MALAYSIAN PROPERTY AND CONSTRUCTION COMPANIES: DIVERSIFICATION POTENTIAL, STOCK PRICE BEHAVIOUR AND ITS RESPONSE TOWARDS MACROECONOMIC SHOCKS

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ABSTRACT

This thesis investigates diversification benefits of investing in the property and construction stocks in Malaysia from 1995 to 2013 by using correlation analysis. Panel ARDL (autoregressive distributed lag) is used to examine the relationship between both sectors' stock prices and their fundamental variables (NAV (net asset value), EPS (earnings per share) and DPS (dividend per share)), where it involves panel cointegration and error correction mechanism (ECM). Another objective of this thesis is to discover the impact of macroeconomic shocks on both sectors' stock prices, which is investigated through the impulse response analysis and variance decomposition analysis. Annual data from twenty-eight listed property companies and sixteen listed construction companies are evaluated. Diversification benefits do exist between both sectors' stocks. EPS is a significant fundamental variable for explaining both sectors' stock price change while NAV is only significant in influencing property stock price changes. DPS is not relevant for both sectors. The ECM shows that both sectors' stock prices move back to equilibrium at a fairly similar speed. The impulse response functions results indicate that interest rate changes influence stock prices the most while trade openness shocks have slight effects on the stock prices. Variance decomposition analysis found that the percentage movement in the stock prices is highest when shocked by interest rate changes while trade openness changes do not influence the stock prices significantly. The impact on property stock prices is higher to economic shocks compared to the construction sector. The findings could aid investors in making sound decisions about their investment as it is proven that they could benefit from investing in both sectors. Investors could look into the fundamental variables which are useful in determining the stock prices movements. Policy makers should control the interest rate adjustments, determine the GDP growth rate, monitor the inflation rate and trade openness policies as shocks to these variables are proven to affect stock prices significantly.

Keywords: property sector, construction sector, diversification, fundamental variables, macroeconomic shocks

ABSTRAK

Tesis ini mengkaji manfaat kepelbagaian melabur dalam saham hartanah dan pembinaan di Malaysia dari tahun 1995-2013 dengan menggunakan analisis korelasi. Analisis panel ARDL (autoregresif lat teragih) digunakan untuk mengkaji hubungan di antara harga saham kedua-dua sektor dengan pemboleh ubah–pemboleh ubah asasnya (NAV (nilai aset bersih), EPS (perolehan per syer) dan DPS (dividen per syer)) di mana ia melibatkan kaedah kointegrasi panel dan anggaran pembetulan ralat (ECM). Satu lagi objektif tesis ini adalah untuk mencari kesan kejutan makroekonomi terhadap harga saham kedua-dua sektor yang disiasat melalui analisis tindakbalas impuls dan varians penguraian. Data tahunan daripada dua puluh lapan syarikat hartanah dan enam belas syarikat pembinaan yang tersenarai dalam Bursa Malaysia dinilai. Manfaat kepelbagaian ternyata wujud di antara saham kedua-dua sektor. EPS didapati merupakan pemboleh ubah asas yang penting bagi menerangkan perubahan harga saham kedua-dua sektor manakala NAV hanya penting dalam mempengaruhi perubahan harga saham sektor hartanah sahaja. DPS didapati tidak relevan untuk kedua-dua sektor. ECM menunjukkan bahawa harga saham kedua-dua sektor bergerak kepada keseimbangan pada kelajuan yang agak sama. Keputusan analisis tindakbalas impuls menunjukkan bahawa perubahan kadar faedah paling banyak mempengaruhi harga saham manakala kejutan keterbukaan perdagangan kurang memberi kesan pada harga saham. Analisis varians penguraian mendapati bahawa peratus perubahan dalam harga saham adalah paling tinggi apabila dikejutkan dengan perubahan kadar faedah manakala perubahan keterbukaan perdagangan tidak mempengaruhi harga saham. Kesan ke atas harga saham sektor hartanah adalah lebih tinggi apabila dikejutkan berbanding sektor pembinaan. Hasil kajian ini dapat membantu pelabur dalam membuat keputusan yang bernas kerana terbukti bahawa mereka boleh mendapat manfaat daripada pelaburan dalam kedua-dua sektor. Para pelabur boleh mengawasi pemboleh ubah-pemboleh ubah asas yang didapati berguna dalam menentukan pergerakan harga saham. Pihak kerajaan perlu mengawal pelarasan kadar faedah, menentukan kadar pertumbuhan KDNK (Keluaran Dalam Negara Kasar), memantau kadar inflasi dan dasar keterbukaan perdagangan kerana perubahan pada pemboleh ubah-pemboleh ubah ini terbukti memberi kesan kepada harga saham secara signifikan.

Kata kunci: sektor hartanah, sektor pembinaan, kepelbagaian, nilai-nilai asas, kejutan makroekonomi

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ETP	: Economic Transformation Programme
GNI	: Gross National Income
NKEA	: National Key Economic Area
KL	: Kuala Lumpur
KV	: Klang Valley
GDP	: Gross National Product
MRT	: Mass Rapid Transit
PPP	: Public-Private Partnership
US	: United States of America
UK	: United Kingdom
NAV	: Net Asset Value
ARM	: Adjustable Rate Mortgages
ECM	: Error Correction Mechanism
DPS	: Dividend per Share
EPS	: Earnings per Share
ARDL	: Autoregressive Distributed Lag
CPI	: Consumer Price Index
SC	: Securities Commission
BNM	: Bank Negara Malaysia
CMSA	: Capital Markets and Services Act 2007
BAFIA	: Banking and Financial Institutions Act 1989
NPL	: Non Performing Loan
LTV	: Loan-To-Value
KLCI	: Kuala Lumpur Composite Index
FTSE	: Financial Times Stock Exchange
MESDAQ	: Malaysian Exchange of Securities Dealing and Automated Quotation
ACE	: Alternative Market of Bursa Malaysia Securities
REHDA	: The Real Estate and Housing Developers' Association of Malaysia
INSPEN	: The National Institute of Valuation
NAPIC	: National Property Information Centre
FIC	: Foreign Investment Committee
FDI	: Foreign Direct Investments
OPR	: Overnight Policy Rate
CIDB	: Construction Industry Development Board

PIA	: Public Amenities Maintenance Projects
PIAS	: Basic Infrastructure Projects
EPF	: Employees Provident Fund
10MP	: Tenth Malaysian Plan
MPT	: Modern Portfolio Theory
EMH	: Efficient Markets Hypothesis
MHPI	: Malaysian Housing Price Index
REIT	: Real Estate Investment Trust
BRICS	: Brazil, Russia, India, China and South Africa
NYSE	: New York Stock Exchange
OU	: Ornstein Uhlenbeck Process
DDM	: Dividend Discount Model
RIM	: Residual Income Model
ROA	: Return on Assets
ROE	: Return on Equity
BVPS	: Book Value per Share
EVA	: Economic Value Added
GAAP	: Generally Accepted Accounting Principles
R&D	: Research and Development
P/E	: Price/earnings
P/CF	: Price/Cash Flow
P/BV	: Price/Book Value
P/S	: Price/Sales
CAPM	: Capital Asset Pricing Model
APT	: Arbitrage Pricing Model
FVM	: Fundamental Valuation Model
HPM	: Hedonic Price Model
VAR	: Vector Autoregressive Regression
ASEAN	: Association of Southeast Asian Nations
RM	: Ringgit Malaysia
USD	: US Dollar
EUR	: Euro Dollar
JPY	: Japanese Yen
AMEX	: American Stock Exchange
NASDAQ	: National Association of Securities Dealers Automated Quotations

S&P : Standard and Poor's
DJIA : Dow Jones Industrial Average
DR : Debt Ratio
NPM : Net Profit Margin
PBR : Price-to-Book Ratio
ETR : Effective Tax Rate
IBES : Institutional Brokers' Estimate System
CRSP : The Centre for Research in Security Prices
T-Bill : Treasury Bill
ROCE : Return on Capital Employed
PPI : All-Property Price Index
URA : Urban Redevelopment Authority
M1 : Measure of Physical Money Supply
M2 : Measure of Money Supply that includes Cash, Checking Deposits and Near Money
KLSE : Kuala Lumpur Stock Exchange
SES : Stock Exchange of Singapore
TSE : Toronto Stock Exchange
PMG : Pooled Mean Group
MG : Mean Group
LLC : Levin-Lin-Chu
ADF : Augmented Dickey-Fuller
SBC : Schwartz Bayesian Criterion
VMA : Vector Moving Average
IRF : Impulse Response Function
PP : Phillips-Perron
NOPAT : Net Operating Profit after Taxes

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Property companies listed on Bursa Malaysia mainly consist of three categories: namely, the property development companies, plantation holding companies and property investment companies. Most of the property companies listed on Bursa Malaysia are property development companies carrying out building development, which means that these companies are directly related to the construction sector. This study will focus only on property development companies as it is comparable to the construction sector, where the aim is to compare the price behaviors of these two sectors.

As at 31st October 2014, the property sector in Bursa Malaysia has eighty-six counters while in comparison, the construction sector consists of forty-four counters. Both sectors are also generally vulnerable to economic conditions. Prices for both sectors soar whenever the economy booms and dip during economic downturns. This can be seen from the movement of both indices. Thus, it can be said that both sectors complement each other in terms of contributing to the country's economic growth. According to the Malaysian Economy in Figures 2013, a report which was published on 30th December 2013 by the Economic Planning Unit of the Malaysian Prime Minister's Department, the construction sector turnover in year 2013 was valued at RM10.45billion with a volume of 5.84billion units while the turnover for the property sector was valued at RM14.87billion (volume of 12.40billion units). This shows that there is some

similarity in terms of their share of contribution to the overall equity market in Malaysia as the difference in their contribution is not far apart.

The economic stimulus packages introduced in 2008 and 2009 to stimulate the country's economy included fund allocation for construction of houses, government facilities and improvement of infrastructure throughout Malaysia is seen to be a catalyst to the construction sector as these projects help boost the sector with the flow of projects involved.

The Economic Transformation Programme (ETP) was introduced in the 4th quarter of 2010 by the Malaysian Prime Minister, Dato' Seri Najib Tun Razak to transform Malaysia into a high income country by year 2020 through lifting the country's gross national income (GNI) per capita from USD6700 in 2009 to USD15000 in 2020 (Economic Transformation Programme, 2013). In line with the growth in the GNI, it is estimated that more than 3.3 million fresh employment opportunities will be generated by year 2020 which will move the nation to become middle and high-income wage earners. The ETP focuses on twelve (12) National Key Economic Areas (NKEAs) which contributes to the Malaysian economic expansion, and obtain prioritized public ventures and strategy aids. It is mainly driven by large infrastructure projects which mainly include the construction sector and drives up the prices of property, thus boosting the value of property companies involved.

The real estate and construction sectors in Malaysia are particularly involved in the Greater Kuala Lumpur/Klang Valley (KL/KV) NKEA as the government has a vision

for it to be a city that instantaneously obtains a top-20 position in city economic development [as defined by city Gross Domestic Product (GDP) growth rates] as well as being known as one of the top-20 most livable cities by year 2020. Progress in Greater KL/KV economic actions will expand job opportunities in the Klang Valley from 2.5 million in 2010 to 4.2 million by 2020. The Malaysian government is aiming for a population boom in Greater KL/KV area to ten million by 2020 from the current six million, where foreigners comprise 20% of the population, which will certainly boost up property sales.

Among the projects involved in this NKEA are the Mass Rapid Transit (MRT) project (the largest infrastructure project ever undertaken by Malaysia) and the integrated development in Pusat Bandar Damansara. These two projects which is estimated to cost RM36.6 billion and RM1.9 billion respectively will involve the construction and property sectors as it involves land acquisition, development and building of infrastructure.

The government's support on these sectors could also be observed in the Malaysia's Budget 2011 strategies which include the intensifying of the Public-Private Partnership (PPP) proposal to lift the private sector participation in economic exercises. Among the PPP projects are construction of highways and development of projects (Unit Kerjasama Awam Swasta, 2014). These projects will enhance the construction and property development sectors further with allocation from the Government of Malaysia as a tipping point for infrastructure support. In March 2011, the Prime Minister of Malaysia launched the "My First Home Scheme", which enables those who earn less than

RM3000 a month can purchase their first house with 100% financing whereby the house price ranges from RM100,000 to RM220,000. The loan period extended to them is for a maximum of 30 years (Skim Rumah Pertamaku, 2013). The National Mortgage Corporation (Cagamas Berhad) will endure the expenses of the 10% deposit for the buyers. This move is seen to boost the property market further as more people, including the lower-income group will be able to afford their own homes.

Both the property and construction sectors stand to benefit from the economic stimulus packages, ETP-related projects and other government initiated projects. These projects should enhance the value of the property and construction companies involved. However, the effects of the growth of the company on its share prices are not immediately known.

Research done in a few countries, which includes the United States (U.S), United Kingdom (U.K.) and Singapore had found that property stock prices always trade below their net asset values (NAV). So far in Malaysia, there have not been any studies conducted on the behavior of property and construction stock prices in relation to their fundamental variables[1]. This study seeks to analytically examine the hypothesis that property stock price move towards their fundamental variables in the long run. The rate at which the price mean reverts is then tested and compared to the behavior of its construction counterpart. This is important to provide investors with information on whether it is profitable for them to invest in the property and construction sectors. It can guide property and construction investors who are seeking to invest in the long run. The

[1] This is according to the author's knowledge.

knowledge on the price movement in these sectors will also aid the government in developing policies to avoid speculation in these industries. The effects of shocks on macroeconomic variables on property and construction stock prices are also evaluated to provide insight to investors and policy makers on the effects of sudden changes in government monetary policies.

1.2 Problem Statement

The property and construction sectors are known to be indicators of the nation's economic performance. Since local banks disburse large amounts of loans to these sectors [total loans disbursed by banks in Malaysia to property and construction sector in 2013 are about 9.74% of total loans to all sectors (Bank Negara Malaysia Financial Stability and Payment Systems Report 2013)], a breakdown in the property sector market may initiate intense consequences such as collapses of banks, which indirectly causes a collapse in the construction sector. This can be seen based on the effects of the 1997 Asian financial crisis where the property and construction sectors were badly affected and led to the collapse of several financial institutions. Property development companies, in particular, are even more closely linked to construction companies as both depend on each other for their resources.

Malaysia underwent recession during the worldwide financial catastrophe of 1997-1998 and again around the year 2007 when the sub-prime mortgage crisis in the U.S. affected economies worldwide. The sub-prime mortgage crisis which was a real estate crisis that led to financial crisis was provoked by a drastic increase in mortgage offences and foreclosures in the U.S., with major damaging results for banks and financial markets

worldwide. This crisis is an example of how dynamic the real estate industry is, whereby economies worldwide was affected by this real estate problem.

The bursting or eruption of the U.S. housing bubble provoked the financial crisis which climaxed around 2005–2006. High rates of payment failures on "subprime" and adjustable rate mortgages (ARM) started to grow rapidly. Increase in simpler and longer terms on loan agreements had led to borrowers taking up second mortgages as they assumed it would be easier to pay off their loans. However, as interest rates started to appreciate and housing prices began to fall in 2006–2007 in most cities in the U.S., remortgaging became more difficult. Failure to pay loan installments and foreclosure activity rose intensely as earlier terms expired, home prices failed to climb as predicted, and ARM interest rates rise. Prices which drop continuously also led to lower house prices compared to the loans which consequently led to defaulters entering foreclosures. The foreclosure endemic which started in late 2006 in the U.S. continues to be the main reason that leads to the worldwide economic crisis, because it removes consumers' wealth and disintegrates the financial durability of banking institutions.

The deterioration of the value of a real estate or financial asset can also cause a recession. Koo (2010) indicated in his study that Japan's "Great Recession" (1990) was a balance sheet recession. It was provoked by the downfall of land and stock prices, causing firms in Japan to face a situation where their liabilities worth become more than their assets (negative equity). This case shows that an economic downturn can be caused entirely by a collapse in the real estate industry. The downfall of the real estate industry is able to produce a negative impact on a country's economy. Therefore, a study on the

property and construction sectors that are closely linked to real estate is very much needed in Malaysia.

There is evidence provided from a study by Mahmood and Zakaria (2007) that developers in Malaysia profit more than their contractors' counterparts. This is mainly due to lower capital gearing in the developers' part as compared to the contractors. Many studies had been done on the relationship of stock prices and their underlying values. However, studies on property and stock price relationships have been limited to only several countries, namely, Singapore, the U.K., the U.S., Hong Kong and countries in the European continent. No study had been done on the connection between property stock prices and their fundamental variables in Malaysia. So far, studies on the property market in Malaysia has been focused on performance analysis (Ting, 2002), profitability (Mahmood and Zakaria, 2007) and the role of securitized real estate (Lee and Ting, 2009). This study aims to add to the current literature on the stock price relationships in the Malaysian context. Studies in the other countries had found that property stock prices deviate considerably from their fundamental variables before they mean revert to equilibrium. By studying the behavior of property and construction stock prices in Malaysia, the results will enable us to make comparison with other studies which are already available in other countries.

The property and construction markets in Malaysia have seen a tremendous growth in the recent years. However, the stock price behavior of both sectors has not been investigated. Will the stock prices move towards the fundamental value? If it is discovered that the prices do mean revert, then the speed of the error correction

mechanism (ECM) can be investigated to discover the period for the stock prices to revert to equilibrium.

The features and the magnitude of the relationship between property stock price and its fundamental value relationship remains an issue (Liow, 2003). The question that arises following investigations regarding relationships between stock prices and real estate company fundamental variables is, whether property stocks can produce a return that is significantly higher than the return on the underlying real estate assets over a short or long term period.

It is crucial for us to determine the mean reverting behavior of Malaysian property and construction stock prices as it is an area which has not been explored before. Investors and analysts should be aware if the prices do move back to equilibrium in the long-run to enable them to make informed decisions on their investments. If the prices are found to mean revert to equilibrium, then investors could benefit from this finding where they will be able to predict when to sell or buy the stocks to maximize on the stocks' profitability.

However, there is no study in Malaysia that has focused on the behavior of property and construction stock prices and compared them in the long-run. It is vital to examine the similarities and differences of both sectors' stock prices and to evaluate if their stock prices move together as investors and analysts do not have empirical evidence to guide them on investments in these two sectors. Prices of both sectors can be compared to see if they do mean revert to their fundamental variables, and if they do, how is the speed of

reversion alike or different from the other sector? Both sectors should also be tested for their correlation with each other as highly correlated stocks do not offer diversification benefits. If both stocks are highly positively correlated, then there is no purpose to include both stocks in an investor's portfolio.

Fundamental variables that predict share movements have to be identified in order to estimate the underlying value of the stocks. Dividends per share (DPS) were proposed by Fama and French (1988) as it could explain stock returns significantly. Campbell and Shiller (1988) found DPS and long-term earnings per share (EPS) to be able to significantly justify returns. For property investment firms, there is usually a small correlation among the property portfolio worth and the value of the companies' stocks which are prices that correspond to the net asset value (NAV) instead of price-to-earnings (Liow, 2003). Since NAV is the principal basis for valuation of property companies, property stock prices are hypothesized to mean revert towards their NAVs. However, the inclusion of these variables in estimating the fundamental value of property and construction stocks in Malaysia has not been tested before. The question that arises from this situation is, are these variables the best proxies to represent the fundamental variables of property and construction prices in Malaysia?

Property and construction sectors form integral parts of the Malaysian economy in terms of their contribution to GDP and loans disbursements from banks. Hence, changes in economic factors should influence stock prices in these two sectors. Studies in other countries show that macroeconomic factors such as interest rates, GDP, inflation and trade openness are important in explaining stock price movements. How property and

construction stock prices react to shocks in certain macroeconomic variables in Malaysia have yet to be determined. Do the shocks explain the movement of Malaysian property and construction stock prices? What are the macroeconomic variables that account for most of the variation?

The subprime mortgage crisis which initially started in the U.S. and brought down the economies of countries around the world sparked a global economic crisis which makes it extremely important to study the property industry. Considering that previous studies had not delved into the above problems, the behavior and the long-run relationship of property and construction stock prices in Malaysia will be examined.

1.3 Scope of Study

The scope of this study is limited to stock prices from property companies whose revenues derived 50% or more from property development activities and construction companies whose revenues are 50% or more from construction activities only. These stocks are listed in Bursa Malaysia. The reason for limiting the sample of study to only companies whose core activities are mainly property development and construction is because these two sectors are very closely related and they complement each other in terms of their needs for resources. It is assumed that the stock prices for these two sectors would move together as they are seen to be inter-related. Therefore, this study seeks to find evidence to this claim and to study the long-run relationship of both stocks, whether there exists similarities in their behaviors or otherwise and if there exists diversification benefits for investors by investing in both stocks.

This study includes stock prices from the year 1995 to 2013. This period will include the up and down phases of the property and construction cycle in Malaysia to minimize any possible partiality based on a particular time period. Since this study includes an investigation to the mean reversion of the share prices, it is essential to obtain data on stock prices of at least 20 or 30 years. This is described by Balvers *et al.* (2000), where they opined that a restriction in discovering mean reversion is the lack of dependable time series as mean reversion is assumed to be an unhurried process and can only be detected over long horizon.

1.4 Research Questions

Three primary research questions frame this study:-

i) Do property and construction stocks offer diversification benefits to investors who wish to invest in both sectors?

ii) Do property and construction stock prices in Malaysia mean revert to their fundamental variables?

iii) Do shocks on macroeconomic factors influence the movements of property and construction stock prices?

1.5 Research Objectives

The main objective of this study is to discover the long run behavior of property and construction stock price behaviors in Malaysia. The specific objectives of this study are:

i) To determine whether property and construction stocks do offer diversification benefits.

ii) To examine if the stock prices mean revert to their fundamental variables.

iii) To discover the effect on property and construction stock prices to shock in macroeconomic variables.

1.6 Significance of Study

The knowledge of the direction of stock prices has important implications. By studying the stock price behaviors of property and construction sectors, it is hoped that the findings will reveal whether property stocks are likely to provide returns which contradicts considerably from the returns on the underlying real estate assets over a fairly long period and whether construction stocks follow the stock price behavior of the property sector. This information can be used as a guidance tool for investors who are eyeing the property and construction markets to make a long term profit.

Real estate influences the industrial and commerce sectors such as banks, finance companies and insurance companies, all of whom have significant exposure in the property markets. The Monthly Statistical Bulletin (January 2014) published by the Central Bank of Malaysia (BNM) shows that the loans disbursed by licensed banks in Malaysia in year 2013 amount to RM62.223 billion for the construction sector and RM41.568 billion for the real estate sector. Together, the banks had disbursed a total of RM103.791 billion to both the construction and property sectors, which contributed about 10% of overall loan disbursed for that year. Changes in the property and construction sectors could affect financial institutions which give out loans for property purchases and development as the financial institutions bear the risk in the case of a

collapse in the two sectors. Thus, it is vital for these institutions to understand the behavior of stock prices of property and construction companies. They can avoid the instability created by unexpected changes in the property and construction stock prices by understanding the dynamics of the stock prices.

This study is also driven by the lack of empirical research on property and construction stock prices and their fundamental variables. It addresses the relationship between the stock prices and their fundamental variables and also compares the stock price behaviors of both sectors. Studies in other countries show that property stock prices deviate from their fundamental variables and mean reverts to equilibrium. This study aims to add to the academic writings in the property and construction sectors in Malaysia and to fill the gap in addressing this relationship. It is believed that this study is among the first done in Malaysia whereby it is unique and significant on many counts. It is the first attempt to simultaneously compare the behaviors of property and construction stock prices, their long-run relationships with their fundamental variables and their responses to macroeconomic changes. The value of this study lies in the baseline of comparison for subsequent studies as there is paucity of published research implications stated in the price discovery theory, efficient market hypothesis, mean reversion theory and modern portfolio theory that have been investigated in a single study, particularly in Malaysia.

Furthermore, there appears to be a dearth of empirical evidence in the literature linking stock fundamental variables and macroeconomic variables with the stock prices from the property and construction sectors. This is also the first study conducted in Malaysia which applies the panel ARDL method on the property and construction sectors to

evaluate the stock price behaviors. By including NAV, EPS and DPS as fundamental variables and interest rates, GDP, CPI and trade openness as macroeconomic variables to evaluate the behaviors of the stock prices, this study has made a significant contribution towards closing the perceived gap in the existing literature as no other study has included all these variables in a single study to be tested on the properties and construction sectors in Malaysia.

Regulators such as the Securities Commission of Malaysia (SC), the Central Bank of Malaysia (BNM) and the Malaysian Ministry of Finance are hoped to benefit in their policy making from the findings of this study. The SC has the power to devise and produce guidelines, practice notes and rules under sections 377 and 378 of the Capital Markets and Services Act 2007 (CMSA). The BNM is fixed with complete legal powers under the following constitution to manage and oversee the financial system. Among the pieces of constitution includes; the Financial Services Act (FSA 2013) and Islamic Financial Services Act (IFSA 2013) which provides laws for financial institutions or any other institutions which carry on businesses pertaining to the financial system. It empowers BNM to investigate and indict illegal activities which involve the financial system of Malaysia. The BNM therefore has the power to relax the rules on financing of property and construction companies by reducing the criteria for financing in an effort to boost these sectors. This could likely be done if there is an understanding of the stock price behaviors of these two sectors, which this study attempts to investigate.

Laws against speculation should be drawn up as investors are known to capitalize on the gap of the stock prices and their fundamental variables to make profit as they know that

stock prices are known to mean revert after a certain extent of time. Real estate speculation is known to have serious effects in a country's economy. Financial institutions can be caught into over-lending and the level of Non Performing Loans (NPLs) will increase significantly when speculation in real estate gets rampant. This happens when real estate prices which have been climbing steadily for a period of time suddenly decline, leading to defaults in the financial system. A steep increase in NPLs can lead to failures in the banking system where over-valued collaterals lead to a banking crisis in the economy, leading to currency crisis and contraction in the economy. This will then lead to unemployment and an economic recession. Malpezzi and Wachter (2004) found that most critically influenced economies will initially go through a downward trend in property prices, a subsequent slowdown of banking systems before proceeding to undergo an exchange rate crisis, a financial crisis and a business cycle crash.

One of the steps taken by the Malaysian Government to restrict speculation is by implementing a maximum loan-to-value (LTV) ratio of 70%, which will apply to loans taken out to finance a third house by a borrower. This step should be reviewed as a LTV which is too low may hamper the growth of the construction and property sectors as demand declines. However, an LTV which is too high will be too risky for financial institutions when there is no way to recover loans and personal bankruptcies will increase causing a substantial reduction of consumption and production. This will also lead to unemployment, which, if goes on for a long period, will cause the economy to deteriorate.

The property sector market volume grew from 2010 to 2012 with an increase of 18% job growth in the industry whereas the construction sector employed about 1,163,700 jobs a year (Department of Statistics Malaysia, 2013). This shows that both sectors contribute significantly to the country's economy in terms of growth and employment. Hence, it is vital to discover the direction of the prices in the long run. By observing the stock price behaviors, the stability of the company being studied can be predicted. Stable companies lead to a sturdier economy as these companies play a big role in the country's growth. Both the property and construction sectors are also known to be cyclical industries. This means that both sectors are deeply affected by the economic cycle of the country. If the country's economy is going into recession, the property and construction are the first sectors to show deterioration in terms of their performance. Figure 1.1 shows the declination of the percentage changes in GDP for the two sectors during periods approaching recession in Malaysia.

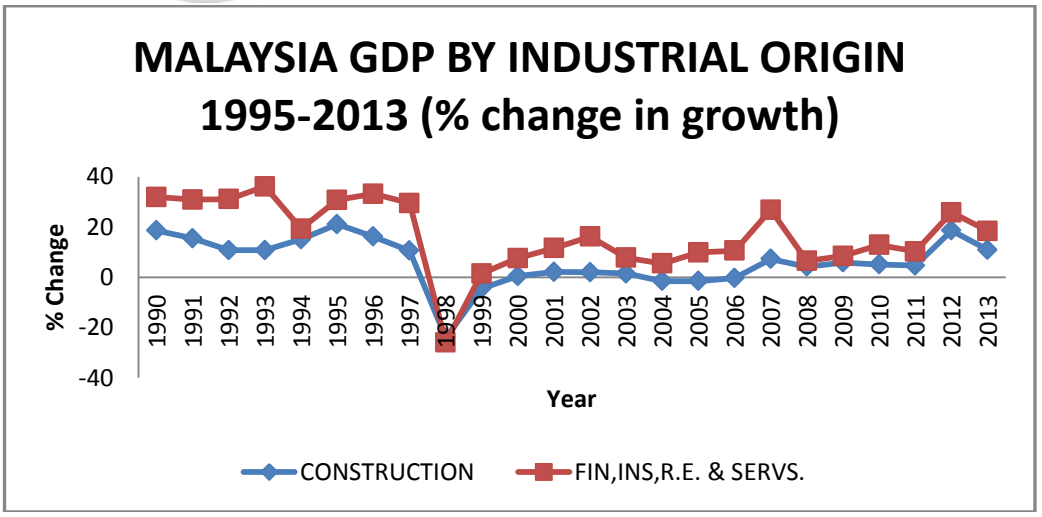

Figure 1.1
Percentage Change in GDP Growth by Construction and Real Estate in Malaysia – Years 1990-2013
Source: Ministry of Finance Malaysia, 2014

Another reason for comparing the price behaviors of the property and construction sectors is to see how they correlate with one another. Investors would be able to predict the direction of one sector by observing the trend of the other sector. They can then decide to invest in either one or both sectors according to their correlation with each other. However, if it is found that both sectors are highly positively correlated, then there are no diversification benefits by including both stocks in a portfolio. Hence, information from this study will give investors a more clearer insight into the behavior of property and construction stock prices in terms of how much they deviate from equilibrium, how fast they adjust to equilibrium and provide the investors with a choice of whether to choose property and/or construction stocks to diversify their portfolio.

Since the property and construction sectors contribute significantly to the nation's economy, it is important to study the impact of shocks in macroeconomic variables such as monetary policy, consumer prices, gross domestic product and trade openness on property and construction stocks. For example, the results in this study will reveal whether changes in interest rates give significant impact on the shifting of property or construction stocks in Malaysia. If the macroeconomic variables are found to influence the pricing of the stocks, it would enable investors to earn profits by exploiting available news on macroeconomic changes.

1.7 Organization of the Study

This thesis consists of six chapters. Chapter two elaborates on the property and construction industries in Malaysia and how they have evolved over the years. Chapter three reviews the literature; underlying theories applied in this study and empirical

evidences from previous studies. Chapter four includes the data, its' sources, model specifications, the theoretical framework, research design and hypothesis development while chapter five analyzes and discusses the results. Chapter six concludes this study with the summary, implications, limitations and recommendations for future studies.

CHAPTER TWO

PROPERTY AND CONSTRUCTION SECTORS IN MALAYSIA

The property and construction sector in Malaysia have gone through periods of boom and bust in the past few years. The number of companies listed within these two sectors in the Bursa Malaysia (Malaysian Stock Exchange) has grown since the market recovery period in 1988-89. Currently there are eighty-six property companies and forty-four listed construction companies in the Bursa Malaysia (as at 31st October 2014). Property development is the main activity of the majority of the listed property companies. In this study, a company is categorized as property development company if its' core activity involves property development and revenue from its' property development activity contributes to 50% or more of its' total revenues. Most construction companies are also involved in property development. Therefore, to determine which activity the construction companies focus on, a company with 50% or more of its revenue derived from purely construction activities is acknowledged as a construction company.

Property developers are closely linked to construction companies as they are found to complement other sectors in an economy by supplying foundation for creating input, income, profit and jobs, which are essential for encouraging economic growth (Mahmood and Zakaria, 2007). However, the construction sector is still considered small and less profitable compared to its property developer counterpart. Ball, Farshchi and Grili (2000) found that the construction sector was less prominent as there was not much value added by contractors, while they also needed to depend on developers' interim payment for financing. The property development companies also depend on the

construction companies for their services to develop their properties. The stock price behaviors of these two sectors in the Bursa Malaysia have not yet been investigated upon to discover if these prices are linked or do the prices move away from the fundamental variables and mean revert back to equilibrium since these sectors are dependent on each other.

2.1 Significance of the Real Estate and Construction Sectors to the Malaysian Economy

The property sector continues to be widely perceived as one of the most favorable investment opportunities as direct property investment is said to be able to act as hedging for inflation, provide diversification advantages and display promising ability for above average returns (Rasheed and Tajudeen, 2006). However, direct property investment has some disadvantages, where, the investment is known to be illiquid and leads to problems which arise during direct acquisition whereby transaction costs (such as the real property gains tax) and huge capital are involved. These obstacles in direct property investment can be overcome by switching to investment in shares of listed property companies, which are known as securitized property investments. This type of investment has many advantages over direct property investment as it has higher liquidity, provides ease of entrance to and exit from the market and allows investors to share in the rise of property cycles and the economic benefits that come along with it.

The property and construction sectors enhance the other sectors in the economy through creation of fixed assets (Mahmood and Zakaria, 2007). Thus, both sectors can be said to play crucial roles in the growth of a country's economy. Malaysia's economy

experienced a growth of 4.7% in 2013 compared to the previous year, bolstered by increases in the manufacturing and services sector as well as higher exports. As can be seen in Table 2.1, employment in the construction sector has increased regularly over the years with a total of 1,163,700 jobs in 2012 compared to 1,133,600 jobs the year before. The real estate sector has also provided about 69,000 jobs in the year 2012 (Department of Statistics Malaysia, 2013). Both sectors make up about 9.7% of the total workforce in Malaysia.

Table 2.1
Employment and Labour Statistics Malaysia (Year 2010-2012)

EMPLOYMENT AND LABOUR STATISTICS - MALAYSIA			
Employment by Sector ('000)	**2010**	**2011**	**2012**
Agriculture, forestry and fishing	1614.9	1410.0	1601.7
Mining & Quarrying	57.2	76.0	80.6
Manufacturing	2108.5	2222.3	2227.9
Water supply, sewerage and remediaiton activities	66.7	70.8	80.4
Electricity, steam and sir conditioning supply	55.5	51.6	62.1
Construction	1082.7	1133.6	1163.7
Finance and Insurance	323.4	317.6	322.9
Real Estate activities	58.5	61.2	69.0
Wholesale and retail trade	1887.8	1999.5	2116.0
Transport, Storage and Communication	733.6	812.8	833.2
Professional, scientific and technical activities	285.6	329.0	307.8
Accomodation and food services	856.7	942.2	957.0
Administrative and support services	359.2	448.9	530.9
Public administration and defence	787.7	749.0	697.6
Education	779.3	785.0	786.2
Health and social work	280.0	382.5	414.8
Other service sctivities	182.9	181.5	190.2
Activities of household as employers	285.4	222.5	194.6
Total	11805.6	12196	12636.6

Source: Department of Statistics Malaysia, 2013

According to the Department of Statistics Malaysia's Economic Statistics Publication (2014), the construction sector contributed a total of RM29,554 million to Malaysia's

Gross Domestic Product (GDP) in 2013 whereas the real estate sector contributed RM44,536 million. The trading volume for Malaysia's listed construction sector on October 31st, 2014 was 26.561 million units with a value of RM52.234 million while the listed property sector's trading volume on the same date was 46.573 million units with a value of RM40.521 million (Maybank Investment, 2014).

Table 2.2 shows that the construction and real estate and business services sectors in Malaysia contributed 3.75% and 5.65% respectively to the GDP of Malaysia in year 2013 (Department of Statistics Malaysia, 2014). Although the percentage contributed by these two sectors are less than the agriculture, mining, manufacturing, finance and insurance and also trade sectors, these two sectors still play a crucial duty in the country's economy in terms of creation of jobs. The construction and real estate markets are expected to grow rapidly as various economic plans which involved development of residential, industrial and infrastructure were launched in years 2010 and 2011, that would indirectly affect the companies that are listed in the property and construction sectors of Bursa Malaysia.

Table 2.2
Malaysia Gross Domestic Product (GDP) by Sector (Year 2010-2013)

GROSS DOMESTIC PRODUCT (GDP) BY SECTOR (2010-2013) - AT CONSTANT 2005 PRICES

	SHARE OF GDP (%)			
	2010	**2011**	**2012**	**2013**
AGRICULTURE	7.58	7.62	7.31	7.12
MINING	9.7	8.8	8.41	8.08
MANUFACTURING	25.16	25.04	24.84	24.53

Table 2.2 (Continued)

GROSS DOMESTIC PRODUCT (GDP) BY SECTOR (2010-2013) - AT CONSTANT 2005 PRICES

	SHARE OF GDP (%)			
	2010	**2011**	**2012**	**2013**
CONSTRUCTION	**3.17**	**3.16**	**3.54**	**3.75**
SERVICES				
Transport and storage	3.65	3.66	3.64	3.63
Communication	3.63	3.73	3.87	4.06
Finance and insurance	9.07	9.21	9.41	9.14
Real estate and business services	**5.41**	**5.43**	**5.51**	**5.65**
Wholesale and retail trade	12.11	12.42	12.30	12.55
Accommodation and restaurants	2.44	2.46	2.46	2.48
Other Services	5.08	5.08	5.00	5.14

Source: Department of Statistics Malaysia, 2014

The Malaysian construction sector experienced steady growth from 2009 to 2013, increasing from 6.2% in 2009 to 10.9% in 2013 (refer to Table 2.3) despite the worldwide debt crisis which emerged from the sub-prime mortgage crisis in the U.S. The real estate experienced a boost in its growth from 2009 to 2013 which was at 7.5% due to various projects announced in the ETP where various land banks were identified to be included as development projects. However, both sectors faced slowdown in their growth in year 2011, assumed to be associated with the worldwide economic crisis, but regained momentum in year 2012 to experience high growth of 18.6% and 7.2% respectively. Figure 2.1 shows that the growth of the construction and real estate industries faced a boost from year 2011 onwards due to the beginning of mega infrastructure and development projects under the ETP.

Table 2.3
Growth in Malaysian Construction and Real Estate Sectors (2009-2013)

National Income & Domestic Production	2009 RM (mil)	Growth (%)	2010		2011		2012		2013	
Construction	19270	6.2	21459	11.4	22464	4.7	26640	18.6	29554	10.9
Real Estate	34016	3.6	36601	7.6	38654	5.6	41447	7.2	44536	7.5

Source: Department of Statistics Malaysia, 2014

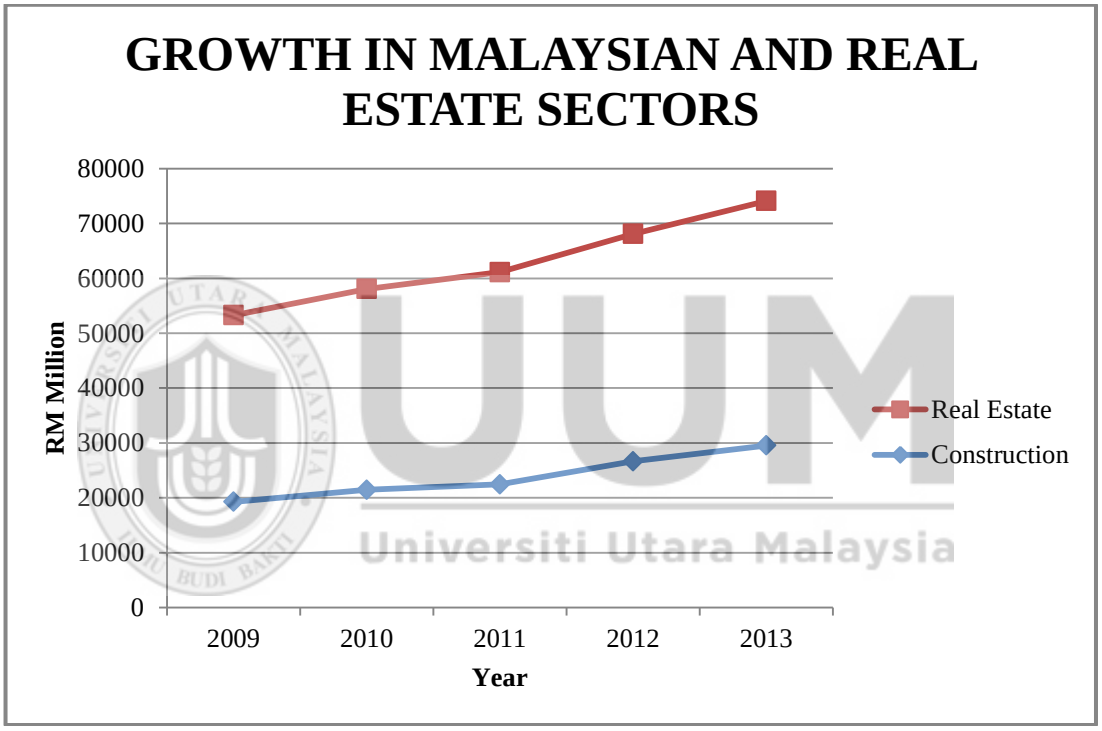

Figure 2.1
Growth in Malaysian Construction and Real Estate Sectors (RM Million) (2009-2013)
Source: Department of Statistics Malaysia, 2014

Figure 2.2 shows the breakdown of various sectors listed in the Bursa Malaysia. As at October 2014, the trading/services, finance and industrial products sector contribute 72% to the overall market. The properties sector takes up 5% while the construction sector takes up 3% of the market share in Bursa Malaysia. Although the fragments of market share in these two sectors are less than the trading/services, finance, industrial

products and consumer products, the figures are still significant in terms of their contribution to the economy as both sectors make up a total of 8% of market capitalization in the Bursa Malaysia.

