.00*	ALLE	0.56	0.00*	0.09
VIAC	0.00*	0.00*	0.00*	AAL	0.00*	0.00*	0.00*
AAP	0.00*	0.00*	0.00*	AME	0.00*	0.00*	0.00*
AMZN	0.00*	0.00*	0.00*	BA	0.00*	0.00*	0.00*
APTV	0.00*	0.00*	0.00*	CHRW	0.00*	0.00*	0.00*
AZO	0.00*	0.00*	0.00*	CARR	0.00*	0.00*	0.00*
BBY	0.00*	0.00*	0.00*	CAT	0.00*	0.00*	0.00*
BKNG	0.00*	0.33	0.00*	CTAS	0.00*	0.00*	0.00*
BWA	0.00*	0.00*	0.00*	CPRT	0.00*	0.00*	0.00*
KMX	0.00*	0.00*	0.00*	CSX	0.00*	0.00*	0.00*
CCL	0.00*	0.00*	0.00*	CMI	0.00*	0.00*	0.00*
CMG	0.44	0.00*	0.00*	DE	0.00*	0.00*	0.00*
DHI	0.00*	0.00*	0.00*	DAL	0.00*	0.00*	0.00*
DRI	0.00*	0.00*	0.65	DOV	0.00*	0.00*	0.00*
DG	0.00*	0.00*	0.00*	ETN	0.00*	0.00*	0.00*
DLTR	0.00*	0.00*	0.00*	EMR	0.99	0.00*	0.00*
DPZ	0.00*	0.00*	0.00*	EFX	0.00*	0.00*	0.00*
EBAY	0.00*	0.00*	0.00*	EXPD	0.00*	0.00*	0.00*
EXPE	0.00*	0.00*	0.00*	FAST	0.00*	0.00*	0.71
F	0.00*	0.97	0.00*	FDX	0.00*	0.00*	0.00*

Table C- 15 Wald Test results for Portfolio 16, 17, 18 in the US – continued (1)							
Code	P16	P17	P18	Code	P16	P17	P18
GPS	0.00*	0.00*	0.00*	FLS	0.00*	0.00*	0.00*
GRMN	0.00*	0.00*	0.00*	FTV	0.00*	0.00*	0.00*
GM	0.00*	0.00*	0.00*	FBHS	0.00*	0.00*	0.00*
GPC	0.3	0.00*	0.00*	GD	0.00*	0.00*	0.00*
HRB	0.00*	0.00*	0.00*	GE	0.00*	0.00*	0.00*
HBI	0.00*	0.00*	0.00*	GWW	0.00*	0.00*	0.00*
HAS	0.00*	0.00*	0.00*	HON	0.00*	0.00*	0.00*
HLT	0.00*	0.00*	0.00*	HWM	0.82	0.00*	0.00*
HD	0.00*	0.65	0.44	HII	0.00*	0.00*	0.00*
KSS	0.00*	0.00*	0.00*	IEX	0.00*	0.00*	0.00*
LB	0.00*	0.00*	0.00*	INFO	0.00*	0.00*	0.00*
LVS	0.00*	0.00*	0.00*	ITW	0.00*	0.00*	0.00*
LEG	0.00*	0.00*	0.00*	IR	0.00*	0.00*	0.00*
LEN	0.00*	0.00*	0.00*	JBHT	0.00*	0.00*	0.58
LKQ	0.00*	0.00*	0.00*	J	0.00*	0.00*	0.00*
LOW	0.87	0.00*	0.00*	JCI	0.00*	0.00*	0.00*
MAR	0.00*	0.00*	0.00*	KSU	0.00*	0.14	0.00*
MCD	0.00*	0.43	0.00*	LHX	0.00*	0.00*	0.00*
MGM	0.00*	0.00*	0.00*	LMT	0.00*	0.00*	0.00*
MHK	0.00*	0.00*	0.00*	MAS	0.00*	0.00*	0.00*
NWL	0.00*	0.00*	0.00*	NLSN	0.00*	0.00*	0.00*
NKE	0.00*	0.00*	0.00*	NSC	0.00*	0.00*	0.00*
NCLH	0.00*	0.00*	0.00*	NOC	0.92	0.00*	0.00*
NVR	0.00*	0.00*	0.00*	ODFL	0.00*	0.00*	0.00*
ORLY	0.00*	0.00*	0.00*	OTIS	0.00*	0.00*	0.00*
PHM	0.00*	0.00*	0.00*	PCAR	0.00*	0.00*	0.00*
PVH	0.00*	0.38	0.00*	PH	0.00*	0.00*	0.00*
RL	0.66	0.00*	0.00*	PNR	0.00*	0.00*	0.00*
ROST	0.00*	0.00*	0.00*	PWR	0.00*	0.00*	0.00*
RCL	0.00*	0.00*	0.00*	RTX	0.00*	0.00*	0.00*
SBUX	0.00*	0.00*	0.00*	RSG	0.00*	0.00*	0.00*
TPR	0.00*	0.00*	0.00*	RHI	0.00*	0.78	0.47
TGT	0.00*	0.00*	0.21	ROK	0.00*	0.00*	0.00*
TIF	0.00*	0.00*	0.00*	ROL	0.00*	0.00*	0.00*
TJX	0.00*	0.00*	0.00*	ROP	0.00*	0.00*	0.00*
TSCO	0.00*	0.18	0.00*	SNA	0.00*	0.00*	0.00*
ULTA	0.00*	0.00*	0.00*	LUV	0.00*	0.00*	0.00*
UAA	0.00*	0.00*	0.00*	SWK	0.5	0.00*	0.00*
UA	0.00*	0.00*	0.00*	TDY	0.00*	0.00*	0.00*
VFC	0.00*	0.00*	0.00*	TXT	0.00*	0.00*	0.00*
WHR	0.00*	0.00*	0.00*	TT	0.00*	0.00*	0.00*
WYNN	0.00*	0.00*	0.00*	TDG	0.00*	0.00*	0.00*
YUM	0.92	0.00*	0.00*	UNP	0.00*	0.00*	0.00*
MO	0.00*	0.00*	0.00*	UAL	0.00*	0.00*	0.00*

Table C- 15 Wald Test results for Portfolio 16, 17, 18 in the US – continued (2)							
Code	P16	P17	P18	Code	P16	P17	P18
ADM	0.00*	0.91	0.00*	UPS	0.00*	0.00*	0.00*
BF.B	0.00*	0.00*	0.00*	URI	0.00*	0.00*	0.00*
CPB	0.00*	0.00*	0.00*	VRSK	0.00*	0.00*	0.00*
CHD	0.00*	0.00*	0.00*	WAB	0.00*	0.00*	0.00*
KO	0.00*	0.00*	0.00*	WM	0.00*	0.00*	0.00*
CL	0.00*	0.00*	0.00*	XYL	0.00*	0.17	0.39
CAG	0.00*	0.00*	0.00*	ACN	0.00*	0.00*	0.00*
STZ	0.00*	0.00*	0.00*	ADBE	0.00*	0.00*	0.00*
COST	0.00*	0.00*	0.00*	AMD	0.38	0.00*	0.00*
COTY	0.00*	0.00*	0.6	AKAM	0.00*	0.00*	0.00*
EL	0.35	0.00*	0.00*	APH	0.00*	0.00*	0.00*
GIS	0.00*	0.00*	0.00*	ADI	0.00*	0.00*	0.00*
HRL	0.00*	0.28	0.00*	ANSS	0.00*	0.00*	0.00*
SJM	0.00*	0.00*	0.00*	AAPL	0.00*	0.00*	0.00*
K	0.00*	0.00*	0.00*	AMAT	0.00*	0.00*	0.00*
KMB	0.00*	0.00*	0.00*	ANET	0.00*	0.00*	0.00*
KHC	0.00*	0.00*	0.00*	ADSK	0.00*	0.00*	0.00*
KR	0.00*	0.00*	0.00*	ADP	0.00*	0.00*	0.00*
LW	0.00*	0.00*	0.00*	AVGO	0.00*	0.00*	0.00*
MKC	0.00*	0.00*	0.00*	BR	0.00*	0.00*	0.00*
TAP	0.00*	0.00*	0.00*	CDNS	0.00*	0.00*	0.88
MDLZ	0.00*	0.11	0.00*	CDW	0.00*	0.00*	0.00*
MNST	0.37	0.00*	0.00*	CSCO	0.00*	0.00*	0.00*
PEP	0.00*	0.00*	0.00*	CTXS	0.00*	0.92	0.00*
PM	0.00*	0.00*	0.00*	CTSH	0.00*	0.00*	0.00*
PG	0.00*	0.00*	0.00*	GLW	0.00*	0.00*	0.00*
SYY	0.00*	0.00*	0.00*	DXC	0.2	0.00*	0.00*
CLX	0.00*	0.00*	0.00*	FFIV	0.00*	0.00*	0.00*
HSY	0.00*	0.00*	0.00*	FIS	0.00*	0.00*	0.00*
TSN	0.00*	0.00*	0.00*	FISV	0.00*	0.00*	0.00*
WBA	0.00*	0.92	0.00*	FLT	0.00*	0.00*	0.00*
WMT	0.00*	0.00*	0.00*	FLIR	0.00*	0.00*	0.00*
APA	0.00*	0.00*	0.00*	FTNT	0.00*	0.00*	0.00*
BKR	0.00*	0.00*	0.3	IT	0.00*	0.00*	0.00*
COG	0.68	0.00*	0.00*	GPN	0.00*	0.00*	0.00*
CVX	0.00*	0.00*	0.00*	HPE	0.00*	0.00*	0.00*
CXO	0.00*	0.00*	0.00*	HPQ	0.00*	0.00*	0.00*
COP	0.00*	0.00*	0.00*	INTC	0.00*	0.00*	0.00*
DVN	0.00*	0.00*	0.00*	IBM	0.00*	0.00*	0.69
FANG	0.00*	0.00*	0.00*	INTU	0.00*	0.00*	0.00*
EOG	0.00*	0.00*	0.00*	IPGP	0.00*	0.00*	0.00*
XOM	0.00*	0.00*	0.00*	JKHY	0.6	0.00*	0.00*
HAL	0.00*	0.45	0.00*	JNPR	0.00*	0.5	0.00*
HES	0.00*	0.00*	0.00*	KEYS	0.00*	0.00*	0.00*

