

A Dynamic Heterogeneous Panel Estimation of the Impact of Income, Inflation and Happiness on Stock Returns

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This study examines the long-run relationships and short-run dynamic interactions between stock returns and its determinants comprising of GDP per capita, inflation and happiness, over the period 1973 to 2012. The study applies the dynamic heterogenous panel estimation techniques of Mean Group (MG), Pooled Mean Group (PMG) and Dynamic Fixed Effects (DFE) to analyse a set of macro panel data on selected OECD countries to establish the possible causal relations between these variables. The theoretical framework of this study is based on the stock returns theories of Present Value Model/Discounted Cash Flows and "Risk-as-feelings" Theory. The results of this study show evidence that income has a favourable impact on stock returns, while inflation dampens stock returns. Interestingly, the study also revealed that happiness is not significant in determining stock returns in these selected countries, indicating that the market participants are rational economic beings who always act in self-interest, making optimal decisions by trading off costs and benefits weighted by statistically correct probabilities.

JEL Codes: G100, G120

1. Introduction

This study aims to investigate the response of the equity market to changes in the levels of GDP per capita, inflation rate or happiness, i.e., to determine whether stock returns can be explained by the macroeconomic conditions in a country and its level of happiness. The stock market plays a pivotal role in the economy, as it enhances the growth of industries and businesses in a country. The stock market is closely watched by various stakeholders of the economy such as the government, various industries, the investors and the central bank of the country which pays close attention to what goes on in the stock market. Both the industry as well as the investors views the stock market as an essential entity in the economy, specifically in the financial sector.

Numerous studies have been conducted in this area, which is of interest and concern to many, both for theoretical and empirical reasons. The present value model (PVM) or discounted cash flow theory relates the stock price to future expected cash flows and the future discount rate of these cash flows, and has been applied to the long run relationship between stock prices and

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macroeconomic variables in a number of studies (Nasseh and Strauss 2000; Chaudhuri and Smiles 2004). On the other hand, the “Risk-as-feelings” theory (Loewenstein et al. 2001) posits that people’s feelings and emotions often influence their decisions, especially when such decisions involve risk and uncertainty. Wright and Bower (1992) found that people with good moods tend to make positive judgements compared to those with bad moods, revealing how changes in emotional state or happiness of investors can affect stock returns. Empirical studies on stock returns have shown how the macroeconomic factors affect stock returns (Nasseh and Strauss 2000; Chaudhuri and Smiles 2004; Ratanapakorn and Sharma 2007; Rasiah 2010), but very limited studies have been conducted on the impact of happiness on stock returns. Besides, the use of the pooled mean group estimation technique adds further to the empirical literature on the determinants of stock return. Our study is in the right direction as it contributes further to the existing body of knowledge by investigating how happiness and the economy via its economic variables affects share price movements.

Governments must emphasize on sustainable policy efforts and decision making in an effort to ensure sustainable financial and economic development takes place. Further in-depth research must be carried out to scrutinize the impact of happiness and the economy and its variables on share prices. Our study is significant as the findings will assist policy makers to make better and more inclusive financial policy decisions that would ensure sustainable financial and economic development takes place, while taking into account human happiness. This study is therefore in the right direction as it explores how human happiness and the economy determine the movements in share prices.

This paper is organised as follows. Section 2 provides a literature review of the various studies that investigate the determinants of share price movements; Section 3 explains the methodology used in this study; while Section 4 provides an in-depth empirical analysis of our findings and Section 5 concludes.

2. Literature Review

The determinants of equity share prices have been studied extensively in the past few decades. Literature has shown evidence that investors’ investment decisions have been influenced by the fundamental macroeconomic variables. While many studies have focused on developed countries, in recent times there has been an increasing interest in investigating the determinants of stock prices in the developing economies. The major studies that have been conducted on developed countries include studies done by Nasseh and Strauss (2000), Morley (2002), Kia (2003), Chaudhuri and Smiles (2004), Huang and Yang (2004), Ratanapakorn and Sharma (2007) and Somoye, Akintoye and Oseni (2009). The macroeconomic variables researched in these studies include exchange rates, interest rates, inflation, industrial production, money supply, gross domestic product (GDP), FDI inflows, private consumption and price of oil. Using the multivariate cointegration methodology in their study, Chaudhuri and Smiles (2004) found evidence of a long-run relationship between real stock price and the measures of aggregate real activity including real GDP, real private consumption, real money and real oil price in the Australian market. Their study also found that the movements in the Australian stock returns was greatly affected by the stock returns variation in the US and New Zealand markets. Nasseh and Strauss (2000) utilised the Johansen Cointegration tests in their study and documented evidence of a significant, long-run relationship between stock returns and both domestic and international economic activities in six European countries. The domestic variables include industrial production, business surveys of manufacturing orders, short and long-term interest rates, while the international variables include foreign stock returns, short-term interest rates and production. The study also utilised variance decomposition to “support the strong explanatory power of macroeconomic variables in contributing to the forecast variance of stock returns”.