MARKET CAPITALIZATION OF INDICES IN BURSA MALAYSIA

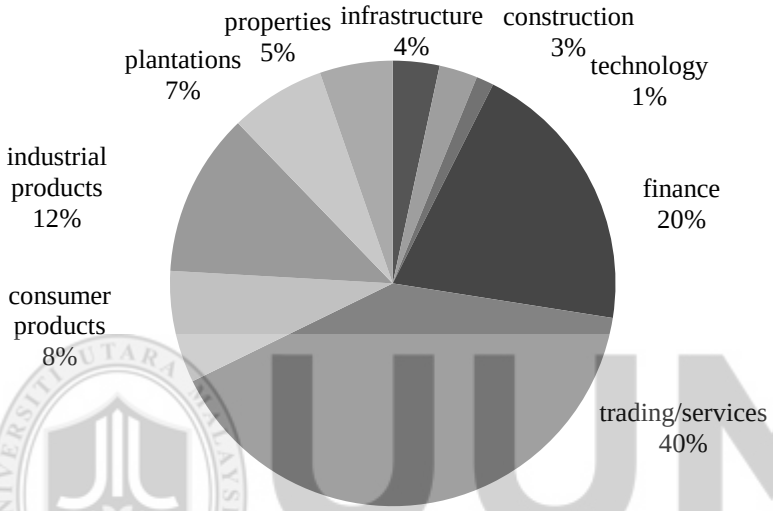

Figure 2.2
Bursa Malaysia Market Capitalization per sector (%) - October 2014
Source: Maybank Investment, 2014

Figure 2.3 shows the market value of indices traded in Bursa Malaysia in the month of October 2014. Trading and services sector are observed to have the highest value among the indices traded in Bursa Malaysia. Industrial and consumer products and the finance indices have higher market value compared to the property and construction indices. Property and construction sectors are almost equal with regards to the market value of its indices traded where the construction index is only traded slightly higher than the property index.

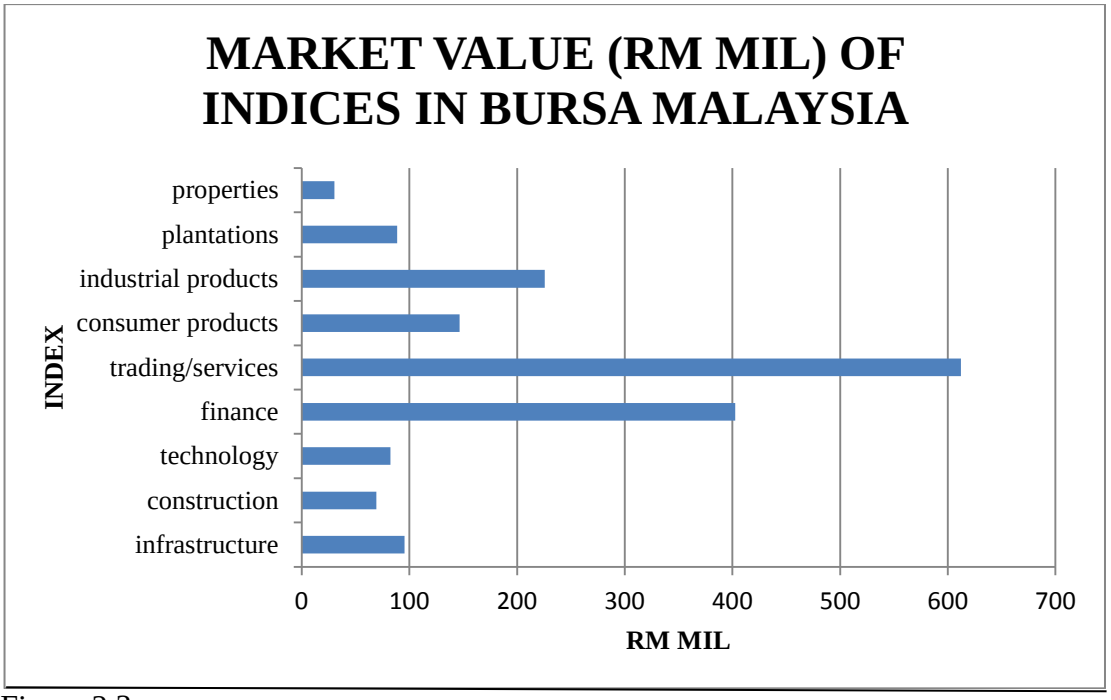

Figure 2.3
Market Value of Indices Traded in Bursa Malaysia as at October 2014
Source: Maybank Investment, 2014

Past studies show a positive correlation between the construction industry and a country's economic situation. Conflicting results on the diversification potential of the property and construction stocks were also obtained from previous literature. While studies in Malaysia by Ting (2002) found that there is no additional benefit by including property shares into an investment portfolio, studies in Nigeria by Rasheed and Tajudeen (2006) found the opposite in their country. They found that both property and construction stocks are lowly correlated with the stock market when contained in an equity investment portfolio.

Both the property and construction companies are closely linked as both sectors need resources from each other especially where the property development companies are concerned. These two sectors could be studied together to evaluate the stock price

behaviors and possible diversification benefits by including both types of stocks in a portfolio. This can be done by comparing the similarities or differences in their stock price behaviors, which in this case, the mean reversion properties and time period of each type of stock to move to long-run equilibrium.

2.2 Background of Bursa Malaysia

Bursa Malaysia is a company dealing in stock exchange which was established under Section 15 of the Capital Markets and Services Act 2007. It functions as an exchange whereby it provides a wide variety of services linked to stock exchanges that includes trading, clearing, settlement and depository services.

Currently, Bursa Malaysia is one of the most substantial bourses in Asia with 1230 listed stocks (as at November 2014), that provides extensive investment selections to the world. Effective 6th July 2009, the Kuala Lumpur Composite Index (KLCI) adopted FTSE's (Financial Times Stock Exchange) global index standards, thus identifying it as FTSE Bursa Malaysia KLCI. The components of FTSE Bursa Malaysia changed from 100 to 30 companies as representation of the Malaysian stock market. The 30 largest companies transformed the FTSE Bursa Malaysia KLCI to a large capitalization index.

The Malaysian Securities Commission and Bursa Malaysia started a new pooling of funds structure and listing board framework for a further adept introduction toward the capital market. Beginning from 3 August 2009, the new structure revealed the consolidation of Bursa Malaysia's Main Board and Second Board to shape the Main Market. Furthermore, the MESDAQ Market was revamped into the ACE Market, a

substitute which caters for companies of different magnitudes and sectors. The FTSE Bursa Malaysia Second Board Index is relinquished while the FTSE Bursa Malaysia MESDAQ Index is now known as the FTSE Bursa Malaysia ACE Index. There are 23 indices in the Bursa Malaysia's Index family which includes FTSE Bursa Malaysia KLCI, FTSE Bursa Malaysia Top 100, FTSE Bursa Malaysia Mid 70, FTSE Bursa Malaysia Small Cap, FTSE Bursa Malaysia EMAS, FTSE Bursa Malaysia Fledgling, FTSE Asean 40, FTSE Bursa Malaysia EMAS Shariah, FTSE Bursa Malaysia Hijrah Shariah, FTSE Bursa Malaysia ACE, FTSE Bursa Malaysia Asian Palm Oil – Malaysian Ringgit, FTSE Bursa Malaysia Asian Palm Oil - U.S. Dollar, FTSE Bursa Malaysia Palm Oil Plantation, Construction Index, Consumer, Industrial Products, Trading/Services, Technology, Finance, Properties, Plantation, Mining and Industrial .

The properties and construction listed stocks are represented by the properties and construction indices in Bursa Malaysia. Both indices are created to determine the performance of the underlying properties and construction stocks in the Malaysian stock market. By understanding how indices react in the economic trends over time, the market trend for both sectors investigated in this study can be evaluated in relation to the movement of the stock prices towards their equilibrium.

Figure 2.4 shows all the indices derived from companies listed in the Main Market and weighted by market capitalization. Both the property and construction sectors' market capitalization in Bursa Malaysia are represented by their own indices. The volume of the construction and property indices are both traded below a volume of 100 million units as at November 2014. Thus, it can be said that the similarity between both indices is that

they trade not more than 100 million units a day. However, it can be observed on Table 2.4 that the volume traded in the construction sector is less than half of the volume traded in the properties sector. Nevertheless, it is essential to investigate whether this difference can provide diversification benefits to investors. Since it is perceived that changes in macroeconomic factors also influence stock prices, it is essential to investigate the effects as these two sectors' are found to be traded actively in the Bursa Malaysia.

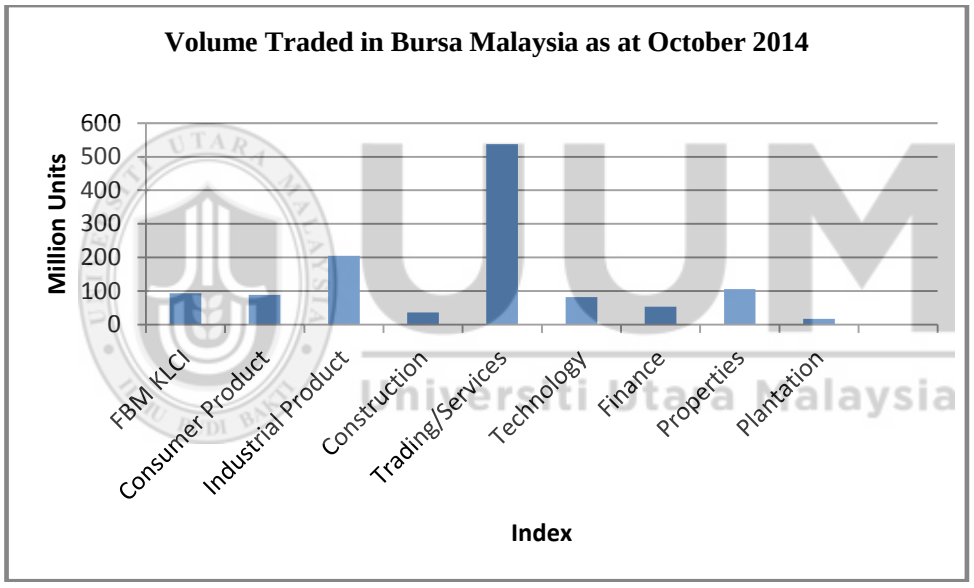

Figure 2.4
Volume Traded In Bursa Malaysia as at October 2014
Source: Maybank Investment, 2014

2.3 Overview on the Malaysian Property Sector

The number of listed property companies in Malaysia has doubled since the property market recovery in 1988-89. Malaysian listed property companies mainly comprise of developers, plantation holding companies and property investment and management companies. Property development companies consist of over 60% of total property

companies listed in Bursa Malaysia. The property development entities are mostly included in the development of residential townships ranging from the size of 500 acres and above (Ting, 2002).

To be eligible for listing in the Main Market of Bursa Malaysia, property development firms are required to own land banks with a minimum of 1,000 acres or 405 hectares (Securities Commission Malaysia Equity Guidelines, 2013 update). The company will need to possess enough property development projects which are still in progress to enable it to uphold equitable earnings for a minimum of five years after listing. Another requirement is for the company to have achieved a cumulative after tax profit of at least RM30 million for five consecutive full financial years.

As a representative to the authorities and government agencies, The Real Estate and Housing Developers' Association of Malaysia (REHDA) represents property developers in Malaysia. It is acknowledged as the main representative for private property developers as it is largely involved in giving support and providing administration services. Since it is the main body in charge of property development and construction of land in Malaysia, it plays an important role in forging close links between its members, State Governments and other industry players to promote the proper planning and development of the property industry in Malaysia.

The National Institute of Valuation (INSPEN) and the National Property Information Centre (NAPIC) are two agencies formed by the Malaysian Government to overlook the

real estate industry in Malaysia. The Valuation and Property Services Department formed INSPEN in 1985 to improve the flow of information, provide awareness and competence to the real estate industry. It also provides real estate training and research in the South-East Asian region. NAPIC was formed with the objective to supply precise accurate, detailed and well-timed information concerning the country's demand and supply of real estate to government agencies, property developers and relevant groups which are linked to the property industry. Among its functions include collecting data from related parties, developing and maintaining a national property stock depot, providing information to government agencies and other parties involved in the property industry, publishing periodic property publications, advising the government on property development in the country and increasing knowledge to the general public about the significance of property data to the progress of the property industry in Malaysia.

However, so far, neither INSPEN nor NAPIC has looked into the issue of the underlying values of real estate companies in Malaysia compared to the stock prices of these companies. Most of the information available from NAPIC involves valuation of land and buildings needed for feasibility studies, court proceedings, disputes or other purposes, property management and estate agency. Even though INSPEN is involved in training and research for the Ministry of Finance in Malaysia, it has also not done any studies on the deviation of real estate prices from their fundamental variables. It can be observed from their list of research and publications that most research done under INSPEN do not involve studying the stock price behaviors of the real estate sector.

In NAPIC's year 2013 Annual Property Market Report publication, it is reported that the real estate sector experienced a growth of 7.9% whereas loans to property sector rose by 3.1% in comparison to the year before. This shows that the real estate industry achieved healthy growth rates amidst global financial woes in 2008. The report also showed a decline in the residential property sales which was supplemented by an increase in the non-residential property sales.

Housing Index in Malaysia reduced to 6.6% in the second quarter of 2014 from 9.6% in the first quarter of 2014. Housing Index in Malaysia averaged 3.77% from 1997 until 2014, approaching 44.5% in the first quarter of 2000 and then dipped down to -39.2% in the third quarter of 1998. Housing Index in Malaysia is reported by the Central Bank of Malaysia.

As of 3rd November 2010, the Central Bank of Malaysia (BNM) reported the implementation of a maximum loan-to-value (LTV) ratio of 70%. It is aimed only at borrowers who take out loans to finance the purchase of their third houses. This maximum LTV ratio policy is valid till current date. Loans on first and second house purchases are not affected by this policy and the current ratio remains pertaining to each individual bank's policies and guidelines. The objective of the rule is to strengthen and secure the property market and fulfill the need for providing affordable homes to country's population. The reason for executing the 70% LTV ratio is to encourage reasonableness, avoid extravagant spending among house buyers and prevent speculative trading in the suburban real estate market that has led to higher prices. The hike in house prices in one location will lead to higher prices in nearby locations, which

indirectly decreases the purchasing power of authentic house buyers. When speculation in the real estate sector can be controlled, then only the true worth of the underlying real estate assets can be determined, which in the case of this study, the deviation of stock prices from fundamental variables of the firm can be discovered.

In 2009, the Prime Minister of Malaysia, Dato'Seri Mohd.Najib Tun Abdul Razak, announced the lifting of investment guidelines governed by the Foreign Investment Committee (FIC), whereby the amplitude of FIC now involves less transactions, rules and terms. [2]The FIC mandate for property transactions is now only needed when it includes a reduction of Bumiputra (indigenous Malaysian group) or Government owned properties worth RM20million and above. FIC approval every other transactions which include non-Bumiputras and foreigners are no longer required. This move is seen as a step ahead for the economy as foreign direct investments (FDI) is expected to increase significantly with the removal of the FIC guideline.

Transactions which do not require the approval from FIC are separated into 2 sections. (i) sale by non-Bumiputra or foreigners, and (ii) purchase by Bumiputra controlled entity and includes Bumiputra companies which buy over properties from other Bumiputra companies. This will promote higher property transactions and investments, including buy-overs of commercial properties by foreign companies. The easing of these regulations is hoped to enhance the country's value proposition to be known as a promising venue to invest and trade.

[2] The FIC is part of the EPU (Economic Planning Unit) in the Prime Minister's Department

The removal of the FIC and the expected increase in property sales will further increase the need for more information on the relationship of property company assets with their stock prices. With a boom in the property market, the price of real estate assets held by listed property companies will increase significantly. The question that arises during these times is, do the companies trade at a premium or discount to their share prices during this period? Will increases in real estate values lead to higher stock prices? This study seeks to discover the long-run relationship between property stock prices and their fundamental variables through boom and bust periods of the Malaysian economy.

According to the Property Market Report 2013 (produced by the National Property Information Centre), property transaction volumes decreased 10.9% to 381,130 transactions but their value expanded a marginal 6.7% to RM152.37billion from RM142.84bilion in 2012, signaling that prices acquired power in spite of innumerous means created to curb speculation, including prohibition on policies that bear interest and high real property gains tax. Amount disbursed by the Malaysian banking sector to the property sector in year 2013 amounted to RM7.9billion (BNM Annual Report, 2013). This shows that the property sector is a strong driving force behind the financial institutions in Malaysia. The financial sector relies on the stability of the property sector since a large amount of their funds are given out as loans to the property sector. Hence, a downturn in these sectors would affect the banking and financial industries tremendously due to their high dependence on loans given out to the property and construction sectors. Thus, it is imperative that the behavior and long-run relationships between the values of these companies with their stock prices is investigated to detect

problems that may arise when stock prices deviate too much from their fundamental variables.

Changes in interest rates might also affect the loans given out to these sectors. When interest rates are increased, companies might not be able to pay their loans, which will lead to overwhelming amount of non-performing loans (NPLs). When a company is faced with problems servicing their bank loans, their financial status will suffer, and this will show in the movement of their stock prices. Thus, this study attempts to discover the impact of interest rate shocks on stock prices as higher interest rates are often seen to affect a company's financial ability to service loans.

The Malaysian Government introduced two economic stimulus packages which began in the first quarter of 2009 to enable the country to achieve the estimated growth for 2009 and 2010 even though the global economic crisis was worse than forecasted before. In the First Stimulus Package, a total of RM200million was assigned to build 6500 units of low-cost houses (Ministry of Finance Malaysia, 2010). Furthermore, to incite the housing sector, the government suggested that tax exemption be given for interest paid on housing loans with a maximum of RM10,000 per year for three years. These steps which were taken by the Government to boost the construction and property development sector were found to be useful and beneficial as the construction sector GDP were found to grow to 11.4% in 2010 while the property sector GDP showed 7.6% growth for the same period. Property development and construction companies (apart from house buyers) are found to benefit most from this government initiative. Thus, studies on the stock prices behavior of these sectors during this period are most relevant

to observe the impact of these economic packages on the performance of the property and construction companies.

In 2009, the Malaysian Government provided several incentives to boost the property development sector. Among the incentives introduced were, exclusion from paying 50% stamp duty for medium cost house up to RM250,000 , reduction in the Overnight Policy Rate (OPR) to 2%, increase of Civil Servant Housing Loan tenure from 25 to 30 years, housing loan interest exempted from paying tax (RM30,000 over 3 years) and the removal of FIC approval for property transactions (Bank Negara Malaysia, 2009). All these incentives, together with the proposed projects in the ETP, were hoped to raise the demand for property development projects and indirectly increase the value of property development companies in Malaysia. The return of mega projects (in the Greater KL/KV) were expected to strengthen the property development sector. The share prices for these companies were predicted to soar higher with the expected earnings gained from the implementation of the incentives and increase in projects. As all these initiatives by the government were expected to lead the boom in the property sector, a study on the property development listed companies' stock price behaviors could be done during this period to evaluate the stock price behavior of these companies in the long run.

2.4 Overview on the Construction Sector in Malaysia

There are currently 44 construction companies (as at November 2014) listed in the Main Board of Bursa Malaysia. Out of this number, 23 companies are involved mainly in the construction sector, where 50% or more of their revenues are derived strictly from

construction activities. The remaining companies are more involved in providing engineering services, trading in construction related materials and property development. The Government of Malaysia established an organization to develop the capacity and capability of the construction industry. This organization is known as the Construction Industry Development Board (CIDB). Among the functions of CIDB include, advising and making recommendations to the Federal Government and State Governments on matters related to the construction industry. It also undertakes research concerning the construction industry in Malaysia, provides consultancy and advisory services and provides training for skilled construction workers and construction site supervisors.

CIDB also provides information and statistics on the number of contractors registered in Malaysia, construction projects in Malaysia and globally and also construction economic indicators which include the GDP Trend and Output Values of the construction sector, construction demand index and estimation of construction output. Their research concentrates more on building systems, technology, material and construction performance management but lack in financial performances, company valuation and stock price behaviors. Therefore, this study provides insight to long-run behaviors of construction stocks which is not available from CIDB.

The construction sector grew steadily due to brisk property market activities and government's efforts in developing infrastructure projects since 1990 but experienced a slump during the 1998 economic crisis where Malaysia went through recession and a serious economic downturn. However, steps taken by the government to save the construction sector helped revive this sector by the year 2000 when it recorded

productivity, job opportunities and production growth of 2.3%, 0.8% and 3.1% respectively where the progress was due to the utilization of modern construction techniques and advancement of the construction sector (Mahmood and Zakaria, 2007). This sector continued to achieve continued growth except during the 2008-2009 worldwide economic crises which was triggered by the sub-prime mortgage crisis that emerged from the U.S. However, the construction sector rebounded back and continued to perform with positive steady growth beginning from year 2010 (refer to Table 2.3).

In BNM's 4th Quarter 2013 Economic Report, the construction sector was found to have expanded by 11.3% during the last quarter of the year 2013. It was supported mainly by the continued progress in the implementation of projects under Malaysia's stimulus packages. Malaysia's first economic stimulus package which amounted to RM7 billion[3], included RM1.2 billion for the construction of low and medium cost houses, RM500 million for upgrading, renovation and upkeeping of police stations and quarters and military camps and quarters, RM600 million for small projects under Public Amenities Maintenance Projects (PIA) and Basic Infrastructure Projects (PIAS), RM500 million for upkeeping and restoration of public amenities such as schools, hospitals and roads and RM500 million for construction and upgrading rural roads, village roads and agriculture roads for the whole country. All these drastic actions taken to stimulate the country's economy, indirectly involves and benefits the construction sector in Malaysia. However, the spillover effect of these developments to the valuation of their shares remains unknown. Thus, this study examines the relationship between the value of these companies and their stock prices during these boom periods of the economy.

[3] Announced in early November 2008 and began in the first quarter of 2009.

The construction sector in Malaysia contributed RM29.3 million to the Gross Domestic Product in 2013 and contributed 6.2% of total employment in all sectors in Malaysia for year 2013 (Economic Planning Unit, Malaysia). The local construction output accounts for 3.5% to 3.8% of gross domestic product and creates about 1,163,000 jobs (Department of Statistics Malaysia, 2014). The output of this industry has a key influence on the country's capability to preserve a feasible economy and environment. Because of this significant contribution to the Malaysian employment, it is important to study the fundamental variables and stock prices. By providing information to investors based on the outcome of this study, the construction sector can grow more by attracting more investors who understand the dynamics of this sector. In the 2013 annual report published by the Central Bank of Malaysia, total loan disbursed by the banking system to the construction sector amounted to RM62.223 billion. Total loans disbursed in 2013 to all sectors amounted to RM961.148 billion, which means that loans disbursed to the construction sector is about 6% of total loans disbursed by the banking sector in Malaysia for the year 2013. However, the construction sector in Malaysia is seen to be growing healthily as Figure 2.5 shows an increase in the amount of loans disbursed to this sector from 2009 to 2013. This shows that the construction sector is growing amid the setback in 2008 which was influenced by the global economic crisis.

Figure 2.5 shows that more loans were disbursed to construction sector compared to the real estate sector. Although both sectors are seen to experience growth in the amount of loans disbursed to them, it can be seen that the amount of loans disbursed to the construction have always been more than the loans disbursed to the real estate sector since year 2009. Both sectors contribute 9.74% from the overall loans disbursed to all

sectors by the Malaysian banking system. As this amount contributes largely to the overall loans disbursed, banks need to understand more on the behavior of construction and real estate stocks and values when disbursing loan so as to not make wrong decisions of giving out too much loan to one sector while depriving the other sector of available funds.

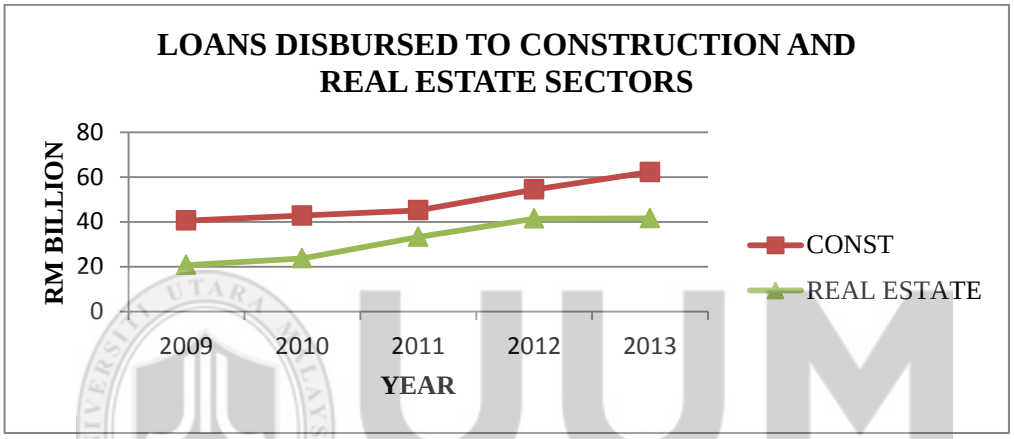

Figure 2.5
Loans Disbursed by the Malaysian Banking Sector to Construction and Real Estate Sectors (2009-2013)
Source: Bank Negara Malaysia Financial Stability and Payment Systems Report 2013

In March 2010, under the New Economic Model for Malaysia, the Prime Minister of Malaysia announced plans to advocate higher stages of economic investment, extension and development of land in Jalan Stonor, Jalan Ampang and Jalan Lidcol in Kuala Lumpur to be tendered out and developed by the private sector. He also announced a joint-venture between the Government of Malaysia and the EPF (Employees Provident Fund) to develop some 3200 acres of land in Sungai Buloh into a new hub for Klang Valley, which is expected to lead to over RM5 billion worth of new investments that will lead to domestic growth. These projects which involve the construction sector and

property development sectors would hopefully promote higher growth for both sectors (National Economic Advisory Council, 2010).

Under the Tenth Malaysian Plan (10MP) for the period of 2011-2015, high impact projects, worth up to RM63 billion were designated for execution. The projects included highway projects, electricity generation plants and land developments. All these projects involve the construction sector and a Facilitation Fund of RM20 billion was provided under the 10MP help the private sector finance these projects.

The Bank Negara Malaysia Quarterly Bulletin (Second Quarter 2013) reported that growth in the construction sector remained strong (14.2% in the First Quarter of 2013), motivated by the civil engineering and residential sub-sectors. The MRT, Tanjung Bin and Janamanjung power plants and Sabah-Sarawak Gas Pipeline continued to be the main motivators in the sub-sector. The construction of high-end residential properties in Klang Valley, Penang and Sabah aided expansion in the residential sub-section.

According to the Quarterly Construction Statistics for Third Quarter 2014 by the Department of Statistics Malaysia, local construction companies listed in the Bursa Malaysia has received contracts worth more than RM2.5301 billion within the third quarter of 2014 which indicate an increase of about 10.7% compared to the previous years' third quarter. This increase is expected to be due to an increase in total tenders issued and execution of projects which received funding from the private funding initiatives of the Economic Stimulus Projects which were introduced late 2009 and early

2010. Overall, the value of construction work done from Q1 2014 to Q3 2014 amounts to RM7.545 billion.

Intrinsically, construction activities are extracted from the local economic activities in Malaysia. The unstable global economy between 2008 and 2009 embodied an overall drop in revenue series in Malaysia's construction market. As the market begins to imitate the general views of global and the country's economy, it has to face economic downturns in every ten years or so (due to recession). Therefore, market progress is inclined to be in a cyclical trend.

It can be observed that with the implementation of the New Economic Model for Malaysia and the 10MP, the construction sector has gone through high growth with high impact projects which lead to increasing amount of contracts and tenders. This will strengthen the economy and encourage inflow of foreign funds from investors who will see this sector as a profitable sector to invest in. It is assumed that the growth in this sector will lead to higher company valuation as companies make more profit from benefitting from these projects, hence, pushing the stock prices higher.

2.5 Summary on the Property and Construction Industries in Malaysia

The local property and construction industries are related as both industries work together to complement other sectors, such as the banking and financial sectors in Malaysia. The banking and financial sectors will be affected during the falling of property prices as properties are mostly used as collateral for loans. During economic

downturns, the loss of construction projects and high interest rates are likely to dampen the construction industry.

Rapid growths in the property sector can strengthen real buoyant economic period gains since property prices appear to employ transitory pro-cyclical outcomes on expenditure and investment. Developing and administering growth in property markets is a perpetual effort by the government and is embedded among the critical goals of the government as the growth impacts on other areas of the economy (Hui, 2009).

In Malaysia, a major property boom period occurred in early 1990s where it peaked twice, once during 1990-1991 and again in 1994-1997. It ended when the financial crisis started in 1997. Subsequently, the property market recovered in 1999-2000 and peaked again in 2001-2006. The worldwide financial crisis which struck many countries starting from 2007 until 2009 showed a slowdown in the Malaysian property market. However, by year 2010, the property market recovered from the slump and grew by 7.8%. The following years from 2011 until 2004 showed steady growth in the Malaysian property market. The property development sector needs the construction sector to build and construct while the construction sector needs the land and marketing expertise of property developers.

It can be seen that the Malaysian government takes the property and construction sectors very seriously based on the implementation of numerous economic plans and stimulus packages designed for these sectors. This is because both sectors are critical to the economy due to their importance to the financial institutions, employment market and

the overall well being of the economy. Hence, it is very important to understand the long-run and short-run behaviors between the property and construction sectors and the macroeconomic variables involved as these sectors are very much affected by the changes in the economic-cyclical nature.

CHAPTER THREE

LITERATURE REVIEW

The literature review contains three sub-sections. The first sub-section covers review on theories which are applied in evaluating stock price behavior with specific focus on property and construction stock price mean reverting behavior. The theories found in the fields of business and finance are applied to explain the objectives listed in this study. The second sub-section uncovers evidences found in previous studies which involve evaluation of stock price behaviors, proxies used to represent fundamental variables, and valuation of shares. Existing literature on other related findings on the real estate and construction sectors in Malaysia and other countries and the relationship between macroeconomic changes and stock prices are reviewed in the final sub-section of this chapter.

3.1 Underlying Theories

The Modern Portfolio Theory (MPT) quantifies the theory of diversification (Harry Markowitz, 1952). The MPT is referred to investigate the diversification benefits of investing in the listed property and construction sectors in Malaysia. The price discovery theory, efficient markets hypothesis (EMH) and mean reversion theory are inter-related within the context of this study. These theories are found to be relevant to the topic of this study, which seek to ascertain the long-run behavior of property and construction stock prices. Price discovery is a procedure where markets seek to discover equilibrium prices (Schreiber and Schwartz, 1986). Since the efficient market hypothesis suggest that information is embedded quickly and fully in stock prices, the

introduction of new information will produce a sequence of trades and price changes as the traders absorb the news, including the price movements and the market looks for a new equilibrium price (Schreiber and Schwartz, 1986).

Harry Markowitz, devised the portfolio problem in 1959 to select the mean and variance of a selection of assets and established the intrinsic formula of mean variance portfolio theory (variance is held constant, expected return is maximized and expected return minimize variance is also held constant). Mean variance portfolio theory was formulated to discover the most ideal portfolio for investors who are concerned with allocations of return across a single time-frame. The MPT states that assets cannot be picked based on only the securities' distinct features, but instead the investor should contemplate on how every security moves together with the other securities. These movements normally result in an adeptness to build a portfolio which had similar expected return and less risk compared to a portfolio designed by disregarding the synergies between securities.

Markowitz (1952) opined that the hypothesis that investors maximize discounted return has to be dismissed. The expected return-variance rule (*E-V* rule) implies diversification for a extensive range of μ_i (expcted value), $\sigma_{i,j}$ (variance). A security might have an extremely high yield (E) and lower variance (V) compared to other securities, where its undiversified portfolio would give maximum *E* and minimum *V*; but for most representative range of μ_i, $\sigma_{i,j}$, the *E-V* rule is a catalyst for efficient portfolios where almost all of which are diversified.

An ideal portfolio is one that capitalizes the ratio of excess return on the portfolio to its standard deviation of returns (Elton, Gruber and Padberg, 1976). They proposed to include a new stock into a portfolio where its surplus return to standard deviation ratio surpass that of the lowest grade stock and will not be included if its surplus return to standard deviation ratio is below that of the highest grade stock.

In the real estate context, the MPT is applied when diversification problems arise in real estate investment decisions. Real estate is considered as a promising new asset class for inclusion in a mixed-asset portfolio as it has (i) low correlation with other asset classes, (ii) potential for inflation hedge ability, and (iii) possibility for predictable returns (Norman, Sirmans, and Benjamin, 1995; and Corgel, McIntosh and Ott, 1995).

Seiler, Webb and Myer (1999) found that it is not only essential to diversify between asset classes but within each asset class as well. Diversification within the real estate sector should be encouraged to expand by purchasing more diverse range of properties since real estate varies in size, property type, geographic (economic) region and metropolitan area (edge city versus business district). In relation to diversification within the real estate class, many studies have found ways to achieve diversification using the fewest number of properties possible.

MPT poses two serious limitations when applied in the construction of real estate portfolios, which are, (i) the intertemporal uncertainty of the portfolio weights and (ii) the rapid decline in efficiency of the most favorable portfolios outside the sample period used to assess asset mean returns. Lee and Stevenson (2000) evaluated optimal portfolio

allocations by using test methods that reduced the impact of estimation inaccuracy on unsurpassed portfolio apportionments. Their study discovered that outstanding performances only developed at longer horizons of about five years, when the Minimum-Variance Portfolio started to exceed the impinging portfolios and the standard indices.

In 2002, Fabozzi, Gupta and Markowitz re-evaluated the MPT's application to current investors as they opined that investment professionals and investors in present day are dissimilar from those 50 years ago. MPT supplied a structure to build and choose portfolios depending on the anticipated progress of the investments and the level of that the investor is willing to take. In their review of the MPT, Fabozzi *et al.* (2002), stated that historical returns are not good estimates for future performance as it depends on the strength and stability of the underlying economies. They also found that by including more asset classes into a portfolio creates larger opportunities, where the boundary covers a larger risk/return spectrum, resulting in lower risk for every level of expected return.

The next theory that is closely related to mean reversion of stock prices is the price discovery theory. The price discovery theory is closely linked to the mean reversion hypothesis where prices are said to revert to equilibrium in the long-run. In 1985, Ho, Schwartz and Whitcomb modeled short-run price determination under transaction price certainty and showed that two conditions must be satisfied for the aggregation of orders to result in a transaction price equal to the theoretically desirable equilibrium price, that is, (i) individuals must be distributed symmetrically according to their demand to own

the stocks, and (ii) expectations of individuals concerning the market clearing price must be unbiased. It is expected that when either condition is violated, the realized market clearing price is perturbed, thus, for traders expecting a clearing price that is less (greater) than the equilibrium value, the resulting transaction price can be greater (less) than the equilibrium value.

Time series, an economic variable, can wander extensively while several pairs of the series may be predicted to move so as to not drift too far apart. Equilibrium relationships are situations where equilibrium is a static point distinguished by causes which are inclined to thrust the economy to return to equilibrium as it shifts away. These ideas were studied by Engle and Granger in 1987 error-correcting models permit long run constituents of variables to overcome equilibrium restrictions while short run constituents have adaptable dynamic details. This condition was introduced as cointegration by Granger (1981) and Granger and Weiss (1983). Engle and Granger (1987) opined that it is important to examine if a set of variables are cointegrated due to economic consequences including whether some system is in equilibrium in the long run. Cointegrated series move together over time to the idea of error correction where when a given movement moves away from long-run cointegration equilibrium in one period, a relative amount of the disequilibrium is rectified in the next period.

In their paper written on price discovery in securities markets, Schreiber and Schwartz (1986) found that a fair price in the securities markets is said to be one that accurately reflects the demand propensities of all traders. This price would not be distorted by inadequate information, perturbed by unexpected jolts in the order flow, obscured by

transitory thinness in the market, or affected by the design of the market's trading system.

A misunderstanding that has arisen is that the efficient market hypothesis (EMH) might lead one to conclude that price discovery is not a problem. Schreiber and Schwartz (1986) found that while the EMH focuses on the issue of whether investors can make above normal returns by exploiting existing information, serial dependence in stock price changes does not violate the EMH, if the pattern is not concentrated enough for its exploitation to be economically viable. However, newly found empirical evidence suggests that such serial dependence does exist and the pattern appears to be diffused but how one might be able to exploit it so as to make above normal trading profits is still unclear. The most fundamental reason that efficient price discovery is not widely recognized is that it is not clear how to assess observed equity prices, because there are no base prices against which to contrast them. This was discovered by Phillips (1985), who pointed out that the existence of a cash price has enabled efficient price discovery to be a clearly recognized function of the futures markets. Schwartz and Schreiber (1986) opined that a promising approach to efficient price discovery is to assess equity price movements in the context of an underlying returns generation relationship.

Yan and Zivot (2007) studied the price discovery dynamics and defined it as an efficient price discovery process represented by the speedy adaptation of market prices from the old equilibrium to the new equilibrium when new details are received. The dynamics of price discovery is characterized by how ascertained prices respond to the ordinary efficient price innovation. Yan and Zivot (2007) opined that a market is more efficient

in the price discovery process if it absorbs a greater amount of new information at a faster speed than another market. There are numerous studies that have supported the price discovery theory in securities market. Many studies have provided evidence of price discovery of real estate stock prices in the U.S, U.K., Australia and Asia. These studies investigated price discovery in the property markets, measures of contribution to price discovery and the dynamics of price discovery.

In 1969, Fama investigated the efficiency of capital markets and performed weak form, semi-strong form and strong form tests and concluded that the efficient markets model stands up well. Fama opined that the random walk model is most suitably deemed as a special case of the more prevalent expected return model. Fama (1969) also stressed that, strong-form tests are concerned if investors have monopolistic access to information which is relevant for price composition. Semi-strong form examines the data which includes all openly accessible news whereas weak form examines the data of past price or return series. The strong form efficient markets model is possibly best observed as a point of reference against which deviations from market efficiencies can be assessed.

In a sequel to his earlier study on efficient markets, Fama (1991) reviewed the topic of market efficiency and classified them into new categories. The result brings to the conclusion that firm-specific information leads to efficient adjustment of prices. The research leads to the discovery that private information is rare while return predictability tests found that returns for short and long time periods are foreseeable from dividend yields, earnings/price ratios and default term spreads of bonds.