Table C- 15 Wald Test results for Portfolio 16, 17, 18 in the US – continued (3)							
Code	P16	P17	P18	Code	P16	P17	P18
HFC	0.00*	0.00*	0.00*	KLAC	0.00*	0.00*	0.00*
KMI	0.00*	0.00*	0.00*	LRCX	0.00*	0.00*	0.00*
MRO	0.77	0.00*	0.00*	LDOS	0.00*	0.00*	0.00*
MPC	0.00*	0.00*	0.00*	MA	0.00*	0.00*	0.00*
NOV	0.00*	0.00*	0.00*	MXIM	0.00*	0.00*	0.00*
NBL	0.00*	0.00*	0.00*	MCHP	0.00*	0.00*	0.00*
OXY	0.00*	0.00*	0.00*	MU	0.00*	0.00*	0.00*
OKE	0.00*	0.69	0.52	MSFT	0.00*	0.00*	0.00*
PSX	0.00*	0.22	0.00*	MSI	0.00*	0.00*	0.00*
PXD	0.00*	0.00*	0.00*	NTAP	0.00*	0.00*	0.00*
SLB	0.00*	0.00*	0.00*	NLOK	0.00*	0.00*	0.00*
FTI	0.54	0.94	0.00*	NVDA	0.00*	0.00*	0.00*
VLO	0.00*	0.00*	0.00*	ORCL	0.79	0.00*	0.28
WMB	0.00*	0.00*	0.00*	PAYX	0.00*	0.00*	0.00*
AFL	0.00*	0.00*	0.00*	PAYC	0.00*	0.00*	0.00*
ALL	0.00*	0.00*	0.00*	PYPL	0.00*	0.00*	0.00*
AXP	0.00*	0.52	0.00*	QRVO	0.00*	0.59	0.00*
AIG	0.00*	0.00*	0.00*	QCOM	0.00*	0.00*	0.00*
AMP	0.00*	0.00*	0.00*	CRM	0.00*	0.00*	0.00*
AON	0.00*	0.00*	0.00*	STX	0.00*	0.00*	0.00*
AJG	0.00*	0.00*	0.00*	NOW	0.00*	0.00*	0.00*
AIZ	0.00*	0.00*	0.00*	SWKS	0.00*	0.00*	0.00*
BAC	0.00*	0.00*	0.00*	SNPS	0.00*	0.00*	0.00*
BRK.B	0.16	0.00*	0.00*	TEL	0.00*	0.00*	0.00*
BLK	0.00*	0.4	0.00*	TXN	0.00*	0.00*	0.00*
COF	0.00*	0.00*	0.32	TYL	0.00*	0.00*	0.00*
CBOE	0.00*	0.00*	0.00*	VRSN	0.00*	0.00*	0.00*
SCHW	0.00*	0.00*	0.00*	V	0.15	0.00*	0.61
CB	0.00*	0.00*	0.00*	WDC	0.00*	0.00*	0.00*
CINF	0.00*	0.00*	0.00*	WU	0.00*	0.00*	0.00*
C	0.00*	0.00*	0.00*	XRX	0.00*	0.00*	0.00*
CFG	0.00*	0.00*	0.00*	XLNX	0.00*	0.00*	0.00*
CME	0.69	0.00*	0.00*	ZBRA	0.00*	0.00*	0.00*
CMA	0.00*	0.00*	0.00*	APD	0.00*	0.00*	0.00*
DFS	0.00*	0.00*	0.00*	ALB	0.00*	0.71	0.00*
ETFC	0.00*	0.24	0.00*	AMCR	0.00*	0.00*	0.00*
RE	0.00*	0.00*	0.00*	AVY	0.00*	0.00*	0.00*
FITB	0.00*	0.00*	0.00*	BLL	0.00*	0.00*	0.00*
FRC	0.00*	0.00*	0.00*	CE	0.00*	0.00*	0.00*
BEN	0.00*	0.00*	0.00*	CF	0.00*	0.00*	0.00*
GL	0.00*	0.00*	0.00*	CTVA	0.00*	0.00*	0.00*
GS	0.27	0.00*	0.00*	DOW	0.00*	0.00*	0.00*
HIG	0.00*	0.00*	0.00*	DD	0.1	0.00*	0.00*
HBAN	0.00*	0.00*	0.99	EMN	0.00*	0.00*	0.00*

Table C- 15 Wald Test results for Portfolio 16, 17, 18 in the US – continued (4)							
Code	P16	P17	P18	Code	P16	P17	P18
ICE	0.00*	0.00*	0.00*	ECL	0.00*	0.00*	0.00*
IVZ	0.00*	0.00*	0.00*	FMC	0.00*	0.00*	0.39
JPM	0.00*	0.00*	0.00*	FCX	0.00*	0.00*	0.00*
KEY	0.00*	0.39	0.00*	IFF	0.00*	0.00*	0.00*
LNC	0.00*	0.00*	0.00*	IP	0.00*	0.00*	0.00*
L	0.00*	0.00*	0.00*	LIN	0.00*	0.00*	0.00*
MTB	0.00*	0.00*	0.00*	LYB	0.00*	0.00*	0.00*
MKTX	0.00*	0.00*	0.00*	MLM	0.00*	0.00*	0.00*
MMC	0.00*	0.00*	0.00*	NEM	0.00*	0.31	0.00*
MET	0.56	0.00*	0.00*	NUE	0.00*	0.00*	0.00*
MCO	0.00*	0.00*	0.00*	PKG	0.00*	0.00*	0.00*
MS	0.00*	0.00*	0.00*	PPG	0.00*	0.00*	0.00*
MSCI	0.00*	0.00*	0.00*	SEE	0.00*	0.00*	0.00*
NDAQ	0.00*	0.00*	0.00*	SHW	0.24	0.00*	0.00*
NTRS	0.00*	0.00*	0.88	MOS	0.00*	0.00*	0.00*
PBCT	0.00*	0.00*	0.00*	VMC	0.00*	0.00*	0.00*
PNC	0.00*	0.00*	0.00*	WRK	0.00*	0.00*	0.16
PFG	0.00*	0.00*	0.00*	ARE	0.00*	0.00*	0.00*
PGR	0.00*	0.8	0.00*	AMT	0.00*	0.00*	0.00*
PRU	0.00*	0.00*	0.00*	AIV	0.00*	0.00*	0.00*
RJF	0.00*	0.00*	0.00*	AVB	0.00*	0.00*	0.00*
RF	0.05	0.00*	0.00*	BXP	0.00*	0.00*	0.00*
SPGI	0.00*	0.00*	0.00*	CBRE	0.00*	0.00*	0.00*
STT	0.00*	0.00*	0.00*	CCI	0.00*	0.00*	0.00*
SIVB	0.00*	0.00*	0.00*	DLR	0.00*	0.00*	0.00*
SYF	0.00*	0.00*	0.00*	DRE	0.00*	0.00*	0.00*
TROW	0.00*	0.00*	0.00*	EQIX	0.00*	0.68	0.00*
BK	0.3	0.47	0.00*	EQR	0.00*	0.00*	0.00*
TRV	0.00*	0.00*	0.00*	ESS	0.64	0.00*	0.00*
TFC	0.00*	0.00*	0.22	EXR	0.00*	0.00*	0.00*
USB	0.00*	0.00*	0.00*	FRT	0.00*	0.00*	0.00*
UNM	0.00*	0.00*	0.00*	PEAK	0.00*	0.00*	0.42
WRB	0.00*	0.00*	0.00*	HST	0.00*	0.00*	0.00*
WFC	0.00*	0.00*	0.00*	IRM	0.00*	0.00*	0.00*
WLTW	0.00*	0.00*	0.00*	KIM	0.00*	0.00*	0.00*
ZION	0.00*	0.00*	0.00*	MAA	0.00*	0.00*	0.00*
ABT	0.00*	0.00*	0.00*	PLD	0.00*	0.00*	0.00*
ABBV	0.00*	0.00*	0.00*	PSA	0.00*	0.00*	0.00*
ABMD	0.00*	0.00*	0.00*	O	0.00*	0.00*	0.00*
A	0.6	0.00*	0.00*	REG	0.00*	0.00*	0.00*
ALXN	0.00*	0.00*	0.00*	SBAC	0.00*	0.00*	0.00*
ALGN	0.00*	0.00*	0.00*	SPG	0.00*	0.00*	0.00*
ABC	0.00*	0.28	0.00*	SLG	0.00*	0.00*	0.00*
AMGN	0.00*	0.00*	0.00*	UDR	0.00*	0.00*	0.00*

Table C- 15 Wald Test results for Portfolio 16, 17, 18 in the US – continued (5)							
Code	P16	P17	P18	Code	P16	P17	P18
ANTM	0.00*	0.00*	0.62	VTR	0.00*	0.61	0.00*
BAX	0.00*	0.00*	0.00*	VNO	0.00*	0.00*	0.00*
BDX	0.00*	0.00*	0.00*	WELL	0.88	0.00*	0.99
BIO	0.00*	0.00*	0.00*	WY	0.00*	0.00*	0.00*
BIIB	0.00*	0.00*	0.00*	Symbol	0.00*	0.00*	0.00*
BSX	0.00*	0.00*	0.00*	AES	0.00*	0.00*	0.00*
BMY	0.00*	0.00*	0.00*	LNT	0.00*	0.00*	0.00*
CAH	0.37	0.00*	0.00*	AEE	0.00*	0.00*	0.00*
CNC	0.00*	0.00*	0.00*	AEP	0.00*	0.00*	0.00*
CERN	0.00*	0.00*	0.00*	AWK	0.00*	0.00*	0.00*
CI	0.00*	0.37	0.00*	ATO	0.00*	0.00*	0.00*
CVS	0.00*	0.00*	0.00*	CNP	0.00*	0.00*	0.00*
DHR	0.00*	0.00*	0.00*	CMS	0.00*	0.00*	0.00*
DVA	0.00*	0.00*	0.00*	ED	0.00*	0.00*	0.00*
XRAY	0.00*	0.00*	0.00*	D	0.00*	0.00*	0.00*
DXCM	0.00*	0.00*	0.72	DTE	0.00*	0.00*	0.00*
EW	0.00*	0.00*	0.00*	DUK	0.00*	0.00*	0.00*
GILD	0.00*	0.00*	0.00*	EIX	0.52	0.00*	0.74
HCA	0.00*	0.00*	0.00*	ETR	0.00*	0.00*	0.00*
HSIC	0.00*	0.81	0.00*	EVRG	0.00*	0.00*	0.00*
HOLX	0.00*	0.00*	0.00*	ES	0.00*	0.00*	0.00*
HUM	0.00*	0.00*	0.00*	EXC	0.00*	0.00*	0.00*
IDXX	0.00*	0.00*	0.00*	FE	0.00*	0.00*	0.00*
ILMN	0.00*	0.00*	0.00*	NEE	0.00*	0.00*	0.00*
INCY	0.00*	0.00*	0.00*	NI	0.00*	0.17	0.00*
ISRG	0.00*	0.14	0.00*	NRG	0.00*	0.00*	0.00*
IQV	0.00*	0.00*	0.00*	PNW	0.00*	0.00*	0.00*
JNJ	0.00*	0.00*	0.00*	PPL	0.00*	0.00*	0.00*
LH	0.82	0.00*	0.00*	PEG	0.00*	0.00*	0.00*
LLY	0.00*	0.00*	0.00*	SRE	0.00*	0.00*	0.00*
MCK	0.00*	0.00*	0.77	SO	0.00*	0.00*	0.00*
MDT	0.00*	0.00*	0.00*	WEC	0.00*	0.11	0.00*
MRK	0.00*	0.00*	0.00*	XEL	0.46	0.00*	0.9
Note: * represent the statistical significance at the 5% level.							

