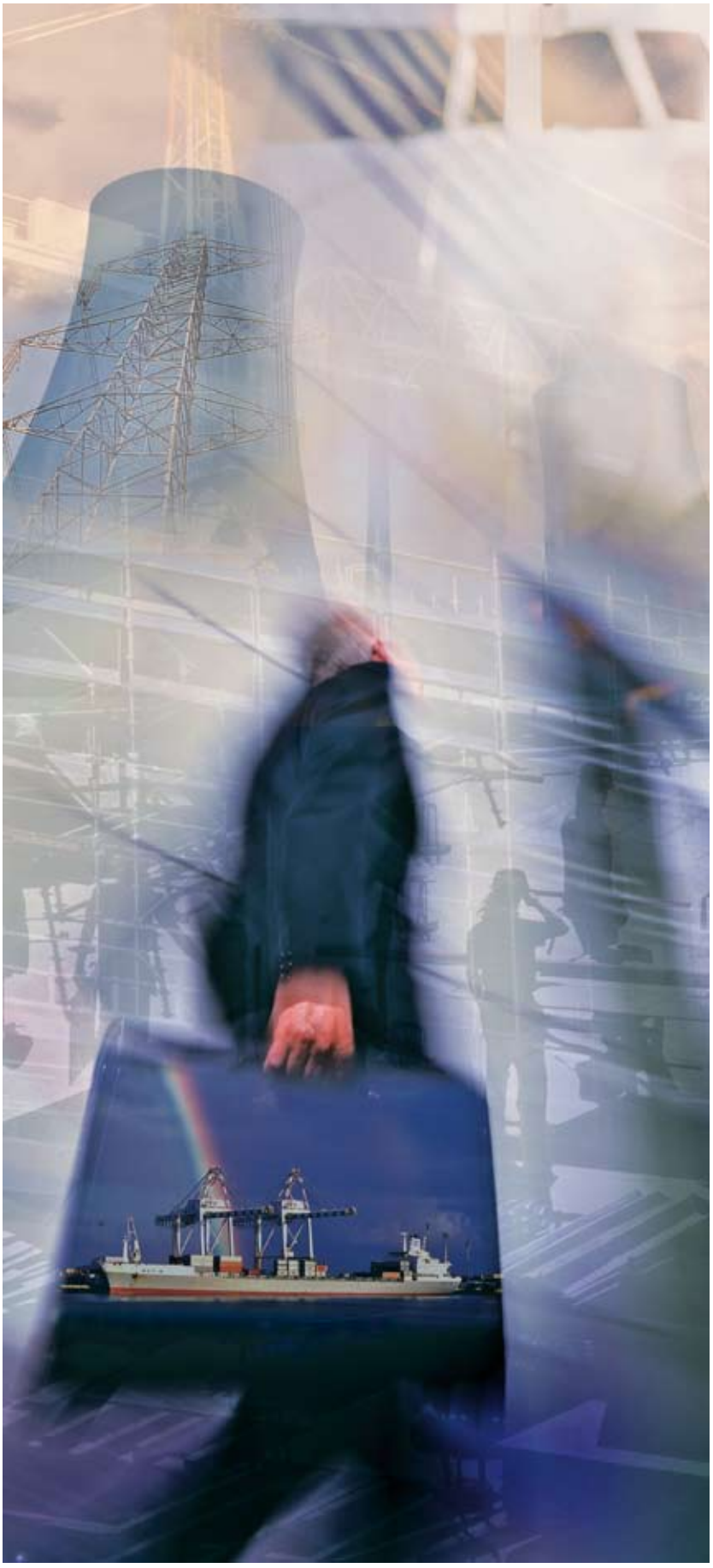

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The Economic Society of Australia warmly welcomes you to the Gold Coast, Queensland, Australia for the 37th Australian Conference of Economists.

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THE IMPACT OF MACROECONOMIC VARIABLE AND DEMOGRAPHIC STRUCTURE ON SHARE PRICES—THE CASE OF NEW ZEALAND

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Short Running Title: Baby boomers and share prices
JEL Code: G23; J10; F49
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Abstract

This paper uses quarterly time series data to investigate the impact on New Zealand share prices (from 1990 to 2006) of macroeconomic variables and demography. Following from Poterba (2001), real GDP, interest rates, inflation and the housing price are used in the model. *Co-integration* and *Error-Correction mechanisms* show the specified models to be robust, the variables under study are co-integrated and long -run relationships are defined between variables. During the 16 year review period, NZ share prices were significantly affected by demography—in particular, numbers in the 45-65 age category. The findings of this study are significant and important—this is the first attempt to quantify the impact of demographic changes (e.g. baby boomers) on share prices in New Zealand. High growth in the NZ share market, its growing integration with the global economy make it an important part of the rapidly growing Asia-Pacific region and increase the importance of this study in providing essential information for policy makers, global investors and financial institutions.

JEL Classification G23; J10; F49.
Keywords: Stock-prices, *Baby Boomer*, Demographics, Macroeconomics

1. Introduction

New Zealand population structure, as in other developed countries (DCs) is a major concern for the policy makers, as the ratio of working population (those aged 15–64 years) to those over 65 years, is declining rapidly (see Table 1a and 1b). Baby-boomers (born after World War II) have had, and continue to have, an important effect on the New Zealand economy. Currently in New Zealand, the population over 65 years of age, counts for 1 in eight—with a sharp increase expected after 2030 that will shift that ratio to one in four. This sharp increase in the ratio of retired people to the working age group will inescapably lead to a substantial future welfare and super-annuation cost. At present the net cost of providing superannuation is 3.4 percent of GDP while the estimated figure for 2030 and 2050 is expected to rise to, respectively, 5.6 and 6.9 percent of GDP (New Zealand Superannuation Fund (2007)).