Mean reversion theory proposes that prices and returns ultimately revert to the mean or average which could be the past average of the price or return or other related average for example, the development in the economy or the average return of a particular sector. Numerous approaches in relation to sales or purchases of stocks whereby current performances differ largely from their historical averages are guided by this theory. Nevertheless, a shift in returns can be an indicator that the firm does not have the same prospects it used to have, whereby it is less possible that mean reversion will take place. This study tests for mean reversion properties of property and construction stock prices towards their mean to predict the potential returns which can be obtained if the stock prices do mean revert to their mean values.

The mean reversion theory states that if stock prices analytically go beyond, then the reversion has to be foreseeable from only historical return data, therefore this theory can be said to be linked to the weak form market efficiency tests. Summers (1986) claims that inefficient market models show that prices take long transitory shifts away from their fundamental variables. Poterba and Summers (1988) opines that the stock market could be less risky when the variance of single-period returns is extrapolated using the random walk model if stock price movements contain large transitory components. Previous views have always suggested that long horizon investors should invest more in equity compared to shorter term investors. These views can be applied only if the prices exhibit mean reverting behavior. The results of this study will reveal whether the property and construction properties do follow the mean reverting behavior leading to a conclusion of whether the market prices are efficient or inefficient.

3.2 Empirical Evidences

This section elaborates on the relationship between the property and construction sectors in Malaysia and the mean reversion behavior of the stock prices to their fundamental variables, which are the NAV, EPS and DPS. The mean reversion sub-section includes literature on property and construction stock price behaviours and stock price valuation methods.

3.2.1 Relationship between Property and Construction Sectors

This relationship and interdependence relationships between the property and construction sectors are displayed in this section. Previous literature on the property and construction industries reveals useful information on both industries in terms of growth and stock prices movements. The impact of developments in these industries on the economy is also discussed in this section.

The real estate and construction sectors rely on each other in property development. The real estate sector depends on the construction companies to build and construct whereas the construction sector relies on the real estate sector for sources of land banks. The performance of both sectors and their diversification opportunities are reviewed in this sector.

The performance of Malaysian listed property companies has been widely studied by Ting in 2002. In his study, he divided Malaysian listed property companies according to their pertinent characteristics. These include, township developers, developers focusing on major cities, developers of high and medium cost housing schemes, branches or

affiliates of plantation holding companies and property investment companies. The listed property companies' were tested to examine whether they achieved higher risk adjusted returns than shares and direct investment in residential properties, if they could offer portfolio diversification potential and whether they could act as substitute for direct investment in residential properties.

Results from Ting (2002) show that property development companies perform better then property investment companies and listed property trusts. However, on an overall basis, the Property Index is not superior in performance compared to other stocks represented by KLCI. Listed property shares also do not offer diversification benefits as it is discovered to be greatly correlated with the stock market. This is because direct residential investment could not be substituted by property shares due to low negative correlation between listed property shares and MHPI (Malaysian Housing Price Index).

The Malaysian property market was deeply affected by the Asian Financial Crises in 1997 as banks were imposed by stringent lending laws enforced by Bank Negara Malaysia (BNM). Ting (2002) examined the share price responses to corporate real estate disposals for the period of January 1992 to December 2001 and also difference in cumulative returns for the two economic periods. He then further examined the cause of the gains/loss to the cumulative returns. He found that during the financial crisis, investors' projections on the profitability of firms are negatively affected by low economic conditions, tight fiscal and monetary policies. The results of this study disclose contrasting price effects during announcements of companies' property

disposals amid a buoyant and recession economic period. Results indicate a significantly positive reaction to the reporting of property disposals.

However, property disposals reported during a recession period leads to a significantly negative price effect. The diversification benefits of securitized real estate in Malaysia were examined by Lee and Ting in 2009. Malaysian property shares were examined to determine whether they could provide any further benefit on risk diversification of return enhancement in a portfolio which includes REITs (Real Estate Investment Trust). Results from the study indicate that little advantage can be obtained by the addition of property shares in a mixed asset portfolio, suggesting that the Malaysian property share market is not a lucrative asset as it does not offer less risk reduction or return enhancement in a mixed asset portfolio. However the study did not include construction stocks in the portfolio. Thus, it differs from our study in the sense that our study aims to discover whether there exists diversification benefits by including both property and construction stocks in a stock portfolio.

A study on the growth and construction output in Malaysia showed that there is a positive correlation between construction output and the GDP (Abdullah *et al.*, 2004). This indicates that the construction industry follows the growth trend of the economy, thus making the economic situation an important factor that influences the future growth of the industry. In Malaysia, the real estate and construction sectors are very susceptible to economic conditions as their stocks prices soar during the bull period and dips when the market slumps. In the early 1990s, falling property prices created problems for financial institutions where most collateral consist of properties. The construction sector

grew at 13.4 percent during the economic boom of early 1990s from active property market and the growth of infrastructure projects but lessened considerably in 1998 due to the Asian financial crisis (Mahmood and Zakaria, 2007).

Another study on the influence of property developments on the real economy of Malaysia was conducted by Hon (2009). He opined that property growths can contribute to a thriving economy as property prices appear to utilize temporary pro-cyclical impacts on both consumption and investment, enabling the property market to be made a policy tool for short-term macroeconomic management. The construction sector experienced a sharp decline in the 1997-1998 crises in response to the property market crash. The findings of the study propose that in the long-run, property booms produce a significantly negative impact on private consumption and a significantly positive effect on gross investment. Hence, the net effect on domestic demand would offset. Results from the ARDL regression shows that real estate price and real GDP are crucial driving forces for domestic demand. The findings in the study reveal that in the long-run, domestic demand and GDP are impartial to changes in property prices. This is because as property booms lead to larger gross investments, a counteracting drop in private consumption. However, in the short-run, the impartiality of demand and GDP to property price oscillations is less definite. Our study aims to discover the effect of changes in the GDP on property and construction stock prices as it is assumed that macroeconomic shocks often lead to movements in stock prices.

Listed construction and property companies in Nigeria were studied by Rasheed and Tajudeen (2006). Property shares were found to be able to present portfolio

diversification when combined with construction and stock portfolios. Both sectors have low correlation with the stock market when combined in an equity investment portfolio in contrast to the findings of Ting (2002) who studied the performance of listed property companies in Malaysia where he found high correlation between property shares and other shares listed in the Bursa Malaysia, thus concluding that property shares in Malaysia cannot offer diversification opportunities. Domian *et al.* (2007) found that the bigger the portfolio size, the lower the risk becomes in the U.S. markets. Small portfolios can achieve less risk by diversifying across industries, but also by purely adding the number of stocks. Based on this finding, we proceed to investigate whether it is possible to achieve diversification benefits by investing across the property and construction industries and therefore increasing the number of stocks. In a more recent study, Lin and Lin (2011) discovered that integration between stock markets and real estate markets in Asia offer diversification potential for investment portfolios in South Korea and Singapore. This finding encourages the research on the diversification potential of the real estate listed stocks in the Malaysian stock market.

3.2.2 Mean Reversion of Stock Prices to Their Fundamental variables

In order to investigate the mean reversion properties of property and construction stock prices to their fundamental variables, the behaviors of the stock prices must be understood beforehand. Previous studies include cointegration tests to discover the relationship between the stock prices. The error correction mechanism is applied to discover the period of time taken to mean revert to equilibrium. Different valuation methods and proxies to represent the fundamental variables have also been applied to find the most suitable variable to value the stocks.

3.2.2.1 Property and Construction Stock Price Behaviors

Easley and O'Hara (1987) studied the subject of the learning process of market makers. The speed at which prices adjust to their 'true' prices are ascertained by a range of factors, including, market size, depth, volume and variance. Higher trading volume could delay the speed of price adjustment, lowering economic efficiency. In this study, the speed of the adjustment of the stock prices to equilibrium is investigated based on its relationship with its NAV, EPS and DPS which are assumed to be the determining factors of the stock prices.

In 1995, Barkham and Geltner studied the securitized (public) and unsecuritized (private) commercial property markets in the U.S. and the U.K. for proof of price discovery. The transitory cross-correlation framework between the securitized and unsecuritized commercial property returns in the respective countries was considered in examining the price discovery question in the paper. The correlations revealed that an obvious symmetry between the leading versus lagging correlations exist in both countries. Since price discovery in this study is implied by positive cross-correlation between the two market structures, the arrangement suggests price discovery occurring in the U.S. and the U.K. market structures. Information was discovered to be not fully transmitted to the unsecuritized market for a year or more. Barkham and Geltner (1995) opined that the existence of price discovery in the securitized markets has some repercussions for capital market theory. It proposes that the trading consistency, liquidity and micro-structure benefits of the securities markets surpass the market broadness and participant refinement benefits of the unsecuritized private markets in commercial real estate.

Several studies on price discovery in the real estate industry have concentrated on the Hong Kong capital market. This is mainly because Hong Kong stock market is liquid and real estate companies make up 25% of stock market capitalization in 1995 (Chau, MacGregor and Schwann, 1997). Also, seven largest developers in Hong Kong provided an average of more than 60% of new residential units for the period of 1980-1994. Chau, MacGregor and Schwann (1997) also noted that there exists solid confirmation of lagged autocorrelation in the direct real estate returns and lagged cross correlations with securitized returns, which means that price discovery exists among the markets.

He (1997) found that price changes in real estate submarket have significant effects on the commerce industry, financial institutions and public utility indexes studied in Hong Kong as the price adjustments were exceptionally significant. The error correction terms significantly raise the informative power of the error correction model and also exhibit the price discovery process among industries in Hong Kong. Cointegration is closely linked to the price discovery process as the test of cointegration checks for a steady long-run relationship along with various macroeconomic time series and to determine if an equilibrium relationship exists between the price processes producing the earnings for two assets. Cointegration constitutes the stationarity of linear composites of the variables. This means, if the variables are cointegrated, they will not drift randomly from each other. Thus, stable long-run relationships are implied amidst these variables in cointegration. This result is relevant to our study whereby cointegration is applied to determine the relationship between the real estate and construction industries.

Madhavan (2000) studied the theoretical, empirical and experimental literature on market microstructure which relates to price discovery, among others. Madhavan (2000) opined that market microstructure is closely affiliated to the field of investments, which analyzes the equilibrium values of financial assets. One of the most crucial questions in market microstructure involves the technique whereby prices confine new information. Thus, models of how prices are determined in securities markets are needed. The study found that identification of factors (for example, fundamental variables) that cause price movements leads to creating of practical models to examine sources of observed patterns and short-run phenomena along with explaining intermittent oscillations in market liquidity, which concerns traders and investors. This is because once causes of price movements are determined; traders and investors can use this information for their benefit in trying to maximize their profits from the stock market by predicting the stock price directions based on the information obtained.

Price discovery is described as one of the main functions of secondary markets where the resourceful and well-timed integration of the information inherent in investor trading is embedded into market prices (Lehmann, 2002). The philosophical difficulties associated with the identification of fundamental variables and abstract notions of heterogeneous private information are bypassed in the market microstructure literature by defining fundamental value as the price of an asset in the distant future and private information as some knowledge as to where prices are headed. Lehmann (2002) further stressed that fundamental value is a permanent component of prices and deviations of current prices from fundamental value may be related to private information that is revealed in the price discovery process. Therefore, fundamental variables such as NAV,

EPS and DPS could be investigated to discover whether they contribute to price discovery process.

In Hong Kong, Schwann and Chau (2003) studied the temporal stability of price discovery relationship using real estate data. They propose that the price discovery procedure differs at different periods, subject to market situations in the markets. A change in regulation or policy is another reason to suspect a shift in price discovery whereby the change would alter the long run equilibrium relationships in and between markets. Schwann and Chau's analysis indicates that extreme events in the history of securitized returns are related to a temporary reduction in the returns to direct property investment and to a reduction in the strength of the price discovery effect. They further propose that the magnitude of price discovery outcome is determined by the extent of real estate information implanted in the history of securitized returns. The evidence from Schwann and Chau's study (2003) indicate that price discovery decreased considerably after a news event. The extent or magnitude of the long run price discovery effect also lessened once the news effects are controlled. Their interpretation of the return events were supported by their estimation as pure shocks to the information flow, as opposed to the interpretation that price discovery responds differently to whether the news is good or bad.

A recent study on price discovery in the real estate context by Yavas and Yildirim (2011) found dynamic correlation between NAV returns and REIT returns and existence of a solid extent of persistence in the correlation series. They discovered that price discovery predominantly happens in the securitized public market. Significant

differences throughout property types and individual firms within each type were also found. It was concluded that designing an ideal portfolio requires firm level analysis of causality and correlation between REIT returns and NAV returns. This finding shows that NAV is a significant factor in the property sector; therefore it can be included as one of the fundamental factors that determine the price of the real estate security.

Summers (1986) claimed that in models of an inefficient market, prices take long impermanent shifts off their fundamental variables where prices have slowly decaying stationary components. Fama and French (1988) discovered that negative autocorrelation of returns produced by a slowly decaying constituent of prices is weak at the short run horizon but turns more powerful as the return horizon expands. This evidence supports Summers' (1986) claim that stock prices have a slowly decaying component. This result indicates that the market is inefficient therefore it does not support the EMH.

In most microstructure models, expectations of security payoffs are important determinants of prices and trading strategies. Hasbrouck (2002) opined that the random walk is an important construct in the empirical analysis of security price dynamics. The security price may be viewed as containing an implicit random walk component which is economically meaningful. A single security that features many prices (such as, last-sale price, bid and offer quotes, and prices taken from alternative trading venues) reflects two considerations (Hasbrouck, 2002). First, every stock price is integrated, hence it includes random walk component. Second, pairs of prices are connected in the long run by arbitrage and/or equilibrium relationships. Thus, any two prices will not arbitrarily

wander over time, hence this information implies that the prices are cointegrated, and they contain a single random walk component. The associated price changes are correlated if both prices are cointegrated. Therefore, it can be said these markets are efficient since the price of a stock or index will follow a random walk because its price is influenced by unforeseen events which take place at random time intervals.

The logic of the random walk idea defined by Malkiel (2003) states that if the flow of news is smooth and is instantly mirrored in stock prices, the next day's price shift would copy only the next day's news and be unrelated to the price shifts that occur today. He also defined efficient financial markets to be markets that do not permit investors to gain above-average returns without taking extreme risks.

In examining the integration relationship within the five main sectors' price indices listed on the Main Board of the Malaysian stock market, Chan and Karim (2005) found that the causal relationship for both the short-run and long-run relationships appears to be more distinct in the daily rather than the weekly price indices, which shows that the price disturbances in all the sectors' price indices take a comparatively shorter period to adapt to equilibrium. This proves that the Malaysian stock market is considered efficient in the adjustment of any short-run and long-run disturbances. However, the study is different from our investigation as it focused on the Malaysian stock market generally as it included five major stock indices in Bursa Malaysia instead of only property and construction indices. Our study aims to discover the movement of stock prices back to their fundamental variables specifically for the property and construction sectors. As the study of Chan and Karim (2005) shows evidence of efficient Malaysian

stock market, it can be predicted that the property and construction stock prices also follow the random walk. However, this issue will be investigated further in the data analysis chapter. Suresh *et al.* (2013) studied the efficiency of the BRICS (Brazil, Russia, India, China and South Africa) stock markets and discovered that these emerging stock indices have a nonlinear data generating process and are stationary. This evidence shows that emerging market stock indices are inefficient. These markets normally involve high costs of raising capital and could lead to inappropriate investments.

DeBondt and Thaler (1985), Fama and French (1988) and Poterba and Summers (1988) all found evidences of mean reversion in their studies on stock trends, portfolios and returns. DeBondt and Thaler (1985) found that it is essential to lengthen the portfolio formation period to generate more extreme observations. They found that more excessive initial price shifts lead to longer reversals. Hence, they suggest that return reversals represent proof of mean reversion. However, they have not specifically gone into the property and construction sectors. Their studies focused on the predictability of long horizon returns for all stocks listed in the New York Stock Exchange (NYSE) for the period of January 1926 to December 1982.

Following a series of papers by Poterba and Summers (1988), Fama and French (1988) and Lo and MacKinlay (1988), which show that sample variance ratios are generally below unity for lags longer than a year and above unity for shorter lags. Kim, Nelson and Startz (1991) examined the empirical evidence for mean reverting behavior in stock prices. They applied variance ratio tests whereby the variance ratio can be regarded as

reviewing the autocorrelations of returns as the sample variance ratio can be revealed as positively weighted sum of the sample autocorrelations plus unity. Stock returns which are distinguished by positive autocorrelations over intervals under a year and by negative autocorrelation over longer intervals are defined as proof of "mean reverting". They found that the variance ratio drops to below one at long lags in historical time series, which is defined as evidence of long term mean reverting behavior in the stock market. The weakness of variance ratio tests is due to their concentration on testing only one variance ratio at a time for a single aggregation interval therefore they are basically individual hypothesis tests. Due to these reasons, we do not include variance ratios to test for mean reversion in this study.

By modeling the fundamental value as a stochastic process, Chiang, Liu and Okunev (1995) conducted a study of mean reversion behavior whereby the market value of an asset is modeled as a mean reverting Ornstein Uhlenbeck (OU) process toward the fundamental value. Earnings and dividends were used as proxies for fundamental variables where the model was tested empirically. The model enables them to achieve the functional form in relation to the asset price to the fundamental value. The speed of adjustment coefficients found were significant suggesting shifts in stock prices are more powerfully mean reverting in the dividend model compared to the earnings model. They also found evidence indicating that the greater the variation amidst the stock price and the fundamental asset value, the more powerful the reinstating force of the motion of the stock price to approach the fundamental value will be. The overall results of the return regressions suggested that both the earnings and dividend models achieve similarly good

performances in predicting asset returns. A disadvantage of the OU process is that the stationary distribution is always normal, thus limiting flexibility in the model.

In a study on the Singapore property market price deviations, Sing, Liow and Chan (2002) found a long-run convergence relationships of listed property stock prices with their fundamental variables over a ten year period, which indicated the existence of mean reversion. They opined that if stock prices mean revert to approach their fundamental variables, corporate investors will have to concentrate on the underlying performance of the stocks with regards to their fundamental variables in their stock picking process as stocks with strong fundamental variables will dominate in the long run in comparison to those that follows the random walk path of the market. The error correction mechanism (ECM) is capable of adjusting stock prices that have deviated from their fundamental variables from time to time, to guarantee that the market is rational instead of over-reacting to past information. The ECM is a useful tool since it corrects the stock prices from deviating far from their fundamental variables whereas other methods such as the variance ratios and the OU process are unable to do so.

The issue of whether stock-price indices of emerging markets can be described as a random walk (unit root) or a mean reversion process is studied further by Chaudhuri (2003). In his study, the mean reverting process of a stock price is described as an inclination for the price level to return to its trend path over time and investors could be able to predict future returns by exploiting information on historical returns while a random walk process is said to indicate the instability of stock price growing without limit in the long run. The null hypothesis of a random walk is rejected (the alternate

hypothesis of existence mean reversion is accepted at the five percent level) for seventeen emerging stock index prices where a positive speed of reversion with a half-life of about 30 months was found.

Liow (2003) investigated the relationship between property company stock prices and their fundamental variables (represented by NAV, net asset value) from a mean reversion outlook. Although mean reversion of Singapore property stock prices towards their NAVs is proven to exist, the movement of the stock price towards NAV is slow and deviation for both markets can be delayed. This indicates that the NAV is significant in capturing the flow of the modifications in the property stock prices and therefore concludes that NAV is relevant in property company valuations. When stock prices observe a random walk process, it signifies that shocks to prices have a lasting effect, which indicates that stock prices will achieve a new equilibrium and impending returns will be not able to be forecasted depending on past drifts of the stock prices (Narayan and Narayan, 2007). Alternatively, if stock prices are mean reverting then shocks to prices based on past behavior can be established as strategies to gain returns.

Mean reversion is likely to cause market levels to have a significantly positive shift when the market declines to ensure that the market will be pulled strongly back to some long run average level over time (Bali *et al.*, 2008). A substantial decline of the market can efficiently increase risk aversion for investors because of liquidity, financial or short sale constraints. The increased risk aversion will consequently lead to a rise in future expected return. They concluded that when there is significant market downturns, mean reversion tends to lead the market to go through a significantly positive shift in order to

return to its long-run average level over time.. In contrast to earlier studies, Narayan and Narayan (2007) find no proof of mean reversion of stock prices, which is conforming to the efficient market hypothesis. They opined that stock market efficiency signifies that prices react speedily and precisely to related news while a random walk procedure depicts an efficient stock exchange. Thus, returns of a stock market will be unpredictable based on historical price changes.

In another study, Culik and Valecky (2010) found that the use of non-linear mean reversion should be avoided as the residual variance for this model is always lower than linear models. It should only be used when factors cannot be separated into simple terms as some terms are a factor times a coefficient and another is a second factor taken to the power of a third coefficient. As the non-linear mean reversion method is a complicated and tedious process, it is best to apply other methods which could be more simple and accurate. A recent study by Mukherji (2011) discovered that mean reversion in stock returns has weakened in recent decades. However, the mean reversion still perseveres, specifically for small company stocks. In another study by Chen and Kim (2011) on emerging Asia markets, evidence show that, using nonlinear unit root tests, proof of nonlinear mean reversion do exist in these markets.

3.2.2.2 Stock Price Valuations

Results from studies by Sing *et al.* (2002) and Liow (2003) in Singapore and Liow and Li (2006) for Asian Pacific companies have shown that dividends per share (DPS), earnings per share (EPS) and net asset value (NAV) have been widely used as proxies for fundamental variables for stock prices of real estate listed companies. The stock

price behaviors of each sector and their long-run relationships in terms of performances and diversification benefits are discussed here.

Limited evidence on proxies for fundamental in the property and construction sectors drives us to investigate the matter by referring to studies on overall fundamental value and stock price performances in various markets. By testing the relationship between corporate fundamental variables and stock price performance, Fama and French (1988) found DPS to be significant in explaining stock returns. In 1988, Campbell and Shiller found evidence that earnings data, when averaged over many years, help forecast the present value of future dividends. They also found evidence of DPS, dividend growth and long term EPS to be significant in explaining returns. Their technique revealed that stock returns and dividend-price ratios are too erratic to be accounted for by news about future dividends.

To answer an integral question in accounting on the relative ability of accrual-based earnings and cash flows to provide information relevant for financial performance measurement and equity valuation, Subramanyam and Venkatachalam (2001) examined the related capability of earnings and cash flows in describing *ex post* intrinsic value of equity. The dividend discount model (DDM) and the residual income model (RIM) are used as measures for intrinsic values in their study as both measures capture the present value of all future cash receipts to investors. Evidence found showed that accrual based earnings is better than cash flows in furnishing information about future cash flows to investors. Valuation performance on a list of value drivers were examined by Liu,

Nissim and Thomas (2001) and they found that multiples[4] derived from forward earnings explain stock prices very well. In their study, they tested several multiples used in equity valuation and found that forward earnings ranked the highest in terms of relative performance, followed by historical earnings, cash flow and book value of equity while sales perform the worst.

In the Malaysian context, Lee and Lee (2008) found that the coefficient of dividend yield and capital gain carried the expected sign and is statistically significant to predict future stock return. However, further tests show that the inclusion of capital gain does not increase the predictive power. For earning to price ratio, the coefficients of all the independent variables are statistically significant, although it was also found that earning yield has less predictive power compared to dividend yield. The difference between Lee and Lee's (2008) study and this study is that their study utilizes dividend yield, earnings yield and capital gains as fundamental variables to determine the movement of stock prices while this study applies net asset value (NAV), earnings per share (EPS) and dividend per share (DPS) as proxies for the stocks' fundamental variables. Liow (2003) found evidence that NAV is relevant in property company valuation in his investigation on property company stock price in Singapore.

Dividend yield and earnings yield are more suitable to be used in comparing returns while DPS show the sum of declared dividends for every ordinary share issued while EPS is the driver of value and is the bottom line measure of a company's profitability

[4] Multiples are used to capture a company's operating and financial characteristics in a single number that can be multiplied by some financial metric to produce an equity value and is normally stated as a ratio. Multiples are useful in comparing similar companies/assets which are currently priced in the market.

whereas capital gains are only realized in the event of the sale of assets or shares. Therefore, it can be said that NAV, EPS and DPS are better proxies for fundamental variables of property and construction stocks compared to dividend yield, earnings yield and capital gains. In another local study, Chan *et al.* (2012) studied several variables comprising property stock performance in Malaysia and found that return on assets (ROA), return on equity (ROE) and earnings per share (EPS) have the strongest relationships with property stock price performance. The study by Chan *et al.* (2012) is similar to this study in the sense that it investigates the effect of EPS on stock prices. However, this study does not apply ROA and ROE but instead NAV and DPS are applied to discover their effects on property and construction stock prices. This is because the objective of this study is to discover the relationship between stock prices with their fundamental variables (NAV, EPS and DPS) and not the link between profitability and stock price performance. ROA and ROE are profitability measures as they indicate how lucrative the company is with respect to its total assets and shareholders' equity. They are also known measures for managers' efficiency in using its assets or shares to generate earnings.

Richardson, Sloan and You (2012) studied stock price movements to determine whether fundamental variables or investor perception controls the movements more and revealed that investor identification controls stock price shifts over short horizons while fundamentals dominated over longer horizons (more than 5 years). Since the objective of this study is to discover the long-run relationship of the stock prices, the investigation of stock price movements shall proceed with their fundamental variables. In a study by Spierdijk *et al.* (2010), they discovered that the speeds at which stocks mean revert to

their fundamental value is higher during economic downturns which were attributable to significant economic and political events. In a study by Glezakos and Mylonakis (2012) on the Athens Stock Exchange, they found that earnings per share (EPS) and book value per share (BVPS) possess explanatory power in the formulation of stock prices and they increase in time. Since NAV is also known as book value of tangible assets per share, it can be said that this study uses similar variables as proxies for fundamental variables as Glezakos *et al.* (2012) to investigate the property and construction stock price behaviors. Similarly, in a recent study by Sukhija (2014) on the fundamental determinants of stock prices in India share market also found EPS to have positive and significant impact on share prices at 5% level in the pre-recession period while book value and DPS have positive link with share price and is statistically significant during post-recession. This discovery shows that the economic situation of a country also influences the fundamental variable that can be used to value a particular stock. However, although this study spans across the 1998 world economic crisis period, the performance of the stocks during this period are not investigated as the main aim is to investigate the overall relationship between the stock prices movements with their fundamental variables across 19 years. This time period is taken to limit any possible prejudice or bias due to a particular time period.

The fundamental valuation equation was studied by Constantinides (1989). The covariance of the asset's return with consumption, the market portfolio return, state variables or economy wide factors are related to the expected excess return. In a different study, Nissim and Penman (2001) identify useful ratios for valuation for the period of 1969 to 1999. Ratios are detected to be able to drive future residual earnings,

free cash flow and dividends. This is further reinforced by Palepu and Healy (2004) who studied on business analysis and valuations using financial statements and found that price multiples are most commonly used by analysts as it is the simplest method which does not call for elaborate multiyear forecasts of parameters such as growth, profitability and cost of capital. However, to value a firm using multiples, an analyst must assess the quality of the variable used as the multiple basis and determine the appropriate peer firms to include in the benchmark multiple. In a study by Worthington and West (2001) on the use of Economic Value Added (EVA) as a proxy to value a company, they discovered that studies in developed countries support the EVA. However, due to implementation an issue, its validity is currently still under debate. Kyriazis and Anastassis (2007) studied the stock performance in the Athens Stock Exchange and found that net income appear more value related than the EVA. EVA unique components were found to only add slightly to accounting profit. Penman (2010) opined that residual earnings measures that adjust GAAP (Generally Accepted Accounting Principles) accounting have been developed to measure the EVA and warned users that the measures undo accounting conservatism by capitalizing and amortizing R&D and advertising. This is relevant in the case of measuring the economic value of intangibles.

Demirakos, Strong and Walker (2004) studied the valuation practices of analysts across several industries in the U.K. They found that price-earnings (PE) models remain the foundation of valuation practice and are complemented by other forms of analysis, such as the DCF (Discounted Cash Flow) models, price-to-sales multiples, growth options or

profitability analysis. Multiperiod valuation is found to be more likely a dominant model compared to single period valuation.

In estimating the intrinsic value of a company, Brown and Reilly (2011) also used the two general approaches to valuation, which are the DCF and Relative Valuation techniques. For the Relative Valuation technique, the price/earnings ratio (P/E), price/cash flow ratio (P/CF), price/book value ratio (P/BV) and price/sales ratio (P/S) were used as multiples to derive the intrinsic value of stocks. Relative valuation uses multiples where the market value is divided by earnings, book values or revenues to arrive at an estimate of standardized value. The multiples are uncomplicated and can be used to acquire estimates of value promptly for firms and assets. The use of multiples and comparables is less time and resource intensive compared to the DCF valuation method. The relative valuation is also simpler which means that it is easier to sell and defend when explanations are needed. It is also more prone to replicate the present market atmosphere since it will produce values that are nearer to market prices across all stocks. The most commonly used equity multiple is the price-earnings ratio, where the market value is scaled to net income.

Damodaran (2006) elaborated on three valuation approaches, namely, the discounted cash flow valuation, the relative valuation and the contingent claim valuation. The DCF valuation approach was found to have more limitations as it can be manipulated to produce estimates of cash flows, growth rates and discount rates that might not have any relationships with the intrinsic value. DCF models could also discover each stock to be overvalued if market opinions exceed fundamentals. It is also a one period model

whereby it is normally used to estimate the future cash flow for a certain period by depending on the growth rates of cash flows and the forecast of the discount rate. Due to this, investors and analysts have found the DCF to be of very little importance in making investment decisions (Barker, 1999). However, all the studies mentioned above focus on discovering the intrinsic value of the stocks based on a single period whereas this study intends to look at the long-run effect of mean reversion of the property and construction stock prices in Malaysia.

The contingent claim valuation was developed to value listed options and it can be utilized to value assets that have option like features (Damodaran, 2006). It is used on assets that cannot be valued with conventional valuation models as their value emanates completely from their option features, therefore it is not relevant to be used to value real estate and construction companies. Evidence show that the utmost appropriate technique for assessing a firm is to discount the forecasted future cash flows since the worth of a company's equity emerges from the firm's capability to develop cash flows for the equity's proprietors (Fernandez, 2007). In further relation to company valuation methods, he studied four main groups which comprised of the most commonly used company valuation methods: balance sheet-based methods, income statement-based methods, mixed methods and cash flow discounting-based methods. He established that the most appropriate technique for appraising a firm was to discount the forecasted future cash flows, as the worth of a company's equity originates from the company's ability to produce cash for the equity's proprietors. However, in contrast, an earlier study by Barker (1999) found that professional analysts and investors grade the P/E model and the dividend yield model as the most significant valuation models to use.

The P/E ratio is subjective as it can vary considerably. Conceptually, if earnings per share rise, the stock price should increase so that the P/E ratio remains the same. In reality, this situation does not happen as P/E ratios can be unstable and fluctuates substantially. The utilization of book value per share as a valuation tool is not imperative because many factors overemphasize or underemphasize the book value of a stock. Property values are commonly documented at historical costs even though the market prices are considerably higher or lower, thus the book value per share is distorted. Hence, they are not suitable for the valuation of property and construction sectors.

Several models have been used to derive the intrinsic value of real estate prices. The stock prices would not mirror the true worth of the real estate due to increasingly high real estate prices which are caused by the demand in real estate properties. Draper and Findlay (1982) examined the usage of the capital asset pricing model (CAPM), the arbitrage pricing model (APT), the fundamental valuation model (FVM) and the hedonic price model (HPM) and their potential application to real estate valuation. They found that it appeared to be 'ill advised' to pursue real estate valuations with the CAPM. The CAPM has long been criticized for a number of reasons. Among the reasons are difficulty in calculating the equity risk premium, unstable beta values and presumption of single-period time horizon which will be in conflict with multi-period nature of investment.

Adams and Venmore-Rowland (1989) released a study on property share valuation where the valuation of property investment/development company shares was based

upon estimated net asset value (NAV). In their study, they found property developers to own fewer assets, and the shares are inclined to be at a premium to NAV as these firms produce high profit and their valuation is derived from profits instead of assets. Several factors were analyzed to evaluate their relationship in influencing the discount/premium to NAV. The factors evaluated include, taxation, added value from management, liquidity, risk, financial gearing, specialist property portfolios (use, tenure, location, age of building), size, minority interest and takeovers. These factors were found to influence the NAVs. It was also discovered that apart from the underlying net asset values, dividend yield and price earnings ratio are also used in assessing property company shares. The variables used by Adams and Venmore-Rowland (1989) to assess the company shares are similar to the variables used in this study to investigate the movements of the listed property and construction stocks in Malaysia. However, the factors included in the Adams and Venmore-Rowland (1989) study to evaluate their relationship with the NAV discount/premium are not utilized in this study as it is not the aim of this study to discover the influencing factors for discount/premium of the stocks to their NAVs.

Scott (1990) examined prices on land and REITs shares in the U.S. for probable proof of divergence from market fundamentals. This study compared ex post values of discounted cash flows with prices and tested if the price series are fair estimators of future discounted cash flows. The regression and mean tests indicate that prices for REITs do not always trail market fundamentals and asset prices have diverged from market fundamentals and have not delivered as dependable estimators of fundamental value. The regression and volatility checks on the national land data indicate dismissal

of prices as fair estimators of market fundamentals. However, the mean tests show that the existence of systematic overvaluation or undervaluation cannot be proven. In conclusion, Scott (1990) opined that both prices on REITs and farm land do not constantly reflect fundamental value. If prices continue to rise higher each day with no evidence of returning back to its fundamental variables, speculative bubbles may develop. At some point, the bubble will burst and the prices must revert to values resolved by its market fundamentals. The reason that the result of this study is not consistent with this theory may be because of the time period of the study which began in the late 1960s to 1985. A period of 15 years may not be enough to study the mean reversion of stock prices. Furthermore, REITs in the U.S. had just been developed in the 1960s; therefore the market may not have been well developed during that period.

The integration of the real estate market and the stock market were investigated by Liu, Hartzell, Greig and Grissom (1990). They opined that integration only exists when the only risk is the systematic risk proportional to the entire market index while segmentation emerges when the only risk is the systematic risk which is relative to the commercial real estate market. This study discovered that the commercial real estate market is segmented from the stock market as due to implicit boundaries, that is, the cost, amount and quality of news for real estate. In another study done in Singapore by Ong (1994), property stocks and real estate prices were tested to assess links between them. Results show that cointegration is significant between property stock prices, real estate prices and interest rates. This means that there is long-run equilibrium contemporaneous relationship between the three variables. Gross returns on real estate price index are also a part of the gross returns on the property stock index and the error-

correction term. Present returns in property stocks and real estate returns were also found to be not reliant on historical returns; thus, historical returns are not a strong sign of future returns. Liow (1996) investigated the possibility of share prices in Singapore property firms to resolve at a discount or at a premium to the fundamental asset values and to evaluate the power of the connection between the share price discount/premium and property market returns through a fifteen-year period. Most of Singapore property companies' shares seemed to trade at a premium to their intrinsic NAVs for the period of 1980-1994. The most powerful proof of relationships between the property equity sector and property market during this period fortifies the aspect that direct and property equity performance are related. However, in this study, the objective is to examine if the stock prices are cointegrated with their respective fundamental variables, namely, the NAV, EPS and DPS and not across industries.

In a related study, Muldavin (1997) opined that many public real estate companies in the U.S. trade at market values that represent a 20% to 30% premium over the value of their underlying real estate assets. In his study, he attempted to discover the fundamental attributes of the real estate companies that justify the net asset value premiums. He discovered that ownership form and structure and the taxes incurred by the different forms of real estate companies determine whether the companies will trade at a premium or at discount. The debt markets also play a role as many banks have diversified their lending by both property type and geography. However, since this study's aim is not to discover whether the property and construction stock prices trade at a premium or discount but rather to examine the mean reversion of the stock prices to their fundamental variables which include NAV, EPS and DPS, ownership form and

structure, taxes and debt are not included as these variables are irrelevant to the purpose of the study.

Net asset value (NAV) discounts for Asian-Pacific real estate companies were examined by Liow and Li in 2006. As NAV in the property perspective depicts the underlying value of the real estate assets of a property stock, it is commonly comparable to the direct worth of underlying real estate values less liabilities. This study investigated the Asian-Pacific real estate company stocks to evaluate their significance to their NAVs in the long-run and the speed of the adjustments that could take place. The concept of cointegration was applied to determine if a long run concurrent relation is present between real estate companies' stock prices and NAV. The results show that the overall Asian Pacific securitized real estate prices' discount to NAV persist and display mean reversion since the prices and NAV are cointegrated. They also imply that shifts in NAVs are transferred to the changes in prices in the short term and would be altered by an ECM to the equilibrium level. This proves that NAV is an essential factor that statistically describes the stock price changes for real estate markets. The results also suggest that property firms' price changes can be clarified by looking into transformations in their real estate asset and portfolio values proxied by NAVs.

3.3 Effect of Macroeconomic Changes on Real Estate and Construction Stock Prices

Macroeconomic changes such as changes in interest rates, gross domestic product, inflation, money supply, unemployment and exchange rates are always linked to changes in the financial markets (Chen, Roll and Ross, 1986). Stock prices are usually

considered to respond to external factors, including shocks to macroeconomic variables. The impact of a shock in monetary policies such as changes in interest rates increases or decreases of the GDP and consumer price index (as measure for inflation) on stock prices can be traced by generating impulse response function using Vector Autoregressive Regression (VAR).

To study the impact of economic forces on the U.S. stock market, Chen, Roll and Ross (1986) included nine variables in their study. These variables include inflation, Treasury-bill rate, long-term government bonds, industrial production, low-grade bonds, equally weighted equities, value-weighted equities, consumption and oil prices. Overall, most of the economic variables were discovered to be significant in describing expected stock returns except for the index of oil price changes which had no overall effect. Similarly, this study also includes inflation and interest rate as monetary variables included in studying the impact of their changes on property and construction stock prices. However, since this study only investigates two sectors, the other variables are not included as the changes in government bond rates, industrial production, low-grade bond rates, weighted equities, consumption and oil price changes are not directly related to property and construction sectors in Malaysia. In another study, Hardouvelis (1987) analyzed the reaction of U.S. stock prices on announcements regarding macroeconomic variables and found that stock prices react initially to announcements of monetary variables. Hardouvelis (1987) found that the 3 month Treasury bill rate reactions showed statistically significant changes in stock prices listed in the NYSE.

McCue and Kling (1994) investigated the relationship between the U.S. macroeconomic variables and real estate returns where equity REIT data was used as substitute for real estate returns. They attempted to determine how real estate returns respond to shocks in the macroeconomic variables. Results indicate that nominal interest rates explain most of the variation in real estate returns while output and investment variables explain very little of the variation. In further studies on the subject of impact on property performance, Brooks and Tsolascos (1999) found that the U.K. real estate returns are not significantly influenced by changes in economic variables; term structure of interest rates and unexpected inflation do have contemporaneous effect on property returns. This finding further supports results by Chen, Roll and Ross (1986), Hardouvelis (1987) and McCue and Kling (1994) which found changes in interest rates and inflation to be significant in explaining stock returns.

Bernanke and Kuttner (2005) opined that money supply influences the monetary value of a stock based on its effect on the interest rate. Interest rate increases with the tightening of money supply, which leads to a hike in the discount rate, thus decreasing the value of the stock. Therefore, since the interest rate variable is already included in this study, there is no need for money supply to be included together. Kaabia, Gil and Chebbi (2002) found that when considering dynamic relationships among a set of economic variables, it is important to focus on the proper description of the model. In their study based in Tunisia, Kaabia, Gil and Chebbi (2002) discovered that if cointegration is not considered, shocks on macroeconomic variables are assumed to have only a transitory effect on its variables. Hence, any policy decision based on this assumption would generate unanticipated responses.

In a study on the impact of macroeconomic variables on stock prices in five ASEAN countries, Wongbangpo and Sharma (2002) found that there exists a negative long-run relationship between stock prices and interest rates in the Philippines, Singapore and Thailand but the opposite was observed in Malaysia and Indonesia. The findings from this study suggest that past values of macroeconomic variables can foresee future movements in stock price indices. Maysami, Howe and Hamzah (2004) provide further support where they discovered that the Singapore stock market and the SES All-S Equities Property Index composed significant links with the macroeconomic variables. This finding suggests the stock market forms cointegrating relationship with variations in the short and long term interest rates, industrial production, price levels, exchange rates and money supply. Nevertheless, West and Worthington (2006) only found interest rates to be a critical element throughout all types of Australian property portfolios.