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As for the developing countries, there have been several notable studies done on the impact of macroeconomic variables on stock returns. These include studies by Kwon and Shin (1999) on South Korea, Maysami and Koh (2000) on Singapore, Ibrahim and Aziz (2003); Ibrahim (2003); and Rasiah (2010) on Malaysia, Erdem et al. (2005) on Israel, Somoye, Akintoye and Oseni (2009) on Nigeria, Belaluddin (2009) on Bangladesh and Javaid (2010) on Pakistan. Kwon and Shin (1999), in their study on whether current economic activities in Korea could explain stock market returns, concluded that stock price indices were cointegrated with foreign exchange rate, trade balance, production level and money supply. In a study on the macroeconomic determinants of stock market development in a sample of Latin American and Asian countries, Garcia and Liu (1999) found Gross Domestic Product (GDP) growth, domestic investment and financial intermediary sector development to be important determinants of stock market development. Ibrahim and Aziz (2003) employed the standard procedures of cointegration and vector autoregression methods to demonstrate the existence of a long-run relationship between four macroeconomic variables (industrial production, exchange rate, money supply and price level) and the Malaysian equity price as well as substantial short-run dynamic interactions between them.

Several studies on the relationship between GDP and stock returns reveal the existence of some contradictory findings. Rasiah (2010) examined the long-run relationships and short-run dynamic interactions between the stock market and various macroeconomic variables in Malaysia over the period 1980 to 2006 by employing the multivariate cointegration methodology and discovered the existence of positive long-run relationships between real stock returns and GDP. However, Siegel (1998) found GDP to have a negative relationship with stock returns. Javaid (2010), on the other hand employed the simple regression model to investigate the impact of certain market variables on the movement of stock prices in Pakistan. It was found that earnings per share and dividends had a significantly positive impact on stock prices, while GDP did not play a significant role.

As far as the inflation-stock returns relationship is concerned, a positive relationship was found in a study by Rasiah (2010), while Geske and Roll (1983), Chen, Roll and Ross (1986), AL- Shubiri (2010) found inflation to negatively relate to stock returns. On the other hand, inflation did not play a significant role in determining stock returns in various studies by Garcia and Liu (1999), Javaid (2010), and Yartey (2010).

The literature on the relationship between happiness and stock returns is rather limited. In a study on the stock market performance and well-being in for Australia for the 2001-2012 period, Frijters et al (2015) found that happiness was positively correlated to stock returns. These findings were consistent with those revealed by Deaton (2012) in his study using the daily Gallup Survey data for the US over the years 2008–2010. Lepori (2015) examined the impact of positive moods on the demand for risky assets (proxied by the performance of the U.S. stock market) covering the 1994 to 2010 period. It was revealed that positive mood had an inverse relationship with equity returns, consistent with the mood-maintenance hypothesis.

Recent developments in the field of mood, investment decisions and stock market outcomes (Hirshleifer and Shumway 2003; Kamstra et al. 2003; Edmans et al. 2007; Al-Hajieh et al. 2011), have led to a renewed interest in how certain factors (sunshine, hours of daylight, holidays, family time, leisure, sports results, and entertainment) can trigger changes in mood or levels of happiness among the investors whose levels of optimism and/or risk aversion will change, leading to changes in portfolio choices that will impact the stock market.

The literature available on the antecedents of share prices have shown mixed results, thus motivating the present study. Aside from this, as there are very limited studies on happiness and stock returns, and the use of Pooled Mean Group technique in such studies, we were further motivated to carry out this study that we believed would contribute significantly to the policy makers

and the financial sector. The results of this study contributes to the existing debate of the determinants of equity share prices by using the pooled mean group (PMG) estimator developed by Pesaran, Shin and Smith (1999), to explore the validity of the findings of previous studies.

