The Impact of Macroeconomic Factors on Stock Market Prices in Ireland

Zhenlan Zhang

Master of Science (MSc) in Finance

School of Business, National College of Ireland

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Abstract

The relationship between macroeconomic variables and stock market prices has been examined by many researchers in many different countries. There is a geographical gap among the literatures. The nature of such a relationship in Ireland is rarely studied. The study uses monthly data from Ireland for the period from January 2009 to December 2019 to examine the relationship between the Ireland Stock Exchange Overall Index (ISEQ All-share) and four selected macroeconomic variables, unemployment rate, consumer price index, real effective exchange rate and crude oil price. The major analysis techniques used are the Granger Causality test and ordinary least square regression - OLS. The Granger Causality test indicates that there is no significant granger causal relationship between the ISEQ all-share prices and each macroeconomic variable. The OLS regression shows that the unemployment rate has a positive and insignificant relationship with the ISEQ all-share. Consumer price index and real effective exchange rate have negative and insignificant relationships with the ISEQ all-share. The crude oil price has a positive and significant relationship with the ISEQ all-share. The results highlight that the Irish stock market is more sensitive to crude oil prices rather than domestic macroeconomic indicators.

Keywords: macroeconomic variables, ISEQ all-share, Granger Causality test and OLS regression.

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1.Introduction

It is essential for investors to understand the relationship between macroeconomic variables and stock market prices, because macroeconomic variables have a systemic impact on stock market returns. In the past few decades, interests in the linkage between stock market and macroeconomy has been generated a large number of literature that has examined this possible relationship using a variety of frameworks and methodologies. The main purpose of this study is to examine the relationship between macroeconomic factors and the stock market prices in Ireland from January 2009 to December 2019. The Ireland Stock Exchange Overall Index (ISEQ) will be the target stock market price for this study. ISEQ is a major stock market index that tracks the performance of all companies listed in the Irish stock market which excluded the UK registered companies. And the key macroeconomic factors are chosen to be the unemployment rate, consumer price index, real effective exchange rate index, and crude oil price. Several formal studies show that macroeconomic variables are important components in stock market prices. Many studies have been done in both emerging markets and mature markets. They all show that there is a certain link among them. This paper will use time-series analysis to exam the relationship and also apply the regression analysis and Granger causality test to the data to show the impact.

Many studies have been conducted on the relationship between macroeconomic variables and stock market performance in advanced economies such as the United States, the United Kingdom, and Germany, but the nature of such a relationship in Ireland is rarely mentioned in studies. There is a geographical gap in this area. Studies about this relationship within Ireland are hard to find. Now, therefore, this research can fill this small gap. The effects of macroeconomic variables could vary from one country to another and from one period to another. This study could identify the impact of macroeconomic factors in Irish stock market performance and give Irish market investors a reference when making an investment decision. Also, this study can explore whether the Irish stock market has a unique growing trend. In the meantime, finding out the relationship between macroeconomic factors and the stock market prices could help investors to forecast stocks' possible future movements. Successful prediction of the future price of the stock can make profits for investors. Lim and Sek (2013) believed that the high volatility of the stock market would lead to great changes in earnings, thus bringing greater risks. Therefore, a full understanding of the factors that influence stock market volatility enables investors to predict stock price movements more accurately, thus

reducing the risk of losses. There is a common consensus among macroeconomists and financial theorists that the performance of the stock market is driven by different macroeconomic factors. Finding the impact of these four selected macroeconomic variables on stock market prices is important for all investors and financial participators to understand the dynamic of the market. The stock market can benefit consumers. The stock market is an important factor for companies or governments to attract funds directly from investors to support investment projects or expand institutions. The stock market facilitates access to cheaper capital, which in turn creates more jobs and sources of capital, which in turn allows products to enter the market at lower prices. Therefore, an in-depth understanding of the changing trend of the stock market is conducive to national regulators to improve the financial management mechanism so as to improve a country's economic conditions. The investors always use the stock market indices as historical data to analyse and predict the stock price. The more knowledge and stronger information that highly related to the dynamic of the stock market, the more gains that investors can have (Abu-Libdeh & Harasheh, 2011). The public at large would have the chance to prepare with possible measurements to estimate any changes in stock prices that might happen in the future. The correlation between stock market prices and macroeconomic fundamentals is also important to both market regulators and policymakers. By knowing the consequence between macroeconomic variables and stock market price, it will create a new vision of making regulations and policies therefore the financial market can be healthier and safer (Iassahaku, Ustarz and Domanban, 2013). According to Fama (1970), the efficient market hypothesis (EMH), Stock prices should reflect the expectations of the future performance of enterprises, and corporate profits generally reflect the current level of social and economic activities. If stock prices accurately reflect fundamentals, then stock prices should be used as a leading indicator of future economic activity, and investors should be able to use analytical methods to predict stocks' future movements, not the other way around. Therefore, the causal relationship and dynamic interaction between macroeconomic variables and stock prices are of great significance to the formulation of national macroeconomic policies. Investors and the public could increase the possibility of aware of any crisis related to the financial market. In the previous literatures, several macroeconomic factors such as money supply, interest rate and GDP have been found a significant relationship with stock price change by Chen, Roll and Ross (1986), Hamao (1988), Ferson and Harvey (1991), Amtiran, Indiastuti, Nidar, and Masyita (2017). These empirical results provide a research direction for this paper.

The remainder of this paper is structured as follows. The second part shows the theory background and the theoretical framework of this study. Part three reviews the relevant previous literatures. Part four describes the data and methodology. And then, part five shows the tests results following with the findings and discussions. Finally, part six summarizes the main conclusions of the paper and the directions for future research.

2.Theoretical Framework

The relationship between macroeconomic factors and stock market has always been an important topic in financial economics circles. This correlation is of constant concern to investors, academics and policymakers. Some theories and empirical evidence have discussed this economic concern in detail. This section focuses on the theoretical background of this study.

Efficient-market theory is an important financial economics theory which is also known as Efficient Market Hypothesis (EMH). It suggests that stock price reflects all the available information. Proponents of the EMH argue that all the public available information is already reflected in stock prices, changes in macroeconomic indicators have no effect on stock prices. Hence, technical analysis, fundamental analysis, and any speculative investing based on them are useless (Fama, 1970). Opponents of EMH use a variety of approaches showing the macroeconomic factors can predict the stock price. EMH invites a debate about the relationship between stock price and market information. The topic of this paper is a branch research of the EMH. Capital Assets Pricing Model (CAPM) and Arbitrage pricing theory (APT) are the two famous financial models. Both of them are used to the determine the theoretical returns of a portfolio or an asset. CAPM was developed in the 1960s by Sharpe and Lintner. According to Sharpe (1964) and Lintner (1965), CAPM is a single factor model which only has one independent variable risk premium of the market. CAPM uses the risk-free rate of return, the beta of an asset in relation to the overall market, expected market return and investment risk in order to help quantify the projected return on an investment. While APT is an advanced theory of CAPM. APT uses fewer assumptions and it may be harder than CAPM to implement. Ross (1976) developed the APT on the basis that the prices of securities are driven by multiple factors, which could be grouped into macroeconomic or company-specific factors. In contrast of CAPM, market risk premium is not the only factor affecting the return, there are other macroeconomic factors influencing the rate of return. In the APT model, the

rate of returns follow a factor intensity structure. It forecasts the relationship between the market returns and various independent macroeconomic factors. The formula is:

$$R_i = \alpha_i + \beta_{i1}F_1 + \beta_{i2}F_2 + \cdots + \beta_{kn}F_n + \varepsilon_i$$

Where is α_i a constant for the asset; $F_n$is a systematic factor, such as a macroeconomic or company-specific variable; β_{kn} is the sensitivity of the asset or portfolio in relation to the specified variable; and ε_i is the error term.