Table C- 16 Wald Test results for Portfolio 19, 20, 21 in the US

Code	P19	P20	P21	Code	P19	P20	P21
ATVI	0.00*	0.35	0.00*	MTD	0.00*	0.46	0.00*
GOOGL	0.00*	0.36	0.00*	MYL	0.00*	0.23	0.00*
GOOG	0.00*	0.45	0.00*	PKI	0.00*	0.51	0.00*
T	0.98	0.46	0.00*	PRGO	0.00*	0.67	0.88
CTL	0.00*	0.85	0.4	PFE	0.00*	0.14	0.00*
CHTR	0.00*	0.00*	0.00*	DGX	0.00*	0.53	0.00*
CMCSA	0.97	0.21	0.41	REGN	0.00*	0.73	0.74
DISCA	0.00*	0.58	0.00*	RMD	0.23	0.41	0.00*
DISCK	0.00*	0.74	0.00*	STE	0.00*	0.91	0.00*
DISH	0.00*	0.8	0.00*	SYK	0.00*	0.44	0.66
EA	0.5	0.48	0.00*	TFX	0.00*	0.07	0.00*
FB	0.00*	0.86	0.00*	COO	0.00*	0.00*	0.00*
FOXA	0.00*	0.33	0.45	TMO	0.00*	0.08	0.00*
FOX	0.00*	0.9	0.00*	UNH	0.35	0.51	0.00*
IPG	0.00*	0.1	0.00*	UHS	0.00*	0.59	0.00*
LYV	0.00*	0.00*	0.00*	VAR	0.00*	0.64	0.6
NFLX	0.00*	0.14	0.00*	VRTX	0.26	0.77	0.00*
NWSA	0.00*	0.16	0.00*	WAT	0.00*	0.68	0.00*
NWS	0.00*	0.76	0.96	WST	0.00*	0.89	0.00*
OMC	0.00*	0.36	0.00*	ZBH	0.27	0.55	0.00*
TMUS	0.00*	0.43	0.00*	ZTS	0.00*	0.51	0.00*
TTWO	0.14	0.28	0.00*	MMM	0.00*	0.29	0.78
DIS	0.00*	0.66	0.00*	AOS	0.00*	0.83	0.00*
TWTR	0.00*	0.96	0.00*	ALK	0.00*	0.45	0.00*
VZ	0.00*	0.65	0.00*	ALLE	0.00*	0.62	0.00*
VIAC	0.00*	0.23	0.00*	AAL	0.00*	0.38	0.00*
AAP	0.00*	0.51	0.00*	AME	0.00*	0.72	0.00*
AMZN	0.26	0.59	0.00*	BA	0.00*	0.71	0.00*
APTV	0.00*	0.71	0.00*	CHRW	0.00*	0.21	0.00*
AZO	0.00*	0.7	0.00*	CARR	0.00*	0.3	0.00*
BBY	0.00*	0.71	0.05	CAT	0.00*	0.47	0.00*
BKNG	0.00*	0.85	0.00*	CTAS	0.00*	0.24	0.00*
BWA	0.00*	0.98	0.00*	CPRT	0.00*	0.00*	0.00*
KMX	0.00*	0.88	0.00*	CSX	0.00*	0.28	0.00*
CCL	0.00*	0.36	0.00*	CMI	0.00*	0.25	0.00*
CMG	0.00*	0.43	0.00*	DE	0.00*	0.64	0.00*
DHI	0.31	0.43	0.00*	DAL	0.00*	0.54	0.00*
DRI	0.00*	0.17	0.00*	DOV	0.57	0.56	0.00*
DG	0.00*	0.96	0.00*	ETN	0.00*	0.86	0.00*
DLTR	0.00*	0.36	0.00*	EMR	0.00*	0.43	0.84
DPZ	0.00*	0.67	0.00*	EFX	0.00*	0.43	0.00*
EBAY	0.00*	0.89	0.00*	EXPD	0.00*	0.57	0.00*
EXPE	0.00*	0.06	0.53	FAST	0.00*	0.28	0.00*
F	0.00*	0.55	0.00*	FDX	0.00*	0.32	0.00*

Table C- 16 Wald Test results for Portfolio 19, 20, 21 in the US – continued (1)							
Code	P19	P20	P21	Code	P19	P20	P21
GPS	0.00*	0.83	0.00*	FLS	0.68	0.74	0.00*
GRMN	0.00*	0.79	0.00*	FTV	0.00*	0.91	0.00*
GM	0.00*	0.15	0.00*	FBHS	0.00*	0.5	0.00*
GPC	0.00*	0.38	0.00*	GD	0.00*	0.78	0.00*
HRB	0.9	0.98	0.00*	GE	0.00*	0.12	0.00*
HBI	0.00*	0.16	0.00*	GWW	0.00*	0.52	0.00*
HAS	0.00*	0.28	0.00*	HON	0.00*	0.41	0.00*
HLT	0.00*	0.99	0.00*	HWM	0.00*	0.51	0.00*
HD	0.00*	0.17	0.00*	HII	0.00*	0.51	0.00*
KSS	0.00*	0.26	0.00*	IEX	0.00*	0.47	0.00*
LB	0.00*	0.5	0.33	INFO	0.00*	0.31	0.00*
LVS	0.00*	0.61	0.00*	ITW	0.00*	0.34	0.00*
LEG	0.00*	0.3	0.00*	IR	0.00*	0.47	0.00*
LEN	0.87	0.58	0.00*	JBHT	0.00*	0.82	0.33
LKQ	0.00*	0.26	0.00*	J	0.55	0.61	0.00*
LOW	0.00*	0.00*	0.00*	JCI	0.00*	0.23	0.00*
MAR	0.00*	0.57	0.00*	KSU	0.00*	0.4	0.00*
MCD	0.00*	0.94	0.00*	LHX	0.00*	0.09	0.00*
MGM	0.00*	0.71	0.00*	LMT	0.00*	0.8	0.00*
MHK	0.00*	0.85	0.77	MAS	0.00*	0.11	0.00*
NWL	0.00*	0.68	0.00*	NLSN	0.00*	0.39	0.00*
NKE	0.00*	0.84	0.00*	NSC	0.00*	0.53	0.00*
NCLH	0.00*	0.58	0.00*	NOC	0.00*	0.08	0.00*
NVR	0.00*	0.18	0.00*	ODFL	0.00*	0.65	0.00*
ORLY	0.00*	0.96	0.00*	OTIS	0.00*	0.16	0.00*
PHM	0.51	0.3	0.00*	PCAR	0.78	0.19	0.07
PVH	0.00*	0.86	0.00*	PH	0.00*	0.46	0.00*
RL	0.00*	0.61	0.00*	PNR	0.00*	0.73	0.00*
ROST	0.00*	0.06	0.07	PWR	0.00*	0.35	0.00*
RCL	0.00*	0.66	0.00*	RTX	0.00*	0.86	0.00*
SBUX	0.00*	0.74	0.00*	RSG	0.00*	0.5	0.00*
TPR	0.00*	0.65	0.00*	RHI	0.00*	0.67	0.00*
TGT	0.00*	0.42	0.00*	ROK	0.43	0.07	0.00*
TIF	0.00*	0.52	0.00*	ROL	0.00*	0.25	0.00*
TJX	0.12	0.87	0.00*	ROP	0.00*	0.17	0.37
TSCO	0.00*	0.92	0.33	SNA	0.00*	0.93	0.00*
ULTA	0.00*	0.84	0.00*	LUV	0.00*	0.83	0.00*
UAA	0.00*	0.24	0.00*	SWK	0.00*	0.73	0.00*
UA	0.00*	0.37	0.00*	TDY	0.00*	0.96	0.00*
VFC	0.00*	0.98	0.00*	TXT	0.00*	0.56	0.00*
WHR	0.00*	0.46	0.84	TT	0.00*	0.55	0.57
WYNN	0.00*	0.45	0.00*	TDG	0.00*	0.37	0.00*
YUM	0.00*	0.98	0.00*	UNP	0.00*	0.37	0.00*
MO	0.00*	0.9	0.00*	UAL	0.00*	0.48	0.00*

Table C- 16 Wald Test results for Portfolio 19, 20, 21 in the US – continued (2)							
Code	P19	P20	P21	Code	P19	P20	P21
ADM	0.00*	0.86	0.00*	UPS	0.00*	0.49	0.00*
BF.B	0.00*	0.66	0.00*	URI	0.00*	0.71	0.00*
CPB	0.82	0.07	0.00*	VRSK	0.00*	0.51	0.00*
CHD	0.00*	0.52	0.00*	WAB	0.00*	0.38	0.00*
KO	0.00*	0.2	0.00*	WM	0.00*	0.38	0.00*
CL	0.00*	0.92	0.00*	XYL	0.00*	0.5	0.00*
CAG	0.00*	0.64	0.00*	ACN	0.00*	0.26	0.00*
STZ	0.00*	0.00*	0.00*	ADBE	0.00*	0.59	0.00*
COST	0.00*	0.63	0.72	AMD	0.00*	0.59	0.00*
COTY	0.00*	0.63	0.00*	AKAM	0.58	0.14	0.00*
EL	0.00*	0.9	0.00*	APH	0.00*	0.73	0.00*
GIS	0.88	0.81	0.00*	ADI	0.00*	0.43	0.33
HRL	0.00*	0.29	0.00*	ANSS	0.00*	0.5	0.00*
SJM	0.00*	0.58	0.00*	AAPL	0.00*	0.64	0.00*
K	0.00*	0.32	0.00*	AMAT	0.00*	0.75	0.00*
KMB	0.00*	0.44	0.00*	ANET	0.00*	0.65	0.00*
KHC	0.00*	0.05	0.00*	ADSK	0.00*	0.12	0.00*
KR	0.00*	0.79	0.5	ADP	0.00*	0.73	0.00*
LW	0.00*	0.47	0.00*	AVGO	0.00*	0.7	0.56
MKC	0.00*	0.74	0.00*	BR	0.00*	0.61	0.00*
TAP	0.07	0.9	0.00*	CDNS	0.00*	0.49	0.00*
MDLZ	0.00*	0.49	0.00*	CDW	0.00*	0.17	0.00*
MNST	0.00*	0.48	0.00*	CSCO	0.00*	0.82	0.00*
PEP	0.00*	0.95	0.00*	CTXS	0.00*	0.31	0.00*
PM	0.00*	0.49	0.00*	CTSH	0.00*	0.7	0.00*
PG	0.00*	0.75	0.00*	GLW	0.00*	0.36	0.00*
SYY	0.00*	0.84	0.00*	DXC	0.00*	0.51	0.55
CLX	0.00*	0.79	0.00*	FFIV	0.06	0.86	0.00*
HSY	0.00*	0.7	0.00*	FIS	0.00*	0.06	0.00*
TSN	0.00*	0.06	0.00*	FISV	0.00*	0.44	0.00*
WBA	0.00*	0.33	0.00*	FLT	0.00*	0.96	0.00*
WMT	0.00*	0.94	0.00*	FLIR	0.00*	0.6	0.00*
APA	0.00*	0.78	0.33	FTNT	0.00*	0.28	0.00*
BKR	0.00*	0.28	0.00*	IT	0.00*	0.16	0.00*
COG	0.00*	0.15	0.00*	GPN	0.00*	0.29	0.00*
CVX	0.46	0.17	0.00*	HPE	0.00*	0.74	0.00*
CXO	0.00*	0.5	0.00*	HPQ	0.00*	0.45	0.00*
COP	0.00*	0.47	0.98	INTC	0.00*	0.72	0.00*
DVN	0.00*	0.67	0.00*	IBM	0.00*	0.25	0.00*
FANG	0.00*	0.26	0.00*	INTU	0.00*	0.4	0.00*
EOG	0.00*	0.95	0.00*	IPGP	0.00*	0.00*	0.00*
XOM	0.00*	0.84	0.00*	JKHY	0.00*	0.23	0.99
HAL	0.00*	0.87	0.00*	JNPR	0.00*	0.62	0.00*
HES	0.00*	0.76	0.00*	KEYS	0.00*	0.8	0.00*