The following three hypotheses were tested in this study:

- H1:** Income has a positive impact on equity prices.
- H2:** Inflation has a negative impact on equity prices.
- H3:** Happiness has a positive impact on equity prices.

3. Methodology

3.1 Sources of Data

The mean group, pooled mean group and dynamic fixed effects techniques were utilized to analyse the long run and dynamic relationship between share price movements and its various determinants comprising of happiness, income and inflation rate; that are believed to impact share prices using the annual data of ten countries for forty years from 1973 to 2012. The ten countries involved in this study are listed in Table 1.

Table 1: List of countries

Belgium	Japan
Denmark	Luxembourg
France	Netherlands
Ireland	United Kingdom
Italy	USA

The share price data used in this study was sourced from the IFS data published by the International Monetary Fund (IMF). The life satisfaction or subjective well-being index is used as the proxy to represent happiness in this study (see Rasiah et al. 2013). The secondary data for happiness for all ten countries were collected from the World Database of Happiness (Veenhoven, 2007), based on the following question: *“Here is a ladder representing the ‘ladder of life’. Let’s suppose the top of the ladder represents the best possible life for you; and the bottom, the worst possible life for you. On which step of the ladder do you feel you personally stand at the present time?”* with answers based on ratings ranging from a scale of 1 to 10.

The GDP per capita and inflation data used in this study were sourced from the World Development Indicators published by the World Bank.

3.2 The Estimating Model

The model specification used to derive the equation for equity share prices was based on the theoretical work of Nasseh and Strauss (2000), Maysami and Koh (2000), Ibrahim (2003), Al-Shubiri (2010), Rasiah (2010), and Nirmala and Sanju (2011). Following their model specifications, we augment the model with the happiness explanatory variable, thereby postulating the following empirical model of the determinants of equity share prices as per equation 1 shown below:

$$\ln ShareP_{it} = \beta_{0i} + \beta_1 \ln Happy_{it} + \beta_2 \ln GDPC_{it} + \beta_3 \ln Inf_{it} + \varepsilon_{it} \quad (1)$$

where *ShareP* is the dependent variable representing equity share prices, β_{0i} is the country-specific intercept, *Happy* is the average self-reported happiness over the period 2000 to 2012, *GDPC* is the

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income per capita; Inf is the inflation rate, ε_{it} an error term, and i represents the country under analysis while t refers to the time period in years, with $i = 1, 2, \dots, N$, and $t = 1, 2, \dots, T$. For estimation, all variables were transformed into natural logarithm.

The independent variables in our study comprised on income (GDPC), inflation and happiness. We justify the use of these three variables as income and inflation are often used as control variables in studies of the macroeconomic determinants of equity price, based on the literature reviewed. As for the inclusion of happiness, as very limited studies have examined the behavioral aspect of the stock market participants, our study intends to make this contribution to the body of knowledge by investigating how happiness (positive emotions) impacts equity prices.

The equity share price equation analysed in this study as shown in equation (1) above has been estimated for ten OECD countries over the period 1973-2012. The justification for using the sample of ten countries is due to the limited availability of happiness data. Only these ten countries had long time-series data needed for carrying out the pooled mean group estimation technique. The pooled mean group estimator (PMG) introduced by Pesaran, Shin and Smith (1999) is the main estimator employed in this study. The PMG technique estimates our study's dynamic heterogeneous panel model which contains a homogeneous long-run coefficient, while allowing the short-run adjustments and convergence speeds to differ across groups in the cross-section. With a given data on time periods of $t = 1, 2, \dots, T$ and cross-sections of $i = 1, 2, \dots, N$, the PMG is generated from a generally-specified Autoregressive Distributed Lag (ARDL) (p, q, q, \dots, q) model as follows:

$$\ln ShareP_{it} = \sum_{j=1}^p \Omega_{ij} \ln ShareP_{i,t-j} + \sum_{j=0}^q \phi_{ij} X_{i,t-j} + \mu_i + \varepsilon_{it} \quad (2)$$

Where $X_{i,t,j}$ is the ($k \times 1$) vector of explanatory variables for group i which comprises of Happiness, GDP per capita and inflation; while μ_i represents the fixed effects; the coefficients of the lagged dependent variables, Ω_{ij} , are scalars; and ϕ_{ij} are $k \times 1$ coefficients vectors. As the T is large (40 years) in this study, we can estimate the model for each group separately.