Although there may be significant variances between regions and population groups, it is the sum total of demographic change that drives the national outcome. The aging of the populations of New Zealand and most other nations arises from two

sources: 1) fewer people are being born; 2) people are living longer. Specifically, in 1950-52 the life expectancy for males at birth was: 67.2; by 2000-02, it had risen to 76.3 years. In 1950-52 the life expectancy for females at birth was 71.3; by 2000-02 it had risen to 81.1years. For the same time periods, life expectancy at age 65 for males and females, respectively, increased from 12.8 to14.8 and 16.7 to 20.0 years. Similar increases have occurred in Australia, USA, and UK (Statistics New Zealand). The effects of changing demographic structure are extensively researched in modern economics and finance literature—it has significant implications for financial markets and consumption, via influences in labour markets, dependency ratio, savings and investments, capital accumulation, asset returns, capital flows, demand for assets (financial and non-financial), economic forecasts and policy decisions.

The effect of demographic change on stock market prices has instigated much concern (by financial economists) over potential market meltdowns as baby-boomers look to retirement and become less risk tolerant—the expected shift to lower-risk securities may cause turmoil and have far reaching consequences. However, the process of how demographic change impacts on investment decisions (and, thus, the stock market) has attracted little empirical research. Thus, the nature and timing of this type of study is likely to be exceptionally useful to New Zealand policy makers—who are currently making major changes to New Zealand's superannuation scheme and should consider such questions as, will ageing baby boomers:

1. Withdraw retirement savings to focus on fixed-income assets or less volatile housing?
2. Via the above withdrawals, spark a supply-side financial melt-down?
3. Raise/lower the equity premium?

The aim of this paper is to test if there is a long run relationship between stock prices and relative numbers in the 45 to 64 age category. This study is conducted via co-integration tests and estimating error correction models (ECM) for quarterly data from 1990 Q1 to 2006 Q4. The effects of GDP, interest rate, inflation, housing prices and the 45-64-age cohort on stock prices were considered. In addition, the superannuation fund was initially included to examine the potential effect of super-fund withdrawals on share prices but was found not to be significant.

In the study: Section 2, discusses the theoretical foundation, literature review and the importance of the study; Section 3, outlines the study's methodology, data and findings; Section 4, concludes the paper and gives the associated policy implications

2 Theoretical Foundation, Literature Review, NZ Stock Market and the Importance of the Study

The theoretical linkages between stock prices and macroeconomic variables and the demographic changes, and the importance of the study are discussed in this section.

Franco Modigliani, Richard Brumberg and Albert Ando in the literature on Life Cycle Hypothesis, in a series of articles in 1950s and 1960s states that people's consumption and investment patterns differ at different stages of their life. Friedman's (1957) literature on permanent income, Modigliani's contribution on lifecycle theory of savings (see Modigliani and Brumberg, (1954) and Ando and Modigliani, (1963)) and in 1986 Modigliani's empirical evidence in support of this theory, supported the view that consumers smoothing consumption over time to maximize their lifetime utility. According to these theories, the stages are that: young households do not invest much because they do not hold much financial wealth; middle-aged household are the most prominent investors; and old households again do not invest much because they have less time to recoup potential losses and enjoy the fruits of their investments (Bakshi & Chen, 1994; Goyal, 2002; Wilson, Malik and Hettihewa 2006). Davis (2003) and Blake (2002) suggest that the pooling of funds have made equities more attractive and accessible and in turn increase stock markets liquidity.

Mankiw and Weil (1989) and Baksi and Chen (1994) studied this phenomenon in the USA and found that housing prices during 1970 and 1980 has been increased when the baby boomers were in their age20s and 30s.

A common adage attributes the equity boom to Baby Boomers, as mandatory savings (e.g. superannuation, in Australia) were heavily invested in stock markets. As a corollary, it is generally expected that a fall in asset prices will occur as the Baby Boom generation reaches retirement. Shifting risk-tolerance (*Life Cycle* Hypothesis) is expected to encourage Baby Boomers to withdraw from retirement savings, as their pension plans mature and to switch to fixed-income assets[3]; and this will put supply-side pressure on the stock market (Siegel,1998).

The impact, on the stock market, of ageing households becoming relatively more risk averse has been examined by researchers Seigel (1998); Brook (2006); Wilson, Malik and Hettihewa (2006); Early investigations which examined the general equilibrium

[3] To better match their liabilities.

theory and Life Cycle Theory in light of baby boomers' retirement and the impact of stock market include Poterba (2001) and (Abel (2001)). A positive relationship between asset demand and price dividend ratio was substantiated in early 2000s with empirical evidence by researchers (see Poterba 2001 for details). There were also counter-arguments, as both demand and supply factors are to be examined with time differences in order to achieve a clear-cut inference. The high growth in the stock market in the early 1990s in developed nations occurred during the high economic growth era and also when the baby-boomers were in their high earnings/savings years Dent,(1998); Sterling and Waite, 1998. Determinants of stock prices and returns can differ for many reasons—e.g. differences in regulations, financial market structures (Kwon & Shin, 1999)—making empirical research on this issue important (Estella and Hardovelis, 1991; Hardovelis, 1987; Keim, 1985; Litzenberg & Ramaswamy, 1982) and is made more necessary by the apparent positive relationship between over-all economic growth and stock prices (Chen (1991)).

According to the General Equilibrium Model, performance in the macro-economy and its income structure should be related to asset returns. The relationship between stock prices and macroeconomic performance is empirically tested and validated in the United States (Brock (1982); Chen, 1991; Chen et al., 1986; Cox, Ingersoll and Ross, (1985); Fama, 1970, 1990, 1991; Fama, 1991; Huang & Kracaw, 1984; Kwon & Shin, 1999; Lucas (1978); Pearce & Roley, 1998; Wei & Wong, 1992) using variables such as production rates, productivity, growth in gross national product, unemployment, interest rates, inflation, money supply, current account, exchange rates, the past and current production rates, the expected productivity of capital and the uncertainty of the production technology.

Empirical research on the relationship between demography and stock prices have yielded mixed results. Poterba (2001), examining the period 1926-1997, was not able to find a robust relationship between demographic structure and stock returns. Thus, while changes in age structure may affect asset demand, they may be too small to be detected while other determinants are more powerful.

