Investigating Emerging Market Economies Reverse REIT-Bond Yield Gap Anomalies: A Case for Tactical Asset Allocation under the Multivariate Markov Regime Switching Model

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THESIS

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ABSTRACT

This paper presents a first time application of a variant of the concepts underpinning the Fed Model, amalgamated with the Bond-Stock Earnings Yield Differential, by applying it to the dividend yields of REIT indices. This modification is termed the yield gap, quantitatively constructed and adapted in this paper as the Reverse REIT-Bond Yield Gap. This metric is then used as the variable of interest in a multivariate Markov regime switching model framework, along with a set of three regressors. The REIT indices trailing dividend yield and associated metrics are the FTSE/EPRA NAREIT series. All data are from Bloomberg Terminals. This paper examines 11 markets, of which the EMEs are classified as Brazil, Mexico, Turkey and South Africa, whereas the advanced market counterparts are Australia, France, Japan, the Netherlands, Singapore, the United Kingdom, and the United States. The time-frame spans the period June 2013 until November 2015 for the EMEs, whilst their advanced market counterparts time-span covers the period November 2009 until November 2015. This paper encompasses a tri-fold research objective, and aims to accomplish them in a scientifically-based, objective and coherent fashion. Specifically, the purpose is in an attempt to gauge the reasons underlying EMEs observed anomalies entailing reverse REIT-Bond yield gaps, whereby their ten-year nominal government bonds out-yield their trailing dividend yields on their associated REIT indices; what drives fluctuations in this metric; and whether or not profitable tactical asset allocation strategies can be formulated to exploit any arbitrage mispricing opportunities. The Markov models were unable to generate clear-cut, definitive reasons regarding why EMEs experience this anomaly. Objectives two and three were achieved, except for France and Mexico. The third objective was also met. The REIT-Bond Yield Gaps static conditions have high probabilities of continuing in the same direction and magnitude into the future. In retrospection, the results suggest that by positioning an investment strategy, taking cognisance of the chain of economic events that are likely to occur following static REIT-Bond Yield Gaps, then investors, portfolio rebalancing and risk management techniques, hedging, targeted, tactical and strategic asset allocation strategies could be formulated to exploit any potential arbitrage profits. The REIT-Bond Yield Gaps are considered highly contentious, yet encompasses the potential for significant reward. The Fed Model insinuates that EME REIT markets are overvalued relative to their respective government bonds, whereas their advanced market counterparts exhibit the opposite phenomenon.

Keywords: Anomaly, Emerging Market Economies (EMEs), advanced economies, Real Estate Investment Trusts (REITs), REIT indices, trailing dividend yields, equity indices, government bonds, nominal government bond yields, Australia, Brazil, France, Japan, Mexico, Singapore, South Africa, the Netherlands, the United Kingdom, the United States, Turkey, quantitative Markov regime switching econometric regression models, tactical asset allocation, reverse yield gap, REIT-Bond Yield Gap, Fed Model, Bond-Stock Earnings Yield Differential (BSEYD), under/over valuation, portfolio management, arbitrage profits, place and evolution of government bonds and REITs, portfolio and asset allocation theories, Modern Portfolio Theory, Post-Modern Portfolio Theory.