The main estimator of our study is the Pooled Mean Group (PMG) estimator. However, for comparison purposes, this study will also show the results of the analysis using the Mean Group (MG) and the Dynamic Fixed Effects (DFE) estimators. There are indeed good reasons to believe in common or homogeneous long-run coefficients across these ten selected OECD countries, given that these economies are highly likely to show similar behavior in terms of their access to common technologies and financial resources, and having significant opportunities for intensive intra-trade and foreign direct investment.

With the PMG procedure, we estimated the following restricted version of the happiness equation on annual data for 10 OECD countries from 1973 to 2012:

$$\Delta \ln ShareP_{it} = \phi_i (\ln ShareP_{i,t-1} - \beta_{0i} - \beta_{1i} \ln Happy_{it} - \beta_{2i} \ln GDPC_{it} - \beta_{3i} \ln Inf_{it}) - \gamma_{11i} \Delta \ln Happy_{it} - \gamma_{21i} \Delta \ln GDPC_{it} - \gamma_{31i} \Delta \ln Inf_{it} + \varepsilon_{it} \quad (3)$$

where $ShareP$ is the equity share prices in a given country, $Happy$ is the average self-reported happiness in a given country, $GDPC$ is real GDP per head of population and Inf is the rate of inflation. The subscripts indicate country (i) and time (t) and ε is the usual error term. In order to control for business cycle fluctuations, the short-run dynamics have been included in our study.

4. Results and Discussions

It is important to initially display the properties or characteristics of the data used in this empirical analysis prior to estimating our model on the determinants of equity share prices. The descriptive statistics of all variables used in this study are shown in Table 2, with observations in an annual or yearly format.

Table 2: Descriptive Statistics for Key Variables

Variable		Mean	Std. Dev.	Minimum	Maximum	Obs.
LShareP	overall	3.66	0.999	1.040	5.310	364
	between		0.383	3.095	4.335	
	within		0.938	1.387	5.442	
LHappy	overall	1.922	0.130	0.940	2.128	398
	between		0.117	1.723	2.093	
	within		0.066	1.138	2.064	
LGDP	overall	10.34	0.344	9.461	11.382	400
	between		0.219	10.116	10.851	
	within		0.274	9.638	11.016	
LInf	overall	2.079	0.416	1.141	3.320	399
	between		0.178	1.778	2.347	
	within		0.380	1.060	3.572	

Having shown the basic characteristics of the data, a graphical representation of the impact of happiness on share prices is shown in Figure 1. There is a very slight positive relationship between happiness and share prices as shown by the slightly positive slope of the line.

Figure 1: Graphical Relationship between Share Prices and Happiness

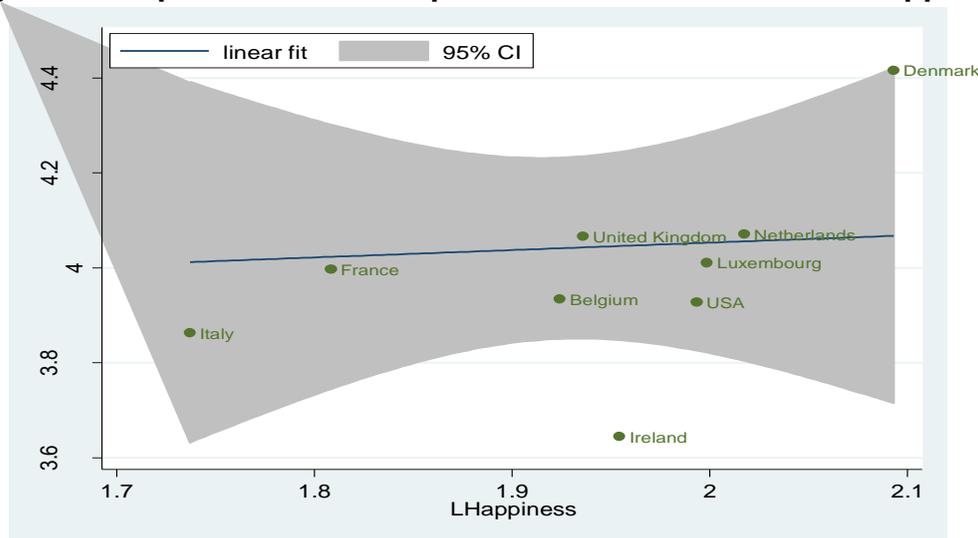


Figure 2, on the other hand, depicts the existence of a positive relationship between share prices and GDP per capita, while Figure 3 shows evidence of a negative relationship between share prices and inflation.