In 2008, Khan studied the role of construction sectors in economic growth in Pakistan to ascertain the presence of long-run linkage between the construction sector and the economic growth (represented by the country's GDP). Results from the study suggest a powerful causal relationship between the aggregate economy and the construction sector exists in Pakistan. In another study, the construction sector growth rate was found to be impacting the growth rate of the economy in India by raising employment and therefore, raising the aggregate output in the economy (Mallick and Mahalik, 2010). However, this study further found that the construction sector in developing countries have minimal impact on business cycles compared to developed economies.

Singh, Mehta and Varsha (2011) studied macroeconomic factors and stock returns in Taiwan and found that exchange rates and GDP appear to influence returns of all portfolios, whereas inflation rate, exchange rate and money supply had negative relationships with return for portfolios of big and medium companies. In a study to investigate the effect of trade openness on long-run growth, Shahbaz (2012) used cointegration, causality and forecast error variance decomposition to test on data from Pakistan. His findings confirm the existence of cointegration where in the long-run, trade openness was found to promote economic growth. Therefore, trade openness is applied as a variable in this study to determine the impact of its changes on property and constrction stock prices. Using the ARDL bounds test method, Lin (2012) found that co-movements between exchange rates and stock prices in the emerging Asian markets are stronger during crises periods, implying that governments incite economic growth and stock markets to draw in capital inflow, thus avoiding currency crises. Since this study spans over a period that encompasses the economic crisis period, it could be observed that the co-movements of the macroeconomic variables and stock prices over time. Lin (2012) discovered that co-movements were not stronger for export oriented industries at all periods, which indicates that trade is not relevant in influencing stock market movements.

The impact of monetary policy shocks on stock prices in Canada and the U.S. was investigated by Li, Iscan and Xu (2010) and the results show that in Canada, the instant reaction of stock prices to internal contractionary monetary policy shock is minimal and their dynamic reaction is short while the U.S. results showed instantaneous reaction of stock price to an identical shock is comparably substantial and dynamic reaction is

comparably extended. The differences are mainly caused by the contrasts in financial market openness, thus dissimilar dynamic reactions to monetary policy shocks.

3.4 Summary

Overall, the studies implemented on deviations of real estate and construction stock prices show that most stock prices deviate from their fundamental variables but they mean revert to their equilibrium prices in time. Different researchers have found different proxies to represent the intrinsic value of shares. Among them are the EVA, P/CF, P/E, P/BV and P/S ratio and the NAV, EPS and DPS. The NAV is seen as an important underlying fundamental value that determines the movement of stock prices for real estate stock prices since Liow (2003) found NAV to be significant in Singapore property company valuations while Liow and Li (2006) discovered that panel cointegration exists between property stock prices in Singapore and NAV. EPS and DPS are also significant in explaining property stock price performance (Campbell and Schiller, 1988). Adams and Venmore-Rowland (1989) also found that valuation of property company shares was based on the NAV. Thus the best underlying fundamental variables to be included to examine the relationship of stock prices are the NAV, EPS and DPS.

The Modern Portfolio Theory (MPT) has been used extensively in previous studies to find the optimum portfolio of assets to gain maximum returns. Diversification benefits from investing in both real estate stocks and construction were found to be obtainable if both stocks are found to be segmented. Real estate stocks were found to be able to provide little benefit when added to a mixed asset portfolio in Malaysia (Lee and Ting,

2009). This shows that the Malaysian real estate stocks could not be classified as attractive to invest together with other stocks listed in Bursa Malaysia since it failed to offer risk reduction nor return enhancement when included in a mixed asset portfolio. While Lee and Ting (2009) concentrated on the diversification potential of including other stocks listed in Bursa Malaysia and bonds to a portfolio which consists of property and REIT stocks, this study aims to test the diversification benefits between only two sectors, which are the real estate stocks and construction stocks. A study in Nigeria by Rasheed and Tajudeen (2006) found diversification benefits when both property and construction stocks were included in a portfolio. This study will attempt to evaluate the diversification benefits of both sectors (in Malaysia) when combined in an equity investment portfolio.

The price discovery theory and mean reversion theory are closely linked as in both theories prices are said to revert to equilibrium in the long-run. Price discovery is found to be much reduced in the period following a news event. Studies done in the U.K. and the U.S. found evidence of price discovery in their property markets. Price discovery in these two countries were signified by positive cross-correlation between both market structures. Price discovery was also found to be relevant in the Hong Kong property markets where strong proof of lagged autocorrelation in direct real estate returns and lagged cross correlations with securitized returns were observed. However, this study aims to find the movement of property and construction stock prices towards equilibrium in the long-run and not the relationship behavior of direct real estate returns with securitized returns.

Variance ratios were found in most studies to be the most effective tests for discovering mean reversion behavior in stock prices. Variance ratios decline to below one at long lags in historical time series, which indicate long-term mean reverting behavior in the stock market. The mean reverting process is also accepted if evidence of cointegration can be obtained between prices and the proxies of fundamental variables. The ECM regulates stock prices to ensure the market is rational. Most of the studies found that stock prices mean revert to their fundamental variables in the long-run. However, variance ratios are not applied in this study as they concentrate on examining one variance ratio each at a time for a single regression interval. Thus, it is not a suitable test for this study since it is an individual hypothesis test.

From all the studies reviewed, it was found that the discounted cash flow method, where a company is valued by discounting the expected future cash flows, is most commonly used. However, the DCF is very time-consuming and information extensive compared to the relative valuation method. It can also be easily manipulated to generate intrinsic values since cash flows, growth rates and discount rates have to be estimated. Another approach to the valuation of companies is the relative valuation technique, where the price/earnings ratio (P/E), price/cash flow ratio (P/CF), price/book value ratio (P/BV) and price/sales ratio (P/S) are utilized as multiples to be compared among companies in the same industry.

The relative valuation approach also has its disadvantages. The ease of which a relative valuation can be assembled can lead to conflicting estimates of value where key variables are ignored. As the valuation multiples reflect the mood of the market, using

relative valuation to estimate value may lead to valuation reports which are too high when other similar firms are overvalued or too low reports when other firms are undervalued. Lastly, limited transparency concerning the fundamental conjectures in comparable valuations exposes them to exploitation. Therefore, it is found that these ratios are not suitable to be used as proxies for fundamental variables in this study. Another valuation method, the contingent claim approach to valuation is also not suitable in valuing real estate and construction stocks as these sectors normally do not involve future payoffs since it was developed to value listed options and assets with option-like features.

Macroeconomic changes such as shocks to interest rates, inflation, GDP, money supply, output and exchange rates have long been studied in relation to their effects on changes in the financial markets. Many studies have found that interest rate change is the most significant variable which explains changes in stock returns. Money supply, output, changes in consumer prices and credit aggregates were found to be irrelevant in predicting stock prices in Malaysia while stock prices and interest rates were observed to form positive long-run relationships.

The price discovery theory, efficient market hypothesis, mean reversion theory and the modern portfolio theory are applied in this study to investigate the long-run relationships between property and construction stock prices and their fundamental variables. In order to study the property and stock price behaviors in the Malaysian stock market, firstly, the diversification property and construction stocks are tested to evaluate if a combination of both stocks in an investment portfolio can provide maximum gain for

investors as conflicting results have been reported from previous studies regarding the diversification benefits of including property and construction stocks in an investment portfolio. When a stock displays mean reversion properties, where the error correction mechanism will push the stock price back to its equilibrium, the stock is said to not follow the random walk and is in strong form of the efficient market hypothesis. Based on the extensive literature on property and construction stock fundamental variables, the NAV, EPS and DPS were found to be most relevant to be used as underlying fundamental variables for stock intrinsic values. By investigating the fundamental variables of companies from both sectors, and how the prices move towards or away from them, investors will use the information to decide to invest in these sectors.

Another aspect that needs to be studied on when deciding to invest in a certain sector is the impact of macroeconomic changes on the stock market. Shocks in macroeconomic variables, especially monetary policy has been known to influence the movement of stock prices. Changes in interest rates, inflation, GDP and trade openness often influence stock performance. Based on past studies, interest rates changes were discovered to be the most relevant in explaining stock price returns.

Table 3.1

Summary of the Literature Review

Researcher	Sample	Findings
3.1 Underlying Theories		
1. Harry Markowtiz (1952)	-	Markowitz model where the risk of a portfolio is due to the variability of returns from the portfolio and an investor is risk averse (Modern Portfolio Theory –MPT)
2. Schreiber & Schwartz (1986)	-	i) New information lead to changes of trade and price ii) Fair price reflects demand tendency of market players iii) Stock prices changes do not violate the EMH if they are not intense enough
3. Elton & Gruber (1997)	-	Support the MPT which states that assets should not be selected based on its own characteristics but on how it moves with other assets
4. Elton, Gruber & Padberg (1976)	-	Optimum portfolio maximizes the ratio of excess return to its returns' standard deviations. Developed decision rules to enable inclusion of a new stock which has excess return to standard deviation ratio more than the lowest ranking stock in the portfolio and exclude it when the ratio is below the highest ranking stock
5. Lee & Stevenson (2000)	Total monthly returns for office, retail and industrial property in London, South and North England from 1987:1 to 1998:12	Out-performance only occurred at longer horizons of about 5 years, which is when the Minimum-Variance Portfolio begin to surpass the tangency portfolios and benchmark indices
6. Fabozzi, Gupta & Markowitz (2002)	-	Historical returns cannot predict future performance unless the economy has been strong and stable. Increasing the asset classes will expand the risk/return spectrum, allowing lower risk for any given level of expected return

Table 3.1 (Continued)

Researcher	Sample	Findings
7. Engle & Granger (1987)	U.S. quarterly real per capita consumption on nondurables and real per capita disposable income for 1947-1981	Cointegrated series move together based on concept of error correction
8. Yan & Zivot (2007)	Bid-ask quotes of spot Fx rates for USD/EUR, JPY/USD and JPY/EUR July 6, 2003 – September 26, 2003	Market is more efficient in price discovery process if it incorporates a larger amount of new information more faster than other markets
9. Fama (1969)	Collected from various studies	Proposed 3 types of efficiency: strong form, semi-strong form and weak form. Market efficiency cannot be rejected without rejecting the model of market equilibrium
10. Fama (1991)	Review of various studies	Firm specific information leads to efficient adjustment of prices and returns are foreseeable from dividend yields, earnings/price ratios and default term spreads of bonds
11. Summers (1986)	-	Inefficient market models show that prices take long impermanent swings away from their fundamental values
12. Poterba & Summers (1988)	NYSE stock returns from 1871-1986 and 17 other equity markets outside the U.S.	Variance ratios are the strongest tests for discovering mean reversion in stock prices and stock market is less uncertain if the variance of single - period returns is extrapolated using random walk model (for stock prices movements with large transitory components
3.2 Empirical Evidences		
13. Ting (2002)	Annual closing prices of property stocks listed in Bursa Malaysia which are divided into their characteristics and plantation stocks from1991-2000	Property development companies perform better than property investment companies and listed property trusts. Listed property shares do not offer diversification benefits as it is highly correlated with the Malaysian stock market

Table 3.1 (Continued)

Researcher	Sample	Findings
14. Ting (2006)	Main and 2nd board companies of Bursa Malaysia except companies in the Property Trusts and Property Sector. Data pooled across 2 periods; i.e. 1992-1996 (pre-crisis period) and 1997-2001 (post-crisis period)	Different price impacts when firms declare property disposals during thriving and slowdown economic period. Results indicate significantly positive feedback to announcements of property disposals but negative when property disposals are announced during economic downturns
15. Lee & Ting (2009)	Monthly returns of Malaysian stocks from January 1991 to December 2006. Securitized real estate is represented by the Property Sector and REITs of Bursa Malaysia	Limited advantage if property shares are added in a mixed asset portfolio, which implies that the Malaysian property stocks are not appealing in the sense that it does not offer diversification benefits
16. Abdullah, Chai, Anuar & Tan (2004)	Construction output and GDP figures in Malaysia from 1965-2003	There is positive correlation between construction output and the GDP which shows that the country's economic growth trend influences the Malaysian construction industry, therefore making the economic trend an important indicator that influences the growth of the industry
17. Mahmood & Zakaria (2007)	25 property companies and 20 construction companies listed in Bursa Malaysia from from 1996 to 2003	Both property and construction sectors are very sensitive to economic conditions. Developers are found to be larger and more profitable compared to contractors due to higher gearing by contractors
18. Hon (2009)	Real gross fixed capital formation, Real GDP, Real user cost of capital, Financial constraints, Real property price, Macroeconomic uncertainty, Real private consumption, Aggregate real disposable income, Real stock market price, Real property price, Real average lending rate in quarterly form ranging from 1991Q1to 2006Q2 (All Malaysian data)	Property booms can reinforce real economic booms as property prices apply non-permanent pro-cyclical effects on consumption and investment. Property market can be made a policy tool for short-term macroeconomic management

Table 3.1 (Continued)

Researcher	Sample	Findings
19. Rasheed & Tajudeen (2006)	Quarterly prices of listed property company in Nigeria and The All Share Index on monthly basis from 1998 -2005	Property stocks offer diversification benefits in the Nigerian Stock Exchange when included into construction and stock and stock portfolios as both sectors have low correlation with the stock market
20. Domian, Louton & Racine (2007)	100 large U.S. stocks from 1/1/1985 to 31/12/2004 subdivided into 10 groups of equal number	As portfolio size grows, risk is reduced. Smaller portfolios can achieve lower risk by investing across industries but more risk reduction can be achieved by adding the number of stocks into the portfolio
21. Easley & O'Hara (1987)	-	The speed of adjustment of stock prices are subject to market size, depth, volume and variance
22. Barkham & Geltner (1995)	Returns to commercial property in the securitized and unsecuritized markets in the U.S. and the U.K. Data ranges from 1969 to 1992	Trading density, liquidity and micro-structure benefits surpass the market broadness and player refinement advantages. Border between leading and lagging correlations between securitized and unsecuritized markets very evident
23. Chau, MacGregor & Schwann (1997)	Hong Kong stock price and valuation indices for the various asset classes from 1983Q1 to 1996Q3.	Strong proof of lagged autocorrelation in direct real estate returns and lagged cross correlations with securitized returns, indicating evidence of price discovery between the markets
24. He (1997)	Data from Hong Kong Hang Seng Index, real estate properties index, financial institutions index, public utilities index, commerce and industry index from 3 March 1989 to 31 December 1991	Changes in real estate submarket prices significantly influence the commerce industry, financial institutions and public utility indexes in Hong Kong and the error correction terms indicate price discovery process within industries

Table 3.1 (Continued)

Researcher	Sample	Findings
25. Madhavan (2000)	-	Determinants of price movements need to be identified to enable traders investors to utilize this information to magnify their profits
26. Lehmann (2002)	-	Fundamental value is a permanent component of prices and deviations of stock prices from it could be due to availability of private information which is revealed during the price discovery process
27. Schwann & Chau (2003)	Quarterly data for Hong Kong from 1986Q1 to 1999Q4 for real estate returns, short-term interest rate and inflation	Extreme events lead to temporary reduction in the direct property investment returns and strength of the price discovery effect. Price discovery size impact relies on the quantity of real estate information impacted in the securitized returns' history
28. Yavas & Yildirim (2011)	Daily 146 REITs prices and REITs NAV values from February 2001 to September 2007 in the U.S.	Price discovery occurs in securitized public market. Optimal portfolio construction needs to include firm level analysis of causality and correlation between REIT and NAV returns
29. Summers (1986)	-	Prices take long temporary diversions from fundamental values in models of inefficient markets where prices have slow decaying stationary components
30. Fama & French (1988)	1-month returns for all New York Stock Exchange (NYSE) stocks for 1926-1985. Stocks ranked on the basis of size at the end of each year. 1-month portfolio returns adjusted for inflation rate	Negative autocorrelation of returns produced by a slowly decaying element of prices is weaker at the short run horizon but gets more powerful as the return horizon expands

Table 3.1 (Continued)

Researcher	Sample	Findings
31. Hasbrouck (2002)	-	a) Each individual price is integrated, thus contains a random walk component b) Pairs of prices are linked by arbitrage and/or equilibrium relationships. Markets are efficient as the stock price/index will follow a random walk since its price is affected by unpredictable events that happen at random time intervals
32. Malkiel (2003)	-	Defined the logic of random walk theory – if flow of information is instantaneously echoed in stock prices then the next day's price change will reflect only the next day's news , thus being independent of the current day's price changes
33. Chan & Karim (2005)	5 out of 9 stock indices in the Bursa Malaysia KLCI main board which includes industrial products, construction, trading and services, finance and property in daily and weekly form from January 4, 1994 to December31,2002, divided into pre, during and post-crisis period	Causal relationships for short and long-run relationships appear to be more obvious in the daily compared to weekly price indices, thus indicating that the price disturbances in all the indices take a comparably briefer period to adjust itself to equilibrium; proving that the stock market in Malaysia is efficient on adapting to short and long-run disturbances
34. Suresh, Joseph& Sisodia (2013)	Monthly average stock indexes of Brazilian, Russian, Indian, China and South African markets from January 2000 to December 2010	Emerging stock indices have nonlinear data generating process and are stationary, indicating that the markets are inefficient
35. DeBondt & Thaler (1984)	Monthly return data for New York Stock Exchange (NYSE) common stocks between January 1926 and December 1982	Initial prices which are more extreme will result in greater subsequent reversals. Return reversals are proposed to personify evidence of mean reversion

Table 3.1 (Continued)

Researcher	Sample	Findings
36. Kim, Nelson & Startz (1991)	Monthly total returns on all NYSE stocks for value-weighted and equal-weighted portfolios from 1926 to 1986	Variance ratio tests are weak as they concentrate on testing only one ratio at a time for a single aggregation interval
37. Jegadeesh (1991)	Monthly returns on the value-weighted and equal-weighted stocks traded in NYSE from 1926-1988 and London Stock Exchange (1955-1988)	Regression model is the most powerful test among other tests against a mean reverting alternative. Equal-weighted stocks traded on the NYSE and London Stock Exchange show mean reversion properties concentrated in the month of January (seasonal mean reversion)
38. Chiang, Liu & Okunev (1995)	Annual data on prices, earnings and dividends of the Standard & Poor's Composite Stock Price Index from 1871 to 1986	Both earnings and dividends models perform similarly well in forecasting asset returns. The bigger the difference between the stock price and the fundamental value, the more powerful the reinstating force will be in moving the stock price to revert to its fundamental value
39. Sing, Liow & Chan (2002)	Stock prices, EPS and dividend yields on 19 listed property companies in Singapore from June 1989 to June 1999	Empirical evidence of mean reverting behavior of property stock prices towards their fundamental variables. NAV and EPS is significant in capturing short-run dynamics of price changes. Ecm can regulate stock prices that have moved away from their fundamental values
40. Chaudhuri (2003)	Monthly U.S. dollar denominated stock price indexes for Argentina, Brazil Chile, Colombia, Greece, India, Jordan, Korea, Malaysia, Mexico, Nigeria, Pakistan, Philippines, Taiwan, Thailand, Venezuela and Zimbabwe. Data includes dividends and capital gains from January 1985 to April 2002	Reject the null hypothesis of a random walk in favor for mean reversion. Evidence of positive speed of reversion with a half-life of about 30 months
41. Liow (2003)	NAV and stock price data of 16 listed property companies in Singapore Stock Exchange from 1985 to 1999	NAV is significant in capturing the price changes dynamics of property stocks. Degree of mean reversion between the property stock prices and NAVs is slow and therefore deviations are prolonged

Table 3.1 (Continued)

Researcher	Sample	Findings
42. Narayan & Narayan (2007)	Real monthly stock prices for G7 countries for January 1975 – April 2003	Stock prices that follow a random walk process indicate that shocks to prices have permanent effects. However, if stock prices are mean reverting, shocks to prices will have a temporary effect, enabling forecast of future price movements based on past behavior and trading strategies can be developed to earn returns
43. Bali, Demirtas & Levy (2008)	Daily returns on NYSE/AMEX/ Nasdaq, NYSE/AMEX, NYSE, Nasdaq, S&P 500 & Dow Jones Industrial Index (DJIA) from 3 July 1962 – 31 December 2005 except for Nasdaq from 15 December 1972 – 31 December 2005	During substantial decline in market, mean reversion will cause it to have significantly positive drift to enable market to be pulled back to long-run average
44. Culik & Valecky (2010)	Daily average electricity prices and returns in California, Nordpool and Austria over period of 2006-2009	Non-linear mean reversion is complicated and tedious and the residual variance is always lower than linear models. Thus, non-linear mean reversion models should always be avoided
45. Mukherji (2011)	Monthly real returns of large and small U.S. stock indices from 1926 -2007	Although mean reversion in stock returns has weakened in the past few years, it still persists in small company stocks
46. Chen & Kim (2011)	Monthly value-weighted stock prices of 9 emerging market Asian indices from December 1987-December 2007	Non-linear unit root tests show proof of non-linear mean reversion towards fundamental variables in emerging markets
47. Liow & Li (2006)	Quarterly NAV and stock prices of real estate companies listed in Asia Pacific markets from 1995 Q1 – 2003 Q4	Real estate prices in the region deviate from their NAV. DPS, EPS and NAV are widely used as proxies for stock price fundamental values

Table 3.1 (Continued)

Researcher	Sample	Findings
48. Miller & Modigliani (1961)	-	Valuation of shares should be based on the rate of return of the share at any given time. The discounted cash flow, the current earnings plus future investment opportunities, the stream of dividends and the stream of earnings approaches are similar approaches for valuation of shares
49. Campbell & Shiller (1988)	Annual prices, dividends and earnings for S&P Composite Stock Price Index from 1926 -1986	Long moving average of real earnings is the most natural variable to be used to present fundamental value. It can be used to forecast future dividends. Thus it is the most powerful predictor of stock returns.
50. Subramanyam & Venkatachalam (2001)	Intrinsic values, earnings, operating cash flows and market value of equity of 7,840 firms in the U.S. from 1988 – 2000	Earnings are superior to cash flows in describing ex post intrinsic values and provide information about future cash flows
51. Liu, Nissim & Penman (2001)	Stock returns, price, actual EPS, forecasted EPS, long-term growth forecast and price to value-driver ratios for companies listed in NYSE, AMEX and NASDAQ (1982-1999)	Multiples based on forward earnings are the best stock price performance predictors
52. Chan, Yap & Nur (2012)	Property firms' stock prices, ROA, ROE, EPS, DR, NPM, ETR and P/E in Malaysia from 2003-2007	ROA, ROE and EPS influence Malaysian property stock prices the most compared to other factors
53. Richardson, Sloan & You (2012)	All available data from IBES and CRSP on earnings forecasts and stock return. Total 41,602 observations from 1986-2008	Investor recognition influence stock price movements over short term periods whereas fundamentals command longer term stock price movements
54. Spierdijk, Bikker & Hoek (2010)	17 developed countries' annual equity, bond & T-Bill rate and index returns from 1900 – 2008	Estimated speed of mean reversion determined by sample period and excess returns can be gained by making use of mean reversion of stock prices

Table 3.1 (Continued)

Researcher	Sample	Findings
55. Glezakos & Mylonakis (2012)	Annual stock prices, EPS and BVPS of 38 companies which comprise of about 10% of total companies listed in Athens Stock Exchange from 1996 -2008	EPS and BVPS (or NAV for property companies) explain stock prices the most but over time BVPS' role increase over EPS
56. Sukhija (2014)	BVPS, DPS, EPS, Dividend coverage, Payout ratio, P/E, ROCE and growth annual data for 39 companies listed in Bombay Stock Exchange from 1/4/1998 – 31/3/2013	Different variables are useful in determining stock prices of different industries but EPS, DPS and BVPS are most important in determining stock prices in most industries and through different economic situations
57. Constantinides (1989)	-	An asset's return covariance with consumption, the market portfolio return, state variables or economy wide factors are related to the expected excess return
58. Nissim & Penman (2001)	Values of typical ratios used for valuation from 1963-1999	Future residual earnings, free cash flow and dividends are driven by ratios while ratios in financial statements are used to forecast future drivers
59. Palepu & Healy (2004)	-	Price multiples are the simplest and most widely used but the quality of the variable must be assessed to ascertain the suitable peer firms to be used as benchmark multiple
60. Worthington & West (2001)	Various literature	Results from most studies support the use of EVA but more evidence is needed to support EVA
61. Kyriazis & Anastassis (2007)	121 non-financial publicly traded Greek firms from1996-2003for net income, operating income, the weighted average cost of capital, EVA, residual income, operating income adjustment, capital changes, Stern Stewart adjustments and stock returns	Net income and operating income and not EVA are most correlated with stock market returns. EVA does not outperform significantly other variables and failed to show stronger value relevance

Table 3.1 (Continued)

Researcher	Sample	Findings
62. Penman (2010)	-	Residual earnings measures were developed to measure the EVA and cautioned users that these measures undo accounting conservatism as they capitalize and amortize R&D and advertising, which is relevant in measuring the economic value of intangibles
64. Demirakos, Strong & Walker (2004)	Reports and forecasts from Wall Street and includes 11,000 U.S. and international companies from 53 industries with period from January 1997 to October 2001	Types of valuations used to justify analysts' recommendations rely on company characteristics
65. Brown & Reilly (2011)	-	DCF and Relative valuation techniques are used widely used for valuation but relative valuation is less time and resource intensive whereby price-earnings ratio is most commonly used
66. Damodaran (2006)	-	Discounted cash flow valuation , relative valuation and contingent claim valuation approaches are compared. Discounted cash flow valuation approach found to be have most limitations compared to the other two
67. Fernandez (2007)	-	The most appropriate technique to value a firm is to discount the expected future cash flows since the worth of the firm's equity originates from the firm's ability to to produce cash flows for its shareholders
66. Adams & Venmore-Rowland (1989)	Property investment/development companies in the U.K.	Property developers have less assets to back them and their shares tend to stand at a premium to their NAV. Dividend yields and price earnings ratio are also used to value the shares. Taxation, added value from management, liquidity, risk, financial gearing, specialist property portfolios, size, minority interest and takeovers are factors that are found to influence the NAVs

Table 3.1 (Continued)

Researcher	Sample	Findings
67. Draper & Findlay (1982)	-	CAPM should not be used in real estate valuation as it makes the calculation of equity risk premium more difficult, the beta values are unstable and the single-period time horizon will not match with multi-period nature of investment
68. Scott (1990)	Monthly data for prices and dividends for REITs and national farm land values, income and returns ranging from 1912-1985	Asset price have deviated from market fundamentals. Tests reject prices as market fundamentals predictor
69. Liu, Hartzell, Greig & Grissom (1990)	Quarterly holding period returns for commercial non-farm real estate returns and equity REITs for July 1978 to Sept 1986	Commercial real estate markets is segmented from the stock market. Integration only exists when the only risk is the systematic risk relative to the overall market index while segmentation arise only when the only risk is the systematic risk which is relative to the commercial real estate market
70. Ong (1994)	Stock Exchange of Singapore Property Index, All-Property Price Index (PPI) and 3 month T-Bill rate in Singapore quarterly data from April 1976 to April 1993	There is a long-term relationship between property stock price index, real estate price index and T-Bill rate. Current returns in property stock and real estate returns are not dependent on past returns, therefore past returns cannot be used to determine future returns
71. Liow (1996)	Quarterly data on 16 listed property companies in Singapore Stock Exchange comprising of NAV (book value of tangible assets per share) , SES All-Share Index, the URA All Property Price Index and three property type Indices – Residential, Commercial and Industrial from January 1980 to December 1994	Share prices of most Singapore property companies were trading at a premium. Property stock index in Singapore are found to lead the real estate market by a quarter. Thus, property stocks can be considered as the leading indicator for real estate in Singapore

Table 3.1 (Continued)

Researcher	Sample	Findings
72. Muldavin (1997)	-	The fundamental reasons for investing in real estate include the strength of the economy and the property markets, the strong growth of the real estate securities markets and the liquidity of the real estate organizations
73. Chen, Roll & Ross (1986)	Data on inflation, interest rate, long-term government bond rate, industrial production, low-grade bonds, equally weighted equities, value-weighted equities, consumption and oil prices in the U.S. from 1958 to 1984	Stock returns are vulnerable to systematic economic news, and are valued correspondingly with their exposures and information can be calculated as changes in variables which can be identified by instinctive financial theory
74. Hardouvelis (1987)	Annual stock price and interest rate data, % change in M1, free reserves, consumer price index and producer price index, unemployment rate, industrial production index, personal income, durable goods, index of leading indicators, consumer credit, retail sales, housing starts and trade deficit in the U.S. from October 1979 to October 1982	Unforeseen shifts in free reserves caused the highest effect amidst the monetary variables as they were linked to responsive and continuous shifts in non-borrowed reserves. Interest rate had the most significant responses after October 1982. Among the non-monetary news, stock prices reacted to trade deficit, the unemployment rate and personal income news. Stock price responses are compatible with the Expected Real Interest Rate hypothesis
75. Mc Cue & Kling (1994)	Monthly equity REIT index, S&P's 500 stock index, CPI, 3month T-Bill rate, Industrial Production Index and Construction Contract Index in the U.S. from May 1974 to December 1991	Nominal interest rate explain the most of differences in the real estate series, whereas output and investment variables explain little of the variation. Nominal rate shocks have a negative significant on real estate returns

Table 3.1 (Continued)

Researcher	Sample	Findings
76. Habibullah & Baharumshah (1996)	Monthly data on stock price indexes, money supply and national output from January 1978 to September 1992 in Malaysia	Trivariate cointegration analysis revealed that stock price indexes and macroeconomic variables are not cointegrated which indicates that KLSE stock price indexes have embedded all historical information on money supply and output
77. Ibrahim (1999)	Monthly data for stock prices, industrial production index, CPI, money supply (M1and M2), domestic credit aggregates, official reserves minus gold and RM/US$ exchange rate from January 1977 to June 1996 in Malaysia	Malaysian stock market is not efficient particularly in terms of consumer prices, credit aggregates and official reserves. This finding suggests that the stock prices react to diversions from the long-run equilibrium detected between the stock market and the macroeconomic variables. Stock prices also can provide information for industrial production, M1 and exchange rate movements
78. Bernanke & Kuttner (2005)	Monthly data on stock prices and the U.S. Federal Reserve funds rates from 1989 to 2002	Tightening of monetary policy lowers stock prices as stocks riskiness increase and investors are less willing to invest in stocks
79. Kaabia, Gil & Chebbi (2002)	Real exchange rate, real money supply, real farm output prices and real agricultural exports annual data from 1963-1998 in Tunisia	By ignoring cointegration, macroeconomic shocks can be assumed to have only a temporary effect on agricultural variables thus, policies based on this assumption is irrelevant. Proper specification of model is important when evaluating dynamic relationships among economic data since cointegrated, long-run relationships need to be accurately identified

Table 3.1 (Continued)

Researcher	Sample	Findings
80. Wongbangpo & Sharma (2002)	Monthly data on Jakarta composite stock price index, KLSE, Philippine stock exchange composite index, Stock exchange of Singapore and Stock exchange of Thailand, nominal GDP, short-term interest rate and exchange rates for all the countries in the study from 1985 to1996	ASEAN-5 stock markets are found to dynamically collaborate with their own key macroeconomic variables
81. Maysami, Howe & Hamzah (2004)	Monthly data of SES All-S Equities Index, All-S Equities Finance Index, All-S Equities Property Index, All-S Equities Hotel Index, CPI, industrial production, proxies for long and short-run interest rates, money supply (M2) and exchange rates from January 1989 to December 2001	Singapore stock market and the SES All-S Equities Property Index possess significant relationships with all macroeconomic variables in the study
82. West & Worthington (2006)	Monthly indices for five Australian indices, market returns, interest rates, expected and unexpected inflation rates and supply and demand-side variables from March 1985 to December 2002	Only interest rates found to be significant in all categories of Australian property portfolios
83. Khan (2008)	Annual data for Pakistan Construction Industry flows and GDP from 1950 to 2005	Strong causal relationship exist between the aggregate economy and construction sector in Pakistan. Construction flow leads GDP growth and there is causal linkage from construction sector to aggregate economy of Pakistan. Thus, it is concluded that the construction industry in Pakistan greatly influence the aggregate economy
84. Singh, Mehta & Varsha (2011)	Data on all companies listed in Taiwan 50 Index including market capitalization, P/E ratio, PBR and yield. Macroeconomic data includes employment rate, exchange rate, GDP, inflation and money supply. Period of study was from 2003 to 2008	Exchange rates and GDP affect all portfolios while inflation rate, exchange rate and money supply had negative relationships with returns for big and medium companies in Taiwan
85. Shahbaz (2012)	Annual data for GDP, FDI, unemployment, human capital, life expectancy, literacy rate, urbanization , trade openness and remittances in Pakistan from 1971 to 2005	Cointegration exists in the long-run where trade openness was found to promote economic growth

Table 3.1 (Continued)

Researcher	Sample	Findings
86. Mallick & Mahalik (2010)	Data on non-food bank credit and employment, interest rate, growth rate of aggregate output, construction growth rate, capital stock and government expenditure for periods of 1961-62 to 2005-06 in India	Growth rate in India might be impacted by construction sector by increasing employment which leads to increase in aggregate output in the economy. However, the impact is less in developing economies compared to developed economies
87. Li, Iscan & Xu (2010)	Monthly data from January 1998 to December 2003 on industrial production index, CPI, stock prices listed in S&P 500 and TSE 300 (for Canada), exchange rates, overnight interest rate, money supply (M2) and crude oil price index for the U.S. and Canada	Stock prices respond immediately to monetary policy shocks in Canada but the response in the U.S. is prolonged, mainly due to trade openness influences. Monetary shocks in the U.S. produce significant impacts

CHAPTER FOUR

METHODOLOGY

This chapter discusses on the methods used to achieve the objectives in this study. It begins with a description of the data used in this study. This is followed by research design where the model specifications and hypotheses are described. In order to determine the diversification potential of stocks from both sectors, correlation tests are implemented. Panel unit root tests and cointegration models are used in this study to test the long-run and short-run relationships of property and construction stock prices. The panel Auto-Regressive Distributed Lag (ARDL) method is also briefly described here. The VAR model, impulse response tests and variance decomposition analysis will be employed to study the impacts of macroeconomic shocks on property and construction stock prices.

4.1 Data Description

This study uses panel data of public listed firms in the property and construction sector for the period 1995 to 2013 (19 years). This period is chosen as it includes the boom and bust periods in the Malaysian economy; hence possible bias based on particular time period would be minimized. A longer period could not be obtained as most companies exit the industries with less than 20 years of operations. Only a handful of financially stable companies exist past 19 years of operations. The data used for this study were obtained from various published reports. Data on EPS, DPS and NAV for listed property and construction companies were obtained from company annual reports. The data used in this study are described as follows:

i) Annual stock prices for Malaysian listed property development companies and construction companies are collected for listed property companies that derive 50% or more of their revenue from property development activities (28 companies as at 31 December 2013) and all listed construction stocks (16 companies as at 31 December 2013) in the Bursa Malaysia within the study period. The reason for choosing only listed property development companies as sample in this study is to make it comparable to the construction industry. Moreover, other studies in Malaysia have not concentrated on the performances of property development companies and its relationships with the construction sector. Only surviving firms are used in this study as it applies the balanced panel which contains only firms which survive through to the end of the sample period. The unit root test in this study included the Im, Pesaran Shin test (IPS Test, 2003) which is a way of combining the evidence on the unit root hypothesis from the *N* unit root tests performed on the *N* cross-section units. Implicit in the test is the assumption that T is the same for all cross-section units and hence $E(t_{i,T})$ and $V(t_{i,T})$ are the same for all *i*. Thus, only balanced data is used. In practice if unbalanced data are used, more simulations have to be carried out to get critical values (Maddala and Wu, 1999). Therefore, for the sake of having data on the same companies each year of the analysis period, the companies that still exist from year 1995 to 2013 are included. Hence, to perform analysis on a balanced panel, only the surviving companies are chosen to work on. The final dataset consist in a balanced panel containing 28 firms, which on average; represent the property development companies listed in Bursa Malaysia. The data on stock prices is collected via DataStream.

ii) Yearly data on variables representing fundamental variables (EPS, DPS and NAV), are all extracted from annual reports published and circulated by the listed companies. EPS is computed by dividing a firm's profit by the number of its common outstanding shares whereas DPS is the sum of declared dividends divided by ordinary share issued. It consists of total dividends paid out for the year (including interim dividends but not including special dividends[5]) divided by total outstanding ordinary shares issued. NAV is described by DataStream as the book value of tangible assets per share calculated by dividing shareholders' equity less intangible assets and preference capital by the number of ordinary shares. Data on these variables are based on yearly data as most annual reports are published and issued yearly to the public.

iii) Annual data from 1995 to 2013 are used in this study to examine the impact of macroeconomic shocks on property and construction stock prices. Monetary policy is represented by real risk free rate in this study. It is the basic interest rate which is the rate of interest excluding inflation with no uncertainty regarding future flows (Brown and Reilly, 2011). Real risk free rate is chosen as this study also includes inflation as a macroeconomic variable to study its effect on the stock prices. Data on real risk free is based on Malaysian Treasury Bill rate obtained from DataStream. Treasury Bills zero default risk as they epitomize and are supported by the credibility of the government. GDP is the quantity of all final goods and services which are valued at selling prices and therefore is a combined value of every industry in the country. Given that real estate is an important part the country's economy, the real estate market conditions should depict

[5] DPS calculations do not include special dividends as these are one-time payoffs to shareholders. Thus, it does not markedly affect valuation or yield calculation

the country's economic growth. GDP report is issued by the Malaysian Statistics Department and is collected from its web address www.statistics.gov.my. CPI calculates the retail prices of a fixed market basket of household purchases of goods and services. Changes in the CPI are used to measure inflation. The CPI data which represents the inflation rate is taken from the Statistics Department of Malaysia's website. Trade openness pertains to the extent of where countries allow or trade with other countries which include import and export, foreign direct investment (FDI), borrowing and lending and reclamation of overseas capital. In Malaysia, trade openness is measured by the sum of imports and exports as a percentage of gross domestic products (GDP). The *trade-to-GDP ratio* (trade openness ratio) is normally utilized to calculate the significance of international dealings in relation to internal or domestic dealings. Every country calculates this ratio as the sum of exports and imports divided by GDP. Data on amount of imports, exports and GDP are also obtained from Malaysian Statistics Department website.

4.2 Research Design

Different studies have used different approaches to study movements of stock prices from their fundamental variables. To accomplish the objectives of the study, several methods were applied to examine and evaluate the relationships of the variables included. The methods are correlation tests, panel unit root tests (IPS test), panel error correction modeling (ARDL test), impulse response estimation test and variance decomposition analysis.

4.2.1 Model Specification and Hypothesis Development

Several models were used to answer the objectives of the study. Firstly, diversification potential between the property and construction sectors will be tested by running correlation tests between both sectors' stocks. Then, to test for long-run relationship between the stock prices and fundamental variables, the panel unit root tests are first performed. In the case of variables which are integrated of different orders, the panel ARDL Bounds Test approach using the pooled mean group estimation and mean group estimation are used to test for cointegration among the variables. Once established, the ECM model is estimated to explain relationships between stock prices and its NAV, EPS and DPS. Lastly, the effects of macroeconomic shocks on property and construction stocks are estimated using VAR model.

4.2.1.1 Diversification Potential between Property and Construction Stocks

In this section, correlation tests are performed to investigate the diversification potential between property and construction stocks which is answering the first objective of the study. The tests are done to determine whether one can benefit from including Malaysian property stocks and construction in an investment portfolio. If both stocks are found to be highly correlated, there will be no benefit to gain from including both stocks in a portfolio. However, if both stocks are found to be not correlated investors will gain from investing in stocks from both sectors. Since correlation measures the degree of movement between two stocks, a negative correlation coefficient would indicate that the stock prices move in opposite direction, therefore more diversification benefits can be achieved.