The earlier studies use the APT framework to explore the effects of macroeconomic factors on stock price changes. Under the APT model, the stock returns is assumed to be a linear function of different macroeconomic variables and the sensitivity of each variables was described by coefficients using the multivariate regression framework. In many previous researches and empirical studies (Chen, Roll and Ross, 1986; Poon and Taylor, 1991; Hamao, 1988), a number of macroeconomic variables have been used in econometric models based on the APT, and it has been proven to affect the market returns. Such as Amtiran, Indiastuti, Nidar and Masyita (2017), they found that GDP and interest rate have a positive relationship with stock return, inflation and exchange rate have a negative relationship withs stock returns in APT framework. APT's analysis thought and method have the consult value for the study of the similar problems. The purpose of this study is to find out the relationship between macroeconomic variables and stock prices. The study uses the APT as the theoretical background to explore the further relationship between financial market and economic market.

3.Literature Review

This section reviews previous studies by different authors and different countries on the relationship between macroeconomic variables and stock market performance.

Various studies have examined the impacts of macroeconomic variables on stock prices in US. The earliest literatures can go back to late 1970s. Nelson (1976) tested the relationship between monthly consumer price index and the monthly common stock returns in the period from January 1953 to December 1974 in US, and the results suggested a negative relationship between them. Fama (1981) built a study focusing on the relationship between stock returns and several economic variables in the United States of America. The results show that real GNP, interest rates, capital expenditures, industrial production, and lagged inflation have positive correlation relationships with stock returns. Chen, Roll and Ross (1986) explore the

relation between financial markets and the macroeconomy. The results indicate that maturity risk premium, default risk premium, inflation and short-term interest rate affect the stock returns in the New York Stock Exchange (NYSE), and they also found the value-weighted NYSE index has an significant influence on expected returns. The above literatures only test the impacts on one index in US. Study results can only reflect one aspect. Asprem (1989) examines this topic on ten European countries. The results indicate that the association between macroeconomic variables and stock market performance are shown to be strongest in Gemnany, the Netherlands, Switzerland and the United Kingdom. Sirucek (2012) and Jareno and Negrut (2016) filled this research gap. Sirucek (2012) tests the relationship between macroeconomic variables and two different US based index, S&P 500 and Dow Jones Industrial Average index (DJIA). Inflation and unemployment rate have been confirmed that they are the most significant factors for both S&P 500 and DJIA (both with a negative impact). Interest rate has larger impact on S&P 500, and Industrial production index has more impact on DJIA. Due to the differences of the stock indices, the level of impact of macroeconomic variables is different. Similarly, Jareno and Negrut (2016) also use both S&P 500 and DJIA as stock indices to run the test. They confirmed GDP, industrial production, unemployment rate and interest rate have significant relationship with the US stock market, and the signs are consistent with the previous literatures. But the consumer price index has no significant impact.

Further, this research has been extended geographically. Several researchers conduct their studies by using two or more countries' data in order to get more comprehensive results. Bhuiyan and Chowdhury (2019) used the monthly data of the United States and Canada from 2000 to 2018 and applied co-integration analysis to establish the relationship model among industrial production, money supply, long-term interest rate and indices of different industries. Results suggest that all the studied macroeconomic variables have stable long-run relationships with the stock indices for the US and Canada, and Canadian stock market can be explained by US money supply and interest rates, but Canadian's macroeconomic variables cannot explain the American stock market. Cheung and Ng (1998) studied the impact of oil price, money supply and GNP on the stock market indices of Germany, Italy, Japan, Canada and the United States by using the Johansen co-integration approach. The results show that the influence of each variable is fuzzy. Oil prices, money supply, and GDP are positively correlated with the stock indices of Germany, Japan, and Italy, and negatively correlated with the stock indices of Canada and the United States.In a similar study, Nasseh and Strauss(2000) investigated the influence of macroeconomic variables on stock indices of Germany, France, Italy, Netherlands,

Switzerland and Britain. The results show that in each selected country, there is a long-term positive relationship between stock index and domestic industrial production index, but a negative relationship with interest rate. They also examined whether macroeconomic variables in Germany could affect stock indices in five other countries. The results show that short-term interest rates, stock prices and industrial production in Germany have a significant effect on stock prices in the other five countries, and vice versa. Baroian (2014) used the ARCH-GARCH model to examine whether macroeconomic instability in the Czech Republic, Croatia, Romania, Poland and Hungary would affect stock market volatility from 2000 to 2013. The results show that a positive relationship exists between exchange rate volatility and stock market volatility in each selected country. In Jareno, Escribano and Cuenca (2019)'s study examines this topic of six countries (Germany, Italy, Spain, France, UK and US) from year 2001 to year 2014. Authors divided the time period into three sub-periods: pre-crisis, crisis and post-crisis. Results suggested that there is an uncertain linkage between CPI and the stock market. GDP has a strong positive impact on stock market for the whole sample period, unemployment rate shows a strong negative impact, and industrial production index shows a less intense and clear relationship with stock market.

Several recent studies have examined the relationship between the German stock market index and macroeconomic variables. Similarly with Jareno, Escribano and Cuenca (2019), Celebi and Honig (2019)'s study also has three sub-periods: the crisis, pre- and post-crisis periods. The dataset contains 24 factors for the time period from 1991 to 2018. They investigate the impact of macroeconomic factors on the main German stock index, called the DAX30 by using the OLS regression. The results show that factors have different impact during these three periods. For instances, M3 has significant negative impact on German stock index during the crisis, but it does not have a significant relationship with the index during the pre- and post-crisis period. And consumer price index, exports and 3-y German government bonds yields show delayed impacts on the stock return. This research examines the relationship in different time periods. Sub-periods analysis provides more persuasive and meaningful results. In the meantime, Abed and Zardoub (2019) apply the bounds testing and the Autoregressive distributed lag approach to find out the relationship between German stock price and macroeconomic variables from 1990 to 2016. The empirical results indicate the interest rate has a significant negative impact on stock return and consumer price index has a significant positive impact. While the M3 aggregate and oil price have no significant impact on stock returns for the whole testing period. Comparing the above two studies we can see that two

studies have different results for consumer price index and M3. Different time period and different methodology could have different results for the same target factor. These two studies together detailly examined the relationship between German stock performance and the macroeconomic variables.