Figure 2: Graphical Relationship between Share Prices and Income

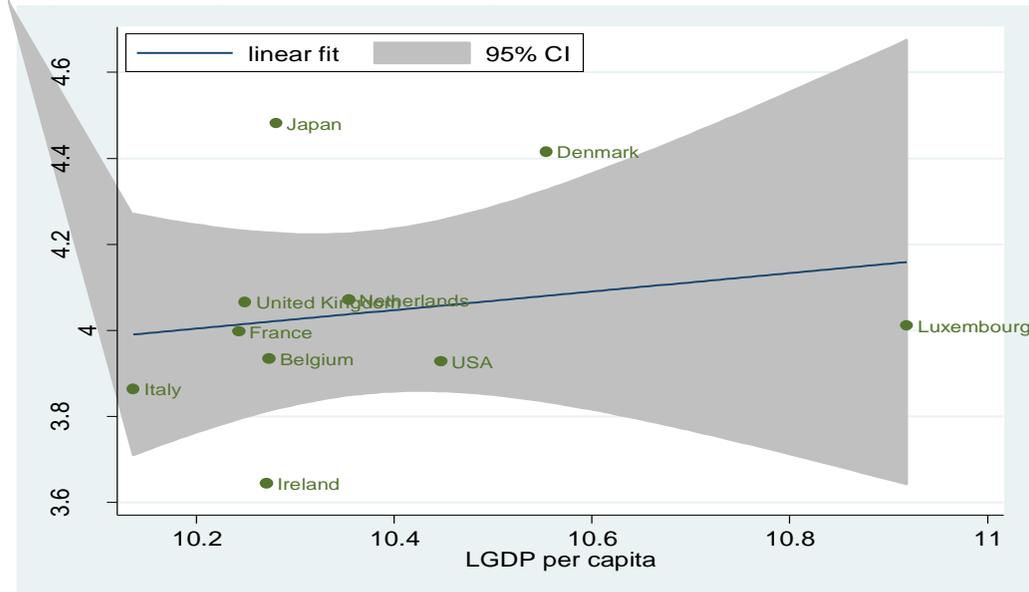
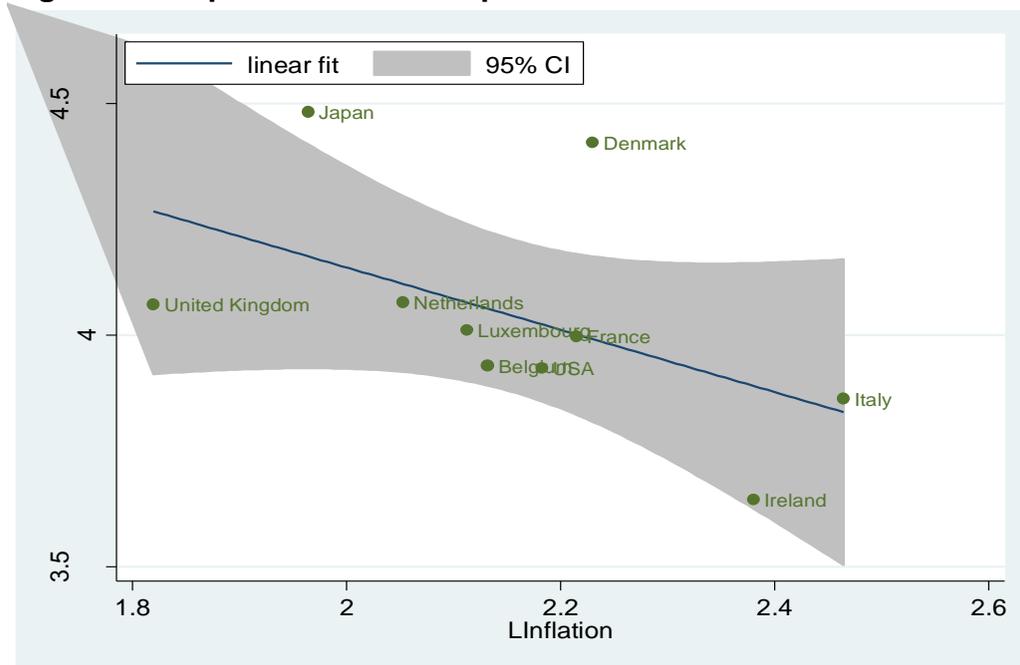


Figure 3: Graphical Relationship between Share Prices and Inflation



We also examined the possibility of multicollinearity between the independent variables and found that the pair-wise correlation values between GDP and Happiness and between Inflation and Happiness were below 0.4, indicating no multicollinearity problem. In order to confirm the relationships between share prices and its explanatory variables, we proceeded with a more meaningful and deeper analysis by estimating the relevant MG, PMG and DFE estimators in equation (3).