The extent of the relationship between two variables is measured by correlation whereby the figure of correlation is between +1 and -1. In portfolios which are diversified, it depicts the extent of the price behaviors among dissimilar assets in the portfolio. A correlation of +1 shows that prices are moving together in the same direction; a correlation of -1 means that prices move in conflicting or inverse directions. A correlation of 0 signals that the price shifts of assets are totally uncorrelated; which implies that, the price movement of one asset does not influence the price shift of the other asset. When assets that have low correlations are put together in a portfolio, investors could get higher returns by accepting the same level of risk, or similar returns with lower risk.

The correlation coefficient (r_{ij}) is a relative measure of the given relationship.

Correlation coefficient, r_{ij}, is defined as:

$$r_{ij} = \frac{cov_{ij}}{\sigma_i \sigma_j} \quad (1)$$

where r_{ij} is a measure of linear association between two variables. *i* and *j* are variables representing stock price to determine the correlation between the stock prices The strength of correlation between a set of variables is measured by covariance. Uncorrelated variables will produce a covariance of zero. Covariance measures the degree to which two assets with risks move together. Asset returns which move together produce positive covariance while returns that move in opposite directions will generate a negative covariance figure. The covariance between variables *i* and *j is* defined as:

$$cov_{ij} = \frac{\Sigma(i - \bar{i})\ (j - \bar{j})}{n} \quad (2)$$

Based on previous studies, by Aslanidis *et al.* (2010), Graham *et al.* (2012), Heaney and Srianantha kumar (2012) and Yang *et al.*, (2012), diversification benefits within stock markets were all tested by correlation analysis. Price data are used to discover the past movement of the prices of two assets between each other. Each pair of assets is given a number that signifies the degree of correlation in their price shifts. This figure can be used for building a "correlation matrix" for different assets. A correlation matrix simplifies the selection of different assets by displaying their correlation with each other in a tabular form. A range of assets which are having different correlations with each other can be chosen from the matrix. The relationship between property and construction stock prices can be observed from the correlation coefficients based on the matrix which indicates its diversification potentials as negative or low positive correlation between the two stocks would indicate high potential diversification benefits while strong positively correlated variables would mean that there would be little or no benefit from investing in both stocks.

To fulfill objective one which is to determine whether property and construction stocks do offer diversification benefits, the following hypothesis is developed:

H_0: Property and construction stocks do not offer diversification benefits

H_1: Property and construction stocks offer diversification benefits

4.2.1.2 Long-run Relationship and Mean Reversion of Stock Prices and Fundamental Variables

In order to determine objective number two which is to examine if stock prices mean revert to their fundamental variables, the panel ARDL Bounds Test is performed. The

stock prices and fundamental variables are said to have a long-run relationship if they are discovered to be cointegrated. When both variables are cointegrated, then it is possible to estimate an error correction model that explains the disequilibrium prices in the short-run. Stock prices with a mean reversion characteristic will revert back to equilibrium after taking temporary swings away (Sing, Liow and Chan, 2002). This study uses the panel data time series and the panel Autoregressive Distributed Lag (ARDL) bound test which utilizes the pooled mean group (PMG) and mean group (MG) estimations to test for cointegration and estimation of error correction model. Cointegration will determine the long-run relationship between stock prices and fundamental variables while the error correction model will forecast the rapidity of adjustment of the prices to equilibrium.

The tests for cointegration and mean reversion are run separately for property and construction sectors to compare the movements and behaviors of stock prices for both sectors and the factors that influence the stock price of each sector. According to Mahmood and Zakaria (2007), the property and construction sectors have an unequal business relationship even though their business is very interrelated. This shows that the two industries are influenced by different variables that influence the stock prices of each sector. This is further supported by the work of Mahmood and Zakaria (2007) who ran a separate regression for each model (property and construction) to study the profitability and capital structures of both sectors. Pahlavani *et al.* (2005) who studied the determinants for expansion of Iranian GDP, also ran separate regressions for each sector involved in their study.

4.2.1.2.1 Panel Cointegration and Panel Error Correction Estimation

Panel data is used in this study as it provides a greater data set with more variability and less collinearity. With further, extra informative data, more dependable forecasts and more refined behavioral models with less prohibitive conjectures can be obtained. Further benefit of panel data sets is their capability to command for individual heterogeneity. In addition it could detect and assess impacts that are not evident in pure cross-sections or pure time-series data. Specifically, panel data sets can evaluate complicated problems of dynamic behavior more effectively (Baltagi, 1998). Panel data possess several benefits over cross-section or time series data. Panel or pooled data yield greater test power than carrying out a separate unit root test for each individual (Levin, Lin and Chu, 2002).

A preliminary step to find the long-run linkage between stock prices and fundamental variables is to determine the stationarity of the series involved. Hence, unit root tests are employed to determine the stationarity of the series involved. If the series is stationary, its mean, variance and autocovariance remain the same regardless of the point it is measured. This series will return to its mean (mean reversion) whereas non-stationary series will have a time-varying mean or a time-varying variance or both. Two variables are said to be cointegrated when a linear combination is found to be stationary, that is I(0). Hence, long-term or equilibrium relationships exist for two variables which are cointegrated. However, in the short-run, disequilibrium could exist, where the error term in the cointegrating regression can be acknowledged as “equilibrium error”. This error term can be tied to the short-run behavior of the variable to its long-run value. The

ECM corrects for disequilibrium. The following sub-sections would describe the steps involved in the cointegration analysis of panel data.

4.2.1.2.1.1 Panel Unit Root Tests

Stationary tests on stock prices and their fundamental variables are done to determine the existence of unit roots. For pooled data, panel unit root is tested instead of the conventional unit root tests.

This study applies the Im, Pesaran and Shin (2003) approach (IPS test), the Augmented Dickey Fuller test (ADF test) and the Phillips-Perron test (PP test) to test for panel unit root instead of the Levin *et al.* (2002) test (LL Test). Maddala and Wu (1999) found the LL test to be a very restrictive test which is rarely of practical interest. The LL test assumes a homogeneous autoregressive parameter and independently distributed error terms across all series. O'Connell (1998) opined that the LL test is affected by size distortion when correlation exists among contemporaneous cross-sectional error terms.

A unit root (stochastic) process for series *Y* is defined as:

$$Y_t = \rho Y_{t-1} + u_t \qquad -1 \leq \rho \leq 1 \qquad (3)$$

where u_t is a white noise term.

If $\rho = 1$, that is, in the case of unit root, the model becomes a random walk model, without drift, which is a non-stationary process.

The IPS is used together with the Augmented Dickey-Fuller test for each cross-section to form the IPS-ADF test as below:

$$\Delta y_{it} = \beta_i + \rho_i y_{i,t-1} + \sum_{j=1}^{\rho i} \emptyset_{ij} \Delta y_{i,t-j} + \varepsilon_{it} \; ; \qquad (4)$$

where i= 1,2,….N; t= 1,2,….T; y_{it} stands for each variable under consideration in the model, β_i is the individual fixed effect and ρ is selected to make the residuals uncorrelated over time.

The IPS statistic which relies on averaging individual Augmented Dickey-Fuller (ADF) statistics is then written as follows:

$$\tilde{t} = \frac{1}{N} \sum_{i=1}^{N} t_{iT} \qquad (5)$$

where t_{iT} is the ADF *t*-statistic for stock *i* based on the stock-specific ADF regression as in equation (4). It appears to be normally distributed under H_0, and the critical values for the given values of N and T are provided in Im *et al.* (2003).

The null hypothesis is tested with a t-bar statistic, developed from the average ADF t-statistics (as in (5)).

H_0: ρ_i =1, i = 1,2,…,N (The series is not stationary)

H_1: ρ_i<1, i=1,2….,N; ρ_i = 1, i = N_1 + 1, N_1 +2,….N (The series is stationary)

If the results of the stationary test indicate non-existence of unit root, it would mean that the series are stationary and there is no need to test for cointegration as it is already known that stationary series are cointegrated. However, if the stationary test shows the

existence of unit root, which means that the series are not stationary, then the need to be differenced once arises in order to turn the series to stationary as it is not stationary in level. Therefore, the series which are differenced once will need to proceed to be tested by cointegration test to determine its relationships.

4.2.1.2.1.2 Short-run Dynamics with Panel ECM Model

The next step after determining the stationarity of the variables is to develop a panel ECM model which will describe the systematic disequilibrium adjustment process that will show a part of the disequilibrium in one period being corrected in the next period.

The dynamic panel data error correction form is as follows:

$$\Delta P_{i,t} = \mu_i + \psi_i(P_{i,t-1} - \alpha_i - \beta_i Y_{i,t-1}) + \sum_{j=1}^{p-1} \delta_{1i,j} \Delta P_{i,t-j} + \sum_{j=0}^{q-1} \delta_{2i,t} \Delta Y_{i,t-j} + \varepsilon_{i,t} \quad (6)$$

where P refers to stock price, Y refers to fundamental value, μ_i represents the fixed effect; β_i represents long-run relation between P and Y (Y is the fundamental value); ψ_i shows the speed of adjustment to the long-run equilibrium and $\delta = (\delta_1, \delta_2)$ is the vector of the short-run coefficients.

4.2.1.2.1.3 The ARDL Approach

The ARDL method is chosen as it has many benefits over the standard cointegration analyses such as pre-testing issues linked to cointegration which compels us to determine whether a variable is exogenous or endogenous. ARDL also overcomes the problem of testing of the null hypothesis of structural stability against the option of a one-time structural break (Pahlavani, Wilson and Worthington, 2005). It is also possible

to have different variables with different optimal number of lags in an ARDL model; whereby Johansen's model does not permit this practice. The main benefit of the bounds test approach is that it can be used in studies with small or finite sample size. Therefore, this method is found suitable to be applied to this study as it has limited sample of 19 years annual data for less than 100 companies in each sector. Furthermore, the ARDL can also be used in the case where variables are stationary at different levels {I (0)} and {I (1)}.

This study employs the method of pooled mean group (PMG) of dynamic heterogeneous panels by Pesaran, Shin and Smith (1999) to test for the relationship between the property and construction stock prices with their fundamental variables. The PMG estimator includes pooling and averaging which permits the intercepts, short-run coefficients and error variances to differ freely across groups, but constraints the long-run coefficients to be the same. The dynamic specification is permitted to differ across groups as equality of the short-run slope coefficients is not imposed.

The ARDL (p,q_1,q_2,q_3) model can be formulated as:

$$P_{it} = \sum_{j=1}^{p} \lambda_{ij} P_{i,t-j} + \sum_{j=0}^{q} \gamma'_{ij} N_{i,t-j} + \sum_{j=0}^{q} \gamma'_{ij} E_{i,t-j} + \sum_{j=0}^{q} \gamma'_{ij} D_{i,t-j} + \mu_i + \varepsilon_{it} \quad (7)$$

where P_{it} refers to stock price, $N_{i,t-j}$ is the stocks' NAV, $E_{i,t-j}$ represents the stocks' EPS while $D_{i,t-j}$ is the stocks' DPS whereas t = 1,2,3…19 (time period in years) while μ_i is the fixed effect.

Model (7) is then reparameterized as suggested by Pesaran, Shin & Smith (1999) as:

$$\Delta P_{it} = \phi_i P_{i,t-1} + \beta_i^* N_{it} + \delta_i^* E_{it} + \theta_i^* D_{it} + \sum_{j=1}^{p-1} \sigma_{ij}^{**} \Delta P_{i,\,t-j} + \sum_{j=0}^{q-1} \beta_{ij}^{**} \Delta N_{i,\,t-j}$$

$$+ \sum_{j=0}^{q-1} \delta_{ij}^{**} \Delta E_{i,\,t-j} + \sum_{j=0}^{q-1} \theta_{ij}^{**} \Delta D_{i,\,t-j} + \mu_i + \varepsilon_{it} \quad (8)$$

The disturbance term ε_{it} is assumed to be independently distributed across *i* and *t*, with zero means. Further, it is assumed that $\phi_i < 0$ for all *i's.* The parameter θ_i determines the long-run relationships between P_{it} , N_{it} , E_{it} and D_{it}. Since one of the aims of this study is to discover the presence of long-run relationship between the stock price and the fundamental variables, the long-run vector θ_i, is of highly important as it indicates the presence of cointegration.

Therefore, equation (8) can be re-written as:

$$\Delta P_{it} = \phi_i \eta_{i,t-1} + \sum_{j=1}^{p-1} \sigma_{ij}^{**} \Delta P_{i,\,t-j} + \sum_{j=0}^{q-1} \beta_{ij}^{**} \Delta N_{i,\,t-j} + \sum_{j=0}^{q-1} \delta_{ij}^{**} \Delta E_{i,\,t-j} + \sum_{j=0}^{q-1} \theta_{ij}^{**} \Delta D_{i,\,t-j}$$

$$+ \mu_i + \varepsilon_{it} \quad (9)$$

where $\eta_{i,t-1}$ is the error correction term and therefore, ϕ_i is the error correction term coefficient which measures the speed of adjustment towards the long-run equilibrium. The coefficient should be negative which would imply that the variables converge towards a long-run equilibrium. An additional proof of the existence of long-run relationship is the presence of a highly significant error correction term.

The following hypothesis is developed to ascertain the relationships of the variables in this study:

H_0 = There are no short-run and long-run relationships between the variables

H_1 = There exist short-run and long-run relationships between the variables

The order of the ARDL (p_1, q_1, q_2, q_3) model is determined by the Schwartz Bayesian Criterion (SBC).

An earlier estimation method to estimate panel data models which is called the mean group estimator (MG) was developed by Pesaran and Smith in 1995. The MG estimator permits the parameters to be openly independent across groups and does not contemplate potential homogeneity among groups. This approach estimates individual ARDL regressions for each group and obtains θ and ϕ as simple averages of individual group coefficients θ_i and ϕ_i. This study will include the MG estimator in addition to the PMG estimator to establish the long-run effects and the speed of adjustment of the property and construction stock prices to their fundamental variables to test for the robustness of the results.

The Hausman test (Hausman, 1978) is conducted in order to test whether there is a significant difference between the two estimators. The effect of heterogeneity on the means of the coefficients is resolved by the Hausman test which is employed to the variation between the MG and the PMG estimators (Pesaran, Shin and Smith, 1999). The Hausman test statistic is given as follows:

$$h = (\hat{\theta}_{MG} - \hat{\theta}_{PMG})' (\hat{V}(\hat{\theta}_{MG}) - \hat{V}(\hat{\theta}_{PMG}))^{-1} (\hat{\theta}_{MG} - \hat{\theta}_{PMG}) \quad (10)$$

where $\hat{V}(\hat{\theta}_{MG})$ and $\hat{V}(\hat{\theta}_{PMG})$ are consistent estimators of the variances of the MG and PMG. The PMG estimates are more efficient compared to the MG estimators in homogenous parameters. The null hypothesis of the homogeneity in the long-run coefficients can be verified with the Hausman test.

H_0 = Long-run homogenous restriction is valid (no significant difference between MG and PMG) and PMG is efficient

H_1 = Long-run homogenous restriction is not valid (there is significant difference between MG and PMG) and MG is consistent

Therefore, generally the Hausman test can be used to detect the suitable choice of estimator among the MG and PMG methods. If the MG and PMG are not significantly different, then the null is accepted. Thus, the PMG estimator is used since it is efficient.

4.2.1.3 Effect of Macroeconomic Shocks on Property and Construction Stock Prices

To discover the effect of macroeconomic variables on property and construction stock prices, this study will concentrate on the impact of shocks on interest rates, GDP growth, inflation and trade openness towards property and construction stock prices. The methods utilized to test the effects of the shocks of the macroeconomic variables include the VAR analysis, Impulse Response Functions and Variance Decomposition.

The macroeconomic variables are chosen based on previous studies, such as Brooks and Tsolascos (1999) where they found proof that interest rate term structure and unexpected inflation have a simultaneous impact on property returns. GDP was chosen as it was suggested by Bernanke and Mihov (1995) that it is the most superior signal for broad economic conditions, while being useful in measuring real activity (Kakes and Pattanaik, 2000).

Normal procedure in VAR analysis is to relate outcomes from Granger-causality tests, impulse responses and forecast error variance decompositions and because of the intricate dynamics in the VAR, these statistics are more explanatory than the estimated VAR regression coefficients of R^2 statistics (Stock and Watson, 2001).

4.2.1.3.1 VAR Analysis

The Vector Autogression (VAR) is estimated to determine the interrelationships among the variables. A VAR is also known as a vector moving average (VMA) where the VMA representation is an indispensable feature of Sims' (1980) method in that it permits for tracing out of the time path of the numerous shocks on the variables restrained in the VAR system.

The Vector Autoregression (VAR) which was developed in 1980 by Christopher Sims, was utilized to ascertain the effect of macroeconomic variable, specifically monetary policy on property and construction stock prices in Malaysia.

The standard panel VAR model can be written as:

$$y_{it} = \alpha_1 y_{i,t-1} + \ldots + \alpha_p y_{i,t-p} + \beta_0 x_{it} + \beta_1 x_{i,t-1} + \ldots + \beta_m x_{i,t-m} + u_{it}^{y} \quad (11)$$

where the error, u_{it}^{y} , is assumed to be serially uncorrelated and *y* and *x* are two arbitrary variables.

The lag length will be determined by the Schwartz Bayesian Criterion (SBC), where the model whose SBC value is smallest is chosen for further analysis. For a VAR to be unrestricted, it is imperative that the same number of lags of all the variables is

employed in all equations (Brooks and Tsolascos, 1999). The significance of all the lags of each individual variable is tested jointly using the F-test.

In this study, the model is designed as follows:

$$P_{1t} = a_{10,0} + \sum_{i=1}^{l} a_{11,i} P_{i,t-n} + \sum_{i=1}^{l} a_{12,i} INT_{i,t-n} + \sum_{i=1}^{l} a_{13,i} GDP_{i,t-n} + \sum_{i=1}^{l} a_{14,i} INFL_{i,t-n} + \sum_{i=1}^{l} a_{15,i} TR_{i,t-n} + u_{1t}$$

$$INT_{2t} = a_{20,0} + \sum_{i=1}^{l} a_{21,i} P_{i,t-n} + \sum_{i=1}^{l} a_{22,i} INT_{i,t-n} + \sum_{i=1}^{l} a_{23,i} GDP_{i,t-n} + \sum_{i=1}^{l} a_{24,i} INFL_{i,t-n} + \sum_{i=1}^{l} a_{25,i} TR_{i,t-n} + u_{2t}$$

$$GDP_{3t} = a_{30,0} + \sum_{i=1}^{l} a_{31,i} P_{i,t-n} + \sum_{i=1}^{l} a_{32,i} INT_{i,t-n} + \sum_{i=1}^{l} a_{33,i} GDP_{i,t-n} + \sum_{i=1}^{l} a_{34,i} INFL_{i,t-n} + \sum_{i=1}^{l} a_{35,i} TR_{i,t-n} + u_{3t}$$

$$INFL_{4t} = a_{40,0} + \sum_{i=1}^{l} a_{41,i} P_{i,t-n} + \sum_{i=1}^{l} a_{42,i} INT_{i,t-n} + \sum_{i=1}^{l} a_{43,i} GDP_{i,t-n} + \sum_{i=1}^{l} a_{44,i} INFL_{i,t-n} + \sum_{i=1}^{l} a_{45,i} TR_{i,t-n} + u_{4t}$$

$$TR_{5t} = a_{50,0} + \sum_{i=1}^{l} a_{51,i} P_{i,t-n} + \sum_{i=1}^{l} a_{52,i} INT_{i,t-n} + \sum_{i=1}^{l} a_{53,i} GDP_{i,t-n} + \sum_{i=1}^{l} a_{54,i} INFL_{i,t-n} + \sum_{i=1}^{l} a_{55,i} TR_{i,t-n} + u_{5t} \quad (12)$$

P_{1it} represents the stock price at time t while INT_{2it} represents interest rate which is the proxy for monetary policy as it is mainly used by central banks as a tool to control inflation, output and lending. GDP_{3it} is the rate of gross domestic product at time t and

$INFL_{4it}$ is the inflation rate as proxied by the CPI (Consumer Price Index), at time *t* while TR_{5it} represents trade openness at time *t*.

4.2.1.3.2 Impulse Response Functions

In order to further investigate the effect of macroeconomic shocks on property and construction stock prices, the impact multipliers (orthogonalized impulse responses) for the estimated VAR models are calculated. The impulse response functions (IRF) (advanced by Sims in 1980 and 1981) trace out the reaction of the dependent variable in the VAR system to shocks in the error terms for several periods in the future. It seeks to discover the impact of a one-unit shock of each explanatory variable on the stock prices over time. The impulse responses are plotted on the Y-axis with the periods from the initial shock on the X-axis. A vector autoregression can be written as a vector moving average (VMA) where the VMA representation is featured in Sim's (1980) method that permits the tracing out of the time path of various shocks on the variables enclosed in the VAR system. Each $\emptyset_{jk}\,(i)$ is interpreted as the time specific partial derivatives of the VMA (∞) function (Enders, 2010):

$$\emptyset_{jk}\,(i) = \frac{\partial x_{ji}}{\partial e_k} \qquad (13)$$

Equation (13) measures the change in the j^{th} variable in period *t* which is the result of a unit shock to the k^{th} variable in the present period. The coefficient ϕ can be used to produce the impacts of shocks on the time path and is known as an impact multiplier. However, it is still not feasible to trace out the time paths of the effects of the shocks as the estimated VAR is under identified. Equation (15) is not sufficient to identify the

primitive system[6]. To impose a restriction on the VAR system in order to identify the impulse responses, the Choleski decomposition has to be employed. It is used to obtain the underlying structural relationships and to perform innovation accounting (Gurguis and Schmidt, 2005).

The Cholesky decomposition of *S* is employed as:

$$S = TT' \qquad (14)$$

where T is a lower triangular matrix and *T'* denotes the conjugate transpose of *T*. The key point for the Choleski decomposition is that the decomposition forces a potentially important asymmetry on the system since a shock on the macroeconomic variable will have simultaneous impacts on both property and construction stock prices. For that reason, the ordering of the variables in the model is important. The ordering of the variables in this study are based on decreasing order of exogeneity whereby the most exogenous variables is placed first followed by the less exogenous variables.

The effects of a one-unit shock of the macroeconomic variable on the stock prices are displayed in impulse response functions graphs where the asymmetry of the decomposition can be seen by comparing the two upper graphs. A one-unit shock in the macroeconomic variable causes the stock price value to increase or decrease and the period taken to achieve equilibrium after the shock can be observed on the graph.

Four sets of hypotheses are formed for this section:

[6] The primitive system of a VAR is defined as the VAR equation in the matrix form

1) H_0: Shocks on nominal interest rate do not influence the movement of property and construction stock prices

   H_1: Shocks on nominal interest rates influence the movement of property and construction stock prices

2) H_0: Shocks on GDP do not influence the movement of property and construction stock prices

   H_1: Shocks on GDP influence the movement of property and construction stock prices

3) H_0: Shocks on CPI do not influence the movement of property and construction stock prices

   H_1: Shocks on CPI influence the movement of property and construction stock prices

4) H_0: Shocks on Trade Openness do not influence the movement of property and construction stock prices

   H_1: Shocks on Trade Openness influence the movement of property and construction stock prices

4.2.1.3.3 Variance Decomposition

The forecast error variance decomposition shows the percentage of the shifts in a series caused by its "own" shocks against shocks to the other variable (Enders, 2010). The variance decomposition analysis attempts to describe the total forecast error variance of

each variable in terms of proportions caused by evolutions in each variable. Similar to the impulse response function, it is necessary to restrict the *B* matrix whereby the Choleski decomposition is used to necessitate all of the one-period forecast error variance. As *t* increases, the variance decompositions should converge. If the correlation coefficient is significantly different from zero, it is customary to obtain the variance decompositions under various orderings. The ordering of the variables is critical in the decomposition as its effectiveness is tantamount to establishing limitation on the primitive form of the VAR.

To estimate the variance decompositions, the variances of interest rates, GDP, CPI and trade openness are decomposed into the percentages assignable to each type of innovation. The orthogonalized innovations are acquired from Choleski decomposition.

The results of the variance decomposition analysis are displayed in a table where each time series explains the predomination of its own past values. It will indicate how many percent of the macroeconomic variable forecast error variance is taken to explain the stock price movement.

4.3 Summary

To achieve the objective of the study, various methods are used. First, to determine the diversification potential of investing simultaneously in both property and construction stock markets in Malaysia, correlation tests are done to determine the level of correlation between the stock prices of both sectors' stock prices. If the stock prices are highly correlated then there would be no benefit in investing in both sectors at the same time.

However, there is potential benefit if the stock prices are found to be positively or negatively correlated with each other. Diversification potential among property and construction stocks is investigated to give a better insight to the benefits of diversifying an investment portfolio to include both stocks. Investors will be able to identify whether it is profitable to invest in both sectors at the same time based on the outcome of correlation tests between both stocks.

Secondly, panel unit root tests by Im, Pesaran and Shin (2003) are employed to test for stationarity of the relationship between stock prices and their fundamental variables. A dynamic error correction model which describes the disequilibrium adjustment process is then estimated. The panel ARDL method is also used to test for cointegration and estimation of the error correction model. Both the panel data time-series models and the panel ARDL approach is used to test for cointegration and speed of adjustment of the stock prices to equilibrium. The ARDL bounds test is a pertinent test as it does not require the data to be stationary or whether the variables are I(0) or I(1) provided that they are not I(2). The pooled mean group (PMG) and mean group (MG) estimation methods by Pesaran, Shin and Smith (1999) are applied to test for the relationships between the stock prices and their fundamental variables whereby the PMG estimator allows the intercepts, short-run coefficients and error variances to be different across groups, but the long-run coefficients are constrained to be homogenous. The MG estimator which was initiated earlier by Pesaran and Smith in 1995 is claimed to be able to generate constant estimates of the average parameters. To test for robustness of both estimators and the hypothesis of homogeneity, the Hausman (1978) test is applied.

Lastly, as macroeconomic shocks have long been recognized as having effect on stock returns, this study will test for the effect of these shocks on property and construction stock prices. The impact of the shocks on interest rates, GDP, inflation and trade openness on property and construction stock prices are investigated by implementing the structured VAR model, impulse response functions and forecast variance decomposition analysis.

CHAPTER FIVE

RESULTS AND DISCUSSION

Results from correlation tests, panel unit root tests, cointegration tests and error correction models are discussed in this chapter. The correlation test result between property and construction sectors in Malaysia explain the diversification benefits of investing in both sectors, which is the first objective of this thesis. In order to fulfill objective number two, the panel ARDL model using the pooled mean group and mean group estimators are used to test for the existence of long-run relationship between the variables and to determine the error correction model which will indicate the speed of adjustment to equilibrium by the variables involved. The third objective is achieved by determining the effect of macroeconomic shocks on property and construction stock prices from the results of structured VAR models, impulse response functions and variance decompositions.

5.1 Descriptive Statistics and Correlation Matrix

In order to proceed with the investigations, the statistics of the property and construction data and also the macroeconomic variables are examined to reveal the properties of the data included in this study. The descriptive statistics displayed in Tables 5.1 and 5.2 summarize the essential characteristics of the data in this study. They furnish details about the variables and the measurements used. The mean, maximum, minimum and standard deviation for all key variables is characterized in the descriptive statistics.

5.1.1 Descriptive Statistics

Table 5.1 consists of descriptive statistics for variables from the property and construction sectors. The property sector mean value for price and NAV does not differ much at RM1.464 and RM1.463, respectively while the EPS and DPS values have a difference of only about RM0.018. The mean value for construction stock price is higher than the property stock price while the mean values for NAV and EPS are also below 1. The mean value for DPS is RM0.026 which is lower than the property sectors' DPS. Over the 19-year period, the highest yearly stock price for the property sector is RM17.083 compared to RM21.744 for the construction stock. Nonetheless, the mean price for both the property (RM1.464) and construction stock prices (1.748) does not show a wide difference with only RM0.284.

The mean standard deviation shows how much each data value deviates from the mean, so the greater the dispersion value, the larger the standard deviation. Overall, the standard deviations for all variables are low except for the construction and property stock price which are RM2.346 and RM1.754 respectively and are higher than the other variables, indicating that the price variable deviates widely from its mean.

Table 5.1
Descriptive Statistics for Property and Construction Stocks' Variables

Variable	Mean	Maximum	Minimum	Std.Dev.	Obs
Property					
Price	1.464	17.083	0.04	1.754	532
NAV	1.463	9.005	-6.255	1.346	532
EPS	0.009	1.067	-13.785	0.647	532
DPS	0.027	0.4	0	0.039	532

Table 5.1 (Continued)

Variable	Mean	Maximum	Minimum	Std.Dev.	Obs
Construction					
Price	1.748	21.744	0.144	2.346	304
NAV	0.891	4.027	-5.1	1.08	304
EPS	-0.04	1.247	-3.69	0.428	304
DPS	0.026	0.563	0	0.052	304

Std. Dev. = standard deviation of the variable; Obs = number of observation for each variable; Price = property and construction stock price for Malaysia; NAV = net asset value per share; EPS = earnings per share; DPS = dividend per share. All figures are in Ringgit Malaysia (RM).

Macroeconomic variables' descriptive statistics are shown in Table 5.2. The highest mean value for the macroeconomic variables is the GDP value at 5.084. The lowest mean value is at 1.938 for trade openness. GDP also has the highest standard deviation value at 3.966 compared to the other variables, which means that it deviates from its mean more than the other variables. The other variables have lower standard deviations which imply that the mean is a fairly good estimate for the values in the distribution. The range for trade openness is found to be lower than the range for the CPI, GDP and interest rate, indicating little differences in its value over the study period. The GDP has the highest range among the variables which means that there are large differences in its value throughout the 19 years of study.

Table 5.2
Descriptive Statistics for Macroeconomic Variables

Variables	Mean	Maximum	Minimum	Std.Dev.	Obs
CPI	2.535	5.400	0.600	1.281	532
GDP	5.084	10.00	-7.400	3.966	532
Openness	1.938	2.204	1.626	0.160	532
Int. rate	3.600	6.86	2.050	1.454	532

Std.Dev = standard deviation of the variable; Obs = number of observation for each variable; CPI = consumer price index which is the proxy for inflation; GDP = Gross Domestic Product growth; Openness = trade openness which is the sum of exports plus imports as a share of GDP; Int.rate = Malaysian interest rate represented by the Malaysian Treasury Bill rate

The higher standard deviation in construction price and GDP indicate that both variables are more widely spread out in the distribution. This indicates that both the construction price and GDP variables are considered to be more volatile compared to the other variables in this study as they deviate far from the mean. Since standard deviation is the result of the square root of variance, it can be said that higher standard deviation involves larger risk.

5.1.2 Correlation Matrix

The correlation matrix for all the variables in this study is shown in Table 5.3. It is observed that for the macroeconomic variables, the interest rate and GDP correlate positively and significantly with the property and construction stock prices whereas CPI has a positive and significant relationship (at 5% level) with property stock price at only 0.10. Trade openness is found to have significant negative relationships with the property stock price. The real risk free interest rate forms the strongest relationship with the stock prices as it has a highly significant positive relationship with the stock prices and the correlation coefficient is the highest among the macroeconomic variables (0.43 and 0.31 for property and construction stock prices respectively). GDP is also found to have positive significant relationship with property stock price and construction stock price at 0.29 and 0.21 respectively. The fundamental value that has the strongest relationship with the property stock price compared to the other fundamental variables is found to be the DPS at 0.37. It is also discovered that the EPS is positively correlated with the property stock prices (0.11) and this relationship is found to be statistically significant at 5%. Similarly, the construction stock DPS is found to be even more positively correlated with its stock price (0.42). However, the EPS for the construction

sector is found to be not significantly correlated to its stock price. NAV is discovered as more highly correlated with the stock prices of both sectors compared to its EPS with correlation coefficients of 0.29 and 0.40 for the property and construction stock prices respectively. Therefore, it can be concluded that the relationships between both sectors' stock prices and their fundamental variables are found to be highly significant except for the relationship between construction stock price and its EPS.

This finding implies that there are positive significant relationships between interest rate and GDP with construction stock prices. Therefore, it can be presumed that when the value of one variable increases, the other one will increase as well. As for fundamental variables, the NAV and DPS are found to have strong positive relationships with the stock prices. As the correlation coefficients for the NAV and DPS are higher for the construction sector compared to the property sector, it can be concluded that the relationships between the construction stock price with their NAV and DPS are stronger than the relationship between these two fundamental variables with the property stock prices. Both the NAV and DPS can be useful at estimating the direction for the movement of both sectors' stock prices as it has positive significant correlation coefficients. The EPS is found to have lower correlation with the property stock price. This indicates that the EPS is a weaker predictor for future property stock price movements compared to NAV and DPS although it still possesses a positive significant relationship with the property stock prices but not with the construction stock prices.

Table 5.3
Correlation Matrix

	PR_1	PR_2	NAV_1	NAV_2	EPS_1	EPS_2	DPS_1	DPS_2	INT	GDP	CPI	OPEN
PR_1	1.00											
PR_2	0.28***	1.00										
NAV_1	0.29***	0.01	1.00									
NAV_2	0.06	0.40***	-0.07*	1.00								
EPS_1	0.11**	0.02	0.33***	-0.02	1.00							
EPS_2	0.09**	0.05	-0.04	0.28***	0.05	1.00						
DPS_1	0.37***	0.08*	0.54***	-0.02	0.16***	-0.03	1.00					
DPS_2	0.07	0.42***	0.01	0.32***	0.02	0.16***	0.03	1.00				
INT	0.43***	0.31***	0.05	0.11**	0.04	0.08*	0.25***	-0.08*	1.00			
GDP	0.29***	0.21***	-0.05	-0.01	0.02	0.05	0.07	0.02	-0.06	1.00		
CPI	0.10**	0.08	0.03	0.05	0.01	0.01	0.13***	0.02	0.60***	-0.18***	1.00	
OPEN	-0.09**	-0.06	-0.08*	-0.03	-0.13***	-0.08*	-0.09**	-0.13***	0.03	-0.01	-0.01	1.00

***, **, * indicates significance at 1%, 5% and 10% levels respectively; PR_1 = stock price for property sector; PR_2 = stock price for construction sector; NAV_1 = net asset value for property sector; NAV_2 = net asset value for construction sector; EPS_1 = earnings per share for property sector; EPS_2 = earnings per share for construction sector; DPS_1 = dividend per share for property sector; DPS_2 = dividend per share for construction sector; CPI = Consumer Price Index; GDP = Gross Domestic Products in RM million; Int = the Malaysian interest rate which is represented by the Malaysian Treasury Bill rate; Open = trade openness which is the sum of exports plus imports as a share of GDP.

While interest rates, GDP and CPI correlate positively with stock prices of both sectors, trade openness has an inverse relationship with the property and the construction sector price. Trade openness is found to have low negative correlation with stock prices of the property sector. The negative significant relationship between trade openness and the property stock prices indicate that these variables move in inverse directions. A possible reason could be that international trade encourages markets to become more competitive where prices are reduced and incentives are raised. As trade barriers are lifted, local firms begin to lose power, thus reducing their company worth and stock prices. However, the relationship between trade openness and the construction stock price is found to be not significant.

5.2 Diversification Potential between the Property and Construction Stocks

The first objective of this study is to discover whether property and construction stocks offer diversification benefits to investors who intend to invest in both stocks simultaneously. To configure a portfolio from two assets, it is essential to estimate how the asset returns correspond with each other. The main factor that determines portfolio risk is the degree of returns on the two assets that are inclined to differ either in together or in opposition (Bodie, Kane and Marcus, 2013). Thus, portfolio risk relies upon on the correlation between the returns of the assets in the portfolio. In order to achieve this objective, correlation tests are done to identify the relationship between property and construction stock prices.

The MPT (Modern Portfolio Theory) states that investors have to consider how each security co-moved with other securities which would result in the capacity to build a

portfolio with similar expected return and less risk rather than a portfolio which is built by disregarding the interactions among securities. Thus, a correlation test is done in this study to examine the strength or degree of linear relationship between both the property and construction stocks for the period of 1995 to 2013.

Correlation coefficients can range from values of -1 to +1. A correlation coefficient of nearer to +1 would indicate no diversification potential compared to a coefficient which is nearer to zero. Correlations of zero would mean that the returns on the assets are not linked to each other whereas a correlation coefficient of -0.99 strongly indicates that the returns on the stocks vary inversely. Values of -1 will imply perfect negative correlation, which is the most powerful inclination for two returns to differ contrarily. A negative correlation coefficient would portray the property and construction sectors as segmented which can offer potential diversification benefits to investors.

The correlation matrix as seen on Table 5.3 shows the correlation of property stocks with construction stocks which is 0.28. This shows that there is a weak positive relationship between the two stocks. A small positive correlation means there is a possibility of risk diversification if both stocks are included in a portfolio. Bodie, Kane and Marcus (2013) stress that perfect correlation (correlation coefficient = +1) is the only situation where there is totally no diversification benefit. At any time, when $\rho < 1$, the portfolio standard deviation will be less than the weighted average of standard deviations of the component securities. Hence, diversification advantages exist if asset returns are not perfectly correlated. According to Markowitz (1952), investors can diversify away the risk of investment loss by lessening the correlation between the

returns from the chosen securities in their portfolio. The goal is to optimize expected return against a certain level of risk. Thus, the low positive correlation between the property and construction stocks indicates the existence of diversification which is consistent to the MPT.

In 2002, Ting studied the performance of listed property companies in Malaysia and found low correlation between the property shares and the KLCI. However, he did not study its correlation with construction stocks. The only study ever found to have a similar aim of [7]investigating correlations between property and construction stocks are done in Nigeria by Rasheed and Tajudeen (2006). They found diversification benefits when incorporating property and construction shares into stock portfolios which are consistent to this study. So far, no study has been done yet in Malaysia to determine the diversification benefits by investing in both property and construction stocks in a portfolio.

The outcomes from this study can be a guide to fund managers to allocate their funds to include both property and construction stocks into their portfolio to derive optimal returns due to the low correlation of the stocks. By investing in low correlated stocks, the fund managers will be able to offset any losses by gains in the other stocks. Including a broader variety of low-correlated assets into a portfolio can raise the investor's chances of easing short-term swings. Fund managers' goal should be to blend

[7] As far as the author has found, no other studies has been done yet on diversification benefits of property and construction stocks in other countries.

two assets which are weakly correlated with each other and perform differently over time to accomplish competitive returns with less risk. Investors that hold a portfolio diversified with low-correlating assets has the chance to gain from returns with lower risk.

Another issue apart from diversification potential of investing in both the property and construction sectors is the ability of predicting price movements. To fully benefit from investing in these two sectors, investors would also be interested to know if the stock prices mean revert to their equilibrium in the long-run and the time period taken. Therefore, the test for the long-run relationships of the stock prices is conducted.

5.3 Long-run Relationship and Mean Reversion of Stock Prices to Equilibrium

The second objective in this thesis is to determine whether the property stock and construction stock prices mean revert to their fundamental variables and if they do, how long they take to achieve the mean reversion. As opined by Schreiber and Schwartz (1986), the price discovery theory is closely linked to the mean reversion hypothesis where prices are said to revert to equilibrium in the long-run. In order to investigate mean reversion, the long-run relationship between the two variables needs to be determined beforehand. A long-run relationship is said to exist when the stock prices and their fundamental variables are cointegrated. The cointegration analysis of panel data includes three steps: First, panel unit root test is conducted instead of conventional unit root test. The test statistics used are the Im, Pesaran and Shin (IPS) (2003) statistics, Augmented Dickey-Fuller (ADF) (1979) test statistics and Phillips-Perron (PP) (1988) test statistics. Secondly, the cointegration in panel data is tested by applying

Pedroni's panel cointegration statistics (1999). Lastly, dynamic ECM panel data models are evaluated for short-run coefficients and the adjustments to long-run relationships executing the Pooled Mean Group (PMG) (Pesaran, Smith and Shin, 1999) and the Mean Group (MG) estimators (Pesaran and Smith, 1995).