Table C- 16 Wald Test results for Portfolio 19, 20, 21 in the US – continued (3)							
Code	P19	P20	P21	Code	P19	P20	P21
HFC	0.00*	0.45	0.18	KLAC	0.00*	0.5	0.00*
KMI	0.00*	0.83	0.00*	LRCX	0.00*	0.7	0.00*
MRO	0.00*	0.47	0.00*	LDOS	0.00*	0.07	0.00*
MPC	0.19	0.33	0.00*	MA	0.00*	0.08	0.00*
NOV	0.00*	0.54	0.00*	MXIM	0.42	0.61	0.00*
NBL	0.00*	0.00*	0.00*	MCHP	0.00*	0.99	0.00*
OXY	0.00*	0.69	0.00*	MU	0.00*	0.07	0.00*
OKE	0.00*	0.55	0.00*	MSFT	0.00*	0.05	0.00*
PSX	0.00*	0.66	0.00*	MSI	0.00*	0.51	0.00*
PXD	0.00*	0.9	0.00*	NTAP	0.00*	0.85	0.00*
SLB	0.00*	0.08	0.00*	NLOK	0.00*	0.21	0.00*
FTI	0.00*	0.54	0.00*	NVDA	0.00*	0.19	0.00*
VLO	0.12	0.11	0.13	ORCL	0.00*	0.66	0.65
WMB	0.00*	0.73	0.00*	PAYX	0.00*	0.97	0.00*
AFL	0.00*	0.35	0.00*	PAYC	0.00*	0.45	0.00*
ALL	0.00*	0.97	0.00*	PYPL	0.00*	0.95	0.78
AXP	0.00*	0.25	0.00*	QRVO	0.00*	0.71	0.00*
AIG	0.00*	0.56	0.00*	QCOM	0.00*	0.11	0.00*
AMP	0.00*	0.73	0.00*	CRM	0.00*	0.44	0.00*
AON	0.00*	0.36	0.00*	STX	0.00*	0.48	0.00*
AJG	0.00*	0.35	0.00*	NOW	0.00*	0.00*	0.00*
AIZ	0.00*	0.67	0.00*	SWKS	0.00*	0.66	0.00*
BAC	0.00*	0.12	0.00*	SNPS	0.29	0.76	0.00*
BRK.B	0.00*	0.91	0.00*	TEL	0.00*	0.35	0.00*
BLK	0.54	0.43	0.12	TXN	0.00*	0.36	0.00*
COF	0.00*	0.69	0.00*	TYL	0.00*	0.06	0.00*
CBOE	0.00*	0.26	0.00*	VRSN	0.00*	0.36	0.00*
SCHW	0.00*	0.24	0.00*	V	0.00*	0.14	0.38
CB	0.00*	0.89	0.00*	WDC	0.00*	0.21	0.00*
CINF	0.00*	0.48	0.00*	WU	0.00*	0.27	0.00*
C	0.00*	0.07	0.00*	XRX	0.00*	0.94	0.00*
CFG	0.00*	0.37	0.00*	XLNX	0.00*	0.96	0.00*
CME	0.00*	0.4	0.00*	ZBRA	0.00*	0.56	0.00*
CMA	0.00*	0.28	0.59	APD	0.00*	0.7	0.00*
DFS	0.00*	0.7	0.00*	ALB	0.00*	0.62	0.00*
ETFC	0.00*	0.07	0.00*	AMCR	0.00*	0.47	0.00*
RE	0.1	0.18	0.15	AVY	0.00*	0.73	0.00*
FITB	0.00*	0.59	0.00*	BLL	0.00*	0.79	0.00*
FRC	0.00*	0.33	0.00*	CE	0.00*	0.98	0.92
BEN	0.00*	0.29	0.00*	CF	0.00*	0.26	0.00*
GL	0.00*	0.83	0.00*	CTVA	0.00*	0.47	0.00*
GS	0.00*	0.44	0.00*	DOW	0.00*	0.37	0.00*
HIG	0.00*	0.19	0.00*	DD	0.00*	0.97	0.00*
HBAN	0.00*	0.98	0.00*	EMN	0.88	0.17	0.00*

Table C- 16 Wald Test results for Portfolio 19, 20, 21 in the US – continued (4)							
Code	P19	P20	P21	Code	P19	P20	P21
ICE	0.00*	0.33	0.00*	ECL	0.00*	0.96	0.00*
IVZ	0.00*	0.32	0.00*	FMC	0.00*	0.46	0.41
JPM	0.00*	0.44	0.00*	FCX	0.00*	0.75	0.00*
KEY	0.00*	0.00*	0.00*	IFF	0.00*	0.5	0.00*
LNC	0.47	0.97	0.00*	IP	0.00*	0.7	0.00*
L	0.00*	0.58	0.00*	LIN	0.00*	0.59	0.00*
MTB	0.00*	0.36	0.00*	LYB	0.00*	0.23	0.00*
MKTX	0.00*	0.75	0.95	MLM	0.00*	0.97	0.00*
MMC	0.00*	0.16	0.00*	NEM	0.00*	0.71	0.00*
MET	0.00*	0.44	0.00*	NUE	0.00*	0.98	0.13
MCO	0.00*	0.19	0.00*	PKG	0.00*	0.18	0.00*
MS	0.00*	0.57	0.00*	PPG	0.00*	0.55	0.00*
MSCI	0.00*	0.77	0.00*	SEE	0.00*	0.05	0.29
NDAQ	0.00*	0.76	0.00*	SHW	0.00*	0.59	0.00*
NTRS	0.00*	0.1	0.00*	MOS	0.00*	0.25	0.00*
PBCT	0.00*	0.56	0.00*	VMC	0.00*	0.3	0.00*
PNC	0.53	0.8	0.00*	WRK	0.00*	0.41	0.55
PFG	0.00*	0.35	0.00*	ARE	0.00*	0.7	0.00*
PGR	0.00*	0.65	0.00*	AMT	0.00*	0.00*	0.00*
PRU	0.00*	0.41	0.00*	AIV	0.00*	0.34	0.00*
RJF	0.00*	0.69	0.00*	AVB	0.55	0.23	0.00*
RF	0.00*	0.68	0.00*	BXP	0.00*	0.26	0.00*
SPGI	0.00*	0.51	0.63	CBRE	0.00*	0.05	0.00*
STT	0.00*	0.15	0.00*	CCI	0.00*	0.85	0.00*
SIVB	0.00*	0.34	0.00*	DLR	0.00*	0.79	0.00*
SYF	0.00*	0.1	0.00*	DRE	0.00*	0.92	0.00*
TROW	0.00*	0.94	0.00*	EQIX	0.00*	0.13	0.00*
BK	0.00*	0.00*	0.00*	EQR	0.00*	0.11	0.3
TRV	0.00*	0.7	0.00*	ESS	0.00*	0.62	0.00*
TFC	0.00*	0.73	0.00*	EXR	0.00*	0.08	0.00*
USB	0.00*	0.89	0.00*	FRT	0.00*	0.13	0.00*
UNM	0.00*	0.92	0.00*	PEAK	0.00*	0.49	0.38
WRB	0.00*	0.08	0.00*	HST	0.00*	0.09	0.00*
WFC	0.00*	0.73	0.00*	IRM	0.00*	0.27	0.00*
WLTW	0.00*	0.16	0.00*	KIM	0.00*	0.47	0.00*
ZION	0.00*	0.85	0.00*	MAA	0.00*	0.43	0.00*
ABT	0.00*	0.59	0.00*	PLD	0.00*	0.15	0.00*
ABBV	0.00*	0.99	0.93	PSA	0.00*	0.99	0.00*
ABMD	0.00*	0.21	0.00*	O	0.79	0.52	0.00*
A	0.00*	0.75	0.00*	REG	0.00*	0.25	0.00*
ALXN	0.00*	0.44	0.00*	SBAC	0.00*	0.89	0.00*
ALGN	0.00*	0.05	0.00*	SPG	0.00*	0.32	0.00*
ABC	0.00*	0.17	0.00*	SLG	0.00*	0.36	0.00*
AMGN	0.00*	0.78	0.00*	UDR	0.00*	0.34	0.00*

Table C- 16 Wald Test results for Portfolio 19, 20, 21 in the US – continued (5)							
Code	P19	P20	P21	Code	P19	P20	P21
ANTM	0.00*	0.73	0.00*	VTR	0.00*	0.22	0.00*
BAX	0.00*	0.28	0.00*	VNO	0.00*	0.97	0.00*
BDX	0.00*	0.73	0.00*	WELL	0.00*	0.52	0.00*
BIO	0.00*	0.92	0.00*	WY	0.00*	0.85	0.00*
BIIB	0.00*	0.78	0.00*	Symbol	0.00*	0.98	0.00*
BSX	0.47	0.3	0.00*	AES	0.00*	0.28	0.69
BMY	0.00*	0.42	0.00*	LNT	0.00*	0.92	0.00*
CAH	0.00*	0.34	0.00*	AEE	0.00*	0.33	0.00*
CNC	0.00*	0.36	0.29	AEP	0.00*	0.78	0.00*
CERN	0.00*	0.19	0.00*	AWK	0.00*	0.95	0.00*
CI	0.00*	0.33	0.00*	ATO	0.00*	0.66	0.00*
CVS	0.00*	0.92	0.00*	CNP	0.00*	0.27	0.00*
DHR	0.00*	0.93	0.00*	CMS	0.00*	0.72	0.00*
DVA	0.00*	0.71	0.00*	ED	0.00*	0.11	0.00*
XRAY	0.00*	0.32	0.00*	D	0.08	0.11	0.00*
DXCM	0.00*	0.25	0.00*	DTE	0.00*	0.67	0.00*
EW	0.00*	0.48	0.00*	DUK	0.00*	0.51	0.00*
GILD	0.00*	0.53	0.00*	EIX	0.00*	0.68	0.00*
HCA	0.00*	0.38	0.00*	ETR	0.00*	0.54	0.00*
HSIC	0.00*	0.93	0.00*	EVRG	0.00*	0.34	0.00*
HOLX	0.00*	0.79	0.00*	ES	0.00*	0.65	0.95
HUM	0.00*	0.21	0.00*	EXC	0.00*	0.92	0.00*
IDXX	0.64	0.36	0.00*	FE	0.00*	0.76	0.00*
ILMN	0.00*	0.57	0.97	NEE	0.00*	0.26	0.00*
INCY	0.00*	0.11	0.00*	NI	0.00*	0.99	0.00*
ISRG	0.00*	0.57	0.00*	NRG	0.00*	0.73	0.00*
IQV	0.00*	0.36	0.00*	PNW	0.00*	0.62	0.00*
JNJ	0.00*	0.79	0.00*	PPL	0.00*	0.18	0.00*
LH	0.00*	0.16	0.00*	PEG	0.00*	0.56	0.00*
LLY	0.00*	0.61	0.00*	SRE	0.00*	0.97	0.00*
MCK	0.00*	0.22	0.74	SO	0.13	0.94	0.00*
MDT	0.00*	0.15	0.00*	WEC	0.00*	0.18	0.00*
MRK	0.00*	0.27	0.00*	XEL	0.00*	0.15	0.94
Note: * represent the statistical significance at the 5% level.							