A quantitative model of how retiring baby boomers (i.e. with their changing risk preference and financial objectives) will impact financial markets will be of enormous importance to policy makers. The time period of the Boomers coming into retirement age varies from country to country—Australia's baby-boomer leading-edge

turned 60 in 2002 (Wilson, Malik and Hettihewa, 2006); in New Zealand, the oldest baby boomer will reach 60 in 2010.

In developed economies, the related issue of rising *old-aged-dependency ratios* is equally important. In particular, do retirees sell particular types of assets as they retire and, as there are fewer domestic young savers to buy those assets (Figure 1), will a rising supply and falling demand for those assets cause a price meltdown—or will demand for those assets from other parts of the world buoy the market or will other (non-demographic) variables that impact on the share market. Essentially, what impacts on the share market should planners expect from the aging baby boomers?

Further, if an equilibrium imbalance occurs, what corrective mechanism (if any) should be planned to restore stability to domestic share markets? This study addresses some of these important questions and suggests future research.

(Insert Figure 1 here)

Similar results to those in Figure 1 are found for most developed countries. In early 1990s, baby boomers in developed nations saved a significant amount for their retirement (Wilson; Malik and Hettihewa 2006) by investing in many different asset types—e.g. fixed income, high-growth, growth-financial, and housing (traditionally seen as being less risky and more secure). It is commonly thought that, as they retire, the baby boomers will start to liquidate their investments to finance themselves. The vital questions centre on: which type of assets will be liquidated and what happens to the economy as baby boomers start retiring in large numbers and changing the mix of their investment assets? Researchers found that in other developed nations (Wilson; Malik and Hettihewa, 2006), retiring baby boomers prefer to sell volatile assets and to re-invest in more stable assets. Important policy issues for consideration centre about the following questions:

1. How the stock market will be affected by changing baby-boomer investment behaviours?
2. What assets will baby boomers want/need to liquidate?
3. To whom will the baby boomers sell the assets they liquidate?
4. What prices/returns will the baby boomers get on the assets they liquidate?
5. Will retiring baby boomers have enough secured savings and/or are existing superannuation/pension plan is sufficient for their retirement needs?

While economies with a stable population growth and age distribution should not expect domestic pressures on their capital markets—as the selling of shares will tend to be counter-balanced by the buying process. However, if *old-age dependency ratio*[4] rises there will, by definition, be fewer young savers to buy assets being sold by retiring baby boomers and this should negatively impact the domestic capital markets and (with globalisation) those negative effects are likely to spill-over into the markets of nations with stable population growth and age distribution.

New Zealand Stock Market: In the last decade the stock market has grown rapidly in most developed countries—with reference to other OECD countries, N.Z has a low market capitalisation measured against GDP indicating it is relatively a small market

(insert figure 2 here)

Comparing the NZ stock market capitalisation Macmillan found differences between the Australian capital market and that of New Zealand (NZ Treasury 2007). In 2005, Australia' market capitalisation is 151 percent of GDP and that of NZ is 42 percent of GDP. However a few years ago in 1994, New Zealand and Australia had similar levels of stock market capitalisation (60 percent of GDP). Supporting market changes occurred in the both markets such as financial deregulation, privatisation of government assets, though in different time frames. In addition to these changes, the introduction of compulsory retirement savings helped support the Australia market to grow much faster. Low capitalisation is also seen as being partly due to strong links between Australian and NZ markets—including bi-national operations in Australian listed companies. This may also provide some avenues for future research on the issue of spillover effect of a market meltdown in NZ on Australian capital market (Gizycki and Lowe 2000).

However, the recent introduction of KiwiSaver scheme by the NZ government and a reduction in taxation of investments, have stimulated household savings and, in turn, may encourage investment in financial assets including stock market.

Overall Capital Markets in DCs: In DCs, this high level of market activities has occurred in a period marked with robust economic conditions, which also

[4] Old age dependency ratio is defined as the number of people aged 65 and over divided by the working population (those aged 20 to 64).

coincided with the Baby Boomers phasing into the prime earning/savings years (Dent, 1998; Sterling and Waite, 1998). During early 1990 to 2000, with the remarkably high growth it is important to find out the exact direct effects of this increase in stock prices as the economies in those countries were sound most of the time during this time period. In Australia, in addition to the above reasons, the introduction of mandatory savings (Eslake, 2000) also enhanced growth in capital markets. Poterba (2001) predicted that there may be a decline in the stock prices due to "asset market meltdown hypothesis"—he examined the effect of demographic variables on stock market and returns found weak effects on other asset prices and strong effect on stock prices and some evidence of positive relationship between projected asset demand and price dividend ratio. Contrary to this, Abel (2001) found that, "the continued high demand for assets by retired baby boomers does not attenuate the fall in the price of capital". Poterba and Able ignored other macroeconomic variables, which may have significant effects on stock prices.

The relationship between macroeconomic variables and stock markets has been well researched over the last few decades. Authors have written extensively on the effects of interest rates, inflation, money supply, industrial production, current account and exchange rates on stock prices. Early studies, which examined the relationship between macroeconomic variables and stock markets before Chen's (1991) use of a robust model to come up with the three way relationship, include Kracaw (1984 and 1988), Hardouvelis (1987), Pears and Roley (1987) and Fama (1990). Although the results vary, it is generally accepted that stock markets rationally signal significant changes in real activity.

While the baby boomers in 1990 were at the doorstep of their prime earning/savings years, many DC economies were, during this period, characterized by declines in aggregate savings. Bakshi and Chen (1994) were unable to find specific evidence that changes in 45-64 age category (considered to be the prime savers, and investors in equities) explained this relationship. Bateman, Kingston and Piggot (2001), suggest that the declining savings rate is attributable to increased indebtedness of households reacting to the boom in housing prices, measurement issues and the aging population.