The impact of macroeconomic variables has been developed in Poland by Hsing and Hsieh (2012). The difference is that M2/GDP ratio is taken as a macroeconomic variable in this study. The results of ARCH and GARCH model show that between 2000 and 2010, if the M2/GDP ratio is less than (greater than) the critical value 43.68%, then the stock market index and the M2/GDP ratio show a positive (negative) relationship. Currency appreciation has a negative impact on stock index, but this negative relationship could change if a certain threshold is reached in the future. Czapkiewicz and Stachowicz (2016) use cointegration analysis to investigate the long-run relationship between macroeconomic variables and stock prices WIG20 in Poland. The results indicate that there is a cointegration relationship between the WIG20 price, EUR/PLN exchange rate, export volume, and CPI. The EUR/PLN exchange rate and CPI both have large positive impacts on the stock market. while the export volume variable has a neglected impact on the stock market in the long-run relationship.

There are also studies based on Asian countries, each using a different approach. Mukherjee and Naka (1995) used vector error correlation to model the relationship between Japanese stock returns and six selected macroeconomic variables from 1971 to 1990. The results show that the relationship between stock index and exchange rate, inflation, money supply and industrial production is the same as assumed, and the same as existing literature. Hamao (1988) restudied the studies of Chen, Roll and Ross (1986) from the perspective of efficient market theory and rational expected asset pricing theory. Monthly data on the Japanese market from 1975 to 1984 were used in this study. The target macroeconomic variables are industrial production, interest rates, inflation, investor confidence and exchange rates. Only industrial production, it turns out, had no effect on Japanese equity returns. The long-term equilibrium relationship between the macroeconomic variables and the Singapore stock market index (STI) has been examined by Maysami, Howe and Hamzah (2004). They applied Vector error correlation, OLS regression and cointegration model on monthly data from January 1989 to December 2001. The results suggest that only short- and long-term interest rates have significant relationship with the financial sector index, while real economic activity has significant relationship with hotel sector index. Money supply has no impact on both indices. Khan and Yousuf(2013) explored

the relationship with deposit interest rate, exchange rate, consumer price index, crude oil price broad money supply and stock price index of Dhaka Stock Exchange. They applied four time series approaches, co-integration, vector error correction model (VECM), impulse response function (IRF) and variance decomposition (VDC) for monthly data collecting from the period January 1992 to June 2011. They found that, with the exception of the consumer price index, all other selected macroeconomic variables had significant correlations with stock prices. Amtiran, Indiastuti, Nidar and Masyita (2017) explored the linkage between Indian stock market and macroeconomic indicators by using the Johansen's cointegrate test and vector error correlation model. The target indicators are GDP, inflation, interest rates and exchange rates. The empirical results show that the GDP, interest rates and exchange rates have a positive relationship with stock returns, inflation has a negative correlation with stock returns.

The following literatures are all based Malaysian. Ibrahim and Yusoff (2001) examined the relationship between Malaysian stock prices and macroeconomic variables, the result shows that the money supply is an important driver of the movement in the Malaysian stock market, and the increase in the money supply will finally lead to an increase in the stock market. Later on, Kabir, Bashar and Masih (2014) use the time series techniques such as vector error correlation, cointegration and long run structural modelling to investigate the relationship between Malaysian stock prices and macroeconomic variables. The evidence suggests that there is a significant statistical relationship between the Malaysian stock prices and exchange rate and foreign stock prices. This study uses the quarterly data from 1991 to 2010. Another Malaysia-based study by Hashim, Ramlan and Rosly (2018) focused on the same topic by using a monthly data set from Malaysia from 2010 to 2014, which was a smaller sample size. It was found that exchange rate and money supply (M2) had a significant positive relationship with Malaysian stock prices. Chauque and Rayappan (2018)'s study results suggested that both the exchange rate and the inflation rate had a significant impact on Malaysian stock prices. In addition, in the long run, both the exchange rate and the inflation rate have a negative impact on Malaysian stock prices. The above literatures used different methodologies and explored different time period. But they all get a similar result to certify the dynamic relationship between stock price and macroeconomic variables in Malaysian.

Also in Indian, the inner connection among various macroeconomic factors and stock prices has been proved by Pal and Mittal (2011). Kalra (2012) added several unusual macroeconomic indicators which are Cash Reserve Ratio (CRR), reverse repo rate, gold price and Wholesale

Price Index (WPI) in the research. The study provided another powerful evidence of the relationship between prices and macroeconomic indicators, also Kalra (2012) developed a model which can help representing the relationships. Gurloveleen and Bhatia (2015) chose ten macroeconomic variables for their research, they are broad money, demand money interest rate, crude oil price, exchange rate, foreign exchange reserve, foreign institutional investors, total fiscal deficit, industrial production index, inflation rate and trade balance. They also chose the BSE500 manufacturing index in the Indian stock market as the target stock market index. The test results showed that none of these variables had anything to do with the closing price of BSE500. The authors show that the Indian stock market was a weak and efficient market during the selected period from April 2006 to March 2015. Giri and Joshi's (2017) study provides the evidence that economic growth, inflation and exchange rate have positive impacts on Indian stock prices and crude oil prices impact the Indian stock prices negatively. The variance decomposition results show that the movement of Indian stock market is mostly explained by its own shocks. A more recent study on Indian stock market price built by Keswani and Wadhwa (2019). In their study, there examined two stock price index NSE and BSE. The provide evidences to show a strong relationship exist between disposable income, government policies, the exchange rate and share price. Gopinathan and Durai (2019)'s study has a relatively large sample period which is from April 1994 to July 2018. The standard cointegration test and the continuous partial wavelet coherency model suggest that there is no stable linear relationship between Indian stock market, money supply, Industrial production index and wholesale price index. The linkage between selected macroeconomic variables and stock index is time-vary.

Studies in Thailand also been built by many researchers. Brahmasrene and Jiranyakul (2007) examine the relationship between Thailand stock market index and selected macroeconomic variables during pre-financial crisis and post-financial crisis. The cointegration model shows that money supply had a positive relationship with the stock market index, and industrial production index, oil price and the exchange rate had negative impacts on Thai stock market index. the Granger Causality test provides that only money supply and stock market index had a granger causal relationship. Forson and Janrattanagul (2013) investigated the long-run equilibrium relationship between the Thai stock exchange index (SETI) and macroeconomic variables. They found that a strong positive long-run relationship between money supply and SETI, and both the industrial production index and consumer price index show negative long-run relationships with SETI. The Granger Causality test results indicate that money supply,

consumer price index, industrial production index and interest rate are all sensitive to Thai stock market movements.

There are also some literatures were conducted in other developing countries. Barakat, Elgazzar and Hanafy (2016) investigated the relationship between stock market and macroeconomic variables in both Egypt and Tunisia by using data from January 1998 to January 2014. The results of Granger causality test emphasize that there is a causal relationship between the Egyptian stock market and CPI, exchange rate, money supply and interest rate. Except for the CPI, the relationship in Tunisia is the same. And these four macroeconomic factors are in common with both stock markets. Ernest, Jnr and Kofi (2016) expanded the scope of research. They apply OLS, FGLS, dynamic least squares and Newey-West model on 41 emerging countries data from 1996 to 2011. The results found that consumer price index, exchange rate, money supply and GDP have significant impacts in explaining the emerging market stock performance. Also increasing in money supply can positively influence stock market. This study provides valuable information for the follow-up emerging market research. Epaphra and Salema (2018) specify 11 models to test the relationship between macroeconomic variables and Tanzania stock market. Model 1 examines the effects of the macroeconomic variables on overall stock price, and model 2 to model 11 tests the effects on each individual firm's stock price. the results show that money supply and exchange rate have significant positive effects, Treasury bill has negative impact, and inflation has no relationship with the overall stock price. Exchange rate, Treasury bill and inflation have different impacts on each individual firm, but money supply is found to be the main influence factor on stock price. This study explores another study direction in this area. Al-Kandari and Abul (2019) applied the Johansen cointegration test and the Var Error Correlation Model to investigate the linkage between macroeconomic factors and Kuwait stock market performance. The factors include money supply, three-month deposit interest rate, oil prices, inflation rate and the US Dollar vs Kuwait Dinar exchange rate. The results confirmed that the short-term relationship exists between only oil prices and Kuwait stock market. No other short-run relationship was found.