In order to ascertain whether the estimated equations are actually cointegrated, we would first need to determine the stationarity of the variables being studied. The Im, Pesaran and Shin or IPS (1997, 2003) test is used to verify for the presence of unit roots in our panel data series. The results are shown in Table 3.

Table 3: Im-Pesaran-Shin (2003) Panel Unit Root Test

Variable	Level	First Difference
LShareP	-0.686	-8.592 ***
LHappy	-0.983	-9.850 ***
LGDP	-0.433	-6.464 ***
LInf	-0.738	-4.888***

Notes: The asterisks ***, **, and ' indicate the rejection of unit root null hypothesis at 1%, 5%, and 10% of significance levels, respectively.

The panel unit root above takes the presence of a unit root (or non-stationarity) as the null hypothesis. The results for the IPS test confirms that the null hypothesis of the unit roots for the panel data of the share price, happiness, GDP per capita and inflation series cannot be rejected in level. These results strongly indicate that the variables in level are non-stationary and stationary in first differences at a 1% level of significance. Therefore, all variables in this study are I(1); that is, integrated of order 1. Since all variables are stationary at first difference, we proceed with the dynamic estimation techniques for the three alternative pooled estimates MG, PMG and DFE.

Table 4 displays the short-run and long-run coefficients as well as the error-correction terms using the MG, PMG and DFE estimation techniques. The model employs the explanatory variables, comprising of happiness (lhappy), income level (lgdpc) and inflation (linf) to show its impact on equity share prices.

The results display several important points. Firstly, to show the robustness of the data, we looked at the signs and magnitude of the long-run coefficients and found similarity across the three estimators. Secondly, we take note that all three explanatory variables (lhappy, lgdpc and linf) provide significant long-run coefficients; indicating that, on the whole, the variables chosen can be considered the antecedents of equity share prices.

It appears from Table 4 that the values of the error correction coefficients for all three estimation techniques are significant and negative, thereby indicating the existence of cointegration (long-run) among the considered variables. The results generally illustrate the existence of a significant and positive long-run coefficient for income, while inflation has a significant and negative long-run coefficient. Happiness is also found to have a negative long-run coefficient but it is not significant, based on the PMG model.

Table 4: Estimated Long-run Coefficients and Speed of Adjustment

	(MG)	(PMG)	(DFE)
Dependent variable: Ishareprice			
Long-run coefficients			
lgdpc	3.143*** (3.65)	3.325*** (9.43)	2.090*** (3.84)
linf	-0.373 (-1.30)	-0.790*** (-4.50)	-0.905* (-2.47)
lhappy	2.696 (0.84)	-0.365 (-0.44)	0.925 (0.53)
Error correction coefficient	-0.312*** (-6.38)	-0.169*** (-3.70)	-0.0991*** (-4.24)
Short-run coefficients			
D.lgdpc	3.373*** (4.95)	3.609*** (5.60)	3.110*** (7.62)
D.linf	-0.150* (-2.26)	-0.132** (-2.97)	-0.110* (-2.08)
D.lhappy	-0.279 (-0.41)	0.0964 (0.33)	-0.0246 (-0.11)
Constant	-12.73* (-2.06)	-4.796*** (-3.74)	-1.767* (-1.99)
No. of countries	10	10	10
Observations	350	350	
Hausman test		0.2737	

Notes: 1. The numbers in parentheses are t statistics.

2. The asterisks ***, **, and * indicate the rejection of null hypothesis at 1%, 5%, and 10% of significance levels, respectively.

As a consequence of the diverse nature of the three estimation techniques used, differences exist in the results shown in Table 4. The MG estimation method is the least restrictive procedure as it allows for heterogeneity of all parameters, resulting in potentially inefficient estimates, while the PMG method allows the intercepts, short-run coefficients and error variances to differ, while imposing long-run homogeneity to all slope coefficients. The DFE is the most restrictive in nature, as it only allows the intercepts to vary across countries.