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I. INTRODUCTION

1.1. Background to the Research

The roots of national debt marks the historical juncture by which old principles were applied in new ways to fund sovereign expenditures. Long before public expense management was subsumed under parliamentary control, national debt was contracted under the auspices of sovereign states - notably under British royal helms and monarchical linage (Hewins,1888). Hamilton (1947) shares Munro's (2003) perspective that the earliest roots of public debt can be traced back to 12th century Republic of Venice.[1] Hewins (1888) disagrees, and instead traces it back to 16th century England, although he agrees with Homer (1975) in relation to the only forms of national debt existing prior to the 1688 Revolution being provided by a nation's bankers – notably that of Italy. The new little Dutch Republic was the first nation that established a working model capital market, following which the Bank of Amsterdam was established (Homer, 1975; Munro, 2003). The Amsterdam Stock Exchange then emerged in 1613, where trade commenced in perpetual annuities and regular stocks in both domestic and internationally domiciled markets.[2] The Dutch financial system was soon mirrored elsewhere (Homer, 1975). King William III of Dutch origins exported so called "Dutch finance" to England, following which the Bank of England materialised (Homer, 1975; Munro, 2003). The Dutch-British finance model eventually gained global momentum, with Alexander Hamilton exporting the system to the United States (U.S.) (Homer, 1975; Munro, 2003). Modern day financial markets have since evolved from perpetual to fixed maturity bond issues. Some bond exchanges have been born out of the historical oppressions of the past, for example, in contrast to other African and Emerging Market Economies (EMEs), South Africa (S.A.) has historically depended more heavily on its domestic bond market relative to borrowing abroad, largely a function of S.A.'s previous Apartheid regime ruling government (Mboweni, 2006).[3] Many of the detrimental implications caused by this were non-conducive to the establishment of effective bond markets (Davey & Firer, 1992; Hassan, 2013). However, the late 1980s and 90s witnessed various improvements, including the establishment of the Bond Market Association (BMA), which later transformed into the Bond Exchange of South Africa (BESA) (Hassan, 2013; Mboweni, 2006). Other researchers also espouse the emergence of sovereign debt by departing from conventional economic history, even suggesting that the reputation of intermediaries were used to help pave the way for the development of sovereign bond markets (Flandreau & Flores, 2009). On the other hand, Blommestein and Wehinger (2007) contextualise contemporary strategies and motivations underlying sovereign borrowing. While information on historical sovereign debt may appear unbounded, Tomz and Wright (2013) assert that many historians, political scientists and economists have had the archaeological task of unearthing, synthesising and narrowing the knowledge gap between sovereign debt's empirical literature and data. Technical features like quantifying the stock of sovereign debt, amongst others, have themselves created bones of contention. Other complexities relate to the lack of consensus regarding the financial statutes that regulate global government bond laws. Wray (1998) also offers an alternative and largely eclectic vantage point on sovereign debt, contending that the real purpose of government bonds is not to 'finance' government spending, but to actually drain excess liquidity from the monetary system.

In a similar vein, the place and evolution of Real Estate Investment Trusts (REITs) is traced back to the U.S. state of Massachusetts in the 1850s as an extension of the business trust form of organisation, even though the first contemporary REIT structure was only ratified into U.S. law in 1960 (Bailey, 1966; Packer, Riddiough & Shek, 2014; Schulkin, 1971; Videlefsky, 2014). In the late 1960's, REITs became a prominent capital provider for construction and development loans, equity-based real estate funds and long-term mortgages (Schulkin, 1971; Lee, 2010). Lee (2010) and Videlefsky (2014) are in agreement with Leone (2011) that the motivation behind the establishment of REITs was to demolish financial barriers to entry of small-scale investors, allowing them to begin tapping into larger-scale income producing real estate assets. The early REIT era witnessed the majority of its shares being traded over-the-counter (OTC), whilst only a handful were listed on a formal exchange, resulting in a thinly traded and regional parameter constrained market for REIT shares. The first REIT index was then created in 1962 by a brokerage house. Following

[1] The Venetian state issued interest-bearing debt, backed by earnings from its state-owned salt monopoly business. This led to the development of a system by which tax revenues of future salt production were auctioned to issue new debt (Hamilton, 1947).

[2] Homer (1975) claims that the Dutch people of the 16th century pioneered most modern stock-trading techniques, including bulls, bears, auctions, margins, options and short sales.

[3] The bulk of South African government bonds are denominated in S.A.'s domestic currency - the Rand (international ticker code 'ZAR'). The Rand is traded under a flexible exchange rate regime, and given its volatile position in global markets, domestic borrowers rarely have incentives to issue alternative currency denominated liabilities (Hassan, 2013).