Many DC governments attempted to implement a saving regime to support the future retirement of their aging populations. The US Government implemented the

401(k) savings plan in 1981[5] to allow individuals to provide for their future retirement. Compulsory Superannuation in Australia came into effect in 1992, but had existed in different forms since the 1980s. A considerable percentage of the super funds are invested in stock markets. The US plan works similar to Australia's Superannuation system, individuals have the option to have a portion of their before tax pay check deducted and placed into a 401 (k) plan, just like Australia there are numerous tax advantages. However, unlike Australian Superannuation it is not a compulsory system (Wilson, Malik and Hettihewa, 2006).

The importance of this study:

The importance of this study arises from how aging populations are increasingly raising issues for developed countries. With the level of share market capitalisation increasing and an increased level of capital raising on the market since 1992, it is essential for global investors to understand the demand and supply sides of share prices in the global economies—especially, emerging fast-growing new markets, like new Zealand, which are seen as low-political-risk destination for investment capital.

As with the high growth from China, India, Russia, Brazil and with the high demand for their major exports, the increasing use of managed funds as investment vehicles has grown substantially, for this reason so too has the level of investment in the share market. This has proved true for many countries; Australia currently has (USD) $689,256 million in managed funds compared with December 1988 of (USD)$161,682. In Australia the market capitalisation has seen a growth of approximately 213%[6] since 1992, indicating the importance of the Australian share market not only in the highly growing Asia Pacific region but also in the global economy. Being closer to this high growth Australian market, NZ has a high potential for future growth and it is important to consider the current phase of growth in its capital markets—including any probable impacts from its changing demographic structure.

With the deregulation of financial markets in the early 1990's and the increasing level of globalisation, the NZ market has become dependant on international investment for much of its economic growth. With the close proximity

[5] www.401k.com/401k/about/basics.htm
[6] ASX Statistician

and strong international trade ties to the Asian Pacific Region and the strong political and economic alliance with the USA, the NZ markets have become interdependent. While the dependence varies in degree between each nation, NZ's increasing level of growth and movement of funds is of interest to both the Asia Pacific and the USA. With NZ having a growing capital market with strong political stability, it opens the door for the potential expansion of its capital markets, for this reason the NZ market may become more attractive to many international investors as an investment region with growth prospects.

Although NZ stock market has appeared to be buoyant and dynamic with investment trends of the past decade, it is important to examine its future stability with the coming of retirement for many in the Baby Boomer generation. This paper provides valuable information to the investors both national and global with an opportunity to discover areas of growth for investment purposes in the coming future.

3. Model, Data and Findings

The Model:

In light of the above discussion the following long run cointegration relation is specified for the quarterly data (equation (i)):

$$\ln SP_t = \hat{a}_0 + \hat{a}_1 \ln NGDP_t + \hat{a}_2 \ln INT_t + \hat{a}_3 \ddot{A} \ln CPI_t + \hat{a}_4 \ddot{A} \ln DEM_t + \hat{a}_t \quad \text{---(i)}$$

Where, lnSP= natural log of NZAll share price index, lnRGDP=natural log of the real gross domestic product, lnINT=natural log of the interest rates, lnCPI= the natural log of the consumer price index and lnDEM= first difference of the natural log of the demographic variable[7]. Superannuation assets (including assets in private trading corporation shares and financial sector shares, but excluding assets in unit trusts) were

[7] ln*DEM* is integrated of order two therefore we have used the first difference which is integrated of order one. Hence all the series are non-stationary and the standard regression analysis may produce spurious results. However, most series may be made stationary by differencing the data in the first instance. Once the series are made stationary (by appropriately differencing them), they can be used in regression analysis. But the drawback of this method is the possibility of losing long-run information in the variables.

initially included in the analysis but removed when found to be statistically unimportant and insignificant. All calculations were performed using the econometric package EViews, version 6.1 .

Data:

Time series data was obtained on share prices from NZ stock Exchange (NZX) and per the DX Data Series and OECD Main Economic Indicators Database: money supply, real and nominal GDP, interest rate, exchange rate, and superannuation assets. The time series on demography are taken from Statistics New Zealand various issues. All of the quarterly observations span from 1990 Q1 to 2006Q4.

The NZX All share price index is re-based to 1995. Money supply is based on the M1 definition measured in billion NZ$, and is seasonally adjusted. GDP is seasonally adjusted expressed in NZ$. Interest rates are three-month (90 days) bank bill rates measured in percentages per annum (% pa). The exchange rate is the US$ Spot: USD/NZ. The demographic variable used is the 45-64-age cohort and this is measured as number of people. All data was transformed into natural logarithms prior to analysis.

Methodology:

i) Unit Root Test:

A prerequisite in the analysis of time series data is to test the stationary properties of each variable under study. We perform the Augmented Dickey-Fuller (ADF) test (Dickey and Fuller, 1981, 1979).

The ADF tests are based on the OLS estimation of the following equation:

$$\Delta X_t = \alpha_0 + \alpha_1 t + \partial_2 X_{t-1} + \sum_{i=1}^{m} \lambda_i \Delta X_{t-i} + e_t \quad \text{----(ii)}$$

The above equation is estimated with and without the trend variable.

In the above equation (ii) Δ is the first difference operator; and e_t is the covariance stationary random error term. For the ADF the lag length n is determined by the Schwarz Information Criteria (SIC) to ensure serially uncorrelated residuals.