Furthermore, the joint Hausman test was employed to test the long-run homogeneity and the results once again displays the consistency and efficiency of the PMG estimator. Since the Hausman test cannot reject the null hypotheses of the homogeneity of long-run coefficients, the PMG estimator is preferable to the MG estimator. With the PMG estimator being the most consistent and efficient estimator, our discussion will focus on the results of the PMG estimation.

As noted, our study found GDP to have a significantly positive relationship with equity share prices, concurring with several prior studies (Ibrahim 2003; Al-Shubiri 2010 and Yartley 2010). The negative impact that inflation has on equity share prices is expected. Studies on the inflation-share price link have mostly shown evidence of a negative relationship (McCarthy et al. (1990) and Al-Shubiri (2010), concurring with our findings. Financial markets and stock returns are adversely affected as inflation reduces real asset returns and increases credit market frictions. The results of

Nasseh and Strauss (2000); and Ratanapakorn and Sharma (2007), however, contradicts with our findings.

Our findings show evidence of the negative long run impact of happiness on stock returns, although it is found to be not significant. The negative relationship between happiness and stock returns was also revealed in the findings of Hirshleifer and Shumway (2003); and Cao and Wei (2005). Our results also show that, in the short run, happiness is positively related to stock returns, although the relationship is not significant.

As table 4 indicates, based on the PMG results, it is evident that the error correction term is negative and the magnitude of this disequilibrium correction is relatively moderate (-0.169). An analysis of the results indicates that long-run causality does exist between the regressors and the regressand, as seen in the significant error correction term. The speed of adjustment or error correction term reveals that only approximately 17% adjustment or correction takes place in one year.

5. Conclusion

This study explored the antecedents of stock returns and upon perusing the wide array of literature and the findings of this study, it is clear that the antecedents of stock returns are somehow dissimilar using different sets of data, in different types of countries, in different parts of the world and during different periods of time. Our study shows evidence that income has a positive relationship with stock prices, while inflation relates negatively to stock prices. Happiness is found to relate positively in the short run but negatively in the long run, though not significantly, reflecting the possibility that in the short run, the higher the levels of happiness, the higher the demand for stocks, thus causing stock prices to increase. However, in the long run, any further increases in happiness will bring about a drop in stock prices.

There exists ambiguity in the results of the past studies on the economic determinants of stock returns. Our research findings are different from several previous studies, in that we found GDP to positively relate to equity share prices, which contradicts with the findings of Siegel (1998). As for inflation, our findings of a negative inflation-stock returns relationship contradicts with the findings of Nasseh and Strauss (2000); and Ratanapakorn and Sharma (2007). Our findings, therefore sheds light on the ambiguous findings of past studies, by contributing further evidence to the body of knowledge in this field of study.

This study is indeed significant as it provides valuable insights for governments and policy makers to recognise the some major factors that would lead to higher stock prices. It is imperative that countries' develop appropriate and inclusive strategies to effectively achieve their objectives of sustainable development with higher levels of happiness. The findings of this study show the significant role played by income in stock market development. It is important to initiate policies to foster economic development as countries liberalize their financial systems. Our study also reveals the negative impact that inflation has on the stock market, implying the importance of governments in control prices from spiraling persistently. Our findings of the insignificant impact of happiness on the stock market, does reveal to us that as far as these OECD countries are concerned, how happy people are does not matter as far as equity prices are concerned. These findings certainly do provide some contribution to the rather limited body of knowledge in the happiness-stock returns area.

While the findings of this study are important for policy making, there are limitations to this study. Our study was conducted using data for ten countries for a period of forty years. Therefore, it may

not be totally representative of the antecedents of stock prices over a wider range of countries. It is also important to include other regressors in our study to further enrich the findings. Yet another limitation is that the happiness variable is measured based on one survey question. While this survey question has gone through substantial validity and reliability test, it would be good to use other well-being variables such as Happy Planet Index to strengthen our findings. This can be a suggestion for future studies.

Despite the limitations mentioned above, the findings of this study does contribute to the existing body of literature on stock returns and can be used to assist short-term and long-term investors to make optimal portfolio choices by developing strategies based on the precise modelling of the relationship between stock returns and various economic factors.

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