Table C- 17 Wald Test results for Portfolio 22, 23, 24 in the US

Code	P22	P23	P24	Code	P22	P23	P24
ATVI	0.00*	0.00*	0.57	MTD	0.00*	0.00*	0.00*
GOOGL	0.88	0.22	0.00*	MYL	0.00*	0.24	0.99
GOOG	0.00*	0.00*	0.00*	PKI	0.15	0.00*	0.00*
T	0.3	0.00*	0.56	PRGO	0.00*	0.82	0.00*
CTL	0.00*	0.00*	0.00*	PFE	0.67	0.00*	0.12
CHTR	0.00*	0.52	0.39	DGX	0.00*	0.00*	0.00*
CMCSA	0.00*	0.00*	0.00*	REGN	0.00*	0.00*	0.00*
DISCA	0.00*	0.00*	0.00*	RMD	0.00*	0.00*	0.00*
DISCK	0.12	0.00*	0.00*	STE	0.00*	0.42	0.00*
DISH	0.00*	0.00*	0.00*	SYK	0.00*	0.00*	0.00*
EA	0.00*	0.35	0.00*	TFX	0.00*	0.33	0.00*
FB	0.00*	0.00*	0.00*	COO	0.00*	0.00*	0.26
FOXA	0.00*	0.00*	0.00*	TMO	0.00*	0.00*	0.00*
FOX	0.00*	0.00*	0.00*	UNH	0.79	0.00*	0.00*
IPG	0.00*	0.00*	0.44	UHS	0.00*	0.00*	0.97
LYV	0.00*	0.00*	0.00*	VAR	0.00*	0.00*	0.00*
NFLX	0.00*	0.00*	0.00*	VRTX	0.00*	0.00*	0.00*
NWSA	0.79	0.47	0.00*	WAT	0.00*	0.00*	0.00*
NWS	0.00*	0.00*	0.00*	WST	0.00*	0.00*	0.00*
OMC	0.00*	0.00*	0.00*	ZBH	0.65	0.09	0.00*
TMUS	0.00*	0.00*	0.3	ZTS	0.00*	0.00*	0.00*
TTWO	0.00*	0.00*	0.00*	MMM	0.00*	0.00*	0.00*
DIS	0.00*	0.00*	0.00*	AOS	0.00*	0.00*	0.00*
TWTR	0.00*	0.00*	0.00*	ALK	0.00*	0.00*	0.00*
VZ	0.00*	0.00*	0.00*	ALLE	0.00*	0.00*	0.00*
VIAC	0.00*	0.00*	0.00*	AAL	0.00*	0.00*	0.00*
AAP	0.00*	0.00*	0.00*	AME	0.00*	0.00*	0.00*
AMZN	0.00*	0.00*	0.00*	BA	0.00*	0.00*	0.00*
APTV	0.00*	0.65	0.00*	CHRW	0.00*	0.00*	0.89
AZO	0.36	0.00*	0.00*	CARR	0.00*	0.00*	0.00*
BBY	0.00*	0.00*	0.00*	CAT	0.00*	0.00*	0.00*
BKNG	0.00*	0.00*	0.00*	CTAS	0.74	0.68	0.00*
BWA	0.00*	0.86	0.00*	CPRT	0.00*	0.00*	0.00*
KMX	0.00*	0.00*	0.25	CSX	0.00*	0.00*	0.00*
CCL	0.00*	0.00*	0.00*	CMI	0.00*	0.00*	0.00*
CMG	0.00*	0.93	0.00*	DE	0.08	0.00*	0.00*
DHI	0.00*	0.00*	0.00*	DAL	0.00*	0.00*	0.00*
DRI	0.00*	0.00*	0.00*	DOV	0.00*	0.00*	0.00*
DG	0.00*	0.00*	0.00*	ETN	0.00*	0.00*	0.00*
DLTR	0.00*	0.00*	0.00*	EMR	0.00*	0.00*	0.00*
DPZ	0.00*	0.00*	0.00*	EFX	0.00*	0.00*	0.00*
EBAY	0.8	0.00*	0.08	EXPD	0.00*	0.00*	0.00*
EXPE	0.00*	0.00*	0.00*	FAST	0.00*	0.00*	0.00*
F	0.00*	0.00*	0.00*	FDX	0.00*	0.00*	0.36

Table C- 17 Wald Test results for Portfolio 22, 23, 24 in the US – continued (1)							
Code	P22	P23	P24	Code	P22	P23	P24
GPS	0.00*	0.00*	0.00*	FLS	0.00*	0.00*	0.00*
GRMN	0.00*	0.00*	0.00*	FTV	0.00*	0.00*	0.00*
GM	0.00*	0.00*	0.00*	FBHS	0.00*	0.74	0.00*
GPC	0.00*	0.23	0.00*	GD	0.00*	0.00*	0.00*
HRB	0.00*	0.00*	0.00*	GE	0.00*	0.00*	0.00*
HBI	0.00*	0.00*	0.00*	GWW	0.92	0.00*	0.00*
HAS	0.00*	0.00*	0.00*	HON	0.00*	0.00*	0.00*
HLT	0.00*	0.00*	0.00*	HWM	0.00*	0.00*	0.00*
HD	0.00*	0.94	0.00*	HII	0.00*	0.00*	0.00*
KSS	0.00*	0.00*	0.00*	IEX	0.00*	0.00*	0.00*
LB	0.00*	0.00*	0.00*	INFO	0.00*	0.00*	0.00*
LVS	0.00*	0.00*	0.00*	ITW	0.00*	0.00*	0.00*
LEG	0.18	0.67	0.36	IR	0.00*	0.00*	0.00*
LEN	0.00*	0.00*	0.00*	JBHT	0.38	0.00*	0.00*
LKQ	0.00*	0.00*	0.00*	J	0.00*	0.00*	0.92
LOW	0.00*	0.00*	0.00*	JCI	0.00*	0.00*	0.00*
MAR	0.00*	0.00*	0.00*	KSU	0.00*	0.00*	0.00*
MCD	0.00*	0.00*	0.00*	LHX	0.00*	0.55	0.00*
MGM	0.00*	0.00*	0.00*	LMT	0.75	0.00*	0.00*
MHK	0.00*	0.00*	0.00*	MAS	0.00*	0.00*	0.00*
NWL	0.00*	0.00*	0.00*	NLSN	0.00*	0.00*	0.00*
NKE	0.89	0.00*	0.38	NSC	0.00*	0.00*	0.00*
NCLH	0.00*	0.00*	0.00*	NOC	0.00*	0.00*	0.00*
NVR	0.00*	0.00*	0.00*	ODFL	0.00*	0.00*	0.00*
ORLY	0.00*	0.1	0.00*	OTIS	0.00*	0.00*	0.00*
PHM	0.00*	0.00*	0.00*	PCAR	0.54	0.00*	0.00*
PVH	0.00*	0.00*	0.00*	PH	0.00*	0.00*	0.00*
RL	0.12	0.00*	0.00*	PNR	0.00*	0.00*	0.00*
ROST	0.00*	0.18	0.00*	PWR	0.00*	0.00*	0.00*
RCL	0.00*	0.00*	0.00*	RTX	0.00*	0.07	0.81
SBUX	0.00*	0.00*	0.00*	RSG	0.00*	0.00*	0.00*
TPR	0.00*	0.00*	0.00*	RHI	0.00*	0.00*	0.00*
TGT	0.00*	0.00*	0.00*	ROK	0.00*	0.00*	0.00*
TIF	0.00*	0.00*	0.00*	ROL	0.00*	0.00*	0.00*
TJX	0.00*	0.00*	0.00*	ROP	0.00*	0.00*	0.00*
TSCO	0.00*	0.00*	0.00*	SNA	0.00*	0.00*	0.00*
ULTA	0.00*	0.00*	0.00*	LUV	0.00*	0.00*	0.00*
UAA	0.00*	0.00*	0.57	SWK	0.51	0.00*	0.00*
UA	0.00*	0.00*	0.00*	TDY	0.00*	0.00*	0.00*
VFC	0.00*	0.42	0.00*	TXT	0.00*	0.00*	0.00*
WHR	0.00*	0.00*	0.00*	TT	0.00*	0.00*	0.00*
WYNN	0.00*	0.00*	0.00*	TDG	0.00*	0.00*	0.00*
YUM	0.26	0.00*	0.00*	UNP	0.00*	0.00*	0.00*
MO	0.00*	0.00*	0.00*	UAL	0.00*	0.00*	0.00*

Table C- 17 Wald Test results for Portfolio 22, 23, 24 in the US – continued (2)