this inception, REITs began to perform more a less in tandem, and become integrated with the general stock market (Bailey, 1966; Eichholtz & Hartzell, 1996; Leone, 2011; Sebehela, 2008; Sing & Ling, 2003).[4] A milestone year in REIT history was achieved in 1986 following the Tax Reform Act, which encompassed the REIT Modernisation Act (Packer, Riddiough & Shek, 2014). Deregulation then allowed REITs to manage various categories of income-producing commercial real estate. Consequentially, greater REIT diversification was conducive to greater streams of rental revenue income, ultimately culminating in strong dividend growth. As a result, institutional, corporate and individual investors began to unlock latent intrinsic REIT value. From the early to the mid-1990's, certain economic factors were also conducive to the exponential growth in REITs, fostering a REIT Initial Public Offering (IPO) boom in the U.S. (Lee, 2010; Packer, Riddiough & Shek, 2014). Low interest rate environments resulted in capital searching for higher yields, whereas REITs were ideal candidates since they are known to be high dividend yielding instruments. Akin to government bonds, the birth of REITs was also mirrored elsewhere, first by the Netherlands and subsequently Australia, before dispersing around the globe. The Dutch adopted the REIT investment vehicle structure in 1969, making them the second country after the U.S. and the first in Europe (Boshoff & Bredell, 2013). The Dutch REIT structure is the most stringent amongst all global REIT markets, and Dutch REIT authorities were even the creators of REIT leverage constraints (Boshoff & Bredell, 2013). Dutch and Australian REITs are required to distribute 100 percent (%) of their net-taxable fiscal earnings as dividends, meaning that they are the complete opposite to Turkish REITs, who have no minimum payout requirements. (Boshoff & Bredell, 2013; Erol & Tirtiroglu, 2011). Another interesting depiction emerges when examining Brazilian REITs. Although they share similar governance structures with the global REIT model, they must be administered by financial institutions, relative to conventional practice in which REITs fall under the directorship of its own executives (da Rocha Lima & Tavares de Alencar, 2008; Gabriel, de Sousa Ribeiro Post & Rogers, 2015). These fund managers are tasked with, amongst others, the mandate of negotiating rental rates - updating them approximately every five years (da Rocha Lima & Tavares de Alencar, 2008). This is surprising given Brazil's historical epochs of hyperinflation, and contrasts markedly with S.A., in which it is surmised that domestic lease contracts are structured with annual embedded escalation rates which are usually tied to a consumer price index (CPI), and even impose an additional premium over and above the CPI (Ambrose, Hendershott & Klosek, 2002; Crosby, Gibson & Murdoch, 2003; Grenadier, 2003). Ambrose, Hendershott and Klosek (2002) find the upward-only adjusting lease contract structure is commonly used in the United Kingdom (U.K.) and other Commonwealth nations, and explain that these are reset approximately every five years to adapt to prevailing market conditions.[5] These findings may be contrasted with Brazil and S.A., in which Brazilian lease contract structures do not adjust more frequently than once in five years.

The examination of the place and evolution of government bonds and REITs provides the backdrop to a steadfast path to an enriched and in-depth contemporary analysis of the factors driving their yields. It begins with an investigation into the theories that weave together the Fed Model literature – the pivotal component of the puzzle.[6] The Fed Model is the informal product of market practitioners, following former Fed chairman Allan Greenspan's conference regarding irrational exuberance in November, 1996 (Berge, Consigli, & Ziemba, 2008).[7] It was initially purported to act as a tool to help understand and forecast fluctuations in the Equity Risk Premium (ERP). The Fed Model in its original 1996 form postulates that the equilibrium price level of stocks should be equated to expected corporate earnings, discounted by the current ten-year Risk Free (RF) rate (Berge, Consigli, & Ziemba, 2008; Asness, 2003; Aubert & Giot, 2007).[8] The model then compares the dividend (or earnings) yields on aggregate equity indices with the nominal yield on long-term government bonds. Aubert and Giot (2007) postulate that stocks are then said to be over (under) valued when their dividend (or earnings) yield is less (greater) than the yield on long-term government bonds, and in equilibrium when the two yields are equal. Asness (2003) also claims that although no consensus exists as to what the model is insinuating, it is generally accepted that the two yields should be compared to each other, and that low (high) inflationary and/or interest rate environments are conducive with relatively low (high) earnings (or dividend) yields.

[4] The notion of integration in the context of financial markets implies that the relation between RPs and systematic risk are the same in two different markets. This means that the cost per unit of exposure corresponding to risk elements must be identical, irrespective of the market in which those risk elements are priced (Ling & Naranjo, 1999).

[5] The most prominent of these conditions are usually both expected and current demand and supply for rental space, with the same applying to inflation (Ambrose, Hendershott & Klosek, 2002; Grenadier, 2003).

[6] The Fed is the acronym for the Federal Reserve Bank (the central bank) of the U.S.

[7] Ed Yardeni of Deutsche Morgan Grenfell gave the Fed Model its name following Allan Greenspan's conference (Berge, Consigli, & Ziemba, 2008).

[8] The RF rate is usually proxied by the yield on ten-year government bonds (Berge, Consigli, & Ziemba, 2008; Ilmanen, 2003).

Conversely, Berge, Consigli, and Ziemba (2008) claim that its theoretical tenets suggest that optimal asset allocations between equity and bonds is interconnected via their relative yields. If the yield on either instrument deviates from the other, a market correction may be expected in the form of shifting capital from the asset class with the lower to the higher yield. This is also related to Koivu, Pennanen and Ziemba's (2005) and Durre and Giot's (2007) notion that stocks and bonds are substitutes that compete with each other for capital flows in the so-called 'flight to quality' phenomenon. Durre and Giot (2007) suggest that the present value tenets embedded in the Fed Model articulates the use of discounted cash-flow valuation by linking the causality of rising (falling) discount rates to rising (falling) yields on ten-year government bonds, which in turn decreases (increases) the present value of discounted future cash flows – stock prices.