The impacts of interest rate, exchange rate, GDP, inflation, money supply M2, oil price, export and foreign direct investment on Pakistan stock market have been examined by Khan and Zaman (2012), Hunjra, Chani, Shahzad, Farooq and Khan (2014). The tests periods are from 1998 to 2009, and from January 2001 to December 2011. Both studies indicate that inflation, exchange rate, GDP and interest rate have negative impacts on stock market price. Money

supply M2, foreign direct investment and oil prices have insignificant relationship with Pakistan stock market performance. In contrast, Ilahi, Ali and Jamil (2015) applied multiple linear regression on Pakistan stock market price, exchange rate, inflation rate and interest rate from the period of January 2007 to December 2012. The results indicate there is a weak link between these macroeconomic variables and the Karachi stock market. Khan and Khan (2018)'s study used monthly data from May 2000 to August 2016 which is the largest dataset among the researches based on Pakistan. Cointegration, ARDL and bound testing approach were applied in this study. Empirical findings suggest that money supply, exchange rate, and interest rate have significant affections on Karachi stock price in long term.

The above literatures examine the same topic in different countries which includes both developing countries and developed countries by using different methodologies. The most examined macroeconomic variables are money supply, GDP, consumer price index and interest rate. The effect of some macroeconomic variables could vary from one market to another and from one period to another. The impacts of these variables vary in different countries. Even in the same country, the macroeconomic variables have different impacts on different stock indices. The most used methodologies are OLS regression, Granger Causality test, and vector error correlation model. And each literature has its own focus and limitation. By reviewing these previous literatures, this study aims to avoid some research limitations and fill the geographical gap.

4.Data and Methodology

This section firstly states the research question and the main hypotheses, and then explains the aims and objectives of this study. The detail information about each independent variable and dependent variable will be represented clearly, and the methodology will be presented step by step.

4.1 Research Question

The purpose of the study is to examine whether there is a relationship between the Irish stock market index ISEQ all-share, unemployment rate (UN), consumer price index (CPI), real effective exchange rate (REER), and crude oil price (OP). The objectives of this study are to

fill the geographical research gap and provide more information to help investors understanding the linkage between the Irish financial market and macroeconomy. It is essential for investors to understanding the structure of the economics and the prospects opportunities of the country before making any investment decisions. And the nature of this study provides more information for the Irish policy and regulation makers to consummate the financial system. The hypotheses of this study are as follows:

H_0: $UN, CPI, REER\ and\ OP\ do\ not\ have\ impact\ on\ the\ ISEQ$.

H_1: $UN, CPI, REER\ adn\ OP\ do\ have\ impact\ on\ the\ ISEQ$.

The empirical analysis is carried out by using the monthly data. In order to avoid the influence of the Financial Crisis, the sample period starts from January 2009 to December 2019. There are 132 raw observations in total. The ISEQ all-share is selected to represent the Ireland stock market. The monthly stock prices data will be the end of month close price of ISEQ all-share. Back to 1980s, there are a large number of studies have shown that there is an important relationship between some macroeconomic variables and stock returns, and multi-factor models have been widely used to explore the changes in the rate of return on securities. Existing literature shows that a wide range of macroeconomic factors can explain the change of stock price (Fama, 1981; Chen et al., 1986; Bilson, Brsilsford and Hooper, 2001; Asprem, 1989; Bulmash and Trivoli, 1991; Flannery and Protopapadakis, 2002; Baroian, 2014). These variables include money supply, exchange rates, interest rates, political risk, oil prices, consumer price index, budget deficits, trade deficits, domestic consumption, unemployment rate, and real wages. Due to time and resources constraints, this paper cannot study all the macroeconomic variables. Based on other European countries' researches, unemployment rate, consumer price index, interest rate and oil price are widely studied in literatures based on Germany, Italy, Spain, France and UK (Abed and Zardoub, 2019; Jareno, Escribano and Cuenca, 2019). Hence, the target macroeconomic variables for this study are the unemployment rate (UN), consumer price index (CPI), and real effective exchange rate (REER) and crude oil prices (OP). All data are sourced from Eurostat (https://ec.europa.eu/eurostat/en/web/products-datasets) and Yahoo Finance (https://finance.yahoo.com).

4.2 Data

The ISEQ all-share is an index in Irish stock market which contains the performances of all companies listed in the Irish stock market which excludes UK register companies. Indexes in

the stock market play an important role in the country's economic and industrial growth as well as the vigorous development of the economy by increasing the performance of trend stocks. Index is largely invested by investors to track the market performance. Impact on the stock index provides a general view of the impact on the stock market. Unemployment rate (UN) is the percentage of the labour force that is unemployed. It is a lagging indicator, meaning it generally rises or falls with economic conditions, rather than predicting them. As a macroeconomic factor, unemployment rate reflects a country's economic development within a time period in some level. Consumer price index (CPI) is another important economic indicator, which measures the changes in the price level of a weighted average market basket of consumer goods and services purchased by households. Real effective exchange rate (REER) is the weighted average of a country's currency in relation to an index or basket of other major currencies. It is used to determine an individual country's currency value relative to the other major currencies in the index. Crude oil prices (OP) has been used as a macroeconomic factor in recent years. The price of oil influences the costs of production and manufacturing. The complexities of the link between oil prices and stock prices have been scrutinised for years. Authorities such as the International Monetary Fund (IMF), Bank Of International Settlements (BIS), U.S. Energy Information Administration (EIA) and the U.S. Federal Reserve (FED) have examined the topic extensively. Conclusions range from the presence of a strong correlation to no correlation whatsoever between crude oil price and stock market performance.

4.3 Methodology

The study adopted quantitative design method to conduct the research. The study proceeds in the following steps: First, feature scaling all the original data by using the Z-score scaling method. Second, testing the stationary of all the series by using the Augmented Dickey Fuller (ADF) test and determining the order of integration of the series if the series is non-stationary. Third, Granger Causality test is conducted in order to determine the causal relationship between the independent variables and the ISEQ. Fourth, OLS regression model will be applied to determine the linear relationship between the macroeconomic variables and the ISEQ. Finally, normality test, multicollinearity test and heteroskedasticity test will be applied in order to check the fitness of this OLS regression model.