Code	P22	P23	P24	Code	P22	P23	P24
ADM	0.00*	0.00*	0.00*	UPS	0.00*	0.78	0.41
BF.B	0.00*	0.00*	0.85	URI	0.00*	0.00*	0.00*
CPB	0.00*	0.11	0.00*	VRSK	0.00*	0.00*	0.00*
CHD	0.00*	0.00*	0.00*	WAB	0.00*	0.00*	0.00*
KO	0.00*	0.00*	0.00*	WM	0.00*	0.00*	0.00*
CL	0.00*	0.00*	0.00*	XYL	0.99	0.00*	0.00*
CAG	0.00*	0.00*	0.00*	ACN	0.00*	0.00*	0.00*
STZ	0.00*	0.00*	0.00*	ADBE	0.00*	0.00*	0.00*
COST	0.00*	0.00*	0.00*	AMD	0.00*	0.00*	0.00*
COTY	0.00*	0.00*	0.00*	AKAM	0.00*	0.00*	0.00*
EL	0.82	0.63	0.00*	APH	0.00*	0.00*	0.00*
GIS	0.00*	0.00*	0.00*	ADI	0.00*	0.00*	0.00*
HRL	0.00*	0.00*	0.00*	ANSS	0.00*	0.00*	0.00*
SJM	0.00*	0.00*	0.00*	AAPL	0.11	0.00*	0.00*
K	0.00*	0.00*	0.00*	AMAT	0.00*	0.00*	0.00*
KMB	0.00*	0.00*	0.00*	ANET	0.00*	0.52	0.42
KHC	0.00*	0.00*	0.00*	ADSK	0.00*	0.00*	0.00*
KR	0.64	0.00*	0.86	ADP	0.00*	0.00*	0.00*
LW	0.00*	0.00*	0.00*	AVGO	0.00*	0.00*	0.00*
MKC	0.00*	0.79	0.00*	BR	0.00*	0.00*	0.00*
TAP	0.00*	0.00*	0.00*	CDNS	0.32	0.00*	0.61
MDLZ	0.00*	0.00*	0.00*	CDW	0.00*	0.00*	0.00*
MNST	0.00*	0.00*	0.17	CSCO	0.00*	0.00*	0.00*
PEP	0.00*	0.00*	0.00*	CTXS	0.00*	0.00*	0.00*
PM	0.00*	0.00*	0.00*	CTSH	0.00*	0.00*	0.00*
PG	0.75	0.65	0.00*	GLW	0.00*	0.00*	0.00*
SYY	0.00*	0.00*	0.00*	DXC	0.00*	0.00*	0.00*
CLX	0.00*	0.00*	0.00*	FFIV	0.00*	0.00*	0.00*
HSY	0.00*	0.00*	0.00*	FIS	0.00*	0.00*	0.00*
TSN	0.00*	0.00*	0.00*	FISV	0.00*	0.00*	0.00*
WBA	0.00*	0.00*	0.00*	FLT	0.00*	0.61	0.37
WMT	0.00*	0.00*	0.00*	FLIR	0.00*	0.00*	0.00*
APA	0.00*	0.00*	0.00*	FTNT	0.00*	0.00*	0.00*
BKR	0.00*	0.00*	0.00*	IT	0.00*	0.00*	0.00*
COG	0.00*	0.67	0.00*	GPN	0.00*	0.00*	0.00*
CVX	0.00*	0.00*	0.00*	HPE	0.00*	0.00*	0.00*
CXO	0.00*	0.00*	0.00*	HPQ	0.00*	0.00*	0.00*
COP	0.00*	0.00*	0.00*	INTC	0.00*	0.00*	0.00*
DVN	0.00*	0.00*	0.00*	IBM	0.57	0.00*	0.00*
FANG	0.00*	0.00*	0.00*	INTU	0.00*	0.87	0.00*
EOG	0.14	0.00*	0.00*	IPGP	0.00*	0.00*	0.00*
XOM	0.00*	0.00*	0.00*	JKHY	0.00*	0.00*	0.28
HAL	0.00*	0.00*	0.00*	JNPR	0.00*	0.13	0.00*
HES	0.00*	0.34	0.00*	KEYS	0.00*	0.00*	0.00*

Table C- 17 Wald Test results for Portfolio 22, 23, 24 in the US – continued (3)							
Code	P22	P23	P24	Code	P22	P23	P24
HFC	0.00*	0.00*	0.00*	KLAC	0.00*	0.00*	0.00*
KMI	0.00*	0.00*	0.00*	LRCX	0.92	0.00*	0.07
MRO	0.00*	0.00*	0.81	LDOS	0.00*	0.00*	0.00*
MPC	0.00*	0.00*	0.00*	MA	0.00*	0.00*	0.00*
NOV	0.00*	0.00*	0.00*	MXIM	0.00*	0.00*	0.00*
NBL	0.00*	0.00*	0.00*	MCHP	0.00*	0.00*	0.00*
OXY	0.00*	0.00*	0.00*	MU	0.00*	0.00*	0.00*
OKE	0.00*	0.00*	0.00*	MSFT	0.00*	0.00*	0.00*
PSX	0.00*	0.57	0.00*	MSI	0.00*	0.00*	0.00*
PXD	0.00*	0.00*	0.00*	NTAP	0.4	0.00*	0.00*
SLB	0.00*	0.00*	0.00*	NLOK	0.00*	0.00*	0.00*
FTI	0.2	0.00*	0.00*	NVDA	0.00*	0.00*	0.00*
VLO	0.00*	0.00*	0.00*	ORCL	0.00*	0.00*	0.00*
WMB	0.00*	0.00*	0.00*	PAYX	0.00*	0.25	0.00*
AFL	0.00*	0.00*	0.00*	PAYC	0.00*	0.00*	0.00*
ALL	0.00*	0.00*	0.00*	PYPL	0.00*	0.00*	0.00*
AXP	0.00*	0.00*	0.00*	QRVO	0.00*	0.00*	0.00*
AIG	0.00*	0.7	0.00*	QCOM	0.00*	0.00*	0.00*
AMP	0.00*	0.00*	0.00*	CRM	0.00*	0.66	0.00*
AON	0.00*	0.00*	0.00*	STX	0.00*	0.00*	0.45
AJG	0.00*	0.00*	0.00*	NOW	0.00*	0.00*	0.00*
AIZ	0.00*	0.00*	0.00*	SWKS	0.00*	0.00*	0.00*
BAC	0.00*	0.00*	0.00*	SNPS	0.00*	0.00*	0.00*
BRK.B	0.00*	0.00*	0.8	TEL	0.00*	0.00*	0.00*
BLK	0.55	0.00*	0.00*	TXN	0.00*	0.00*	0.00*
COF	0.00*	0.00*	0.00*	TYL	0.00*	0.17	0.00*
CBOE	0.00*	0.00*	0.00*	VRSN	0.00*	0.00*	0.00*
SCHW	0.00*	0.00*	0.88	V	0.97	0.00*	0.00*
CB	0.00*	0.00*	0.00*	WDC	0.00*	0.00*	0.36
CINF	0.18	0.14	0.00*	WU	0.00*	0.00*	0.00*
C	0.00*	0.00*	0.00*	XRX	0.00*	0.00*	0.00*
CFG	0.00*	0.00*	0.00*	XLNX	0.00*	0.00*	0.00*
CME	0.00*	0.00*	0.00*	ZBRA	0.00*	0.00*	0.00*
CMA	0.00*	0.00*	0.00*	APD	0.00*	0.00*	0.00*
DFS	0.00*	0.00*	0.00*	ALB	0.00*	0.00*	0.00*
ETFC	0.00*	0.00*	0.00*	AMCR	0.00*	0.00*	0.00*
RE	0.00*	0.00*	0.00*	AVY	0.00*	0.00*	0.00*
FITB	0.00*	0.00*	0.00*	BLL	0.00*	0.00*	0.00*
FRC	0.00*	0.00*	0.00*	CE	0.00*	0.00*	0.00*
BEN	0.00*	0.00*	0.00*	CF	0.00*	0.00*	0.00*
GL	0.00*	0.00*	0.00*	CTVA	0.00*	0.47	0.00*
GS	0.00*	0.97	0.00*	DOW	0.00*	0.00*	0.00*
HIG	0.00*	0.00*	0.00*	DD	0.00*	0.00*	0.00*
HBAN	0.00*	0.00*	0.00*	EMN	0.00*	0.00*	0.00*

Table C- 17 Wald Test results for Portfolio 22, 23, 24 in the US – continued (4)							
Code	P22	P23	P24	Code	P22	P23	P24
ICE	0.9	0.00*	0.00*	ECL	0.00*	0.35	0.00*
IVZ	0.00*	0.00*	0.00*	FMC	0.3	0.00*	0.00*
JPM	0.00*	0.00*	0.00*	FCX	0.00*	0.00*	0.00*
KEY	0.00*	0.00*	0.00*	IFF	0.00*	0.00*	0.00*
LNC	0.00*	0.00*	0.00*	IP	0.00*	0.00*	0.00*
L	0.00*	0.00*	0.00*	LIN	0.00*	0.00*	0.00*
MTB	0.51	0.11	0.64	LYB	0.00*	0.00*	0.00*
MKTX	0.00*	0.00*	0.00*	MLM	0.00*	0.00*	0.00*
MMC	0.00*	0.00*	0.00*	NEM	0.00*	0.26	0.06
MET	0.00*	0.00*	0.00*	NUE	0.58	0.00*	0.00*
MCO	0.00*	0.00*	0.00*	PKG	0.00*	0.00*	0.00*
MS	0.00*	0.00*	0.00*	PPG	0.00*	0.00*	0.00*
MSCI	0.00*	0.00*	0.00*	SEE	0.00*	0.00*	0.00*
NDAQ	0.00*	0.00*	0.00*	SHW	0.00*	0.00*	0.00*
NTRS	0.00*	0.00*	0.00*	MOS	0.00*	0.00*	0.00*
PBCT	0.00*	0.86	0.00*	VMC	0.00*	0.00*	0.00*
PNC	0.00*	0.00*	0.00*	WRK	0.58	0.00*	0.00*
PFG	0.00*	0.00*	0.00*	ARE	0.00*	0.00*	0.00*
PGR	0.00*	0.00*	0.00*	AMT	0.00*	0.00*	0.00*
PRU	0.00*	0.00*	0.00*	AIV	0.00*	0.00*	0.00*
RJF	0.00*	0.00*	0.00*	AVB	0.00*	0.66	0.00*
RF	0.00*	0.00*	0.00*	BXP	0.00*	0.00*	0.00*
SPGI	0.00*	0.00*	0.00*	CBRE	0.00*	0.58	0.00*
STT	0.00*	0.00*	0.00*	CCI	0.00*	0.00*	0.00*
SIVB	0.00*	0.73	0.00*	DLR	0.00*	0.00*	0.00*
SYF	0.00*	0.00*	0.00*	DRE	0.00*	0.00*	0.00*
TROW	0.00*	0.00*	0.00*	EQIX	0.59	0.00*	0.00*
BK	0.00*	0.16	0.00*	EQR	0.00*	0.00*	0.00*
TRV	0.00*	0.00*	0.00*	ESS	0.00*	0.00*	0.00*
TFC	0.00*	0.00*	0.00*	EXR	0.00*	0.00*	0.00*
USB	0.25	0.00*	0.91	FRT	0.00*	0.00*	0.00*
UNM	0.00*	0.00*	0.00*	PEAK	0.81	0.00*	0.00*
WRB	0.58	0.00*	0.00*	HST	0.00*	0.37	0.00*
WFC	0.00*	0.00*	0.00*	IRM	0.00*	0.00*	0.00*
WLTW	0.00*	0.00*	0.00*	KIM	0.00*	0.00*	0.00*
ZION	0.00*	0.00*	0.00*	MAA	0.00*	0.00*	0.69
ABT	0.00*	0.55	0.00*	PLD	0.93	0.00*	0.00*
ABBV	0.99	0.00*	0.00*	PSA	0.00*	0.00*	0.00*
ABMD	0.00*	0.00*	0.00*	O	0.00*	0.00*	0.00*
A	0.00*	0.00*	0.00*	REG	0.00*	0.00*	0.00*
ALXN	0.00*	0.00*	0.00*	SBAC	0.00*	0.00*	0.00*
ALGN	0.00*	0.00*	0.00*	SPG	0.00*	0.00*	0.00*
ABC	0.00*	0.00*	0.00*	SLG	0.00*	0.00*	0.00*
AMGN	0.00*	0.00*	0.00*	UDR	0.00*	0.00*	0.00*