The null hypothesis of non-stationarity is tested using the t-statistic with critical values calculated by MacKinnon (1991). This null hypothesis will be rejected if π_2 is negative and statistically significant. These tests are carried out for all variables. To control the level of significance of the ADF testing and avoid pre-testing distortion to the test size, all series were initially differenced so that the I(2) hypothesis was tested against the I(1) alternative before then testing I(1) against the I(0) alternative (Dickey and Pantula, 2002). Only in the case of lnDEM could the I(2) hypothesis not be rejected; all the other series lnSP, lnGDPN, lnINT, lnCPI were found to be I(1) when testing I(1) against the I(0) alternative. This non-stationarity among the variables poses serious challenges to standard regression analysis which may produce coefficients suffering the spurious regression problem (Granger and Newbold, 1974). To overcome this we adopt a methodology appropriate for handling non-stationary data where the series may exhibit cointegration (Engle and Granger, 1987).

ii) Cointegration and Error Correction Model

There are a number of techniques in the literature for testing and estimating the cointegrating relationships among I(1) series; the most popular of these is Johansen's maximum likelihood test procedure (Johansen, 1988 and Johansen and Juselius, 1990). This procedure is considered to be one of the most efficient as it tests for the existence of the number of cointegrating vectors. This procedure gives two likelihood ratio tests for the number of cointegrating vectors: (1) the 'maximal eigenvalue test', which tests the null hypothesis that there are at least r cointergration vectors, as against the alternative that there are r+1, and (2) the 'trace-test', where the alternative hypothesis is that the number of cointegrating vectors is equal to or less than r+1.

In principle, there can be a long-run or equilibrium relationship between the series in a multivariate relationship only if they are integrated of the order one (Campbell and Perron, 1991), so you do not lose any long-run information. Furthermore, Granger's

Representation Theorem (Hamilton, 1994) shows that when the variables are found to be cointegrated then there must exist an associated Equilibrium Correction (EC) mechanism that may take the following form:

$$\Delta \ln Y_t = \ddot{o}_0 + \sum_{i=1}^{p} \ddot{o}_{1i} \Delta \ln Y_{t-j} + \sum_{j=1}^{p} \ddot{o}_{2j} \Delta \ln X1_{t-j} + \sum_{k=1}^{p} \ddot{o}_{3k} \Delta \ln X2_{t-k}$$
$$+ \sum_{l=1}^{p} \ddot{o}_{4l} \Delta^2 \ln X3_{t-l} + \tilde{n}\grave{i}_{(t-1)} + u_t \qquad \text{----------(iii)}$$

where, denotes the first difference operator, $_{(t-1)}$ are equilibrium correction terms, p the lag lengths (determined by SIC) and u_t is a vector of random disturbance term. Here, i, j, k, l and m begin at one in order for the series to be related within a structural ECM (Engle and Yoo, 1987). The equilibrium correction term, $_{1(t-1)}$ is the residual series of the cointegrating vector normalised for lnSP from equation (i) measuring deviations of the series from the long run equilibrium relations. For the series to converge to the long run equilibrium relation, -1″ρ″0 should hold.

Results

Table 2 here

FIGURES 3 & 4 here

Table 2 shows the summary statistics for the whole period of the variables under study (1990 to 2006). The stock prices grew by some 70% over the full sample period which is an annual average stock price growth rate of about 3%. Although the first four quarters in 1990 saw a major market decline of over 30%. The inflation rate displayed substantial volatility particularly the early part of the sample, averaging just over 2% per annum over the full sample whereas nominal GDP grew by an average of almost 5% pa. Interest rates peaked at over 14% pa early in the sample period but had declined to about 7.5% by the end which was close to its average over the full sample. House price inflation was substantial, averaging over 9% pa. The population in the 50 to 64 age group grew at an average annul rate of 2.6% although a peak occurred after 1995 reflecting the post WWII baby boom enter the 50+ age cohort.

Table 3 about here

The results of Augmented Dickey Fuller (ADF) test for unit root of the variables are presented in Table 3. The first part of the table gives the results for lnSP, lnRGDP, lnINT, lnHPR, lnDEM, and lnCPI. The second part of Table 3 gives the results for their differenced forms: lnSP, lnRGDP, lnINT, lnHPR, ^{2}lnDEM and lnCPI. All of the variables have unit roots, and they are integrated of order one in levels except for lnDEM which is I(2). The graph of lnDEM shows a jump in 1996 with the post-war baby boomers arriving in this 50-64 age cohort. We used the Phillips-Perron(1988) test to examine the possibility that I(2) could arise from a structural break starting that year but found the break to be insignificant and I(2) to be robust. Since the above variables under study are non-stationary, standard regression analysis may produce spurious results. Although the series may be made stationary by appropriate differencing and could be used in regression analysis, the drawback of this method is the loss of the valuable information on the long-run relationship between the variables.

Table 4 about here

Table 4 shows the results of the cointegration rank tests using trace and maximum eigenvalue from Johansen's maximum likelihood technique. Column 1 shows the null hypothesis of the VAR model and later columns report the λ_{trace} and λ_{max} statistics generated from the maximum LR test statistic. It is found that there is a deterministic trend in the equation (iii).[8] It can be ascertained from the λ_{trace} and λ_{max} statistics for the series lnSP, lnGDPN, lnINT, lnCPI, lnHPR and lnDEM are cointegrated; that is, there exists a linear combination of these non-stationary variables that links them in a stable long run relationship. It also appears from the Johansen's test that we cannot reject the hypothesis that there is at least one cointegrating vector. In fact, the data reported in the Table 4 show that the null hypothesis of no cointegrating vector can be rejected at least for 1% level, thereby suggesting the presence of one cointegrating

[8] We have tested cointegration both with and without the deterministic trend, but reported the result with the trend.

equation whose residuals (Equilibrium Correction term) can be obtained to measure the respective deviation between the variables based on the long run relationship. In all cases, the eigenvalue statistics drop sharply for alternative hypothesis of six cointegrating vectors (k =6). Thus, we can conclude that our model for the six variables is fair representations for the time frame.

Table 5 here

The cointegrating equation (normalised on the share price index) is reported in Table 5. These estimates are obtained by using the Johansen maximum likelihood procedure. In Table 5 note that the normalisation on lnSP with its coefficient of +1 rather than -1, results in sign reversal for the estimated coefficients relative to conventional equation presentations. All of the long run coefficients are statistically significant (the t-statistic given in the parenthesis are significant at least at a 5% level) and have *a priori* sensible signs. Nominal GDP, house prices, demographic growth and the CPI each has a positive association with the movements in share price, while the interest rate variable is negative; with rises in nominal interest rate associated with declines in the share price index. Hence, each of these long run coefficents has its anticipated sign. We can conclude that the population growth rate is positively related with the share price in the long run, which conforms to our expectation.