Asness (2003) asserts that while the Fed Model may portray an image of reality, it lacks a coherent foundation. Its caveats begin at the most basic level, in that it suggests a comparison between real and nominal metrics, the earnings (or dividend) yields on aggregate equity indices and the nominal yield on long-term government bonds, respectively (Asness, 2003; Aubert & Giot, 2007; Berge, Consigli, & Ziemba, 2008). However, Aubert and Giot (2007) claim that even though this fallacious comparison results in 'money illusion', they agree with Asness (2003) that it is against the backdrop that corporate profits already covary with inflation, and hence earnings (or dividend) yields are therefore a sufficient Fed Model input.[9] Conversely, Bekaert and Engstrom (2009) argue that money illusion is shown to have very limited ability at explaining the observed strong correlation between equity and bond yields, and a large proportion is actually ascribed to protracted stagflation periods.[10] Asness (2003) warns that analysts erroneously confuse the Fed Model's descriptive ability regarding how price-to-earnings (P/E) multiples are set with its use as an investment selection tool in isolation, and it should therefore rather be used as a complementary tool. Some empirical applications of the Fed Model and its variations contextualise the subject matter. Maio (2012) employed the yield gap and its logged variant to predict aggregate equity risk premia, and found significant value-enhancements to Sharpe ratios linked to dynamic trading strategies have been recorded by employing the yield gap in applications of dynamic portfolio selection and optimisation investment strategies.[11] The yield differential between long-term government bonds and stocks has also been successively used to gauge stock market volatility, for example, market collapses during 1948 and in 1989 in the U.S. and Japan (Koivu, Pennanen & Ziemba, 2005). Durre and Giot (2007) incorporated the Fed Model into a cointegrating Vector Autoregressive (VAR) framework, since it can disentangle both long and short-term dynamic effects, finding that inflation rates are the main variable propelling long-term government bond yields (GBYs). Svensson (2005) created an adjusted Fed Model (AFed-model) to determine whether EME stock prices were in disequilibrium, finding that bond and earnings yields on aggregate fluctuated in tandem, which in contrast to assertions by Bekaert and Engstrom (2009), supported the 'money illusion' conception. The bond-stock yield ratio (BSYR) forms the nexus between the RF rate and equity yield. This is also linked to the bond-stock earnings yield differential (BSEYD).[12] The BSEYD was modified by Berge, Consigli, and Ziemba (2008) into an investment strategy, in which a hypothetical 100 U.S. Dollars (US$) invested grew to US$4650 in the U.S. market and from US$8480 to US$10635 over 1975 to 2005, with a simultaneous significant reduction in portfolio variance. The majority of the BSEYD modified strategies out yielded buy and hold techniques in the U.K., yet were also outperformed by the market in some scenarios (Berge, Consigli, & Ziemba, 2008).

In order to provide the Fed Model literature with meaningful weight, a short financial history on the correlation and cointegration between general stocks, REITs and government bonds is explored. Central banks are increasingly using stock-bond comovements as a market barometer for inflation and growth expectations (Ilmanen, 2003). Ilmanen (2003) states that inflationary expectations are one of the major driving forces behind the positive time-varying nature of stock-bond return comovements. Through a rise in required ERPs caused by epochs of heightened stock market uncertainty, stock-bond comovements may become temporarily distorted, supporting the 'flight-to-quality' phenomenon. Historical

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[9] Money illusion relates to earnings and wealth misconceptions, in that their true values might be distorted by inflation. In this regard, Svensson (2005) found that countries with high interest rates corresponded to lower earnings yields. Earnings yields are computed by taking the inverse (or reciprocal) of the P/E ratios (Aubert & Giot, 2007).

[10] Stagflation is when simultaneously high inflation and unemployment rates are coupled with 'stagnating' economic growth rates (Bekaert & Engstrom, 2009).

[11] The yield gap is the deviation between dividend (or earnings) yields and long-term government bond yields. Maio (2012) developed two yield gap statistics. The first uses a dynamic accounting disaggregation incorporating earnings yields, future short-term interest and growth rates, and future dividend payout ratios, modelled as functions of expected ERPs. The second employs dividend yields and their correlation with anticipated future ERPs.