Table C- 17 Wald Test results for Portfolio 22, 23, 24 in the US – continued (5)							
Code	P22	P23	P24	Code	P22	P23	P24
ANTM	0.00*	0.00*	0.00*	VTR	0.00*	0.98	0.00*
BAX	0.00*	0.09	0.00*	VNO	0.79	0.00*	0.00*
BDX	0.00*	0.00*	0.00*	WELL	0.00*	0.00*	0.00*
BIO	0.00*	0.00*	0.00*	WY	0.00*	0.28	0.00*
BIIB	0.57	0.00*	0.00*	Symbol	0.00*	0.00*	0.00*
BSX	0.00*	0.00*	0.00*	AES	0.08	0.00*	0.00*
BMY	0.00*	0.00*	0.00*	LNT	0.00*	0.00*	0.00*
CAH	0.00*	0.00*	0.11	AEE	0.00*	0.00*	0.00*
CNC	0.00*	0.00*	0.00*	AEP	0.00*	0.00*	0.00*
CERN	0.00*	0.00*	0.00*	AWK	0.00*	0.00*	0.00*
CI	0.00*	0.00*	0.00*	ATO	0.00*	0.00*	0.00*
CVS	0.00*	0.00*	0.00*	CNP	0.00*	0.00*	0.00*
DHR	0.00*	0.00*	0.00*	CMS	0.00*	0.86	0.99
DVA	0.00*	0.84	0.00*	ED	0.00*	0.00*	0.00*
XRAY	0.00*	0.00*	0.00*	D	0.00*	0.00*	0.00*
DXCM	0.00*	0.00*	0.00*	DTE	0.00*	0.00*	0.00*
EW	0.00*	0.00*	0.00*	DUK	0.97	0.00*	0.00*
GILD	0.00*	0.00*	0.00*	EIX	0.00*	0.00*	0.00*
HCA	0.18	0.00*	0.00*	ETR	0.00*	0.00*	0.00*
HSIC	0.00*	0.00*	0.00*	EVRG	0.00*	0.00*	0.00*
HOLX	0.00*	0.00*	0.00*	ES	0.63	0.00*	0.00*
HUM	0.00*	0.00*	0.00*	EXC	0.00*	0.00*	0.00*
IDXX	0.00*	0.00*	0.5	FE	0.00*	0.00*	0.00*
ILMN	0.93	0.00*	0.00*	NEE	0.00*	0.00*	0.00*
INCY	0.00*	0.00*	0.00*	NI	0.00*	0.61	0.00*
ISRG	0.00*	0.55	0.00*	NRG	0.00*	0.00*	0.00*
IQV	0.00*	0.00*	0.00*	PNW	0.00*	0.00*	0.00*
JNJ	0.00*	0.00*	0.00*	PPL	0.00*	0.00*	0.00*
LH	0.82	0.00*	0.00*	PEG	0.97	0.00*	0.00*
LLY	0.00*	0.00*	0.00*	SRE	0.00*	0.00*	0.00*
MCK	0.16	0.29	0.81	SO	0.00*	0.00*	0.96
MDT	0.00*	0.00*	0.00*	WEC	0.00*	0.53	0.00*
MRK	0.00*	0.00*	0.00*	XEL	0.15	0.00*	0.00*
Note: * represent the statistical significance at the 5% level.							

Table C- 18 Wald Test results for Portfolio 25, 26 in the US

Code	P25	P26	Code	P25	P26
ATVI	0.00*	0.17	MTD	0.00*	0.00*
GOOGL	0.98	0.00*	MYL	0.00*	0.00*
GOOG	0.00*	0.24	PKI	0.93	0.59
T	0.00*	0.00*	PRGO	0.00*	0.00*
CTL	0.00*	0.00*	PFE	0.00*	0.00*
CHTR	0.00*	0.17	DGX	0.00*	0.46
CMCSA	0.84	0.00*	REGN	0.00*	0.00*
DISCA	0.00*	0.00*	RMD	0.45	0.79
DISCK	0.00*	0.8	STE	0.00*	0.00*
DISH	0.00*	0.00*	SYK	0.00*	0.00*
EA	0.00*	0.00*	TFX	0.00*	0.00*
FB	0.00*	0.00*	COO	0.00*	0.00*
FOXA	0.00*	0.00*	TMO	0.24	0.00*
FOX	0.00*	0.00*	UNH	0.00*	0.66
IPG	0.2	0.00*	UHS	0.43	0.00*
LYV	0.00*	0.00*	VAR	0.00*	0.00*
NFLX	0.00*	0.00*	VRTX	0.00*	0.00*
NWSA	0.00*	0.00*	WAT	0.00*	0.00*
NWS	0.77	0.00*	WST	0.00*	0.00*
OMC	0.00*	0.00*	ZBH	0.00*	0.00*
TMUS	0.00*	0.5	ZTS	0.00*	0.00*
TTWO	0.00*	0.00*	MMM	0.00*	0.00*
DIS	0.00*	0.00*	AOS	0.00*	0.00*
TWTR	0.00*	0.97	ALK	0.00*	0.00*
VZ	0.00*	0.00*	ALLE	0.00*	0.00*
VIAC	0.00*	0.00*	AAL	0.00*	0.00*
AAP	0.00*	0.00*	AME	0.21	0.00*
AMZN	0.00*	0.00*	BA	0.00*	0.00*
APTV	0.00*	0.00*	CHRW	0.00*	0.86
AZO	0.00*	0.00*	CARR	0.00*	0.00*
BBY	0.00*	0.00*	CAT	0.00*	0.00*
BKNG	0.00*	0.00*	CTAS	0.00*	0.00*
BWA	0.00*	0.00*	CPRT	0.00*	0.00*
KMX	0.00*	0.00*	CSX	0.00*	0.00*
CCL	0.00*	0.00*	CMI	0.00*	0.00*
CMG	0.06	0.71	DE	0.00*	0.00*
DHI	0.00*	0.00*	DAL	0.00*	0.00*
DRI	0.00*	0.00*	DOV	0.00*	0.00*
DG	0.00*	0.15	ETN	0.91	0.00*
DLTR	0.55	0.00*	EMR	0.00*	0.00*
DPZ	0.00*	0.00*	EFX	0.00*	0.62
EBAY	0.00*	0.00*	EXPD	0.00*	0.00*
EXPE	0.00*	0.00*	FAST	0.00*	0.00*
F	0.00*	0.00*	FDX	0.00*	0.00*

Table C- 18 Wald Test results for Portfolio 25, 26 in the US – continued (1)					
Code	P25	P26	Code	P25	P26
GPS	0.00*	0.00*	FLS	0.24	0.00*
GRMN	0.00*	0.00*	FTV	0.00*	0.00*
GM	0.00*	0.00*	FBHS	0.00*	0.00*
GPC	0.00*	0.00*	GD	0.00*	0.00*
HRB	0.00*	0.00*	GE	0.00*	0.00*
HBI	0.00*	0.00*	GWW	0.00*	0.00*
HAS	0.00*	0.91	HON	0.00*	0.00*
HLT	0.00*	0.00*	HWM	0.00*	0.00*
HD	0.00*	0.00*	HII	0.00*	0.00*
KSS	0.00*	0.76	IEX	0.93	0.00*
LB	0.00*	0.00*	INFO	0.00*	0.00*
LVS	0.00*	0.00*	ITW	0.00*	0.69
LEG	0.85	0.00*	IR	0.00*	0.00*
LEN	0.00*	0.00*	JBHT	0.00*	0.00*
LKQ	0.00*	0.00*	J	0.00*	0.00*
LOW	0.00*	0.00*	JCI	0.00*	0.00*
MAR	0.00*	0.00*	KSU	0.00*	0.00*
MCD	0.00*	0.00*	LHX	0.00*	0.00*
MGM	0.00*	0.00*	LMT	0.79	0.00*
MHK	0.00*	0.00*	MAS	0.00*	0.00*
NWL	0.00*	0.00*	NLSN	0.00*	0.00*
NKE	0.00*	0.49	NSC	0.00*	0.00*
NCLH	0.00*	0.00*	NOC	0.00*	0.00*
NVR	0.00*	0.00*	ODFL	0.06	0.00*
ORLY	0.00*	0.00*	OTIS	0.00*	0.00*
PHM	0.00*	0.00*	PCAR	0.00*	0.00*
PVH	0.00*	0.00*	PH	0.00*	0.49
RL	0.32	0.18	PNR	0.00*	0.00*
ROST	0.00*	0.00*	PWR	0.00*	0.00*
RCL	0.00*	0.00*	RTX	0.00*	0.00*
SBUX	0.00*	0.00*	RSG	0.00*	0.00*
TPR	0.41	0.00*	RHI	0.00*	0.00*
TGT	0.00*	0.00*	ROK	0.00*	0.00*
TIF	0.00*	0.88	ROL	0.84	0.00*
TJX	0.00*	0.00*	ROP	0.00*	0.00*
TSCO	0.00*	0.00*	SNA	0.00*	0.57
ULTA	0.00*	0.00*	LUV	0.00*	0.00*
UAA	0.00*	0.00*	SWK	0.00*	0.00*
UA	0.00*	0.00*	TDY	0.00*	0.00*
VFC	0.00*	0.00*	TXT	0.00*	0.00*
WHR	0.00*	0.00*	TT	0.00*	0.00*
WYNN	0.00*	0.00*	TDG	0.00*	0.00*
YUM	0.00*	0.00*	UNP	0.00*	0.00*
MO	0.00*	0.00*	UAL	0.00*	0.00*