Feature scaling: It is a necessary first step for quantitative study. It also refers as the normalization or the standardization of data. The purpose of the feature scaling is to ensure all the testing data series have the equal feature level. If one of the features has a wide range of values, then the distance will be affected by that particular feature. Therefore, the range of all features should be standardized so that each feature contributes roughly proportionately to the final distance. Z-score scaling method is used in this study. This approach is to calculate the mean and the standard deviation of each series and scale each observation by subtracting the mean and dividing by the standard deviation.

Stationary Test: In this study, all the data is time series data. The important pre-requisite for getting a meaningful result in time-series analysis is to have stationary dataset. A stationary time series data is the one whose statistical properties such as mean, variance, autocorrelation and so on are constant over time. Stationary dataset enhances the accuracy and reliability of the model. Consequently, using non-stationary time series in a regression framework could lead to spurious regression and unproductive inference. In statistics, a unit root test verifies whether a time series variable is non-stationary and possesses a unit root. A commonly used test that is valid in large samples is the Augmented Dickey Fuller (ADF) test. If a series is said to be non-stationary, then the first difference will be applied. The first difference of a time series is the series of changes from one period to the next. If Y_t denotes the value of the time series Y at period t, then the first difference of Y at period t is equal to Y_t-Y_{t-1}. And checking the stationary again until the series is stationary.

Granger Causality Test: It is a statistical hypothesis test for determining whether a time series is useful in forecasting another (Granger, 1969). The method is a probabilistic account of causality; it uses empirical data sets to find patterns of correlation, for instance, a variable X is causal to variable Y if X is the cause of Y or Y is the cause of X. However, the Granger causality does not test a true cause-and-effect relationship, the results indicate whether a particular variable is significant in forecasting another variable (Abu-Libdeh and Harasheh, 2011).

OLS Multiple Regression Analysis: It is a method to analysis link between one dependent variable and several independent variables. There are three important assumptions for the regression model. First, the residuals or errors are approximately normally distributed. The normality of the error terms is to make sure the regression can make valid inferences. Jarque-bera test is applied to test the normality of the residuals. The test statistic is defined as follows,

$$JarqueBera = \frac{n}{6}\left(S^2 + \frac{1}{4}(K-3)^2\right)$$

Where n is the number of observations, S is the sample skewness and K is the sample kurtosis. If the value is far from zero, then the sample is non-normal distribution. Second, the data must not show multicollinearity. Multicollinearity refers to a situation in which two or more independent variables in a regression model are highly correlated. This leads to the problem of understanding which independent variables contribute to the variance of the dependent variable interpretation and the technical problem of computing multiple regression models. The Variance Inflation Factor (VIF) and Pearson's bivariate correlation matrix are applied for checking the multicollinearity of the independent variables in the regression model. VIF provides an index that measures how much the variance of an estimated regression coefficient is increased because of collinearity. The VIF value is defined as follows,

$$VIF_i = \frac{1}{(1-R_i^2)}$$

Where i represents the UN, CPI, REER and OP, and R_i^2 is the coefficient of determination of the regression equation where independent variable i as a function of all the other independent variables. A VIF value of 1 means that the independent variable i is not correlated with other variables. The higher the value, the greater the correlation of the variable with others. The Pearson correlation coefficient measures the linear association between two variables. It ranges from -1.0 to +1.0. The coefficient is closer to +1.0 or -1.0, the more closely the two variables are related. If it close to 0, it means that there is no relationship between the variables. Third, data needs to show homoscedasticity which is as you move along the best-fit line, the variance remains similar along the best-fit line. The Breusch-Pagan test is used to test for heteroskedasticity in a linear regression model. The Breusch-Pagan chi-squared value is defined as follows,

$$BP\ chi^2 = n \times R_{new}^2$$

Where n is the number of observations, and R_{new}^2 is the R squared value of the new regression in which the squared residuals are used as the response variable. Then the hypotheses will be,

H_0: $the\ residuals\ are\ not\ heteroscedastic\ (homoscedatic)$

H_1: $the\ residuals\ are\ heteroscedastic$

If the test statistic has p-value below the significant level 5%, then the null hypothesis of homoscedasticity is rejected and heteroskedasticity assumed.

5.Empirical Results and Findings

The figure below shows the changings of all five variables during year 2009 to year 2019. The ISEQ all-share price has several fluctuations, but the general trend is increasing. The ISEQ all-share price is increased around 246% from 2074 to 7183. The unemployment rate is increasing from 2009 to the middle of 2012, and then continuously decreasing to a lowest point in this period. Consumer price index is highly fluctuated. It changes between 97.4 to 101.3. Real effective exchange rate is the most stable variable. The general trend is decreasing, but there is no drastic change. It decreased 18.7% during 2009 to 2019. The line graph is smooth comparing with others. Crude oil price is unstable. From 2009 to 2010, oil price increased from 40 to 80, and then the price kept in a high level from 2011 to the middle of 2014. From 2014 to 2015, there is a precipitous drop in oil price. All macroeconomic variables are moving individually, there is no similar trend between each other.

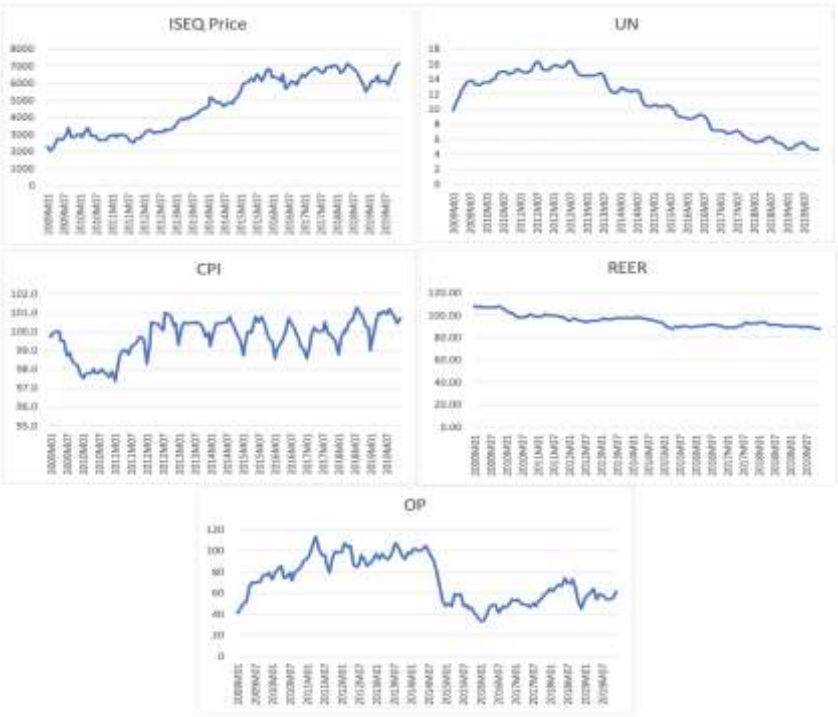

Figure 1. Line graph of each variable

5.1 Feature Scaling

Table 1. First few observations

Time	*ISEQ*	*UN*	*CPI*	*REER*	*OP*
2009M01	2311.39	9.90	99.70	108.49	41.68
2009M02	2074.32	10.90	99.90	106.62	44.76
2009M03	2193.95	11.60	100.00	108.14	49.66
2009M04	2622.05	12.30	100.00	107.51	51.12
2009M05	2722.52	12.90	99.50	107.43	66.31
2009M06	2706.08	13.50	99.50	107.38	69.89