Table 6 here

The existence of a long run equilibrium relationship implies the existence of equilibrium correction (EC) mechanisms holding the equilibrium in place through time (Granger's Representation Theorem, 1987). These estimated EC models (presented in equation (iii) above) capture short run behaviour of relationship between the variables under study. Table 6 presents the results of the equilibrium correction equations. The coefficients on the EC terms within each equation represent the speed of adjustment back to the long run relationship among the variables. The largest (absolute value) and most highly significant EC coefficient is for the interest rate

equation; it shows that the equilibrium relationship being held in place through the adjustment in the interest rates. The other estimated coefficients in the interest rate equation show the lagged impact on the variables under study. The relatively high goodness of fit of the regression is encouraging. The EC term also feeds directly into the share price and CPI equations; so these too represent strong reinforcement helping to sustain the long run cointegrating relationship. The model suggests that the adjustments to sustain the equilibrium are through changes in the interest rates, the inflation rate and changes in the share price.

The diagnostic tests on the model (also in Table 6) for the acceptability of the equilibrium correction equations show satisfactory results from each EC equation for the absence of serial correlated residuals, acceptable functional form (Ramsey's Reset tests) and normality of the residuals (Jacques-Bera tests).

4. Conclusion

In this study we have examined the long-run relationship between the stock prices and the GDP, interest rates, inflation, housing prices and the demographic changes (baby-boomer population for the 45 – 64 age group) in New Zealand for the period 1990 – 2006 using quarterly data and using a Vector Equilibrium Correction model. Our findings show that the empirical tests of the model are successful. Following Wilson, Malik and Hetihewa (2006), our study has considered a range of non-demographic factors as control variables which Poterba (2001), one of the major contributors to the literature, has ignored. Our empirical evidence show that the variables examined and quarterly data are co-integrated and there is a firm long-term relationship between them. We have also found that there is a significant positive relationship between the 45–64 age cohort and the stock prices in New Zealand supporting previous researchers (Poterba (2001)). This is of great importance to economies, as the economic health of a nation's economy relies heavily on the stability of the financial system. Since there is a close relationship between share prices and baby boomer generation coming to the retirement age, the effect of this changed investment behaviour has to be addressed by the policy makers to make a safer environment for the increasing retirees; suggesting that the government should implement measures to neutralise the effect of the baby boomers. As this is an international issue today, this

study provides important result relevant to finding common solution while allowing countries to incorporate specifics to suit for country specific problems for the issues relate to the aging population.

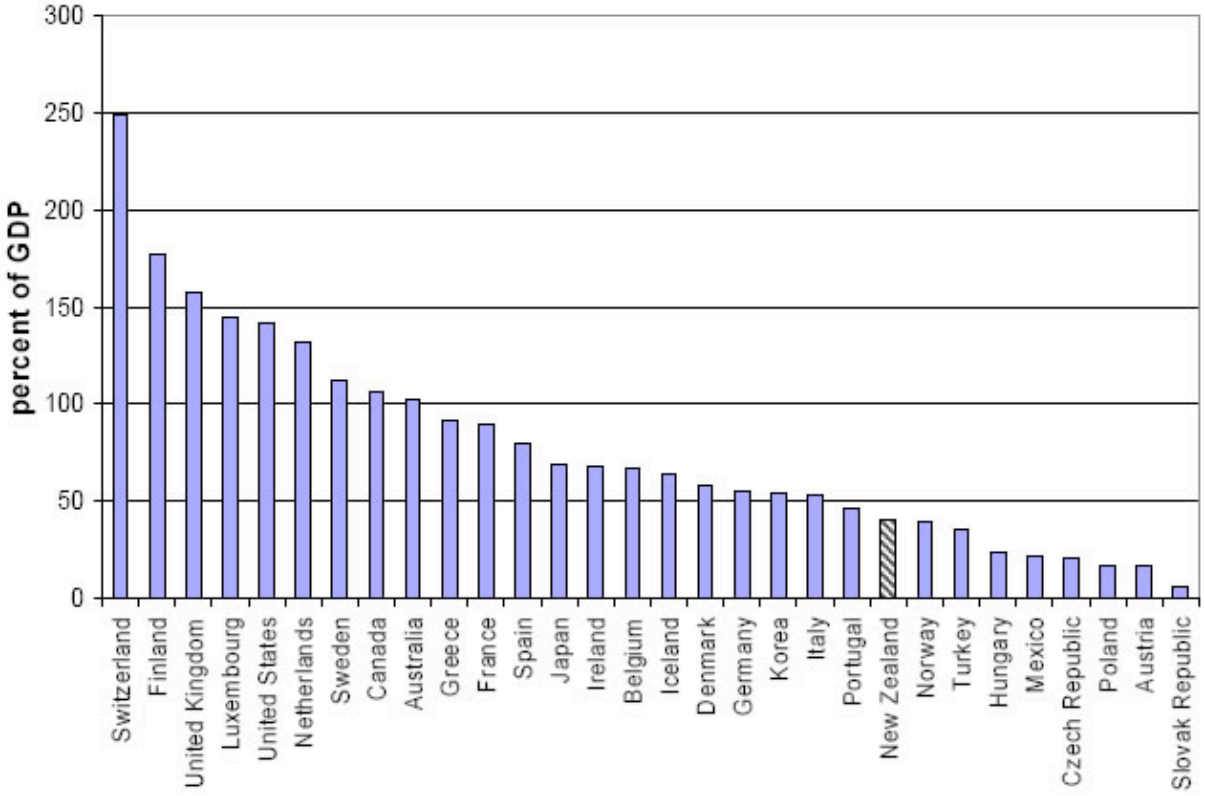
Through the findings of this paper, we suggest that it is utmost important for the NZ policy makers to implement policies, in a timely manner, that address well the exiting problems of the baby boomer generation to maintain the performance and the intensity of the stock market.