5.3.1 Panel Unit Root Tests

Panel unit root tests are applied in this study to test the stationarity properties of the series involved. As the lag selection is an important step in unit root tests, this study tests up to 6 lags to ascertain the optimal lag length. It is essential to choose the correct number of lags when conducting the panel unit root test. Too few lags will lead to the regression residuals not behaving like white-noise processes and the model will not correctly secure the actual error process and its standard error cannot be predicted accurately while too many lags will reduce the strength of the test to reject the null of a unit root as the higher number of lags demands the prediction of extra parameters and a loss of degrees of freedom.

Table 5.4 displays the SBC statistics for selecting the optimal lag order for property stocks and construction stocks respectively. The lowest SBC value is selected to decide on the maximum length for the series. This is because the model with the smallest SBC is believed to be the most suitable model as it curtails the variation from the given model to the 'true' model. The statistic for lag lengths is obtained by regressing each variable against its own lagged value. The optimal lag length for stock price, NAV, EPS and DPS for property stocks is 6. As for the construction sector, the optimal lag length for NAV and EPS is also 6 whereas the best lags are 5 and 7 for stock price and DPS respectively.

After determining the optimal lag length for each variable, the panel unit root test is administered to establish the stationarity of each variable. The null hypothesis is that the series contains a unit root and thus, it is not stationary.

Table 5.4
Statistics for Selecting Lag Order: Property and Construction Stocks

Panel A: Property Stocks

	Price	**NAV**	**EPS**	**DPS**
Lag	**SBC**	**SBC**	**SBC**	**SBC**
1	3.375	2.413	2.015	-4.366
2	3.107	2.526	2.081	-4.445
3	2.280	1.893	2.153	-4.419
4	1.410	1.914	2.212	-4.925
5	1.332	0.675	-0.287	-5.434
6	1.266#	0.618#	-0.499#	-5.526#

Panel B: Construction Stocks

	Price	**NAV**	**EPS**	**DPS**
Lag	**SBC**	**SBC**	**SBC**	**SBC**
1	3.818	1.833	1.073	-3.508
2	3.353	1.886	1.097	-3.508
3	2.454	1.912	1.155	-3.518#
4	2.020	1.910	1.223	-3.498
5	2.008#	1.795	0.765	-3.368
6	2.042	1.702#	0.717#	-3.368

Note: # shows optimal lag selected based on SBC
SBC = Shwartz Bayesian Criterion

The IPS (Im, Pesaran and Shin, 2003) test and Fisher tests which include the ADF (Augmented Dickey-Fuller) and PP (Phillips-Perron) tests are applied on all series to determine the existence of unit root. The LLC (Levin-Lin-Chu, 2002) test is ignored as it has several limitations, for example, during situations where simultaneous correlation cannot be eliminated by subtracting the cross sectional average. The LLC test also relies on the independence presumption across individual variables; therefore, it cannot be applied if cross sectional correlation is present. The conjecture that every individual variable are indistinguishable regarding the presence or absence of a unit root is also

rather prohibitive, as discovered by Maddala and Wu (1999). Since correlation among some variables do exist in this study, the LLC test result is not applied to the analysis of the panel unit root test here.

For panel unit root tests, the statistic W_{tbar} is the appropriate critical value and has an asymptotic standardized normal distribution. We include the ADF and PP Fisher tests as it is mentioned by Maddala and Wu (1999) to be directly comparable with the IPS test as both tests the same hypothesis. The aim of including both tests is to ensure the robustness of the tests where the Fisher tests are non-parametric while the IPS test is a parametric test.

Results of the panel unit root tests for property and construction stocks are displayed in Table 5.5. The results from panel unit root tests reveal the stationarity of variables in this study in order to determine their long-run relationships. Based on the results of the panel unit root tests on property stocks, Panel A of Table 5.5 shows that for all the variables, the null hypothesis of existence of unit root at 1%, 5% and 10% level based on the W_{tbar} critical values for the IPS test and the χ^2 critical values for the ADF and PP Fisher tests can be rejected. Stock price, NAV, EPS and DPS were found to be stationary in level, i.e. I(0) since the p-value for the existence of unit root for the variables is 0.00. This denotes that all the variables for property stocks are stationary at level.

Table 5.5

Panel Unit Root Test Statistics for Stationarity: Property and Construction Stocks

Panel A: Property Stocks

	Price (lag 6)		**NAV (lag 6)**		**EPS (lag 4)**		**DPS (lag 6)**	
	Level	1st Diff	Level	1st Diff	Level	1st Diff	Level	1st Diff
IPS	-5.027***	-15.984* **	1.717***	-15.667***	-7.689* **	-16.972***	-14.103* **	-21.413***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ADF	113.623***	341.397***	66.393***	379.990***	193.839***	372.392***	466.058***	490.501***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
PP	413.677***	667.434***	111.703***	383.139***	212.535***	1175.2***	543.577***	968.084***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Panel B: Construction Stocks

	Price (lag 5)		**NAV (lag 6)**		**EPS (lag 6)**		**DPS (lag 3)**	
	Level	1st Diff	Level	1st Diff	Level	1st Diff	Level	1st Diff
IPS	-21.88***	-12.317***	-0.5571	-7.647***	-5.44740***	-11.815***	-2.642***	-8.02***
	(0.000)	(0.000)	(0.7113)	(0.000)	(0.000)	(0.000)	(0.0041)	(0.000)
ADF	337.31***	204.738***	34.956	130.068***	98.9174***	193.990***	41.297**	101.448***
	(0.000)	(0.000)	(0.3294)	(0.000)	(0.000)	(0.000)	(0.0154)	(0.000)
PP	74.43***	463.355***	33.2139	185.086***	103.939***	701.352***	39.602**	178.841***
	(0.0000)	(0.000)	(0.4079)	(0.000)	(0.000)	(0.000)	(0.0236)	(0.000)

Notes: The null hypothesis is that there is unit root in the panel data. ***, **, * denotes rejection of a unit root based on W_{tbar} critical values for IPS test and χ^2 critical values for the ADF and PP tests at 1%, 5% and 10% level respectively. The figures in the parentheses are the p-values. The *IPS, ADF and PP* tests assume individual unit root process. Probabilities for Fisher tests (ADF and PP) are calculated using an asymptotic Chi –square distribution. All other tests assume asymptotic normality.

Panel unit root tests for construction stocks display different results compared to property stocks. Panel B of Table 5.5 shows a mixture of stationary and non-stationary variables. The IPS, ADF and PP panel unit root tests on NAV show that the variable is not stationary at level. However, the first order differenced data on NAV of construction stocks show that the series is stationary at first difference, i.e. I(1). As for DPS, the IPS test show that it is significant at 1% level while the ADF and PP panel unit root test found the variable to be significant based on the χ^2 critical value at 5%. The null hypothesis of presence of unit root in the data is rejected for the construction stock price. Price, EPS and DPS for construction stocks were discovered to be stationary at level.

Since the variables in the property stocks are stationary at level, the panel cointegration test can be used. However, the variables in the construction stock sector are integrated of different orders. The discovery of mixed stationary properties of the variables involved leads to the conclusion that the Pedroni panel cointegration test cannot be applied in this study. Enders (2010) opined that two variables which are integrated of different orders cannot be cointegrated.

5.3.2 ARDL Bounds Test

The introduction of the Autoregressive Distributed Lag (ARDL) approach by Pesaran in 2001 allows testing for cointegration of variables which are integrated of different orders, therefore allowing for the eradication of pre-testing for unit roots. Bahmani-Oskooee and Nasir (2004) applied the ARDL approach in their study of productivity bias hypothesis as they found this approach is able to avoid the difficulty of determining the degree of integration and pre-testing for unit roots. Similarly, Pahlavani, Wilson and Worthington (2005) applied the ARDL approach for cointegration test as the results of unit root tests for the series in his study were mixed thus, not allowing him to continue with the conventional Johansen cointegration test. Therefore, it is appropriate to include the ARDL approach in this study to determine the long-run relationships between the variables as they are also integrated of different orders.

Due to all these supporting evidences on the use of the ARDL approach, the panel ARDL method is applied in this study to test for cointegration between the stock prices and their fundamental variables. Since the ARDL can be applied on all variables regardless of whether they are stationary or not, it is applied in this study for both the

property stock and construction variables. This is to ensure a more uniformed result is reported. The results might be difficult to compare if different cointegration tests are applied on each sector. The ARDL test is also a more statistically significant technique for ascertaining cointegrating relationships in small samples (Pahlavani *et al.*, 2005). It would further reveal if cointegration exists among the variables. Short-run dynamics and speed of the stock prices' convergence back to equilibrium are also displayed by the results from the ARDL Bounds Test model.

5.3.2.1 Panel ARDL: Pooled Mean Group (PMG) and Mean Group (MG) estimations

In order to fulfill this study's second objective, which is to determine whether the stock prices in this study do mean revert to their equilibrium levels and the time taken to mean revert, long-run relationships among the stock prices and their fundamental variables (NAV, EPS and DPS) must be established before any inferences can be made. Pesaran and Smith (1995) introduced the panel ARDL method to establish cointegration by utilizing the mean group (MG) and the pooled mean group (PMG) estimators. The MG estimator which was initiated by Pesaran and Smith (1995) allows for heterogeneity of all the parameters and obtains the long-run parameters for the panel from an average of the long-run parameters from ARDL models for individual variables. It estimates separate regressions that can furnish regular estimates of the long-run coefficients. The PMG estimator (Pesaran, Shin and Smith, 1999) pools the long-run parameters and avoids the problem of heterogenous short run dynamic relationships. It permits the intercepts, short-run coefficients and error variances to vary freely across groups, but constraints the long-run coefficients to do the same (Pesaran, Shin and Smith, 1999). This permits the dynamic specification to differ across groups. The assessment of the

PMG demands reparameterization into error correction system. The Hausman (1978) test is conducted to test for homogeneity of the long-run parameters and to choose the more efficient estimator between the PMG and the MG estimators.

Both the PMG and MG estimations demand adopting the suitable lag length for the individual stock equations. The Schwartz Bayesian Criterion (SBC) is used to select the appropriate lag length where the lag with the smallest SBC value is chosen as the optimal lag for the OLS equation of the individual variables. Table 5.6 displays the statistics for selecting the lag order for both the property and construction stocks. The appropriate lag length for property stocks is found to be lag 3,4,5,3 while the most suitable lag length for construction stocks is 3,4,3,2. This lag length indicates that the optimal lag length for price and NAV for both stocks are 3 and 4 lags respectively while the appropriate lag length for property and construction EPS is 5 and 3 lags respectively. As for DPS, It is found that the most suitable lag length for property stocks is 3 while the best lag length for construction stocks is 2 lags.

Table 5.6:
Statistics for Selecting Panel ARDL Lag Order

Panel A: Property stocks	
Lag (price,NAV,EPS,DPS)	**SBC**
3,4,5,3	1405.49#
3,3,5,3	1405.545
3,4,4,3	1656.565
3,4,4,2	1661.97
3,4,5,2	1408.228
Panel B: Construction stocks	
Lag(price,NAV,EPS,DPS)	**SBC**
3,4,3,2	1030.645#
3,4,3,1	1037.872
3,3,3,2	1114.318
3,3,2,3	1101.444
3,4,4,2	1031.857

*# shows optimal lag selected based on SBC. SBC = Shwartz Bayesian Criterion

The results of the MG and PMG estimations are shown in Table 5.7. Panel A displays the results for the MG and PMG estimates for the property stock price and its fundamental variables. The MG estimates show that in the long-run all the variables are not significant in influencing the movement of their stock price. This shows that they do not determine the changes in the stock prices in the long-run period when estimated using the MG estimator. However, the PMG estimates show that property sector NAV and EPS are significant in explaining the long-run stock price movement. This result indicates that a Ringgit increase in the property NAV will increase the stock price by about RM0.305 while an increase in its EPS will lead to a decrease of RM0.815 in the property stock price in the long-run. Since the long-run coefficients for NAV and EPS are highly significant, it can be concluded that there exists cointegrating relationships between property stock price and property NAV and EPS.

Table 5.7
Panel ARDL PMG and MG estimates

Panel A: Property Stocks - ARDL (3,4,5,3)		
Variables	**MG**	**PMG**
Long-run coefficients		
NAV	-7.495(0.362)	0.305(0.000)
EPS	6.872(0.194)	-0.815(0.000)
DPS	-46.657(0.286)	-10.230(0.196)
Error Correction Coefficient		
ϕ_i	-0.355(0.352)	-0.657(0.049)
Short-run coefficients		
NAV	0.738(0.065)	0.832(0.111)
EPS	0.143(0.518)	0.167(0.452)
DPS	5.730(0.504)	11.472(0.231)
Hausman Test 1.48(0.6868)		

Panel B: Construction Stocks – ARDL (3,4,3,2)		
Variables	**MG**	**PMG**
Long-run coefficients		
NAV	-0.932(0.606)	0.253(0.438)
EPS	1.673(0.716)	-1.635(0.013)
DPS	13.046(0.781)	7.240(0.247)

Table 5.7 (Continued)

Variables	MG	PMG
Error Correction Coefficient		
ϕ_i	-0.151(0.885)	-0.675(0.024)
Short-run coefficients		
NAV	-0.068(0.912)	0.302(0.694)
EPS	1.223(0.177)	0.376(0.738)
DPS	62.625(0.372)	30.594(0.482)
Hausman Test 4.43(0.2185)		

Panel ARDL Models A and B lag orders are selected based on SBC; MG = Mean group, PMG = Pooled mean group; P values are shown in parentheses.

As for the construction sector, where the results are shown in Panel B of Table 5.7, the PMG estimates show that only EPS is found to be able to affect the stock price movement. It is found that a unit increase of EPS will bring down the construction stock price by RM1.635 in the long-run. However, DPS does not influence stock prices of both sectors in the long-run. Therefore, it can be concluded that while increases in NAV affects property stock price positively, stock prices of both sectors decline whenever there are increases in their EPS over the long-run. This means that an inverse relationship exists between EPS and stock prices for the property and construction sectors in Malaysia in the long-run. Since the long-run EPS coefficient is found to be significant, it can be said that construction stock price and its EPS are cointegrated.

In the short-run, most of the explanatory variables coefficients are found to be statistically insignificant by both the MG and PMG estimators. This indicates that the fundamental variables are not expected to influence the stock prices of both sectors in the short-run. Nevertheless, the MG estimator in panel A of Table 5.7 found the property NAV to be significant at influencing the stock price where a unit increase in the

NAV will bring to a short-run change of about RM0.738 (significant at 10% critical level).

The long-run MG and PMG estimates for both property and construction EPS show inverse relationships between the fundamental variable with their stock prices. This means that increases in EPS will lead to stock price declination. Most studies before this have always found EPS to have positive relationships with their stock prices (for example, Chiang *et al.*, 1995, Sing *et al.*, 2002, Chang *et al.*, 2008 and Oh *et al.*, 2006). It is likely that the inverse relationship of EPS and the stock prices where these two sectors are being influenced by the EPS data that are mostly negative during the period of the study. Due to this negative relationship, it is decided that the findings on the EPS relationship with the stock prices of both sectors could not be applied as it is being influenced by the negative EPS of the data.

Meanwhile, the error correction coefficient for the MG estimate is also found to be not significant in explaining the adjustment of the short-run price movement. However, it is found that by utilizing the PMG estimate, the error correction coefficient for the short-run deviation is significant at 5% level and is negative, as expected. The size of the ECM for PMG estimation of the property sector is -0.6570 which indicates a comparatively high speed of adjustment from the short-run deviation to the long-run equilibrium stock price. This shows that around 65% of deviation from its long-run

stock price is corrected each year. It also implies that the property stock price takes about 1.53 years to adjust towards its long-run equilibrium.[8]

The speed of adjustment from the deviation for the short-run deviation for the construction sector is also found to be not significant when measured by the MG estimator. Similar to the property sector, the error correction coefficient for the construction sector is also found to be significant at 5% level and negative as expected in the PMG estimation. The ECM for construction stock price to move back to equilibrium is -0.675 which means that the long-run stock price is adjusted by about 67% yearly. This shows that construction stock price reverts to its long-run equilibrium in approximately 1.49 years[9], which is rather similar to the speed of the movement of property stock price to equilibrium. Considering that the market is inefficient as it takes a while for the stock prices to move towards their equilibrium, the speed of mean reversion is considered slow as it could still lead to arbitrage.

Similar to this study, Sing, Liow and Chan (2002) found long-run convergence relationships between Singapore property stock price and their NAVs. The NAV is a common variable used in valuing property companies as it is the principal basis for valuation of property companies. Sing, Liow and Chan (2002) also found the EPS to be one of the most significant fundamental variables, apart from NAV, that explains the long-run stock price changes. Meanwhile, this study also found construction companies'

[8] The calculation for the duration taken for the property stock prices to revert to its long-run equilibrium is as follows: 100/65= 1.53 years

[9] The calculation for the duration taken for the property stock prices to revert to its long-run equilibrium is as follows: 100/67= 1.49 years

EPS to be significant in justifying the long-run behavior of the stock price. Based on the results from the estimated long-run coefficients, it can be said that EPS is a significant fundamental value that determines the property and construction stock price changes in Malaysia. In contrast, the estimated long-run coefficients of DPS for both sectors are found to be insignificant. Therefore, it cannot be a useful predictor for the long-run movement of property and construction stocks in Malaysia. Sing, Liow and Chan (2002) found a weak relationship between DPS and property stock prices in Singapore where DPS was significant in explaining only two of the VECM relationships in their study. The reason why DPS is not relevant in explaining the long-run relationship with property stock prices and construction stock prices in this study could be because the amount that the firms declare as dividends may not necessarily mirror the performance of the entity. For example, a firm may choose to cut its dividend in a period where EPS has doubled to provide cash for future cash growth and expansion (purchase of equipment or materials). Pandey (2003) found that in Malaysia, construction companies had the lowest dividend payout compared to other companies in other sectors. This may have influence on the insignificant result of DPS in predicting property and construction stock prices in Malaysia.

In order to choose between the estimators (MG and PMG), the Hausman test statistics with the null hypothesis of no difference between MG and PMG estimators is suggested by Pesaran *et al.* (1999). Hausman (1978) suggested a homogeneity test for long-run parameters. Pesaran *et al.*(1999) opined that effective long-run homogeneity decreases the standard errors of the long-run coefficients, but the estimates are not changed considerably. In this study, the Hausman test statistic of 1.48, which is $\chi^2(3)$ and 4.43,

which is also χ^2 (3) for property and construction sectors respectively, under the null hypothesis of no difference between the MG and PMG estimators and efficiency of MG for construction sector confirms this statement by Pesaran *et al.* (1999). This result suggests that the PMG estimator is a more efficient estimator compared to the MG estimator. The Hausman test provides formal statistical evidence to select the PMG estimate rather than the MG estimate. The PMG estimator is also more preferable as it has much lower standard errors compared to the MG estimator (Pesaran, 1999). In this study, the Hausman test serves as a robustness test to pick the more useful estimator among the two estimators. It can be established that the PMG estimator is the more efficient estimator and the result from the PMG estimates can be utilized for this study.

The results from this study support the results of previous findings where EPS is found to be significant fundamental value in predicting property stock prices. While NAV is a good measure of company profitability for the property sector, it is not a good stock price predictor for construction companies. NAV is found to be only significant in explaining long-run stock price movements for the property but not for the construction sector. This could be because NAV is a general measure of a property company's value since its assets are measured by the amount of landed property it owns while construction companies generally do not own large pieces of land but rather machinery and equipment. So far, other studies done in other countries, particularly Singapore, have found NAV to be one of the most significant fundamental variables in explaining property stock price changes. Sing, Liow and Chan (2002) found NAV and EPS to be the most significant fundamental variables in explaining the long-run convergence relationships with property stock prices. Their results gave suggestions to investors to

concentrate on the underlying performance of the stocks, especially their NAV and EPS, in their stock selection process. In another study by Oh *et al.* (2006), stock prices in Korea seem to move with the stock's EPS in the long-run but not necessarily at the same rate.

EPS is found to influence stock prices of the property and construction sectors significantly in the long-run. However, EPS is not significant in explaining the stock price movements in the short-run for both property and construction sectors. Meanwhile, this study has found that DPS does not have any effect on stock price movements of both sectors. Thus, it can be concluded that NAV is only relevant in predicting property stock prices in the long-run, while EPS has significant negative relationships with both the property and construction stock prices. Changes in DPS do not affect stock prices of both sectors.

The results from the panel ARDL estimation indicate that property and construction stock prices in Malaysia supports the mean reversion theory as the prices do mean revert to equilibrium. In this study, the results show that stock prices in both property and construction sectors mean revert to its long-run equilibrium at similar rate which is at about 1.5 years. Earlier studies have found mean reversion behavior to exist in property stock prices towards their fundamental variables. Saji and Harikumar (2013) found that chances exist for investors in Indian markets to earn extra returns by pursuing fundamental approach to stock valuation. This is because the duration taken for the stock prices to revert to equilibrium can be known by performing the error correction test. In a study done in Singapore, Liow and Li (2006) found that NAV can statistically

explain the stock price changes for many Asia Pacific real estate markets despite their mean reverting behavior.

5.4 Effect on Property and Construction Stock Prices in Response to Shock in Macroeconomic Variables

In order to investigate further on the property and construction stock price behavior in Malaysia, another area of study which is related to the stock price movements is the impact of changes in the macroeconomic variables on the movement of the stock prices. Therefore, the third objective in this study is to discover whether changes in macroeconomic variables could influence the movement of the property and construction stock prices in Malaysia. To fulfill this objective, first, a VAR (Vector Autoregressive) model is estimated to determine the impact of interest rate, inflation, GDP and trade openness on property and construction stock prices in Malaysia. Then, impact multipliers (orthogonalized impulse responses) are calculated for the estimated VAR models. The impulse response functions (IRF) depicts the reaction of the stock prices in the VAR system to shocks in the error terms. It seeks to determine the effect of a one-unit shock of each explanatory variable on the stock prices over time. Lastly, the variance decomposition is estimated to provide explanation on the proportion of the movement in a series as a result of its "own" shocks as opposed to shocks from the other variables. Both impulse response analysis and variance decompositions which when used in tandem are known as 'innovation accounting' can be beneficial instruments to test the relationship among the interest rates, inflation rates, GDP and measures of trade openness in this study.

5.4.1 The VAR Model

The VAR model for the period from 1995 to 2013 is estimated where all variables are acknowledged as potentially endogenous. Every variable in the VAR model will be taken in to associate its difference to its own past and other variables' past values (McCue and Kling, 1994).

The results of a VAR rely on the order of the variables. Stock and Watson (2001) opined that the changing order of the VAR variables changes the VAR equations, coefficients and residuals. Following Pesaran, Shin and Smith (1999), who opined that different orderings will give different estimates of the impulse response functions, the ordering of the variables based on the degree of impact that the variable has on the stock prices as discovered by previous studies is applied. The significance of the ordering relies on the extent of the correlation coefficient between the error terms (Enders, 2010). According to Enders (2010), if the correlation coefficient between the variables is low, the ordering is probably not important. The cut-off limit as suggested by Enders (2010) (when the ordering does not have any influence in a VAR residual cross-correlation) is 0.2. In a VAR with several variables (more than 2 variables), it is improbable that all correlations will be small. When the residuals of a VAR are correlated, it is not practical to try alternative orderings.

Table 5.8 shows the VAR residual cross-correlations for property stock price and construction stock prices respectively with the influencing macroeconomic variables. It can be seen that several variables are strongly correlated with each other. GDP is found

to be highly correlated with stock price at 0.474 and 0.348 for the property and construction sectors respectively. It is also negatively correlated with CPI at -0.26. and strongly correlated with trade openness at 0.307. The property and construction stock prices are also seen to be negatively correlated with CPI at -0.284 and -0.235 respectively. Interest is also quite highly correlated with CPI at 0.418 while it is correlated with trade openness at 0.278 in the property sector. It can be observed that stock prices for both sectors are correlated positively with GDP and negatively with CPI while interest is strongly positively correlated with CPI and trade openness. GDP is found to be negatively correlated with CPI at -0.259 for property sector and -0.252 for the construction sector. GDP is also highly correlated with trade openness for both sectors at 0.31. Since the correlation coefficients are more than 0.2, it can be concluded that ordering is important in influencing the outcomes of the impulse response functions and variance decompositions in this study.

Table 5.8
VAR Residual Cross-Correlations

Panel A: Property Sector					
	PRICE1	**INT**	**GDP**	**CPI**	**OPEN**
PRICE1	1.000000	-0.152385	0.473862	-0.284395	-0.006427
INT	-0.152385	1.000000	-0.057004	0.417821	0.278307
GDP	0.473862	-0.057004	1.000000	-0.259271	0.306987
CPI	-0.284395	0.417821	-0.259271	1.00000	-0.149570
OPEN	-0.006427	0.278307	0.306987	-0.149570	1.000000
Panel B: Construction Sector					
	PRICE2	**INT**	**GDP**	**CPI**	**OPEN**
PRICE2	1.000000	-0.112593	0.347987	-0.234592	-0.003265
INT	-0.112593	1.000000	-0.055440	0.419926	0.279875
GDP	0.347987	-0.055440	1.000000	-0.252055	0.312349
CPI	-0.234592	0.419926	-0.252055	1.00000	-0.144867
OPEN	-0.003265	0.279875	0.312349	-0.1448667	1.000000

PRICE1 is the property stock price; *PRICE2* is the construction stock price; *CPI* is the consumer price index which is the proxy for inflation; *GDP* is the Gross Domestic Product which is displayed in RM million; *Open* is trade openness which is the sum of exports plus imports as a share of GDP; *Int* is the Malaysian Interest Rate represented by the Malaysian Treasury Bill rate

Ordering is done by placing the macroeconomic variables (interest rate, CPI, GDP and trade openness) in the decreasing order of exogeneity. Based on economic theory or previous empirical findings, the variable which is most exogenous is placed as the first variable followed by variables in decreasing order of exogeneity. In other words, the variable that is most likely to influence the other will be placed first followed by lesser influencing variables. In this study, the order of the variables is as follows: interest rate, trade openness, CPI and GDP.

Studies mostly done in Asia on stock price movements have shown that interest rates influence stock prices the most compared to other macroeconomic factors. In a study done in Sri Lanka in 2005 by Gunasekarage, Pisedtasalasai and Power, they found that T-Bill rates (an interest rate variable) explain the highest percentage of movements in stock price indexes compared to consumer price index. Hardouvelis (1987) also found that stock prices respond the most to monetary news, with interest rates as the most significant contributor. Similarly, in China, Liang and Cao (2007) discovered that long-term interest rates are economically and significantly related to property stock prices. Boyd, Hu and Jagannathan (2005) also found that interest rates in the U.S. dominate stock prices during economic expansions. Due to these evidences on the significance of interest rates on stock price movements, interest rate is placed as the first variable in the VAR.

Trade openness is placed second in the VAR as the second most influencing variable. Romer (1993) postulates that inflation is influenced by the degree of openness in a

country's trade. Mukhtar (2010) found evidence in Pakistan which supports Romer's (1993) theory that significant negative long-run relationships exist between trade openness and inflation. Sachsida, Carneiro and Loureiro (2003) discovered that the more open the economies are, the fewer the incentives are to generate inflation, therefore causing a negative relationship between trade openness and inflation. Binici, Cheung and Kon (2012) found that trade openness affects inflation most through changes in markets competitiveness and efficiency. This leads to the reason why the third variable in the VAR is the consumer price index (CPI) which is a proxy for inflation.

During periods of inflation, production is increased to meet higher demand. When production is increased, unemployment rate will drop which will lead to further increasing demand. This will eventually lead to higher wages which eventually lead to higher demand as consumers spend more. These events will lead to higher GDP as production is increased dramatically to meet the high domestic consumers' demand. Grimes (1991) discovered that even low rates of inflation are detrimental to a country's economic growth.

Burdekin *et al.* (2004) found that effects of inflation on a country's growth changes substantially as the inflation rate rises. In a study on whether inflation is detrimental or conducive to economic growth, Gylfason and Herbertsson (2001) found that a rise in inflation from 5% to 50% per year decreases the growth rate of GDP per capita by 0.6% to 1.3%, with other things being equal.

Due to all these evidences, it is proposed that in this study, the order of variables are determined by placing first the variable that influences the other variables most followed by the less influencing variables.

5.4.2 Impulse Response Function

To identify the impulse responses, an additional restriction on the VAR system needs to be imposed because it is not possible to know all the parameters of the system. Enders (2010) opined that the knowledge of various parameters and the variance/covariance matrix is not sufficient to identify the primitive system. This is because it is not possible to identify the primitive system (structural VAR) unless one of the parameters is restricted. The Choleski decomposition is imposed in this study to orthogonalize the innovations by disintegrating the residuals in a triangular fashion. The main idea is that the disintegration drives a potentially important asymmetry on the system since a shock on the stock price has contemporaneous effects on the macroeconomic variables.

After determining the order of the variables, the impulse response function test is executed. The impulse responses graphically display the reaction of each property/construction variable to a positive, one standard deviation shocks in every one of the other variables over a nineteen-year period. They are plotted with upper and lower two standard error bands, which allow for statements whether or not the stock price response is significantly positive or negative towards the shock in the interest rate, openness, CPI and GDP.

Figure 5.1 displays the responses to interest rate for the property sector in Malaysia from 1995 to 2013. Initially, a positive monetary policy shock (interest rate) had a positive impact on property stock prices in the first two years whereby the stock price started declining after the second year. After the fifth year, it started to dip down to display a negative impact on the stock price and remained near equilibrium until it achieved total equilibrium by period fifteen. In year two, interest rates had the largest impact on property stock prices where a one standard deviation shock in the interest rate caused the stock prices to increase by about nearly 30%. This result is similar to the findings of Karim, Harif and Adziz (2006) in Malaysia where the effect of interest rate shock had an initial positive impact on the real estate sector before it declined to display a negative impact after the sixth year.

Therefore, it can be said that the property stock price reverts to equilibrium at about eleven years after experiencing an interest rate shock. The result of this impulse response graph proves that changes in interest rates do affect the movement of property stock prices, therefore proving that a shock in interest rates do affect property stock price. Shocks in interest rates would cause an immediate hike in the stock price before moving down and adjusting to equilibrium.

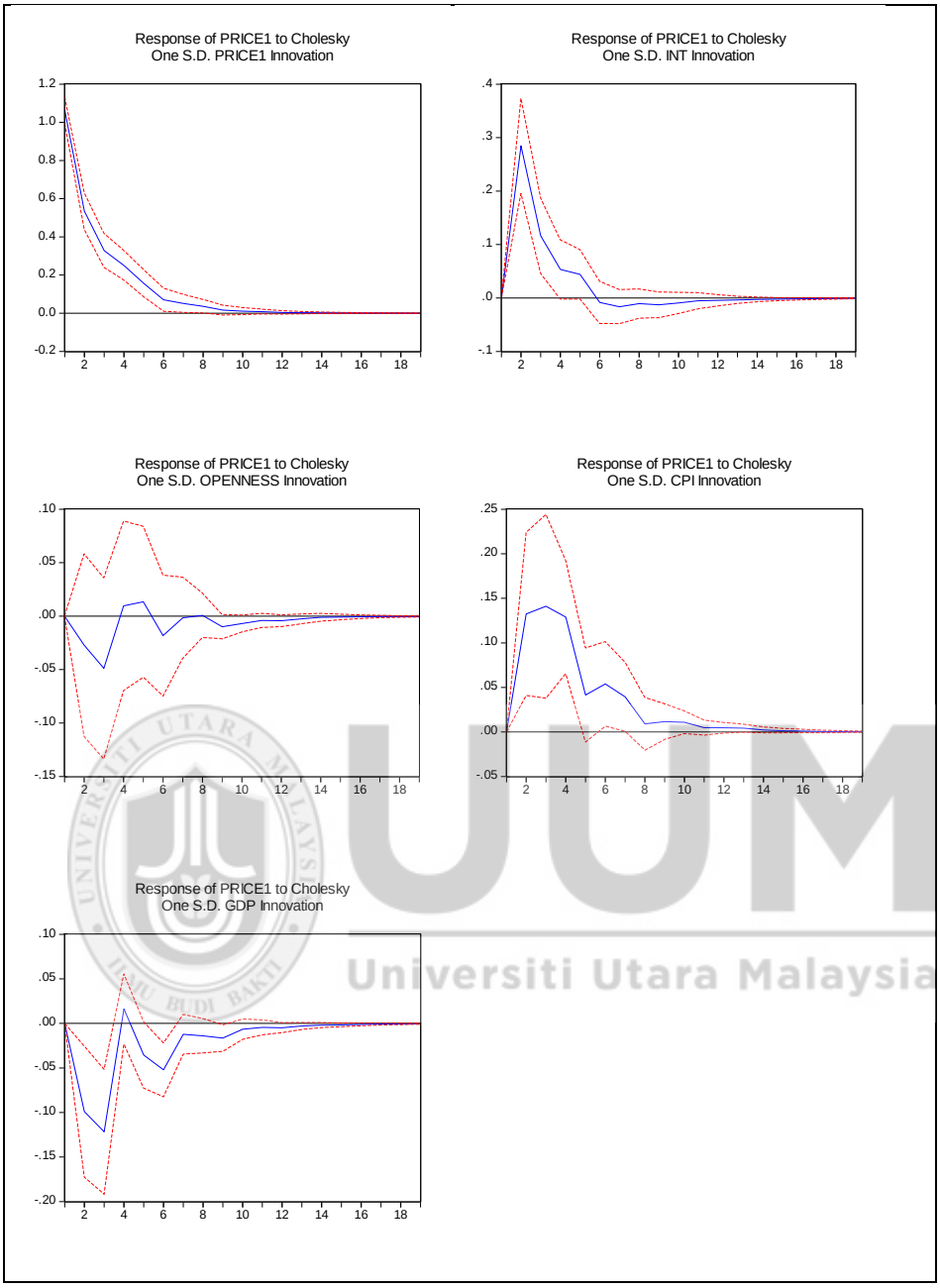

Figure 5.1
Responses to Interest Rate, Trade Openness, Inflation Rate and GDP Impulses: Property Stock Price

Most studies found interest rate changes to correlate negatively with stock prices. However, the result of this study has contradicted this finding. A recent research report by Credit Suisse (May, 2015) revealed that since year 1998, equity and bond yields have been responding positively to rises in interest rates. This could be because lower interest

rates are reflective of sluggish economic growth and vice versa. By using the framework of a discounted cash flow valuation approach, the higher cash flows resulting from higher expected growth compensates for the increase in the discount rate, hence a positive correlation. A study on Korea's economy by Goswami and Jung (1997) indicated that stock prices are negatively correlated with long-term interest rates and positively correlated with short-term interest rate. Since this study utilizes T-Bills (maturity of 3, 6 and 12 months) rate as the representative for interest rate in this study, it can be said that short-term interest rate is used in this study. Therefore, the result of reaction of property stock price towards interest rate shock corresponds with the results of study by Goswami and Jung (1997) where short-term interest rate is found to correlate positively with stock prices.

The response of property stock prices to the shocks in trade openness for the period of 1995 to 2013 is shown in the third graph in Figure 5.1. The results indicate that a rise in trade openness had a negative impact on property stock prices. In period three, it created the largest impact on property stock prices where a one standard deviation shock to trade openness caused property stock prices to decrease by about 5%. Beginning from period nine, the prices began to stabilize and remained close to equilibrium until period fourteen where the stock price finally settled at equilibrium. Basu and Morey (2005) found that countries with full trade opening become integrated with global economy and constraints on imported inputs disappear. Thus growth becomes endogenous resulting in no predictable component in stock returns, making stock prices behave as random walk.

The evidence from the graphs in Figure 5.1 does not support the efficient market hypothesis (EMH) as the theory of EMH declares that it is not possible to "beat the market" as stock market efficiency induces current stock prices to consolidate and echo all related news. The response of the property stock prices towards the changes in trade openness throughout the period of study is erratic and does not correspond either positively or negatively with the movements of the stock prices.

Meanwhile, the impulse response graph in Figure 5.1 suggests that a shock in CPI has a positive impact towards property stock price. The rise in inflation led to a positive impact on property stock prices up to about 15% before beginning to decline after the fourth period. After period eight, it declined at a slower pace and remained close to equilibrium where it achieved full equilibrium at period fifteen. The impulse response graph shows that a rise in inflation leads to an increase in property stock prices. The result indicates that it is possible to predict the movement of the stock prices once the changes in inflation are detected.

Studies on effect of inflation on overall market show that there are always negative relationships between the two variables. Filis (2009) studied the relationship between CPI and stock prices in Greece and discovered that the Greek CPI exerts a significant negative influence in the Greek stock market. Bai (2014) discovered weak negative correlation with very little impact between inflation and China's stock market. However, this study found a positive impact on property stock price in Malaysia from the change of CPI. The reason an increase in CPI is found to have positive change in property stock price is because property has always been used as a hedge against

inflation. Therefore, during periods of high inflation, it is most beneficial to invest in property sector stocks since their values increase as during this time home/property prices will shoot up with a stronger rent growth. Real estate becomes an interesting investment during high inflation periods as their values keep increasing. This, in turn, affects the stock prices which will also increase as the firm's asset values appreciate. Hoesli (1994) concluded that in the long-run, real estate appears to render a better hedge against inflation than common stocks. He found that inflation rate has a negative relationship with most stocks but it produces positive coefficients for real estate.

Figure 5.1 also shows movements on the responses of Malaysian property stock prices towards GDP shock. Upon a positive shock on the GDP, the property stock prices initially dip down for the first three periods. Then, it displayed a slight positive response at period four. The largest impact of GDP on property stock price can be seen during period three where an increase in the country's GDP reduced the property stock price by about 12%. The stock price returned to equilibrium during period fourteen after starting to drift near equilibrium from period nine. Therefore, it can be concluded that upon a positive shock on GDP, property stock prices converge towards equilibrium beginning from period nine and reverts back to its equilibrium by period fourteen.

The reason for the spike in stock prices in period four could be due to the tremendous growth in GDP during that period as the economy was recovering after the 1997 worldwide economic downturn. The property stock price appreciated as demand for property increased due to increase in income which was a result of high GDP growth. So far, studies on the effect of GDP innovations on property stock prices have been

scarce and no other study on the impact of property stock prices by GDP shocks have been recorded. Other researchers have done investigations on the effects of GNP and GDP on stock returns, but not property stock prices in particular.

The response of interest rate shock on construction stock prices in Malaysia for period 1995 to 2013 is displayed in Figure 5.2. Similar to the response of property stock price shock to the positive monetary policy shock, it responded by producing a positive impact in the beginning. The biggest impact was in period two where one standard deviation of interest rate shock produced about 22% of increase in the construction stock price. After period two, the monetary shock impact started declining until it reached equilibrium at period six and declined further to produce a slight negative effect. It then converged to reach equilibrium at period eight and remained close to equilibrium until it achieved total equilibrium at period thirteen. It can be said that interest rate shocks produce positive impact on construction stock prices as the prices showed a positive reaction to the change in interest rate for a long period (from beginning of the period to period six). The reason for this positive relationship could be that the government increased the interest rates during that period as it had anticipated high inflation in the near future. The move on the change of monetary policy due to expected inflation would drive investors to increase their investments in stocks as stock prices tend to appreciate with inflation, thus making the stocks worth higher than before.