Source: Prepared by author

Table 2. Descriptive Statiatics

	ISEQ	*UN*	*CPI*	*REER*	*OP*
Mean	4789.88	10.88	99.71	95.27	71.90
Median	4885.86	11.40	99.90	94.57	69.85
Standard Deviation	1633.77	3.81	0.97	5.41	21.38
Sample Variance	2669203.85	14.51	0.94	29.24	457.32
Kurtosis	-1.64	-1.43	-0.38	-0.02	-1.33
Skewness	-0.07	-0.23	-0.71	0.82	0.12
Minimum	2074.32	4.60	97.40	88.20	33.54
Maximum	7183.41	16.40	101.30	108.49	113.93
Count	132	132	132	132	132

Source: Prepared by author

Table 1 shows first few observations. We can see that there are large differences in ranges the time series dataset. Table 2 shows the descriptive statistics for all the original study variables. The sample size is 132 for each independent variable and the dependent variable. Kurtosis is a measure of the combined weight of a distribution's tails relative to the center of the distribution. The kurtosis values are less than three and they are all negative values, which indicate that the distribution of each variable is platykurtic, it means the distribution produces fewer and less extreme outliners than does than normal distribution. Skewness is a measure of the symmetry in a distribution. A symmetrical dataset will have a skewness equal to 0. The skewness -0.07, -0.23 and 0.12 for ISEQ, UN and OP, we can say that these three data are fairly symmetrical. 0.82 skewness for REER indicates that the size of the right-handed tail is larger than the left-handed tail. The skewness for CPI is -0.71 which indicates the left-handed tail is typically longer than the right-handed tail.

After feature scaling the original dataset by using the Z-score scaling, the first few observations are showing in the table 3 below. The equation is :

$$Z - score\ scaling = \frac{V-\mu}{\sigma}$$

Where V is a feature value for a particular observation, μ is the sample mean and σ is sample standard deviation. For example, the first ISEQ scaling value -1.523 equals 2311.39 mines 4789.88 and divided by 1633.77

Table 3. Data in Table 1. after using the Z-score scaling

Time	*ISEQ*	*UN*	*CPI*	*REER*	*OP*
2009M01	-1.523	-0.258	-0.013	2.454	-1.419
2009M02	-1.668	0.006	0.194	2.107	-1.274
2009M03	-1.595	0.190	0.297	2.389	-1.044
2009M04	-1.332	0.375	0.297	2.272	-0.976
2009M05	-1.270	0.533	-0.220	2.258	-0.263
2009M06	-1.280	0.691	-0.220	2.248	-0.095

Source: Prepared by author

5.2 Augmented Dickey-Fuller Test

Before running the multiple regression analysis, the Augmented Dickey-Fuller (ADF) test should be applied to all variables to check for the stationary. In statistics, a unit root test verifies whether a time series variable is non-stationary and possesses a unit root. Therefore the null and alternative hypothesis of the test are as follows:

H_0: the variable has a unit root. (not stationary)

H_1: the variable does not have a unit root. (stationary)

The study uses 5% significance level for all test. Therefore, if the p-value is lower than 0.05, it means the null hypothesis is rejected and the time-series data is stationary. Otherwise, the researcher fails to reject the null hypothesis and the time-series data is non-stationary.

Table 4. Augmented Dickey-Fuller unit test results

	ISEQ	*UN*	*CPI*	*REER*	*OP*
ADF-Statis	-0.8186	-0.9313	-2.4659	-1.7004	-1.9895
p-value	0.8136	0.7775	0.1240	0.4309	0.2912
Test Critical Values:					
1%	-3.4813	-3.4870	-3.4865	-3.4817	-3.4817
5%	-2.8839	-2.8864	-2.8862	-2.8840	-2.8840
10%	-2.5787	-2.5800	-2.5799	-2.5788	-2.5788

Source: Prepared by the author.

The results of the ADF test for each variable are showing in the Table 2. The p-value for each variable is greater than 0.05, and the test critical value at 5% level is smaller than the ADF test statistic (-2.8839 < -0.8186, -2.8864 <-0.9313, -2.8862 < -2.4659, -2.8840 < -1.7004, -2.8840 < -1.9895). Therefore, the null hypothesis cannot be rejected at 5% level of confidence. ISEQ, UN, CPI, REER and OP are all non-stationary data. With all the time series data is non-stationary, the following regression analysis cannot be carried out. In order to continuous the analysis and get all data time series becoming stationary data, a solution would be to take the order of differences for the non-stationary data and apply the ADF test again for the new data. Table 3 shows the ADF test results for the first and second order differences data. The *_diff* is used to denote the first order differences, and *_2diff* is used to denote the second order

differences. The results show that after taking the first order differences, the p-values of *ISEQ_diff*, *CPI_diff*, *REER_diff* and *OP_diff* are all smaller than the test significant level 5% which means we reject the null hypothesis. *UN_diff's* p-value is 0.0806 greater than 5%. After performing the first difference transformation, ISEQ, CPI, REER and OP become stationary. applying ADF test again for *UN_2diff*, p-value is 0.000 smaller than 5%. Hence, second order is necessary to make UN stationary. sample dataset is now available for the following analysis.

Table 5. ADF test results after differences

	ISEQ_diff	*UN_diff*	*UN_2diff*	*CPI_diff*	*REER_diff*	*OP_diff*
ADF-Statis	-10.8803	-2.6634	-6.8930	-3.1881	-9.6253	-9.9434
p-value	0.0000	0.0806	0.0000	0.0207	0.0000	0.0000
Test Critical Values:						
1%	-3.4817	-3.4875	-3.4870	-3.4865	-3.4817	-3.4817
5%	-2.8840	-2.8866	-2.8864	-2.8862	-2.8840	-2.8840
10%	-2.5788	-2.5801	-2.5800	-2.5799	-2.5788	-2.5788

Source: Prepared by the author.

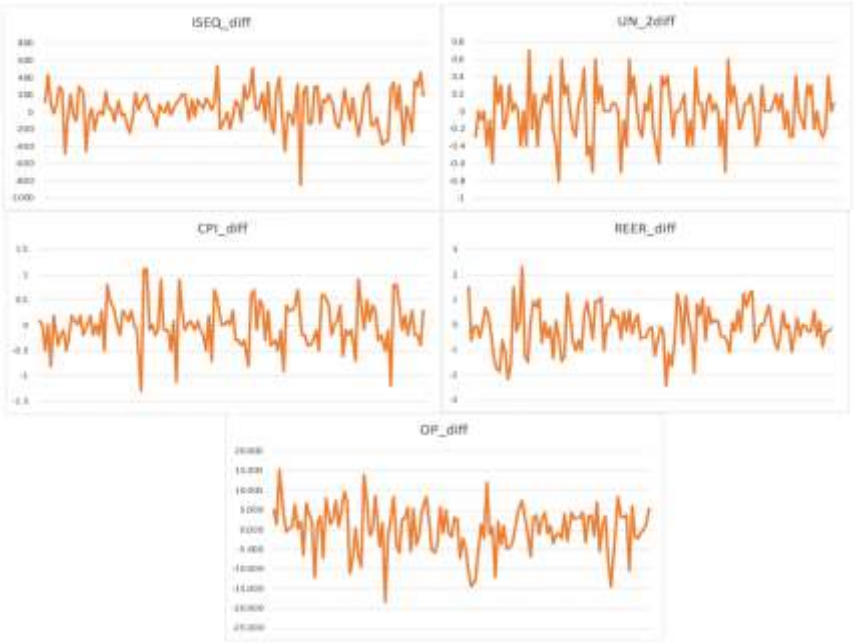

Figure 2. Stationarity Time Series

5.3 Granger Causality Test

Granger Causality test is conducted in order to the causal relationship between each independent variable and the ISEQ. For each independent variable, we run the test twice to indicate the causation is only in one direction (x Granger-causes y), or in both directions (x Granger-causes y and y Granger-causes x) or in neither direction (x does not cause y and y does not cause x). The table 6 shows the results of the granger causality test for each independent variable. The hypotheses for this test are:

H_0: *independent variable does not granger cause the ISEQ*

H_1: *independent variable does granger cause the ISEQ*

And

H_1: *the ISEQ does not granger cause the independent variable*

H_0: *the ISEQ does granger cause the independent variable*

The test significant level is 5%, thus, if p-value is smaller than 5%, we can reject the null hypothesis that there is no granger causal relationship.

Table 6. Granger Causality Test Results.

Null Hypothesis	Observations	F-Statistic	p-value
UN does not Granger Cause ISEQ	129	0.2325	0.7929
ISEQ does not Granger Cause UN		0.3731	0.6894
CPI does not Granger Cause ISEQ	129	0.6728	0.5116
ISEQ does not Granger Cause CPI		1.3215	0.2704
REER does not Granger Cause ISEQ	129	0.2088	0.8119
ISEQ does not Granger Cause REER		0.2492	0.7798
OP does not Granger Cause ISEQ	129	0.3189	0.7276
ISEQ does not Granger Cause OP		0.2898	0.7489

Source: Prepared by author

From table 5 we can clearly see that all the p-value are greater than 5%. We fail to reject all the null hypotheses. Therefore, there is no granger causal relationships between the ISEQ and each macroeconomic variable at 5% level of significance. This means that in the short run, these four macroeconomic variables do not affect the performance of the ISEQ all-share.

5.4 Ordinary Least Squares Analysis

Having taken first and second order differences, the dependent and independent variables are now all stationary, as we checked with the Augmented Dickey Fuller (ADF) test. The next step is to run the OLS regression. Due to the multiple independent variables, the multi-factor regression is applied here. The equation is follows:

$$ISEQ_{diff} = \alpha + \beta_1 UN_{2diff} + \beta_2 CPI_{diff} + \beta_3 REER_{diff} + \beta_4 OP_{diff} + \varepsilon$$

Where:

$ISEQ_{diff}, CPI_{diff}, REER_{diff}, OP_{diff}$ = ISEQ prices, consumer price index, real effective exchange rate and oil prices data in first order difference

UN_{2diff} = unemployment rate in second order difference

α = the intercept term

$\beta_1, \beta_2, \beta_3, \beta_4$ = the coefficients of each independent variable

ε = the error term

The hypotheses for the t-test would be:

$H_0: \beta_i = 0\ (insignificant)$

$H_1: \beta_i \neq 0, where\ i = 1,2,3,4\ (significant)$

The significant level is 5%. If p-value is smaller than 5%, there is a significant relationship between the ISEQ and the variables. Table 7 shows the results of the OLS Multiple Regression.

Table 7. OLS Regression Results.

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0.0199	0.0117	1.6948	0.0926
UN-2diff	0.0709	0.1472	0.4813	0.6311
CPI-diff	-0.0059	0.0264	-0.2250	0.8223
REER-diff	-0.1425	0.0792	-1.7991	0.0744
OP-diff	0.1232	0.0430	2.8675	0.0049
Multiple R	0.2770			
R Square	0.0767			
Adjusted R S	0.0472			

Source: Prepared by author

Based on the above results, the R-squared value (0.0767) is low, which means this regression model has relative low predicting power. Only 7.67% of the ISEQ all-share price can be explained by unemployment rate, consumer price index, real effective exchange rate and crude oil price. Unemployment rate has coefficient value β_1 0.0709, and p-value equals 0.6311 which is greater than 5%. The results suggest that there is insignificant positive relationship between the ISEQ all-share price and unemployment rate. Similarly, consumer price index and real effective exchange rate coefficients, β_2, β_3, are -0.0059 and -0.1425, and p-values are 0.8223 and 0.0744, which indicate that there are insignificant negative relationships between the ISEQ all-share price and consumer price index, and between the ISEQ all-share price and real effective exchange rate. While the crude oil price has a coefficient β_4 0.1232, and p-value equals 0.0049 which is less than 5%. Therefore, the relationship between the ISEQ all-share price and crude oil price is positive and statistically significant.

Among the selected four macroeconomic variables, only crude oil price shows a significant positive correlation with the ISEQ all-share price. There is insufficient evidence to conclude that there is effect at the population level among the ISEQ all-share price, unemployment rate, consumer price index and real effective exchange rate. Therefore, tracking the trend of crude oil price will predict the movement of the ISEQ all-share price. If the significant level is change to 10%, then the real effective exchange rate (P-value < 10%) also has a significant impact on the ISEQ all-share.

5.5 Key Assumptions of Multiple Linear Regression

The multiple linear regression has three key assumptions: the residuals are normally distributed, the independent variables are not highly correlated to each other, i.e. there is no multicollinearity, and the regression is homoscedasticity. In order to make sure the accuracy of the OLS, we applied three supplementary tests to examine each assumption.

Firstly, we tested for the normality of the residuals. This assumption can be simply checked by looking at a histogram (Figure 3). The histogram shows that residuals are not normally distributed.

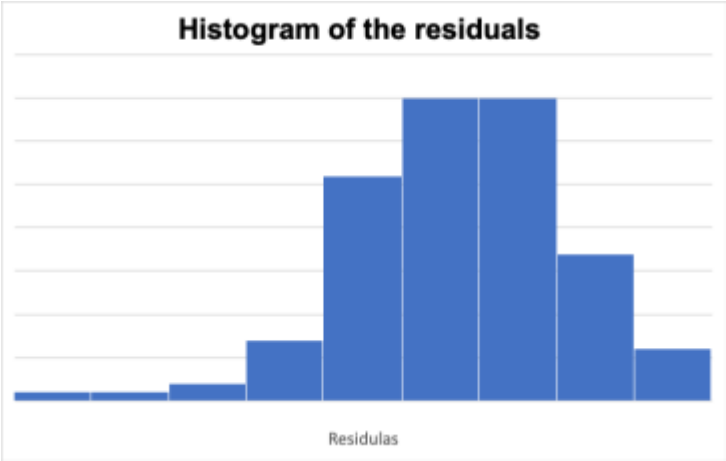

Figure 3. Histogram of residuals

A Jarque-Bera test is then applied to provide more detailed evidence of normality. This test determines the normality of the data by checking whether the data has kurtosis and skewness matching the normal distribution. The null hypothesis and alternative hypothesis are as follows:

$H_0 = residuals\ are\ normally\ distributed.$

$H_1 = residuals\ are\ not\ normally\ distributed.$

The table below shows the Jarque-Bera test results:

Table 8. Jarque-Bera Test Results.