Table C- 18 Wald Test results for Portfolio 25, 26 in the US – continued (2)					
Code	P25	P26	Code	P25	P26
ADM	0.00*	0.00*	UPS	0.00*	0.00*
BF.B	0.00*	0.00*	URI	0.00*	0.00*
CPB	0.00*	0.00*	VRSK	0.00*	0.00*
CHD	0.00*	0.00*	WAB	0.00*	0.06
KO	0.00*	0.15	WM	0.69	0.00*
CL	0.26	0.00*	XYL	0.00*	0.00*
CAG	0.00*	0.00*	ACN	0.00*	0.00*
STZ	0.00*	0.87	ADBE	0.00*	0.00*
COST	0.00*	0.00*	AMD	0.00*	0.00*
COTY	0.00*	0.00*	AKAM	0.00*	0.00*
EL	0.00*	0.00*	APH	0.00*	0.00*
GIS	0.00*	0.00*	ADI	0.00*	0.00*
HRL	0.00*	0.00*	ANSS	0.00*	0.00*
SJM	0.00*	0.86	AAPL	0.00*	0.00*
K	0.00*	0.00*	AMAT	0.00*	0.00*
KMB	0.00*	0.00*	ANET	0.00*	0.93
KHC	0.00*	0.00*	ADSK	0.00*	0.00*
KR	0.00*	0.00*	ADP	0.00*	0.00*
LW	0.00*	0.00*	AVGO	0.00*	0.00*
MKC	0.00*	0.00*	BR	0.53	0.00*
TAP	0.00*	0.00*	CDNS	0.00*	0.00*
MDLZ	0.00*	0.00*	CDW	0.00*	0.00*
MNST	0.00*	0.53	CSCO	0.00*	0.00*
PEP	0.00*	0.00*	CTXS	0.00*	0.00*
PM	0.00*	0.00*	CTSH	0.00*	0.00*
PG	0.00*	0.97	GLW	0.00*	0.00*
SYY	0.00*	0.00*	DXC	0.00*	0.00*
CLX	0.00*	0.00*	FFIV	0.00*	0.6
HSY	0.00*	0.00*	FIS	0.00*	0.00*
TSN	0.98	0.00*	FISV	0.00*	0.00*
WBA	0.00*	0.00*	FLT	0.00*	0.00*
WMT	0.00*	0.39	FLIR	0.29	0.00*
APA	0.00*	0.00*	FTNT	0.00*	0.00*
BKR	0.00*	0.00*	IT	0.00*	0.00*
COG	0.00*	0.3	GPN	0.00*	0.00*
CVX	0.00*	0.00*	HPE	0.00*	0.00*
CXO	0.00*	0.00*	HPQ	0.00*	0.00*
COP	0.00*	0.05	INTC	0.00*	0.00*
DVN	0.00*	0.00*	IBM	0.00*	0.00*
FANG	0.00*	0.00*	INTU	0.00*	0.43
EOG	0.00*	0.00*	IPGP	0.00*	0.00*
XOM	0.00*	0.27	JKHY	0.00*	0.00*
HAL	0.00*	0.00*	JNPR	0.00*	0.00*
HES	0.00*	0.36	KEYS	0.29	0.00*

Table C- 18 Wald Test results for Portfolio 25, 26 in the US – continued (3)					
Code	P25	P26	Code	P25	P26
HFC	0.00*	0.00*	KLAC	0.00*	0.00*
KMI	0.00*	0.00*	LRCX	0.00*	0.00*
MRO	0.00*	0.00*	LDOS	0.00*	0.00*
MPC	0.00*	0.78	MA	0.00*	0.00*
NOV	0.00*	0.00*	MXIM	0.00*	0.00*
NBL	0.00*	0.00*	MCHP	0.00*	0.00*
OXY	0.79	0.00*	MU	0.00*	0.00*
OKE	0.00*	0.00*	MSFT	0.00*	0.00*
PSX	0.00*	0.00*	MSI	0.00*	0.00*
PXD	0.00*	0.00*	NTAP	0.00*	0.00*
SLB	0.00*	0.00*	NLOK	0.00*	0.4
FTI	0.00*	0.99	NVDA	0.00*	0.00*
VLO	0.00*	0.00*	ORCL	0.00*	0.00*
WMB	0.00*	0.26	PAYX	0.00*	0.00*
AFL	0.00*	0.00*	PAYC	0.87	0.00*
ALL	0.00*	0.00*	PYPL	0.00*	0.00*
AXP	0.00*	0.00*	QRVO	0.00*	0.00*
AIG	0.00*	0.43	QCOM	0.00*	0.00*
AMP	0.00*	0.00*	CRM	0.00*	0.00*
AON	0.00*	0.00*	STX	0.00*	0.00*
AJG	0.00*	0.34	NOW	0.00*	0.00*
AIZ	0.00*	0.00*	SWKS	0.00*	0.00*
BAC	0.00*	0.00*	SNPS	0.00*	0.21
BRK.B	0.00*	0.00*	TEL	0.00*	0.00*
BLK	0.00*	0.00*	TXN	0.00*	0.00*
COF	0.00*	0.00*	TYL	0.00*	0.00*
CBOE	0.00*	0.00*	VRSN	0.25	0.00*
SCHW	0.00*	0.75	V	0.00*	0.00*
CB	0.00*	0.00*	WDC	0.00*	0.00*
CINF	0.00*	0.76	WU	0.00*	0.00*
C	0.65	0.00*	XRX	0.00*	0.00*
CFG	0.00*	0.00*	XLNX	0.00*	0.00*
CME	0.00*	0.49	ZBRA	0.00*	0.00*
CMA	0.00*	0.00*	APD	0.00*	0.00*
DFS	0.00*	0.00*	ALB	0.00*	0.61
ETFC	0.00*	0.00*	AMCR	0.00*	0.00*
RE	0.00*	0.00*	AVY	0.00*	0.00*
FITB	0.00*	0.00*	BLL	0.00*	0.00*
FRC	0.00*	0.52	CE	0.00*	0.00*
BEN	0.00*	0.00*	CF	0.00*	0.00*
GL	0.00*	0.00*	CTVA	0.00*	0.00*
GS	0.00*	0.96	DOW	0.15	0.00*
HIG	0.00*	0.00*	DD	0.00*	0.00*
HBAN	0.00*	0.00*	EMN	0.00*	0.93

Table C- 18 Wald Test results for Portfolio 25, 26 in the US – continued (4)					
Code	P25	P26	Code	P25	P26
ICE	0.00*	0.00*	ECL	0.00*	0.00*
IVZ	0.00*	0.00*	FMC	0.00*	0.00*
JPM	0.00*	0.00*	FCX	0.00*	0.8
KEY	0.00*	0.76	IFF	0.72	0.00*
LNC	0.00*	0.00*	IP	0.00*	0.00*
L	0.00*	0.00*	LIN	0.00*	0.00*
MTB	0.00*	0.07	LYB	0.00*	0.00*
MKTX	0.00*	0.00*	MLM	0.00*	0.00*
MMC	0.00*	0.00*	NEM	0.00*	0.00*
MET	0.00*	0.21	NUE	0.00*	0.00*
MCO	0.51	0.00*	PKG	0.00*	0.00*
MS	0.00*	0.00*	PPG	0.00*	0.97
MSCI	0.00*	0.00*	SEE	0.00*	0.00*
NDAQ	0.00*	0.00*	SHW	0.00*	0.00*
NTRS	0.00*	0.00*	MOS	0.00*	0.92
PBCT	0.00*	0.89	VMC	0.91	0.00*
PNC	0.00*	0.00*	WRK	0.00*	0.00*
PFG	0.00*	0.00*	ARE	0.00*	0.00*
PGR	0.00*	0.00*	AMT	0.08	0.67
PRU	0.00*	0.00*	AIV	0.00*	0.00*
RJF	0.00*	0.00*	AVB	0.00*	0.00*
RF	0.00*	0.00*	BXP	0.00*	0.00*
SPGI	0.00*	0.00*	CBRE	0.00*	0.00*
STT	0.00*	0.00*	CCI	0.00*	0.55
SIVB	0.00*	0.45	DLR	0.00*	0.00*
SYF	0.00*	0.00*	DRE	0.00*	0.00*
TROW	0.00*	0.00*	EQIX	0.00*	0.00*
BK	0.00*	0.00*	EQR	0.00*	0.00*
TRV	0.64	0.00*	ESS	0.00*	0.06
TFC	0.00*	0.00*	EXR	0.00*	0.00*
USB	0.00*	0.00*	FRT	0.79	0.00*
UNM	0.00*	0.00*	PEAK	0.00*	0.00*
WRB	0.00*	0.00*	HST	0.00*	0.00*
WFC	0.00*	0.35	IRM	0.00*	0.00*
WLTW	0.00*	0.00*	KIM	0.00*	0.00*
ZION	0.00*	0.00*	MAA	0.00*	0.67
ABT	0.00*	0.00*	PLD	0.00*	0.00*
ABBV	0.00*	0.00*	PSA	0.00*	0.67
ABMD	0.00*	0.00*	O	0.00*	0.00*
A	0.00*	0.00*	REG	0.00*	0.00*
ALXN	0.00*	0.00*	SBAC	0.00*	0.43
ALGN	0.00*	0.00*	SPG	0.00*	0.00*
ABC	0.00*	0.7	SLG	0.00*	0.00*
AMGN	0.00*	0.00*	UDR	0.00*	0.00*

Table C- 18 Wald Test results for Portfolio 25, 26 in the US – continued (5)					
Code	P25	P26	Code	P25	P26
ANTM	0.00*	0.00*	VTR	0.00*	0.71
BAX	0.00*	0.00*	VNO	0.52	0.00*
BDX	0.00*	0.00*	WELL	0.00*	0.00*
BIO	0.00*	0.00*	WY	0.00*	0.00*
BIIB	0.00*	0.73	Symbol	0.00*	0.25
BSX	0.23	0.00*	AES	0.00*	0.00*
BMY	0.00*	0.00*	LNT	0.00*	0.00*
CAH	0.00*	0.00*	AEE	0.00*	0.00*
CNC	0.00*	0.00*	AEP	0.00*	0.00*
CERN	0.00*	0.00*	AWK	0.00*	0.00*
CI	0.00*	0.00*	ATO	0.00*	0.00*
CVS	0.00*	0.51	CNP	0.00*	0.00*
DHR	0.00*	0.00*	CMS	0.00*	0.53
DVA	0.00*	0.00*	ED	0.00*	0.00*
XRAY	0.00*	0.00*	D	0.00*	0.00*
DXCM	0.00*	0.00*	DTE	0.00*	0.00*
EW	0.00*	0.66	DUK	0.00*	0.00*
GILD	0.00*	0.00*	EIX	0.00*	0.24
HCA	0.00*	0.00*	ETR	0.00*	0.00*
HSIC	0.00*	0.00*	EVRG	0.7	0.00*
HOLX	0.00*	0.00*	ES	0.00*	0.00*
HUM	0.00*	0.61	EXC	0.00*	0.72
IDXX	0.00*	0.00*	FE	0.00*	0.00*
ILMN	0.1	0.00*	NEE	0.00*	0.00*
INCY	0.00*	0.83	NI	0.00*	0.00*
ISRG	0.00*	0.00*	NRG	0.00*	0.00*
IQV	0.00*	0.00*	PNW	0.00*	0.00*
JNJ	0.00*	0.72	PPL	0.00*	0.15
LH	0.00*	0.00*	PEG	0.00*	0.00*
LLY	0.75	0.00*	SRE	0.00*	0.00*
MCK	0.00*	0.77	SO	0.00*	0.69
MDT	0.00*	0.00*	WEC	0.00*	0.00*
MRK	0.00*	0.06	XEL	0.58	0.09
Note: * represent the statistical significance at the 5% level.					

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