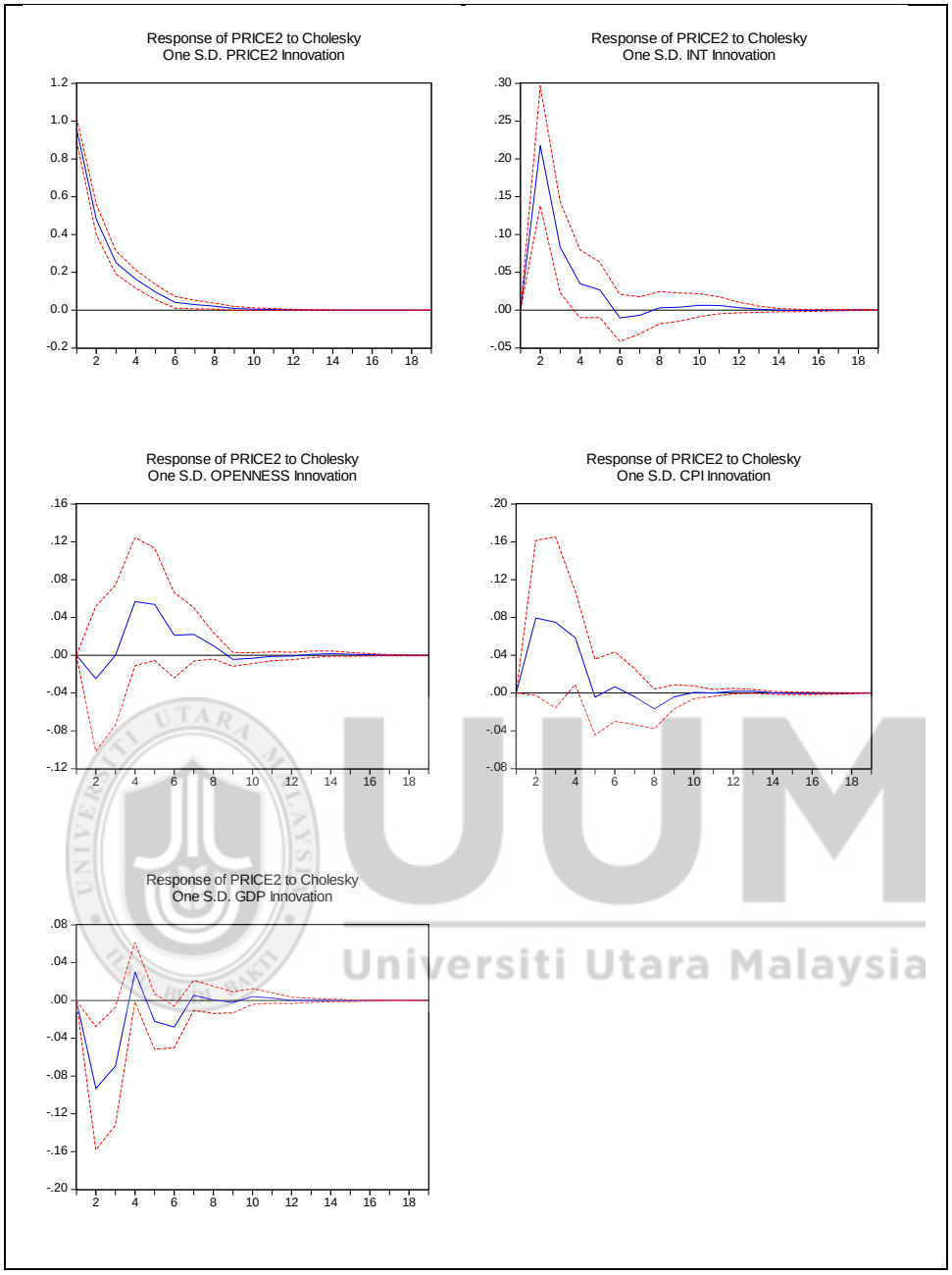

Figure 5.2

Responses to Interest Rate, Trade Openness, Inflation Rate and GDP Impulses: Construction Stock Price

A shock on trade openness initially brings a negative impact on construction stock price for the first three periods before increasing to produce a positive effect, as shown in Figure 5.2. The largest impact is in period four where a one standard deviation of shock on trade openness led to an increase of about 5% on construction stock prices. The stock

price reached equilibrium at period nine. It can be concluded that the stock prices take a shorter period to achieve equilibrium due to trade openness shocks compared to other macroeconomic variable shocks. The impact of stock price changes due to trade openness is minimized due to government intervention to curb speculation in the stock market whereby the Malaysian government declared all the 100 component stocks of the Composite Index of the KLSE as 'designated securities' purportedly to inspect short-selling. Increase in speculative activity by individuals and institutions are triggered by trade openness where constraints are removed (Akyuz, 2014). This often leads to introduction of new preventive measures by governments to control speculation. Another reason for the increase of the stock price after three years it has been shocked by trade openness level could be that stock prices initially dip down immediately as companies face increased competition due to the entry of foreign firms, but as the local companies adjust to open trade and increase their level of efficiency, they begin to improve and perform better than before compared to the foreign firms. Hence, their stock prices would increase in line with their improved performance and efficiency.

Figure 5.2 also shows the response of construction stock prices to the shocks in CPI in Malaysia for 1995 to 2013. Similar to property stock prices, construction stock prices also generally respond positively to inflation shocks. The inflation shock had the biggest impact on construction stock prices in period two where a one standard deviation shock in the CPI caused the stock prices to increase by about 8%. After period four, the stock price began to decrease until it showed a slight negative response during period five and between periods seven and ten. The stock price converged to equilibrium at period ten after responding negatively following the innovation on CPI. The

construction stock price response towards change in CPI differs from the response of property stock price as it displays negative behavior during the fifth period after being shocked whereas the property stock prices remained positive throughout the study period. This result indicates that when inflation rises in the country, construction companies' worth is increased before decreasing after the second period. As inflation rises, construction costs surge up as prices of building materials increase. The increase in costs would push down company earnings, thus, bringing down the stock price after period two.

GDP shock produced initial negative impact on construction stock prices in the first four periods, as shown in Figure 5.2. Similar to the property stock price responses to GDP shock, for a brief period between period four and five, the stock prices displayed positive reactions. However, from period five to period seven, the stock price showed a negative impact before reaching equilibrium during period eight. Therefore, it can be concluded that construction stock prices experience initial negative response towards GDP shock before rising to display positive impact for a short period and settle at equilibrium. In period two, the GDP shock had the largest impact on construction stock prices where a one standard deviation shock in the GDP caused construction stock prices to decrease by about 10%. This decrease in stock prices in respond to GDP innovation is less than the reduction in property stock price when shocked by GDP. It can be concluded that a shock in GDP creates a smaller negative impact to construction stock price compared to property stock price. This could be due to the reason that the smaller percentage of the construction sector contribution towards Malaysian GDP compared to

the property sector.

Overall, it can be concluded that interest rate and CPI impulses affects property stock prices positively while trade openness and GDP produces negative responses on the stock prices. As for the construction sector, all the macroeconomic variables (except GDP) shocks produce positive effect on their stock prices. Most of the stock prices respond within two periods once shocked. The largest impact of shock on stock price can be seen from the response of property stock price to shocks in the interest rate while the lowest impact is on the response of property and construction stock price to shocks on trade openness. The reason the stock prices are influenced so greatly by interest rate changes could be because it is cost of borrowing, thus it greatly influences the companies' profits as these companies typically have high gearing. Trade openness does not greatly influence stock prices of both sectors as stricter rules are enforced within these industries to prevent speculation. Inflation is seen to influence the construction companies negatively for brief periods after responding positively in the first four periods as price of materials surge up during period of high inflation while property stocks are seen to react positively to CPI changes. GDP is seen to move negatively with stock prices whereby a positive shock on GDP produces negative response in the stock prices and vice versa.

Shocks on these macroeconomic variables are seen to influence both sectors quite similarly except for the response of the stock price on trade openness shock where the prices respond negatively for the property sector whereas the positive shock on trade openness created a positive impact on construction stock prices. Bardhan, Edelstein and

Tsang (2008) studied the impact of trade openness on public property companies and discovered that an economy's property security excess (risk-adjusted) returns are negatively related to its openness.

The fact that these sectors in Bursa Malaysia are affected by various macroeconomic variables shows that there is opportunity to gain outstanding returns based on selecting stocks from certain sectors since information is accessible on specific macroeconomic variables. This discovery makes it possible to detect time paths of the effects of pure shocks on stock prices. The time taken for the stock prices to respond to the shocks can now be predicted based on the results of the impulse response analysis.

The results from the impulse response functions tests show that all publicly available information does affect the prices of the property and construction stocks in Malaysia. Information on changes in macroeconomic variables, which in this case are, interest rates, GDP, CPI and trade openness are reflected on the movement of the stock prices. Therefore, it can be concluded that the property and construction stock prices in Malaysia do not conform to the semi-strong form of the Efficient Market Hypothesis (EMH) as it takes approximately ten periods before the price reaches equilibrium.

5.4.3 Variance Decomposition

While impulse response functions attempts to ascertain what the impact of a one-unit shock of each explanatory variable on the stock price series over time, variance decompositions strive to ascertain the degree of the shifts in the property and construction stock price which can be attributed to changes in the explanatory variables,

namely interest rates, trade openness, CPI and GDP. It refers to the classification of the forecast error variance for a specific time horizon. Variance decomposition enables the determination of the comparable significance of each variable in forming fluctuations in other variables (Ratanapakorn and Sharma, 2007). It reports the proportion of the forecast error of each variable that is accounted for by each of the other variables for a specific time horizon. In other words, the degree at which a variable is explained by the shocks in all the variables in the system is described by variance decomposition (Mishra, 2004).

Variance decomposition can indicate whether the interest rates, trade openness, CPI and GDP have short-term and long-term effects on another variable of interest. Essentially, it relays the percentage of the fluctuation in a time series assignable to other variables at selected time horizons. It is calculated from the Vector Moving Average (VMA) representation of a VAR.

Table 5.9 shows the variance decomposition results of the effect of the macroeconomic variables on property stock prices for nineteen years (1995 to 2013). The reported figures show the percentage of movement in each variable that is caused by its own shock and the shocks to the other variables in the system. The results in Table 5.9 indicate that besides its own shock, interest rate had a strong significant influence on property stock prices, especially towards the longer horizon. At the nineteenth-year horizon, the forecast error variance explained by interest rate on the property stock price is 5.514%, followed by CPI at 3.338%, GDP at 1.629% and trade openness at 0.216%.

This result shows that interest rates have strong influence on property stock prices compared to other macroeconomic variables. CPI and GDP also influence the prices while trade openness has less influence in explaining the property stock price movements in Malaysia.

Table 5.9
Variance Decomposition – Percentage of Movements in the Property Stock Price Explained by Shocks to Macroeconomic Variables

Period	S.E.	PRICE1	INT	OPENNESS	CPI	GDP
1	1.064151	100.0000	0.000000	0.000000	0.000000	0.000000
2	1.235761	92.85477	5.305312	0.048435	1.148891	0.642593
3	1.298209	90.52038	5.611933	0.185640	2.221107	1.460944
4	1.329545	89.84050	5.511904	0.182191	3.057554	1.407850
5	1.340624	89.72313	5.529700	0.189189	3.103020	1.454964
6	1.344723	89.45206	5.499878	0.206503	3.244884	1.596680
7	1.346438	89.36972	5.500588	0.206119	3.322566	1.601004
8	1.347077	89.35828	5.501452	0.205951	3.324050	1.610263
9	1.347423	89.32705	5.507625	0.211254	3.329710	1.624361
10	1.347576	89.31322	5.511108	0.213887	3.335405	1.626381
11	1.347635	89.30935	5.512135	0.214763	3.336382	1.627367
12	1.347673	89.30535	5.512887	0.215781	3.337388	1.628591
13	1.347692	89.30312	5.513440	0.216156	3.338263	1.629019
14	1.347700	89.30228	5.513782	0.216222	3.338504	1.629213
15	1.347704	89.30175	5.514027	0.216260	3.338592	1.629368
16	1.347707	89.30147	5.514180	0.216281	3.338636	1.629437
17	1.347708	89.30135	5.514252	0.216291	3.338646	1.629462
18	1.347708	89.30129	5.514283	0.216300	3.338650	1.629475
19	1.347708	89.30126	5.514296	0.216307	3.338653	1.629481

Cholesky Ordering: PRICE1 INT OPENNESS CPI GDP

The finding of a powerful link between interest rates and the property stock price is consistent with earlier studies in the U.S. and Sri Lanka that found interest rates to be significant in explaining stock price returns (Hardouvelis, 1987 and Gunasekarage *et al.*, 2005). Interest rate changes affect stock prices as high interest rates raise borrowing costs which in turn lowers a company's profit as the costs to service debt increases.

The high prices of real estate due to inflation push up the profitability of property companies thus raising the company' stock value. In contrast, a study on the Indian stock market by Naik and Padhi (2012) found that stock prices in India have significant negative relationships with inflation. They also found short-term interest rates to be insignificant in determining stock prices. Similarly, Kalyanaraman and Al Tuwajri (2014) found significant negative relationship between inflation and stock prices in Saudi Arabia. This shows that stock prices in different countries react differently to macroeconomic shocks. As for GDP, the results of this study is consistent with the studies of Liow *et al.* (2005) in Singapore, where GDP was found to have a considerably high correlation with stock prices.

In a study by Gunasekarage *et al.* (2005) in Sri Lanka, by using variance decomposition analysis, they found that money supply and Treasury bill rate explain the highest percentage of movements in stock price index, which also explains the finding in this study where Malaysian Treasury Bill rate which is employed to represent real risk-free interest rate is found to be highly significant in explaining the stock price movements. However, the variance decomposition analysis also disclosed that an important part of the irregularity in the stock market index was justified by its own innovations (89.3%), whereas only a small amount was justified by macroeconomic variables.

The variance decomposition result of the effect of macroeconomic variables on construction stock prices is displayed in Table 5.10. The result is relatively similar with the earlier result of property stock price reaction to shocks in the macroeconomic variable except for the level of influence of GDP and CPI on the shifts of the

construction stock prices. GDP is found to influence construction stock price slightly more as compared to CPI. Hoesli (1994) found that in the long-run real estate appears to generate a better hedge against inflation compared to common stocks; which is why CPI had a bigger influence on property stock price compared to construction stock price. Shocks to interest rate and GDP highly influence the movement of construction stock prices in Malaysia for the period of 1995 to 2013. The reaction of the construction stock prices to shocks in interest rate, trade openness, CPI and GDP is weaker than the property stock result. At the nineteen-year horizon, the forecast error variance ranged from 4.213% for interest rates, 0.582% for trade openness, 1.172% for CPI and 1.173% for GDP.

Table 5.10
Variance Decomposition – Percentage of Movements in the Construction Stock Price Explained by Shocks to Macroeconomic Variables

Period	S.E.	PRICE2	INT	OPENNESS	CPI	GDP
1	0.955227	100.0000	0.000000	0.000000	0.000000	0.000000
2	1.098106	94.78189	3.926509	0.051131	0.523276	0.717190
3	1.134093	93.75864	4.220241	0.047938	0.925606	1.047576
4	1.149664	93.26478	4.198820	0.289509	1.159143	1.087743
5	1.155397	93.02302	4.210347	0.503566	1.149106	1.113956
6	1.156726	92.93466	4.208584	0.535816	1.149913	1.171027
7	1.157343	92.89878	4.207668	0.571820	1.149795	1.171938
8	1.157708	92.87381	4.205750	0.579110	1.170107	1.171221
9	1.157766	92.87028	4.206513	0.580527	1.171257	1.171423
10	1.157807	92.86572	4.209254	0.581226	1.171215	1.172587
11	1.157833	92.86260	4.211955	0.581285	1.171163	1.172995
12	1.157840	92.86153	4.212710	0.581325	1.171452	1.172981
13	1.157842	92.86116	4.212789	0.581388	1.171680	1.172979
14	1.157844	92.86097	4.212780	0.581591	1.171679	1.172976
15	1.157844	92.86087	4.212794	0.581671	1.171687	1.172983
16	1.157845	92.86082	4.212803	0.581688	1.171701	1.172983
17	1.157845	92.86081	4.212803	0.581688	1.171717	1.172984
18	1.157845	92.86080	4.212805	0.581690	1.171721	1.172985
19	1.157845	92.86079	4.212809	0.581693	1.171721	1.172985

Cholesky Ordering: PRICE2 INT OPENNESS CPI GDP

Interest rate had a strong significant influence on the movement of construction stock prices during the period of study. Similar to the property sector, CPI and GDP also influences the construction stock price significantly. However, trade openness is also found to have less influence and insignificant in explaining the construction stock price movements compared to interest rates, CPI and GDP over the nineteen year period.

The results show that interest rate is an important factor in influencing property and construction prices. This could be mainly due to the high reliance of both sectors on bank financing. Reilly and Brown (2011) find that interest rates and inflation are important variables which affect stock prices. Interest rates increase because of a rise in the rate of inflation and corporate earnings. Companies go through higher growth as they are able to increase prices due to higher costs. Stock prices would be somewhat steady as the negative effect of a rise in the required rate of return is partly or entirely compensated by the rise in the growth rate of earnings and dividends which causes an increase in value of stocks. As a result, the returns on stock surge according to the rate of inflation. This shows that stocks would be a good inflation hedge.

A significant change in the GDP would normally create a significant effect on the stock market. Results show that GDP influences the property stock more greatly than the construction stocks. This could be because the real estate sector performance is one of the leading economic indicator which usually, changes before the economy changes. Hence, the real estate sector is effective as short-term predictors of the economy. Decline in leading economic indicators usually begin before the economy as a whole

declines and usually begins to improve before the general economy starts to heal from a slump.

The main impact of inflation on stock prices is from the effect it has on a company's earnings. High inflation would cause the company's profits to be higher which will eventually lead to higher stock prices while low inflation keeps the sale prices low resulting in lower profits. Trade openness has very little effect on property and construction stock prices in Malaysia. This result is in line with the discovery of Basu and Morey (2005) which explored the effect of trade openness on stock price behavior and found that once a country opens up on the trade front, the stock returns show zero correlation with the variable. Similarly, Alajekwu *et al.* (2013) also found that trade openness has no substantial contribution to the growth of the Nigerian stock market in particular.

In summary, it can be concluded that for both property and construction stock prices, variance decomposition results reveal that monetary policy tightening, CPI and GDP contractions significantly influences the stock price at a longer horizon. CPI influences property stock price more strongly compared to GDP. The effect of changes in interest rates, CPI and the GDP has a less profound impact on construction stock prices compared to property stock prices. Trade openness appear to have the least influence on the stock prices where it only influences the property stock price at 0.216% and construction stock price at 0.582%. Although CPI is found to strongly influence the property stock price, it is found to have less influence in affecting the construction stock price.

CHAPTER SIX

CONCLUSION AND RECOMMENDATION

In this chapter, the objectives and main findings with regard to the research questions are summarized. Based on the findings, general conclusions are presented in the first section of this chapter. Section two summarizes the results and findings of the study while section three pertains to the implications of the study with focus on policy makers, investors, fund managers and academicians. As with any other study, this study is not without limitations, therefore the fourth section lists out the limitations which were encountered in this thesis and suggestions for future studies.

6.1 Overview

This study was performed to test the behaviors of the property and construction stock prices in Malaysia from the year 1995 to 2013. Annual stock prices from property stocks and construction stocks are analyzed to evaluate their relationship with their fundamental variables. The impacts of changes in macroeconomic variables (real risk-free interest rates, GDP, CPI and trade openness) on the stock prices are also investigated. Data from property and construction stock prices and their fundamental variables, which included net asset value (NAV), earnings per share (EPS) and dividends per share (DPS), are selected.

The first aim of this study is to examine the diversification benefit of investing in both property and construction stocks simultaneously by determining the correlation coefficient between the stock prices of the two sectors. By implementing correlation

tests, it is found that there exist diversification benefits from investing in both sectors as there is a weak positive relationship between them.

After discovering the diversification benefits of investing in both stocks, the next step is to determine the long-run relationships of the stocks with the fundamental variables to enable investors to maximize on their profits when investing in both stocks. The second objective of this study is to evaluate the relationship between property and construction stock prices with their fundamental variables. This is done by conducting the panel unit root tests to test for stationarity of the variables in order to determine their long-run relationships. The panel unit root test results indicate that all the variables for the property sector were stationary at level but the construction sector variables show a mixture of stationary and non-stationary variables.

To test for cointegration among the variables, the panel ARDL approach is applied using the MG and PMG estimators as both estimators allow for cointegration testing for variables which are integrated of different orders. The long-run coefficients result from the PMG estimation reveal that while NAV and EPS are significant in affecting property stock prices in the long-run, only EPS influences the construction stock price. Therefore, EPS is found to have a significant effect in stock prices of both sectors in the long-run. The panel ARDL method also tests for mean reversion and speed of adjustment to equilibrium. Through the error correction coefficients, it is found that construction stock prices adjust to equilibrium at a slightly faster speed compared to the property stock prices. The Hausman test provides statistical evidence that the PMG

estimates are more reliable than the MG estimates. Therefore, the results from the MG estimates are ignored in this study.

The effects on property and construction stock prices in response to shock in macroeconomic variables are also examined as the third and final objective of this study. VAR models are estimated to test the relationship between the variables. Impulse response function graphs are plotted to trace out the reactions of the stock prices to the macroeconomic variables while variance decomposition analysis shows the proportions of changes in the stock price that can be credited to transformations in the macroeconomic variables. Evidence from the impulse response function indicate that interest rate shocks produce the largest impacts on stock prices of both sectors with the property sector experiencing a greater impact compared to the construction sector. Interest rates and inflation shocks produce positive impacts on the stock prices whereas the stock prices are found to react negatively to GDP. Trade openness changes affects property prices negatively. However, construction stock prices react positively to changes in trade openness. The variance decomposition analysis shows that interest rate and CPI changes influence the stock prices significantly at a longer horizon for the property sector. Interest rate also produces sizable impact on construction stock prices over the nineteen-year period. GDP and CPI changes are found to be less significant in explaining construction stock prices while trade openness changes do not produce any significant changes on stock prices of both sectors.

The Markowitz Modern Portfolio Theory (MPT) proposes a method for selecting optimum investment portfolio where investors should diversify as widely as possible.

The correlation coefficient between the stock prices of both sectors in this study is relatively low. Therefore, according to the MPT, there are benefits of diversification as the stock prices are not highly correlated. Meanwhile, the price discovery theory relates to the process of the markets adjusting to equilibrium prices while the mean reversion theory states that prices revert to their mean/average and the reversal is predictable. Both theories are related as they refer to the adjustment of stock prices back to their equilibrium. The error correction coefficient in the panel ARDL models indicate that the stock prices do mean revert and this confirms the price discovery theory and mean reversion theory that states that prices do adjust to their equilibrium.

In contrast to the Efficient Market Hypothesis (EMH) which implies that stock price movements are commanded by the random walk hypothesis and is essentially unforeseeable, the results of this study do not support these hypotheses. The results clearly show that the stock prices in these two sectors are predictable by observing the fundamental variables of the stocks. The presence of cointegrating relationships between the macroeconomic variables and stock prices also does not support the implication as stated in the EMH.

Overall, the findings of this study answers the research questions presented earlier. To answer the first research question which is, whether property and construction stocks offer diversification benefits to investors who wish to invest in both sectors, it is found that there is a weak positive correlation between the stock prices of both sectors. It can be concluded that there is diversification benefits to investors to invest in both sectors simultaneously.

As for the second question on whether property and construction stock prices in Malaysia mean revert to their equilibrium, the answer is provided through panel unit root tests and the panel ARDL method. The tests revealed that the stock prices do mean revert to equilibrium and the construction stocks are found to move slightly faster to equilibrium compared to the property stocks. The third research question is on whether shocks on macroeconomic factors influence the movements of property and construction stock prices. It is discovered that both interest rate and CPI highly influence the property stock prices whereas CPI and GDP have less influence on construction stock prices. Interest rates were found to produce the biggest impact on the stock prices compared to other macroeconomic variables.

6.2 Summary of Results and Findings

Several tests were done to achieve the three main objectives of the study. To fulfill the first objective, which was to determine whether property and construction stocks offer diversification benefits to investors who intend to invest in both sectors simultaneously, correlation tests were done to identify the relationship between property and construction stocks. Results from the correlation tests showed that there exists a weak positive relationship between both stocks (correlation at 0.28). Bodie, Kane and Marcus (2013) opined that only perfect correlation provides no diversification benefit which means that if the correlation is positive and low such as in this case, there is still diversification benefit. It is concluded that there exists diversification benefit as small correlation statistic means that there is higher inclination for variability in returns on both stocks to affect each other and to lower the portfolio risk.

Once the diversification potential has been determined, it is essential for the investor to know the long-run relationship between the two stocks and their mean reversion properties. After deciding to invest in both sectors simultaneously, the investor would want to know if the stock prices mean revert to their equilibrium and if they do, what is the time frame that the stocks take to reach equilibrium? This information is useful to investors so that they can magnify their profits by investing in the property and construction sectors.

In order to achieve the second objective of the study, several tests were done to investigate whether property and construction stock prices were stationary. The stationarity of the variables need to be determined in order to proceed with tests to establish the stocks' long-run relationships. Long-run relationship exists when stock prices and the fundamental variables are cointegrated. Panel unit-root tests are employed to investigate stationarity of the series as cointegration can only be achieved when all the series investigated are stationary. Although all property sector variables were discovered to be stationary at level, results on the construction sector variables reveal a mixture of stationary and non-stationary variables.

The discovery of mixed stationary properties of the variables involved leads to the conclusion that the Pedroni panel cointegration test cannot be applied in this study. This study applies the mean group (MG) and pooled mean group (PMG) estimations which are panel ARDL models to estimate the relationship among the stock prices and their fundamental variables. Results for the panel ARDL approach show that there is proof of

a long-run relationship between some variables which means that the property and construction variables are cointegrated with some of their fundamental variables. The panel ARDL test revealed that cointegration exists among the variables. With the availability of this information, investors now know that they would be able to predict the future stock prices by looking into the fundamental variables which are cointegrated with the stocks. The error correction coefficient from the PMG estimates provides the speed or duration taken for the stock prices to mean revert to their equilibrium.

Results show that NAV is a statistically significant variable in determining stock prices in the long-run for the property sector. EPS is also found to have a significant effect on property stock prices. However, it is found that EPS has an inverse relationship with the property stock price throughout the study period. As for the construction sector, it is found that only the EPS is crucial in establishing its stock price in the long-run. In contrast, the DPS is found to be not significant in determining the movement of both the property and construction stock prices in Malaysia. In order to profit from investing in the property stocks in the long-run, investor should look into its NAV as it will always mean revert to it. Nonetheless, even though EPS is found to have significant effects on both property and construction stock prices, the result cannot be utilized in this study as it is influenced by the predominantly negative EPS data throughout the study period.

Under the PMG estimation, the error correction coefficients for both property and construction models are highly significant, have the correct signs (negative) and suggest moderate speed of convergences to equilibrium. The results show that the property stocks take around 1.53 years to adjust towards equilibrium while construction stocks

move faster to equilibrium at about 1.49 years. So, it can be concluded that construction stocks mean revert to their equilibrium at a slightly higher rate compared to property stocks in Malaysia. With this information, investors can time their investments to maximize on their profit by buying the stock when it is less than the underlying value and they would be able to know how long to hold on to the stock since they already know the time duration taken for it to revert to its fundamental value. The outcome of heterogeneity in the means of the coefficients can be ascertained by the Hausman test (1978). For homogenous parameters, the PMG estimates are more efficient than the MG. Under the null hypothesis, the distinctness in the estimated coefficients between the MG and PMG are not significantly different and PMG is more efficient and preferable. Therefore, this study applies only the results produced by the PMG estimation to the investigation.

The final objective of the study is to discover if changes in macroeconomic variables are able to influence movements of property and construction stock prices in Malaysia. From VAR models, IRF graphs are developed to trace out reactions of the dependent variables in the VAR system to shocks. The IRF graphs show that interest rate shocks produce the highest impact on both property and construction stock prices compared to the other macroeconomic variables. Interest rate is found to produce positive impact on the stock prices while GDP shocks had a negative effect on the stock prices. CPI shocks produced positive impacts while it can be observed that trade openness shock had negative impact on property stocks whereas construction stocks responded positively. Generally trade openness had little impact on the stock prices. Unlike the property sector, the impact of GDP shock on construction price produced a brief positive effect

for a short period whereas the impact of CPI shock on property stock prices can be observed to be higher than the effect of the shock towards construction stock prices.

The VAR models also lead to Variance Decomposition analysis to seek the proportions of changes in stock prices which are attributed to changes in the explanatory variables. In general, the Variance Decomposition contains the same problem ingrained in impulse response analysis where the Choleski decomposition is used. Therefore, it is beneficial to study the Variance Decomposition at various horizons. The Variance Decomposition analysis results show that for property stocks, interest rates have the strongest influence over a longer horizon, followed by CPI and GDP while trade openness have less influence in explaining the proportion of the stock price movements.

As for the construction stocks, the Variance Decomposition analysis revealed that while interest rate changes still has the strongest influence on the stock prices and GDP shocks appear to influence the stock prices more than the property sector, the other macroeconomic variables were less significant in influencing the construction stock prices compared to property stocks. Since changes in interest rates highly influence the stock prices, policy makers should be careful when making changes in the interest rate, as the changes can have quite a strong impact on the stock prices. Companies and investors should look out for changes in CPI and GDP as shocks on this variable can also highly influence the stock prices in property sectors. GDP is also found to have a sizable impact on construction stocks while the inflation rate and trade openness were found to have less influence in the construction stock prices.

6.3 Implications of the Study

As the real estate and construction sectors are closely related to one another in terms of market capitalization and market value in Bursa Malaysia, investors and fund managers would need to know if they will be able to profit from investing in both sectors at the same time. As investors would assume that since both sectors complement each other and carry similar weights in Bursa Malaysia, it would not be rational to invest in both sectors simultaneously. However, correlation test from this study indicates that there is a potential diversification benefit in investing in stocks from both sectors. Thus, the result of this study will benefit investors who are in doubt on whether or not they should invest in these two sectors as diversification among low positive correlated assets would reduce risk and increase returns. It is also important to diversify as it is not possible to foresee when a particular asset will perform superiorly or poorly in different economic conditions. This knowledge may enhance effectiveness of fund managers in risk management and portfolio allocation.

In addition, the finding that the stocks' fundamental variables do influence the stock price movements to equilibrium should be of interest to investors and fund managers in making decisions for their investments. While NAV has been found to be significant only in the property sector, EPS has been found to be statistically significant in defining stock price movements in both sectors while DPS is not found to be significant in predicting the movement of property and construction stock prices. Since it has been established that the EPS results discovered is not relevant to this study, the implications in this sector will only elaborate on the NAV usefulness. The annual reports and accounting records which contain current and historical details on the NAV will guide

those interested in investing in the property companies to make sound decisions based on what they perceive as the companies' worth through the knowledge of the relationship between the stock prices and their NAV. As the reports contain NAV figures for at least 2 years, investors or fund managers can refer to them as a guide. For example, since this study has already displayed that a unit increase in NAV will bring to about RM0.305 change in property stock price in about 1.5 years, investors or fund managers with this information will be able to make better investment decisions.

A larger share of wealth may be allocated to stocks due to the mean reverting properties of the stocks which will eventually lead to less risky larger investment horizons. The evidence of mean reversion also impacts on the profitability of trading strategies and asset allocation decisions. Since the evidence supports that the property company NAVs are significant in capturing the dynamics of the changes in the company stock prices, the NAV has to be utilized as an important factor to take into consideration for investment decisions. As it is now known that the stocks do mean revert, one can forecast future movements in stock prices and develop trading strategies to earn returns. As the period taken for the stocks to mean revert to their fundamental value is now known from the finding of this study, investors will be able to take advantage of this information to invest in both sectors in the short-term period. Corporate managers can benefit from the mean reversion of the stock prices back to their fundamental variables by better timing the implementation of strategic decisions in their asset re-allocation.

The existence of mean reversion would also mean that investors can reap profit from their knowledge of the stocks' fundamental variables, namely the NAV which will be

used to predict future movements of stock prices. The results have proven that the implication stated in the EMH that stock prices reflect quickly does not apply to stocks in these two sectors in Malaysia. This discovery contributes to the academic literature on the irrelevance of the implication stated in the EMH as the finding of this study in the property and construction sectors display evidence against it. Opportunity exists for profit from inefficiencies of the stock market where information is not reflected in the stock prices. Investors and fund managers should factor in mean reversion effects in rebalancing their portfolio.

The results from this study will also further the understanding on the interaction between the changes in macroeconomic variables with the property and construction stock price movements in Malaysia. This information is especially crucial for investors, fund managers, academicians and policy makers. Those who have interest in these two sectors, will take indications from macroeconomic changes, where changes in the Malaysian T-Bills rates should be their main concern as it is found that the real risk free rate is the main macroeconomic variable that significantly influences stock prices in these two sectors compared to the other variables. It should be expected that a shock in Malaysian T-Bills rates would move the stock prices. News on Malaysian T-Bill rate changes can be reliable indicators to manage positions and portfolios appropriately as to where the stock prices are headed for. A positive shock on the Malaysian T-Bills rate would increase the property and construction stock prices within the first two periods and decrease gradually after that to achieve the equilibrium by period five. Policy makers should pay attention to the situation of the stock market price reactions on

interest rate changes as the finding shows that movement of the property and construction stock prices are influenced by Malaysian T-Bill changes.

The major role of the Central Bank or Bank Negara Malaysia (BNM) is to provide a watchful eye on the conduct of monetary policy, which in turn will guarantee a low and stable inflation rate while ensuring financial stability of the country. Fiscal policies and monetary policies introduced by BNM influence the economic conditions by boosting a flagging economy or cooling off an overheated economy. Evidence from this study show that Malaysian T-Bill rates, CPI and GDP influence the movements of property and construction stock prices in Malaysia. Thus, BNM will need to take caution in implementing changes in Malaysian T-Bill rates that have greater impact on these two sectors. This is to ensure the stability of stock prices and to avoid excessive increase or decrease of stock prices in the construction and property sectors. The finding of this study shows that the biggest impact on the stock prices occur during the second period (year 1996), after a positive shock in the T-Bills rate with the property sector experiencing a 30% increase and the construction sector stock price went up by about 22%. Thus, this study can provide the Central Bank with guidance on what degree of change and time period taken is acceptable so as to avoid a drastic change on the stock prices. Furthermore, the Central Bank would also need to ensure the GDP does not fluctuate too much as this would affect stock prices in the property and construction sectors as a positive change in GDP causes the stock prices of both sectors to decrease up to about 12% within three periods. Inflation rate should be controlled by BNM to ensure stability of the property stock prices in the market. The inflation rate shock

influences the stock prices positively where it experiences the highest impact during period two.

Policy makers need to be cautious in their attempts to affect the economy via changes in macroeconomic variables as they may unintentionally dampen the stock market, and reduce generation of capital which may bring to further declination of the economy (Maysami, Howe and Hamzah, 2004). Thus, when implementing monetary policies, the government would need to exercise caution as certain macroeconomic variables that change will have indirect effects on stock prices which in turn would influence the growth of the country's economy. They would need to revise their decisions in adjusting the T-Bills rate, setting goals for the GDP and controlling the inflation rate if they do not desire to affect the property and construction sectors.

Academicians who are involved in this area can utilize the details on the findings of the study to share with their students as this is the first study on this issue done in Malaysia (according to the author's knowledge). They can use the results of this study to further investigate on the movements of Malaysian property and construction prices to delve deeper into the issue. The information from this study can also be used by investors in deciding on their investment objectives, such as the tenure of their investment in these two sectors. Regulators such as the Securities Commission can utilize this information to reduce arbitrage opportunities on short-term speculative activities. By controlling the changes in macroeconomic factors, the government can indirectly influence the movement of the property and construction stock prices to build a stronger market. For example, an increase in the Malaysian T-Bills rate would bring the property and

construction price up to about 30%. This would lead to a buoyant economy where more jobs can be created, thus solving the problems of social ills in the country. Therefore, the change in the Malaysian T-Bills rate indirectly influences the well being of the society with job employment opportunities.

Relevant companies need to be more cautious with macroeconomic changes. In addition, investors may be able to make sound decisions on whether to invest or pull out from the market when there are sudden movements in certain macroeconomic variables in the country, since movements of macroeconomic variables can be perceived as good indicators of stock price movements. Thus, investors can predict that whenever there is a positive shock on the Malaysian T-Bills rates and CPI, they can purchase the property and construction stock as they know the price will soar in the next period.

6.4 Limitations and Suggestions for Future Research

The results of this study offer explanations on the diversification benefits, mean reversion and long-run behaviors of the stocks and effects of macroeconomics on the stocks. However, several limitations have been encountered.

This study is only limited to property development companies and construction sectors. Results do not show the price behaviors of overall property companies listed in Malaysia thus investors who base their investment opportunities on the results of this study need to be careful in picking the property companies to invest in as this study only applies to property development companies. The reason for picking solely property development companies as sample in this study is to make it comparable with construction

companies. Listed property companies that derive 50% or more of their revenue from property development activities are chosen as sample as their activities are closely linked to the construction sector.

The investigations in this study are restricted to Malaysia. It is done mainly to compare the stock price behaviors of the two sectors in Malaysia that are the main indicators of the country's economy. Stock price behaviors for these sectors for the same period in neighboring countries are not investigated to be compared in this study especially with regard to the stock prices reactions to macroeconomic shocks.

As with many studies, this study raises some questions which lead to future research suggestions. However, most are out of the context of this research and time constraint does not allow for the matters to be followed up in this study. Several issues that could be investigated further to strengthen the literature on the topic of this thesis were identified.

To predict the diversification potential of investing in both property and construction sectors simultaneously in Malaysia, future researchers could include risk and return analysis on both stocks. The results of the risk and return analysis would show the under/over performance of one sector relative to the other. The Capital Asset Pricing Model (CAPM) could also be included in investigating for integration or segmentation of the markets. To discover whether segmentation exists, most finance studies use the CAPM as the base of investigation even though some studies use correlation analysis to evidence segmentation (Liu *et al.*, 1990). The inclusion of the CAPM which is a model

that characterizes the linkage between risk and expected return is utilized in the valuing of risky securities to determine the segmentation of the markets. This explains the need to include the risk and return analysis in the investigation for diversification benefits.

More efforts to retrieve a longer and wider range of data would eliminate the possibility of small sample bias. Collection of data can be extended to all property companies and construction companies listed in the Kuala Lumpur Stock Exchange (presently known as Bursa Malaysia) for the past 30 years and not only companies which profits are from solely property development and construction activities. Data frequency can also be changed into quarterly instead of annually. It may benefit more from a sample consisting of quarterly data as this will lead to bigger sample collected which will solve the problem of lack of representation, thus producing results which will be more precise and accurate.

Since this study is restricted to Malaysia, it could be expanded by comparing the property and construction stock behaviors in Malaysia with other countries, particularly in the South East Asian region. The analysis will reveal the average equilibrium long-run relation and short-run dynamic interactions of the property and construction in this region. The results will be interesting to discover as the countries are a mixture of developed economy (Singapore) and emerging economies (Malaysia, Indonesia, Thailand and Philippines). This will be a new contribution to the literature as these markets have not been examined for both sectors in the past.

As a result of weak relationship between property and construction stock prices and their NAVs, there is a need to rely less on NAV as principal basis for property and construction stocks. Instead, Economic Value Added (EVA) could be considered. EVA is net operating profit after taxes (NOPAT) less a capital charge, whereby NOPAT is the product of the cost of capital and the economic capital. EVA relies upon the residual income idea where earnings in excess of an expected level of performance are tied to the capital employed. Therefore, profit is valued not only by the earnings generated but also by the capital employed, thus displaying the real underlying value of a stock. The effect of EVA on stock prices should be investigated to uncover the mean reversion properties of the property and construction stock prices.

To investigate further the effect of macroeconomic shocks on property and construction stock prices, it is suggested that future research includes shocks on money supply. This is because money supply may influence stock prices through shifts in portfolio replacement or inflationary expectations (Wongbangpo and Sharma, 2002). In a study by Dhakal *et al.* (1993), it is found that the relationship between money supply and stock prices interaction drives a change in money supply which in turn leads to a shift in the equilibrium position of money concerning other assets in the portfolio, transforming the demand for other assets that contend with money balances. Rise in money supply is seen to develop an extra supply of money balances and has the potential to increase the demand for equity, leading to an increase in equity prices. Therefore, it is appropriate to investigate the effect on stock prices based on a shock in money supply to prove the validity of the hypothesis on impact of money supply on property and construction stock prices.