As this is the first attempt to address this particular issue of the relationship between changing demographic structure and the stock market in New Zealand the findings are of a significant importance to the policy makers and global investors. Also, the findings provide a bench-mark for future research, as New Zealand appears to be moving towards compulsory superannuation.

Future examination of the association between stock market and the population demographics should allow for demand–supply relationship, as the impact of rising demand for stock market from emerging markets may affect the overall market trend. Future research should consider the external demand effect from beyond its borders, as the political stability of New Zealand is much higher than that of the emerging economies.

Figure 1: N. Z Population Growth Rate

Figure 2 : Stock market capitalisation: OECD countries (1999-2003 average)



Source: http://www.treasury.gov.anz/pulications/research-policy/ppp/2007/07-02-03.htm .

Empirical Finding
Figure 3: Share Price index

Figure 4:

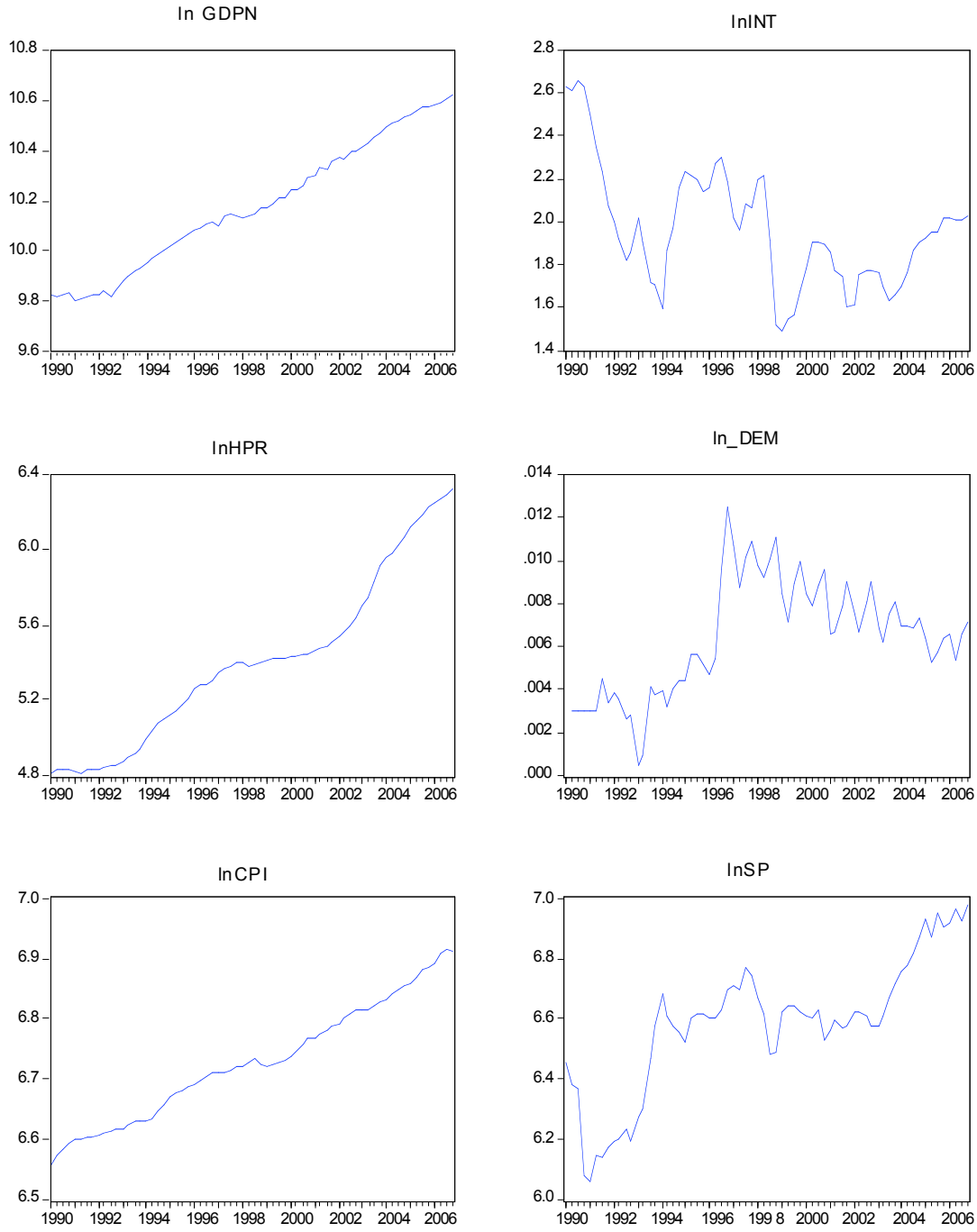

ln GDPN
10.8
10.6
10.4
10.2
10.0
9.8
9.6
1990 1992 1994 1996 1998 2000 2002 2004 2006
lnINT
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1990 1992 1994 1996 1998 2000 2002 2004 2006
lnHPR
6.4
6.0
5.6
5.2
4.8
1990 1992 1994 1996 1998 2000 2002 2004 2006
ln_DEM
.014
.012
.010
.008
.006
.004
.002
.000
1990 1992 1994 1996 1998 2000 2002 2004 2006
lnCPI
7.0
6.9
6.8
6.7
6.6
6.5
1990 1992 1994 1996 1998 2000 2002 2004 2006
lnSP
7.0
6.8
6.6
6.4
6.2
6.0
1990 1992 1994 1996 199 8 2000 2002 2004 2006

Table 1a – Number of people aged 15-64 for each person aged 65+, three fertility assumptions, 2004 - 2051

Year	Low fertility	Medium fertility	High fertility
2004	5.5	5.5	5.5
2011	4.9	4.9	4.9
2021	3.7	3.7	3.7
2031	2.7	2.7	2.8
2041	2.2	2.3	2.4
2051	2.1	2.2	2.4

Source: Statistics New Zealand, http://www.stats.govt.nz

Table 1b – Long-term series of percentage of population in three main age groups, 1951-2051..Projection