Kurtosis	*Skewness*	*Jarque-Bera Test*	*p-value*
1.5216	-0.5049	17.3612	0.0002

Source: Prepared by author

This test bases on 95% confidence level and so the null hypothesis has been rejected with 5% level of significance due to 0.0002 is smaller than 0.05. Both graph and test result prove that the residuals are not normally distributed. The non-normal distribution of the residuals could be explained as that some of the independent variables increased or decreased more than the others. The test period is from 2009 to 2019 where the effects of both the global financial crisis

and the Irish banking crisis still exist. The unemployment rate continued increasing until the middle of 2012. In the meantime, consumer price index is fluctuated. The regression model is not fully explaining the behaviours of the variable. The other possible reason is due to the size limitation of the sample, there are only 132 data to build this model.

Secondly, the variance inflation factor (VIF) and correlation matrix are applied to look for multicollinearity the regression analysis's results. The VIF measures how much the variance of an independent variable is influenced by the correlation with other independent variables. The table below displays the VIF results:

Table 9. VIF Results.

	R Square	*VIF*
UN-2diff	0.0001	1.0001
CPI-diff	0.0830	1.0906
REER-diff	0.1044	1.1166
OP-diff	0.0433	1.0453

Source: Prepared by author

According to the VIF rule of thumb, all the VIF values are close to 1, which indicate that the independent variables are not correlated to each other. Also the results of Pearson's bivariate correlations among all independent variables indicate that there is no multicollinearity. In fact, all the correlation coefficients between two variables are all close to zero (Table 10).

Table 10. Pearson's bivariate correlation matrix.

	UN-2diff	*CPI-diff*	*REER-diff*	*OP-diff*
UN-2diff	1.000	-0.001	-0.009	-0.009
CPI-diff	-0.001	1.000	0.279	0.123
REER-diff	-0.009	0.279	1.000	0.195
OP-diff	-0.009	0.123	0.195	1.000

Source: Prepared by author

Finally, the last assumption behind OLS is homoscedasticity. To check for residuals' homoscedasticity means evaluating whether the residuals have a constant variance. This can be checked through the Breusch-Pagan heteroscedasticity test, which consists in regressing the squared regression residuals on the regression independent variables and assessing the effect of the independent variables on the variation of the error term. The hypothesis statements are as follows:

$H_0 = the\ residuals\ are\ not\ heteroscedasticity\ (homoscedaticity)$

$H_1 = the\ residuals\ are\ heteroscedasticity$

Table 11. Breusch-Pagan Test Results.

Observations	130
R Square	0.0288
degree of freedom	4
Chi-square	3.7408
p-value	0.4422

Source: Prepared by author

Based on the results above (Table 11), the p-value for the Breusch-Pagan statistic is 0.4422 which is greater than the 5% significant level. Hence, we fail to reject the null hypothesis and the residuals are homoscedastic with 95% level of confidence.

5.6 Findings and Limitations

In the very first step, all the variable are non-stationary. After changing the form of the data, all variables are stationary. The Granger causality test indicates that there is no granger causal relationship between the ISEQ all-share price and every independent variable. All four macroeconomic variables do not affect the performance of the ISEQ all-share in short run. Next, the OLS regression gives that there is a positive and insignificant ($p>0.05$) relationship between the ISEQ all-share price and unemployment rate (UN). And consumer price index (CPI) and real effective exchange rate (REER) have negative and insignificant ($p>0.05$) relationships with the ISEQ all-share price. The evolution of these three macroeconomic variables does not seem to be strongly linked to that of the stock market performance, but rather acts more independently. In the previous literatures, unemployment rate (UN) has been shown that a strong negative relationship the stock market in other European Countries (Jareno, Escribano and Cuenca, 2019). While the impacts of consumer price index (CPI) and real effective exchange rate (REER) on stock market performance are changing, different literatures suggest distinct results. The differences might be due to the vary in methodology, sample size and economic environment. Crude oil price (OP) has a positive and significant ($p<0.05$) relationship with the ISEQ all-share price. However, there is no available suitable literature to compare, crude oil price has different impacts on different stock markets. Finally, the tests results indicate that residuals are non-normality, and there is no multicollinearity and heteroscedasticity issues. Different economic structure leads to different financial investment environment. The selected macroeconomic variables unemployment rate, consumer price index and real effective exchange rate are country-wide data, and crude oil price is a global economic indicator. The tests results suggest that Irish stock market index has insignificant

relationship with its own macroeconomic indicators. The ISEQ all-share price is more sensitive to crude oil price rather than the domestic macroeconomic indicators. The Irish financial market reflects more global information rather than country-wide changes. Investors and policy makers can predict and protect the Irish stock by paying more attentions to the trends in the international market.

This study has potential limitations. First, the target study period is from year 2009 to year 2019, which is a relatively short period comparing with the existing researches. The small sample size affects the study results in certain level. The study can only get a periodic conclusion. A long-term relationship cannot be approved. Second, economic events related to Ireland which happened within this period have impacts on the results. Such as the post-crisis and Brexit. This paper does not relate these events to this study. Third, errors might exist in the sample data, because sample data is secondary data which is from third party. And the non-normality of the error terms might reduce the accuracy of the test. Fourth, when choosing the target macroeconomic variables, there is lacking prior similar research on Ireland. Hence, there is a possibility that the most suitable independent variable has not been chosen. Finally, due to the author lacks experience of conducting researches and producing academic papers of such a large size individually, the scope and depth of discussion in this paper is compromised in many levels compared to other experienced scholars.

6.Conclusion

In this paper, we studied the relationship between the Irish stock market index ISEQ all-share price and four macroeconomic variables unemployment rate, consumer price index, real effective exchange rate, and crude oil price. Monthly data is collected from the period January 2009 to December 2019. For this purpose, the Granger Causality test and OLS regression model were applied for the monthly data from January 2009 to December 2019. The Granger Causality test results indicate that there is no significant granger causal relationship between the ISEQ all-share, unemployment rate, consumer price index, real effective exchange rate, and crude oil price. OLS multiple regression model suggests that only crude oil price has a positive and significant relationship with the ISEQ all-share. unemployment rate shows a positive and insignificant impact on the stock market. Consumer price index and real effective exchange rate have negative and insignificant impacts on the ISEQ all-share. The results highlight that

the ISEQ all-share price is more sensitive to crude oil price rather than domestic macroeconomic indicators.

For further research may consider the following several aspects. First, extending the sample size so that the pre-crisis, crisis, and post-crisis periods can be studied individually. Second, including additional macroeconomic variables such as money supply, industrial production index, and GDP in order to get more knowledge about Irish financial market and macroeconomy. Third, apart from including more macroeconomic variables, non-macroeconomic factors such as political stability, control of corruption, and regulatory quality so as to provide a clearer picture of the Irish stock market. Fourth, further research could be applied on the impact of the macroeconomic variables on sectoral stock indices in Ireland. This topic could provide more information to help investors making asset allocation decisions.

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