In addition, another limitation found in this study is that the ordering of variables for VAR analysis influences the results of the study. For future research, the determination of ordering among variables for VAR analysis could be done in hierarchical order following the value of residual cross-correlations in future research instead of in decreasing order of exogeneity to achieve more precise results. In addition, in order to evaluate the stock market as a whole, it could be beneficial to include other sectors in the study of stock price reactions to macroeconomic shocks. Further research can be done to investigate the effects of macroeconomic changes on other sectors such as the finance and REITs sectors. The effect of macroeconomic shocks on these sectors can be compared with the impacts of the shocks on property and construction sectors. The result from this investigation can be of use to investors wishing to diversify their investments in sectors which are indirectly linked with the property and construction sectors.

6.5 Summary

The first panel and ARDL investigation of the time series behaviour of property and construction stock prices in Malaysia is furnished in this study. Based on the Modern Portfolio Theory, which suggested that the investor has to consider how each security co-moved with other securities, this study applied the correlation analysis to test for the relationship between the stock prices of both sectors. It is concluded that there is a potential diversification benefit by investing in both sectors at the same time.

This study postulates that if there is a stable long-run relationship between the stock prices and their fundamental variables, then a long-run cointegrating relationship must

exist between the property prices and their NAVs and EPS and construction stock prices with their EPS. The dynamic error correction coefficient derived from the panel ARDL models with MG and PMG coefficients revealed mean reversion behavior for stock prices from both sectors. It indicated a highly significant correction, has the correct sign and shows the period taken to return to equilibrium. This study reinforces the increased potential importance for investing in property and construction sectors in Malaysia as the short-run and long-run behaviours and their underlying fundamental variables of the stock prices are revealed. The results support both the price discovery theory and mean reversion theory where prices are said to revert to equilibrium in the long-run. However, the results do not support the EMH as the prices can be predicted by the changes in the underlying fundamental variables.

In addition to revealing the long-run behaviour and mean reversion tendencies of the stocks, this study also discovered the effects of macroeconomic shocks on the stock prices. Impulse response function tests found interest rate and inflation influences the stock prices positively while GDP has negative relationships with the stock prices. Property stock prices respond negatively whereas construction stock prices respond positively to trade openness shocks. It also found that the impact of trade openness on stock prices is limited. The variance decomposition analysis found that interest rates, inflation and GDP influence the property stock prices at a longer horizon by a significantly high percentage, while trade openness appears to have less influence on the proportion of changes in the property sector. However, the variance decomposition analysis showed that interest rate affects the construction stock prices strongly and

significantly followed by GDP and inflation while trade openness only affects the stock price movement in small percentages.

However, as with other studies, this study is not short of limitations. While efforts have been made to minimize the shortcomings in this study, there are several unavoidable issues which still stand. This study only includes property development companies and not the overall listed property companies in Malaysia in the sample to be compared to the construction sector. Investors may overlook and base their decision to invest in the whole listed property companies instead of concentrating on only specific property development companies if they are not aware of the sample limitation. Another issue is that this study only focuses the property and construction stock prices in Malaysia. Results from this study is restricted and applicable to only within the country since it is not compared with stock price behaviors of these two sectors within the same period in neighboring countries.

The results of this study leads to a number of suggestions for future research in the area of investment. It is suggested that future studies should include return analysis to evaluate the diversification potential of investing in both markets. A longer and wider range of sample to be included in the study could also improve the accuracy of the result. Similar studies can be done on other South East Asian countries to compare the domestic results with overseas markets. As the results show that the stock performance rely less on NAVs, future studies could include Economic Value Added (EVA) as a proxy for fundamental value, as it has been proven in other studies to be a good proxy for stock fundamental value. It is also recommended to include money supply as

another macroeconomic variable to study the effects of its shocks on property and construction stock prices as previous studies have indicated a link between this variable with the stock market. Finally, by including other sectors, such as finance and REITs, one could evaluate the relationship and performances of the stock prices with these sectors.

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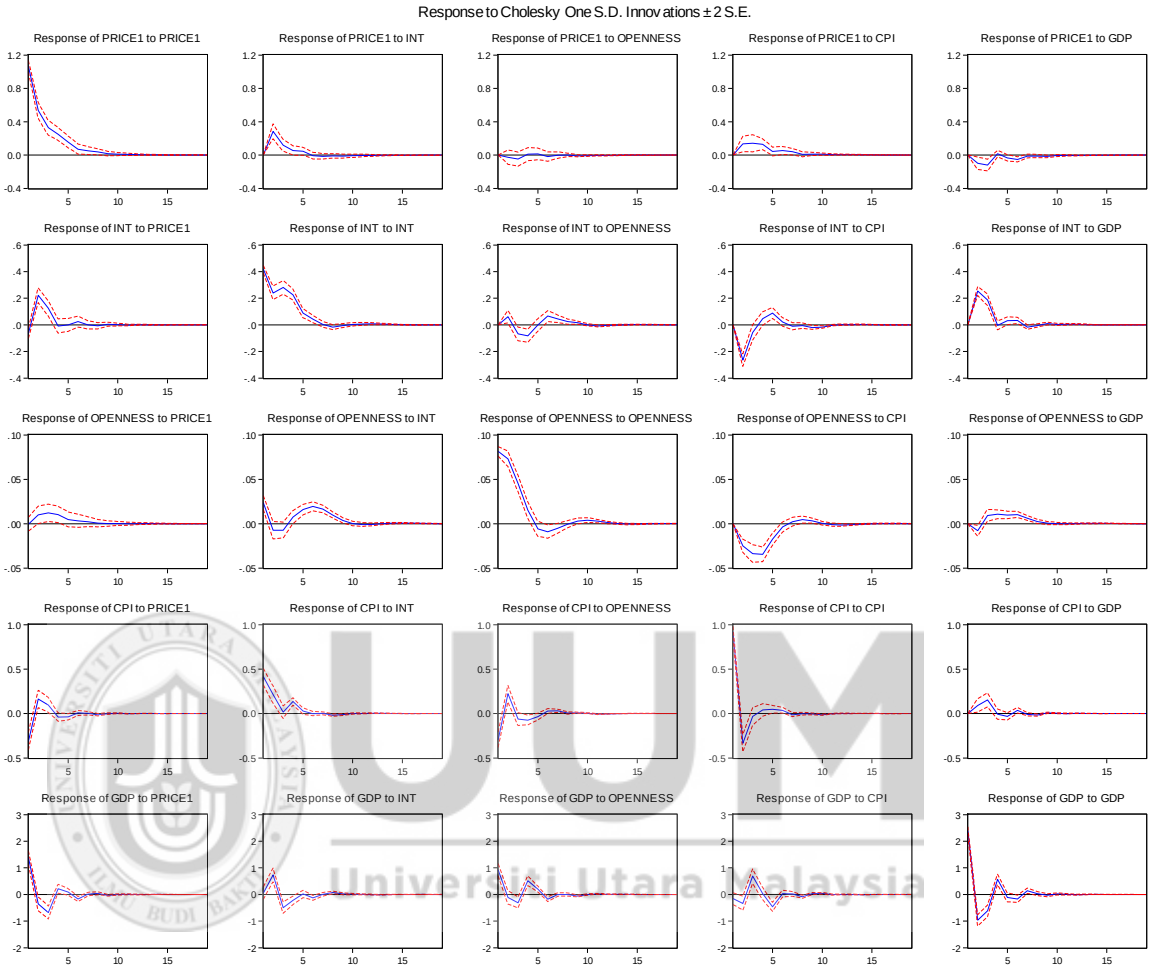
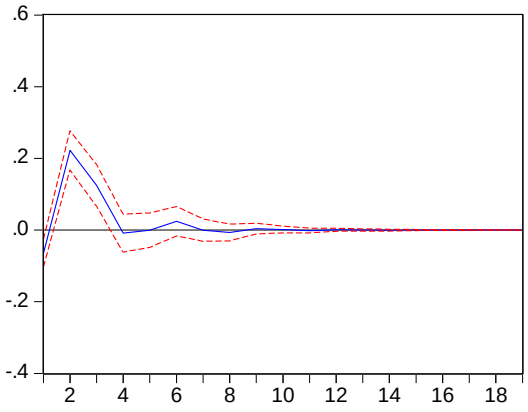
Appendix A: Responses to Interest Rate, Trade Openness, Inflation Rate, GDP and Property Stock Price Impulses



Response to Cholesky One S.D. Innovations ± 2 S.E.

Response of INT to PRICE1



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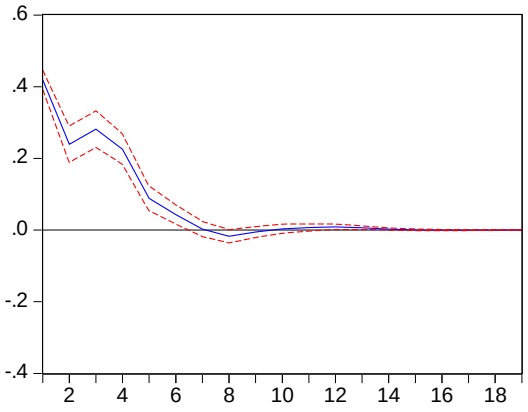
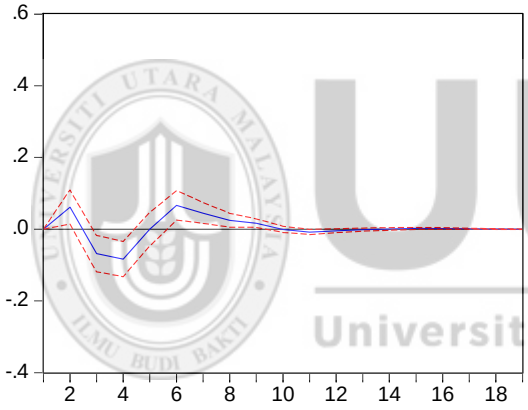
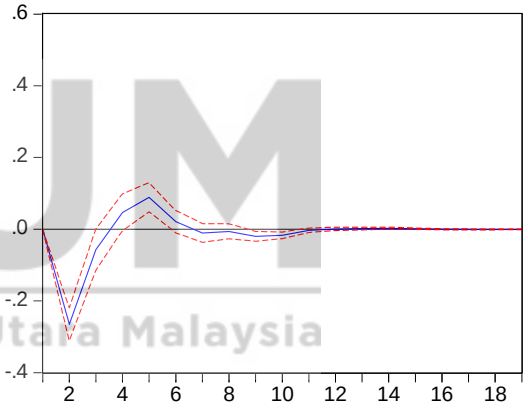


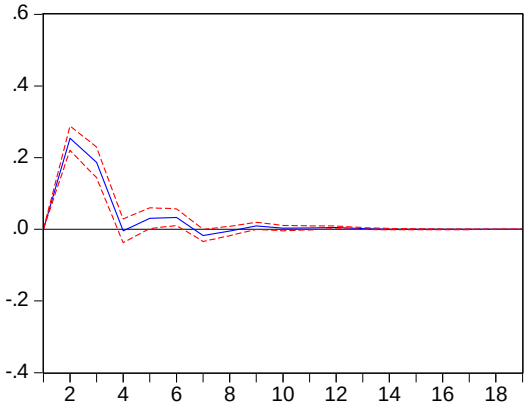
Response of INT to OPENNESS



Response of INT to CPI

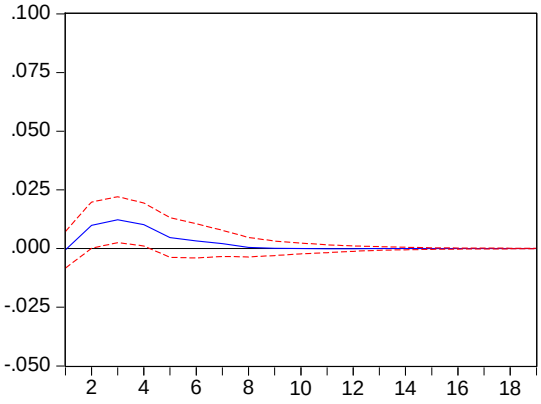


Response of INT to GDP

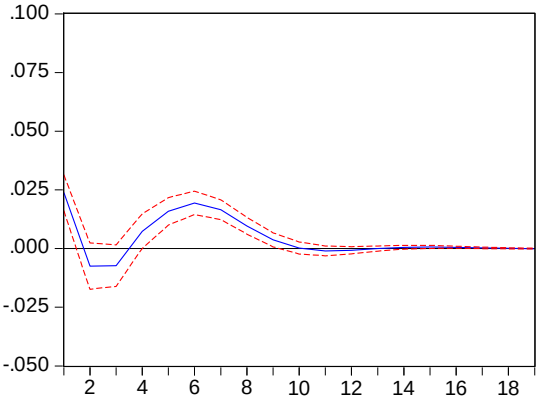


Response to Cholesky One S.D. Innovations ± 2 S.E.

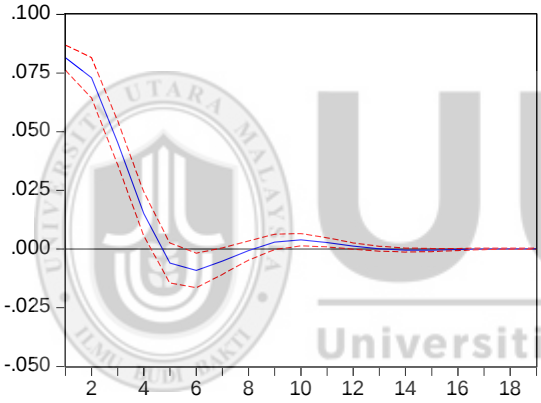
Response of OPENNESS to PRICE1



Response of OPENNESS to INT



Response of OPENNESS to OPENNESS



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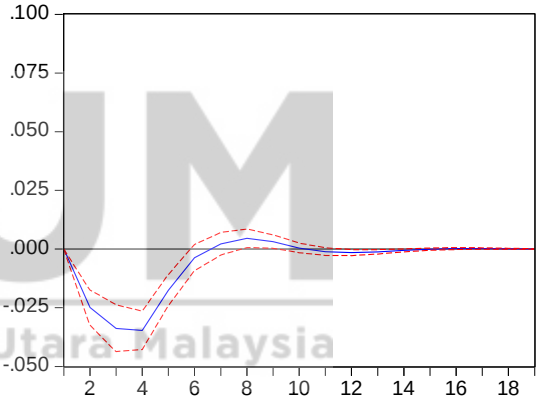
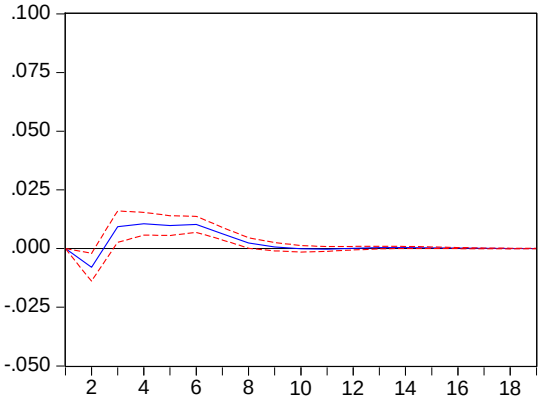
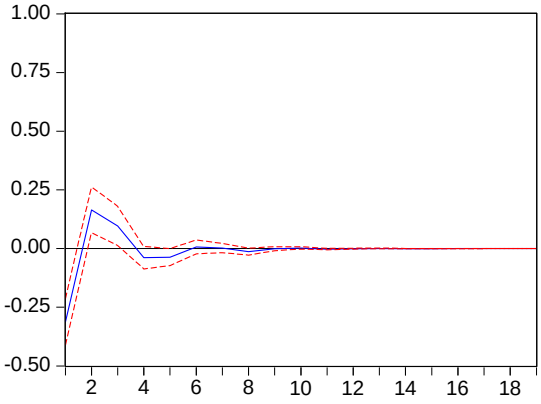


Response of OPENNESS to GDP

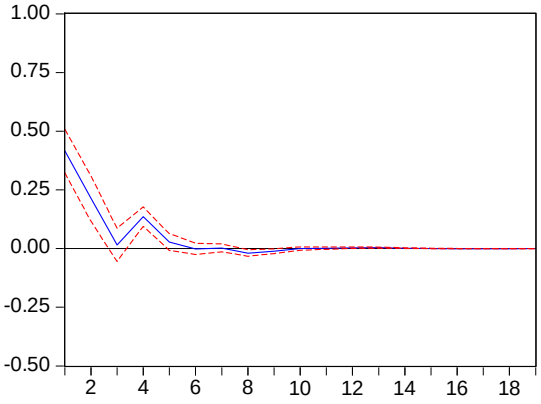


Response to Cholesky One S.D. Innovations ± 2 S.E.

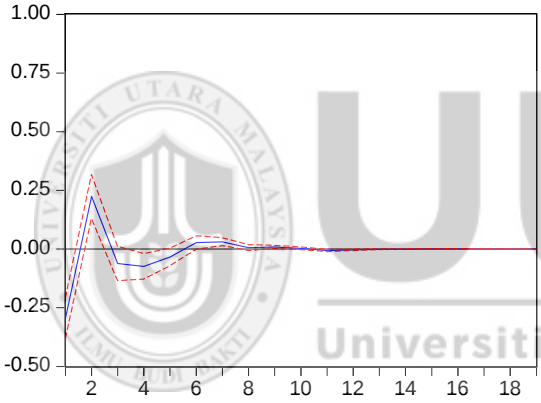
Response of CPI to PRICE1



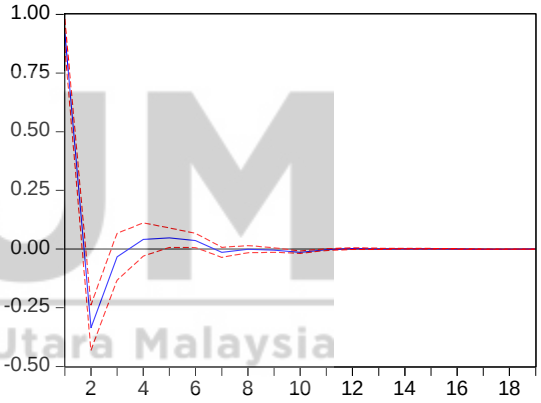
Response of CPI to INT



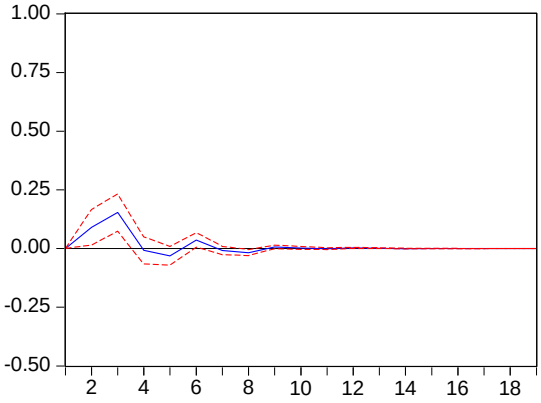
Response of CPI to OPENNESS



Response of CPI to CPI

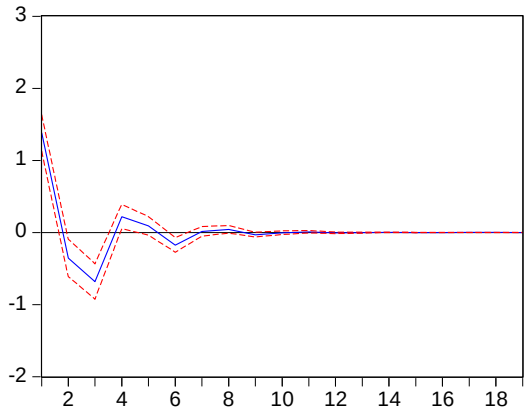


Response of CPI to GDP

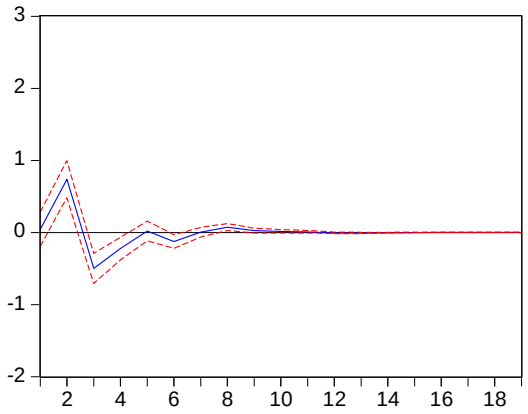


Response to Cholesky One S.D. Innovations ± 2 S.E.

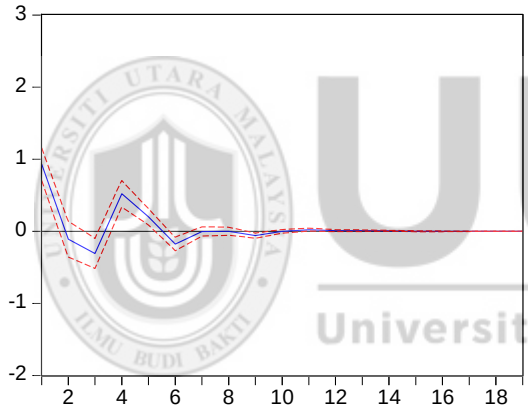
Response of GDP to PRICE1



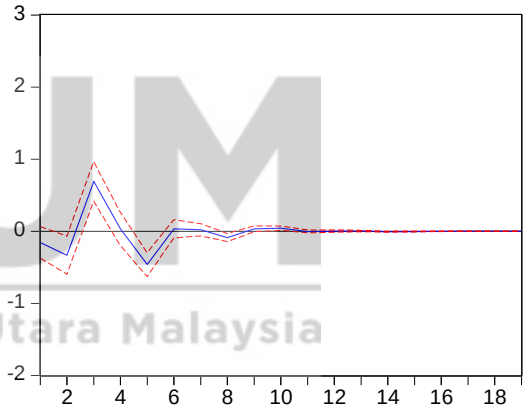
Response of GDP to INT



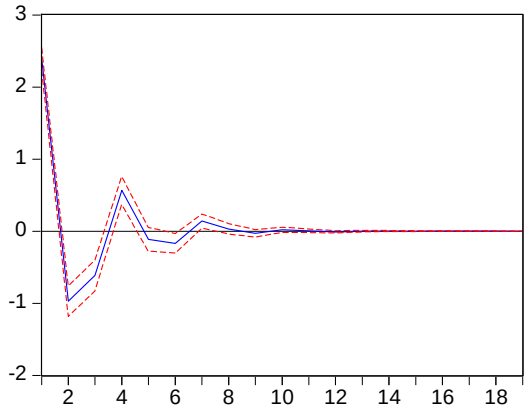
Response of GDP to OPENNESS



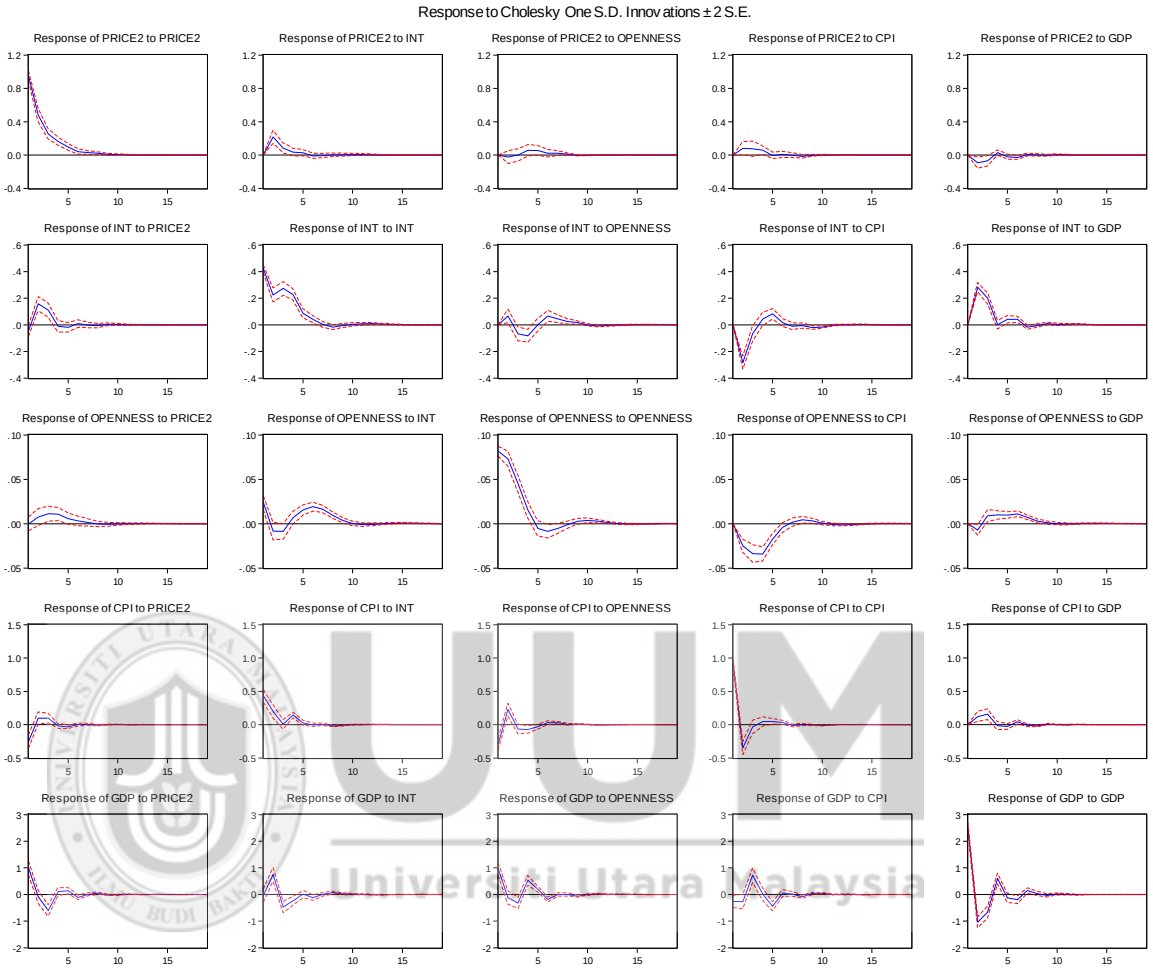
Response of GDP to CPI



Response of GDP to GDP

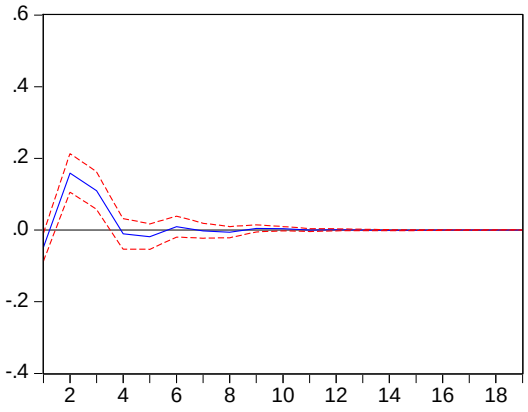


Appendix B: Responses to Interest Rate, Trade Openness, Inflation Rate, GDP and Construction Stock Price Impulses

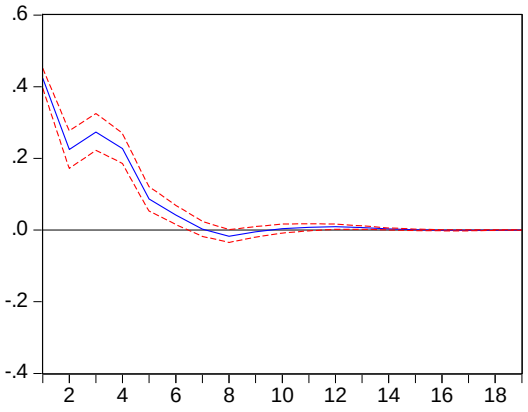


Response to Cholesky One S.D. Innovations ± 2 S.E.

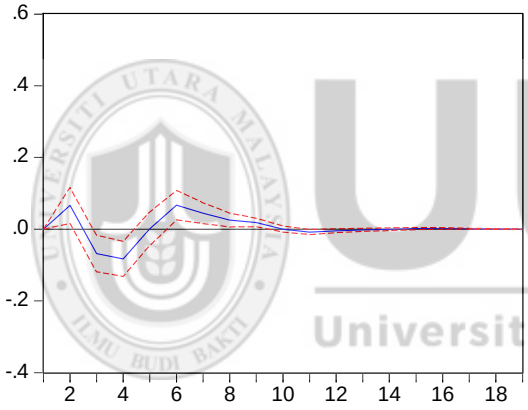
Response of INT to PRICE2



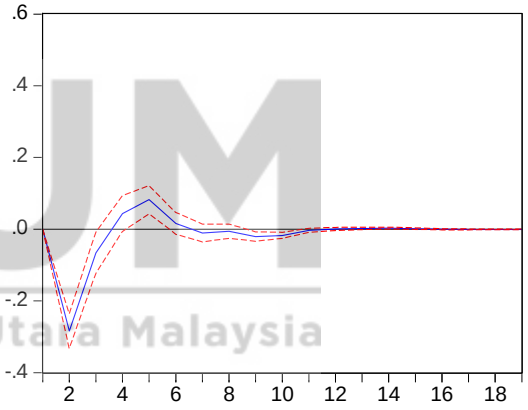
Response of INT to INT



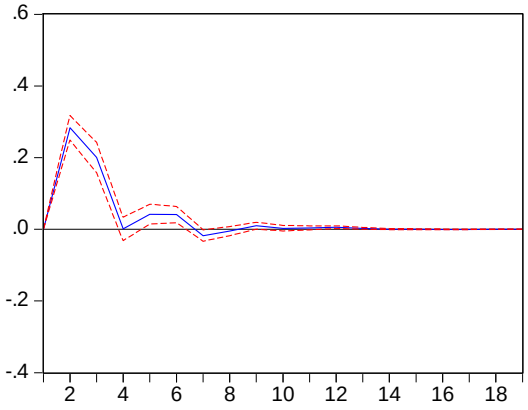
Response of INT to OPENNESS



Response of INT to CPI

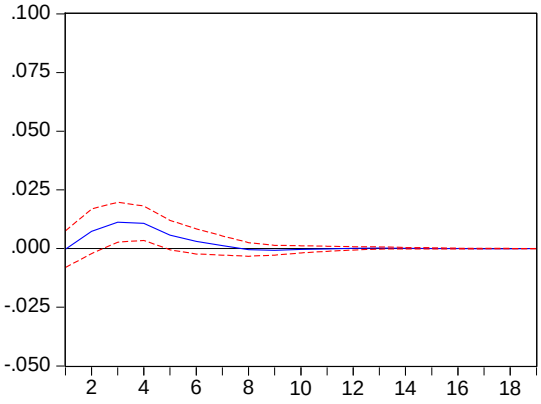


Response of INT to GDP

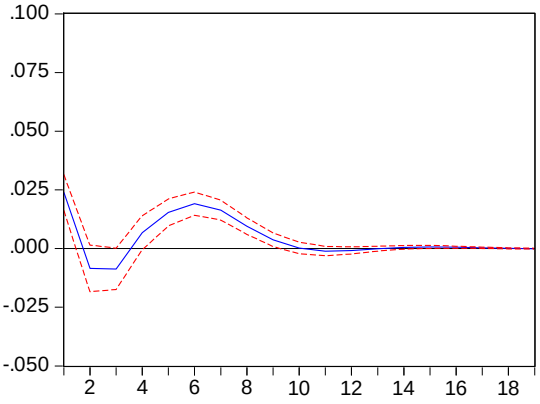


Response to Cholesky One S.D. Innovations ± 2 S.E.

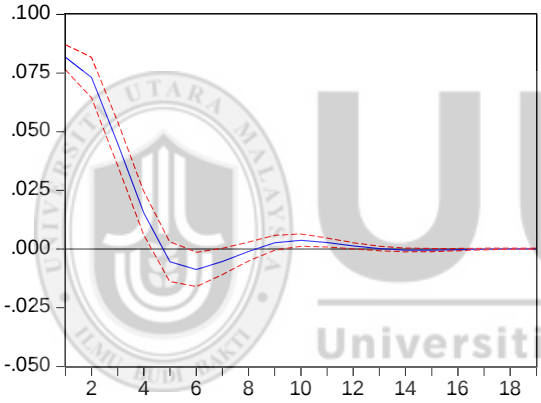
Response of OPENNESS to PRICE2



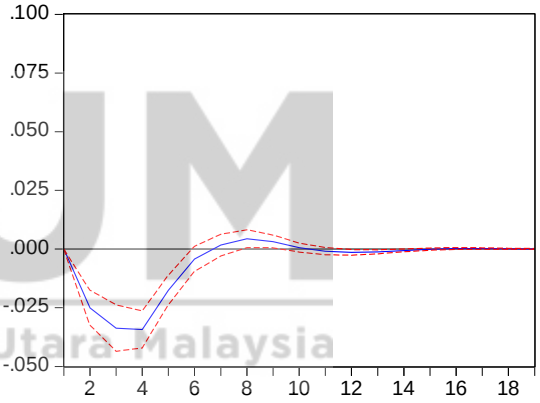
Response of OPENNESS to INT



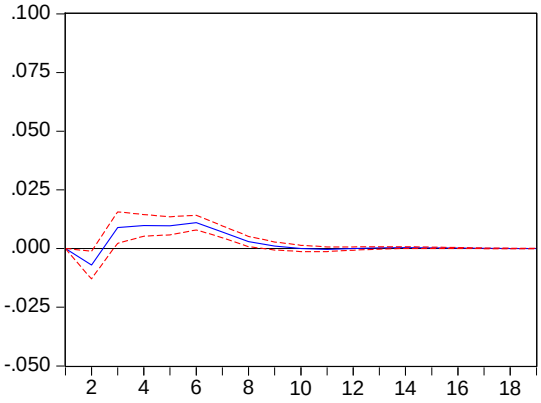
Response of OPENNESS to OPENNESS



Response of OPENNESS to CPI

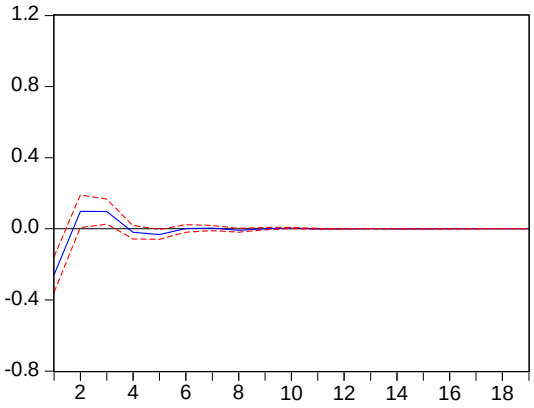


Response of OPENNESS to GDP

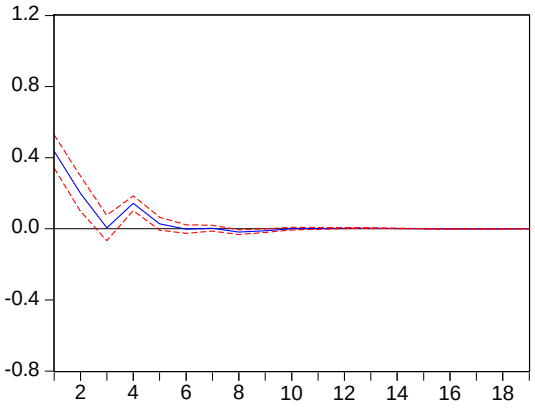


Response to Cholesky One S.D. Innovations ± 2 S.E.

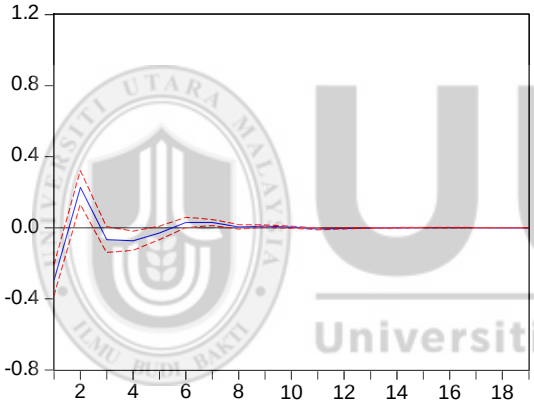
Response of CPI to PRICE2



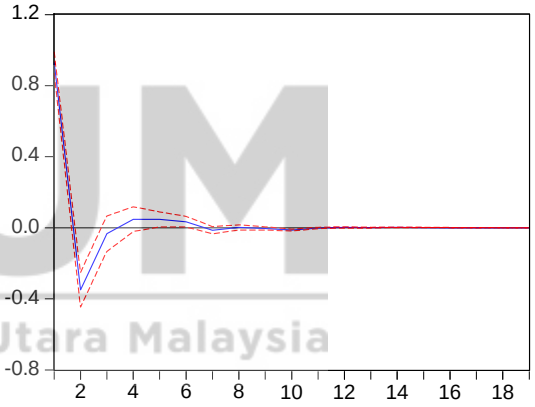
Response of CPI to INT



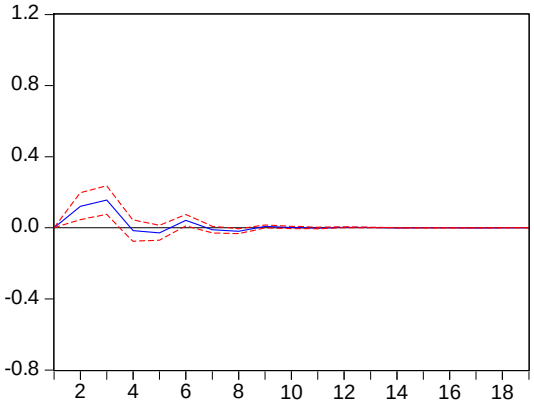
Response of CPI to OPENNESS



Response of CPI to CPI

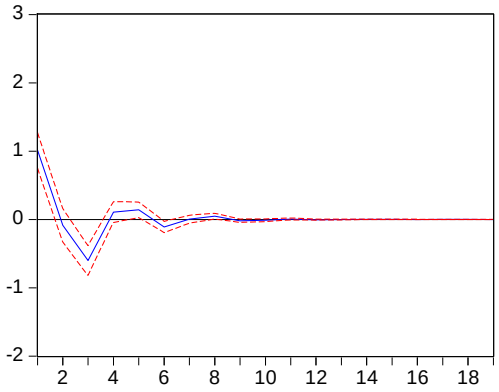


Response of CPI to GDP

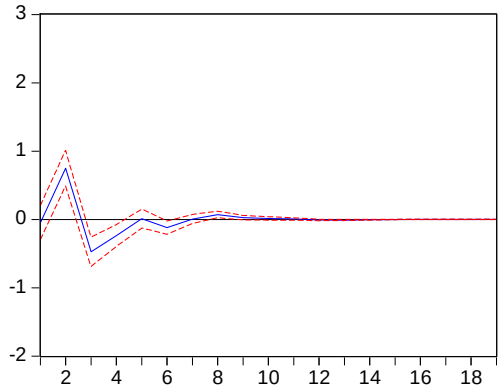


Response to Cholesky One S.D. Innovations ± 2 S.E.

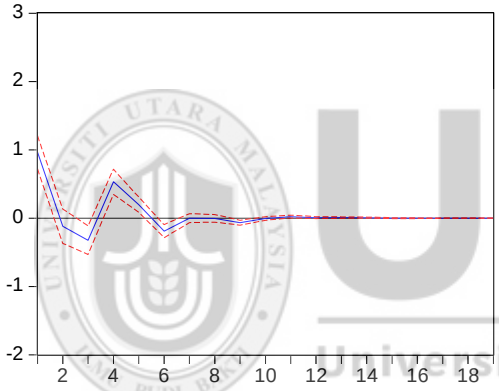
Response of GDP to PRICE2



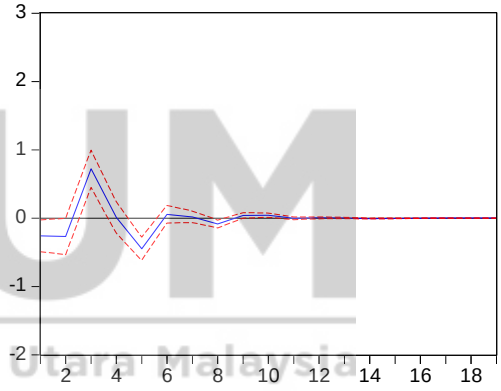
Response of GDP to INT



Response of GDP to OPENNESS



Response of GDP to CPI



Response of GDP to GDP