Age	1951	1961	1971	1981	1991	2001	2011	1021	2031	2041	2051
0-14	29.4	33.1	31.8	26.7	22.8	23	19	18	17	16	16
15-64	61.4	58.3	59.7	63.3	65.9	66	67	65	61	59	59
65+	9.2	8.6	8.5	10	11.2	12	14	18	22	25	25

Source: Calister & Rose, 2000; Statistics New Zealand, htpp://www.stats.govet.nz/census.htm

Table 2 Descriptive Statistics

	Mean	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	J-B Prob	Observations
lnSP	6.5831	0.2229	-0.5051	2.9608	2.8954	0.2351	1990Q1 – 2006Q4
lnGDPN	10.1811	0.2565	0.0996	1.8143	4.0955	0.1290	1990Q1 – 2006Q4
lnINT	1.9633	0.2755	0.6550	3.1592	4.9346	0.0848	1990Q1 – 2006Q4
lnHPR	5.4025	0.4476	0.4649	2.2973	3.8485	0.1460	1990Q1 – 2006Q4
lnDEM	13.2100	0.1413	0.2093	1.5831	6.1850	0.0454	1990Q1 – 2006Q4
lnCPI	6.7288	0.0970	0.1743	2.0123	3.1082	0.2114	1990Q1 – 2006Q4

Where, ln = natural logarithms; SP = share price; GDPN= GDP Nominal; INT=Interest rates; DEMgr= population of the age group to 64; CPI= consumer price index

Table 3 Augmented Dickey Fuller Unit Root Tests

	LEVELS				1ST DIFFERENCES			
	c	lags#	c & t	lags#	c	lags#	c & t	lags#
lnSP	-0.5719	0	-2.3106	0	-7.0141**	0	-6.9969**	0
lnGDPN	1.0977	1	-3.4911	0	-9.6471**	0	-9.8062**	0
lnINT	-3.3370	1	-3.2710	1	-5.2363**	0	-5.3250**	0
lnHPR	1.1444	1	-1.5737	1	-3.0123*	0	-3.4498*	0
lnDEM	-0.6154	3	-3.069	3	-1.5793	2	-1.1829	2
lnCPI	0.6563	1	-2.0714	1	-5.7083**	0	-5.7665**	0

* and ** indicates significance at the 5% and 1% levels respectively
\# number of augmentation lags determined by Schwarz Info. Criterion

Table 4 Unrestricted Cointegration Rank Tests (Trace and Maximum Eigenvalue)

Hypothesized		Trace	0.05		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.#	Statistic	Critical Value	Prob.#
None	0.5014	147.84	117.71	0.0002	44.54	44.50	0.0495
At most 1	0.4679	103.30	88.80	0.0030	40.38	38.33	0.0287
At most 2	0.3906	62.92	63.88	0.0600	31.70	32.12	0.0561
At most 3	0.2189	31.21	42.92	0.4318	15.81	25.82	0.5613
At most 4	0.1468	15.40	25.87	0.5414	10.16	19.39	0.6019
At most 5	0.0786	5.24	12.52	0.5620	5.24	12.52	0.5620

\# MacKinnon-Haug-Michelis (1999) p-values

Table 5 Normalized Cointegrating Coefficients [t stats]

lnSP	lnGDPN	lnINT	lnHPR	Δ(lnDEM)	lnCPI	TREND	c
+1	-6.9722	2.9698	-1.7021	-91.4504	-31.1225	0.2946	267.6347
	[-2.1545]	[6.5759]	[-2.7991]	[-4.1377]	[-4.1058]	[5.1918]	

Table 6 Equilibrium Correction Equations [t stats]

	□**(lnSP)**	□**(lnGDPN)**	□**(lnINT)**	□**(lnHPR)**	□**(ΔDlnDEM)**	□**(lnCPI)**
EC(-1)	-0.0553*	0.0071	-0.1299**	0.0002	0.0012*	0.0050**
	[-1.8640]	[1.1283]	[-3.0502]	[0.0321]	[1.8713]	[3.3672]
□(lnSP (-1))	-0.0143	0.0339	0.1853	0.0576**	0.0032	0.0085
	[-0.1096]	[1.2242]	[0.9903]	[2.0266]	[1.1756]	[1.2979]
□(lnGDPN (-1))	0.4817	-0.2159	0.8302	-0.0340	0.0037	0.0261
	[0.7999]	[-1.6856]	[0.9598]	[-0.2587]	[0.2896]	[0.8651]
□(lnINT(-1))	-0.0222	-0.0020	0.6026**	-0.0057	0.0006	0.0120**
	[-0.2343]	[-0.0989]	[4.4300]	[-0.2735]	[0.3243]	[2.5357]
□(lnHPR (-1))	-0.0314	0.1843*	0.4556	0.7156**	-0.0028	0.0475**
	[-0.0685]	[1.8926]	[0.6926]	[7.1613]	[-0.2970]	[2.0723]
□(□(lnDEM(-1))	2.3015	-0.7661	-11.6005	1.7203	0.1034	-0.1632
	[0.3338]	[-0.5225]	[-1.1715]	[1.1434]	[0.7159]	[-0.4730]
□(lnCPI(-1))	-1.5312	-0.4891	2.2063	0.2280	0.0149	0.0687
	[-0.6289]	[-0.9445]	[0.6309]	[0.4291]	[0.2914]	[0.5634]
C	0.0121	0.0131	-0.0370	0.0054	0.0000	0.0034
R-squared	0.1961*	0.1642	0.4121**	0.6029**	0.1504	0.535***
F-statistic	1.9869	1.5993	5.7090	12.3638	1.4420	9.3141
Durbin-Watson	2.1961	1.9863	1.8760	1.9980	1.9620	1.9921
Func form Chi-Sq (1 d.f.) prob	0.6295	0.2548	0.0214**	0.4387	0.4381	0.5068
Normality Chi-Sq (2 d.f.) prob	0.3907	0.2828	0.5047	0.1197	0.3350	0.6137

Notes * and ** indicate significant at 10% and 5% levels respectively

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