[12] The BSYR is the quotient of the current market value over its theoretically correct value. The BSEYD is computed by subtracting one from the BSYR and multiplying it by the equity yield. Both the BSEYD and BSYR may be used to identify arbitrage opportunities by predicting forthcoming corrections. Since the Fed Model assumes that market prices will fluctuate around their theoretical means, the BSYR is expected to converge upon unity and the BSEYD towards zero (Berge, Consigli, & Ziemba, 2008).

stock-bond correlations have also switched rapidly from positive to negative in the past (Asness, 2000; Baele, Bekaert & Inghelbrecht, 2010), where a rising Chicago Board Options Exchange Volatility Index (CBOE VIX) is believed to be associated with this type of decoupling.[13] Furthermore, some studies underestimate these correlations through the use of present value models, whereas others overestimate them by employing consumption-based asset pricing methodologies (Baele, Bekaert & Inghelbrecht, 2010). Prior to the 1993 U.S. Tax reforms, REITs and equity were not cointegrated (Glascock, Lu & So, 2000; Videlefsky, 2014). Following tax reforms and deregulation, the REIT market exhibited a large capital influx, of which a consequence that is in line with global markets was that their structural characteristics changed, and REITs subsequently began to behave more like equities, particularly small-cap stocks, with their integration increasing markedly (Glascock, Lu & So, 2000; Niskanen & Falkenbach, 2010). One study (Niskanen & Falkenbach, 2010) elaborates as to the benefits of holding REITs in a multi-asset portfolio, claiming that REIT correlation and equity market volatility are positively correlated. Contrastingly, REITs correlation with fixed income securities remains negative during volatile market conditions, but becomes increasingly less correlated when volatility stems from the fixed income market. Thus, marginal diversification benefits of holding REITs in a multi-asset portfolio become dependent on prevailing volatility (Niskanen & Falkenbach, 2010).

Various perspectives on macroeconomic, sovereign risk elements, and their impacts on government bond yields, amongst others, are explored. While bond markets impound past and present macroeconomic fundamental information into their prices, this process is non-uniform across different markets (Thenmozhi & Nair, 2014). Relative to a 'safe-haven' government bond country like the U.S., the spread of the Group of seven (G7) country's intrinsic macroeconomic variables are likely to induce larger impacts on that country's determinants compared to its underlying fundamentals, which will be will be more symmetrical the more substitutable two countries bonds are, relative to a reference benchmark nation (D'Agostino & Ehrmann, 2014). Dewachter, Iania, Lyrio, and de Sola Perea (2015) dissected European Union (EU) bond yield spreads into fundamental and non-fundamental economic components to determine the factors causing their yield differentials.[14] They found that shocks to fundamental economic variables influence government bond spreads, which gain prominence with the lapsing of time.[15] Roley (1981) and Cebula, Angjellari-Dajci and Foley (2014) found U.S. Treasury long-term bond yields are impacted by the yields of alternative securities, inflationary pressures, both stocks and flows of wealth, as well as stocks with lagged asset terms consistent with short-term adjustments in portfolios. Whereas Thenmozhi and Nair (2014) found that bond returns are inversely impacted by long-term interest rates, Akram and Das (2014) shed valuable light by examining an alternative perspective, finding that despite severe Japanese fiscal deficits resulting in inflated debt-to-Gross Domestic Product (GDP) ratios, Japan's long-term nominal government bond yields have remained persistently low and stable. Connock and Hillier (1987) found a progressively steady relation cultivated between the variables proxying anticipated inflation (exchange rate risk) and bond yield metrics, which might be attributed to Purchasing Power Parity (PPP) conditions. An alternative vantage point is offered by Afonso and Guimaraes (2014), advocating that numerically-based fiscal rules can be used to reduce government bond yields. Thomas and Wu (2006) even claim that the global implementation of inflation targeting regimes around the 1990s has altered government bond yield determinants. On the other hand, Jaramillo and Weber (2013) find that during epochs of relative tranquillity prevailing in global markets, EMEs domestic bond yields are affected by forecasts of real GDP growth and inflation. Prudent fiscal policies should be accentuated in EMEs given their susceptibility to rapid swings, which adversely impact their government bond yields and amount of debt outstanding (Hatchondo, Martinez & Roch, 2012; Jaramillo & Weber, 2013; Naraidoo & Raputsoane, 2015). Many researchers even suggest that both larger and anticipated future budget deficits propel long-term government bond yields (Afonso & Guimaraes, 2014; Cebula, Angjellari-Dajci & Foley, 2014; Elmendorf & Mankiw, 1998; Gruber & Kamin, 2012; Thomas & Wu, 2006). Thomas and Abderrezak (1998) found that these are channelled through perceptions of sovereign default risk, where Gruber and Kamin (2012) claim that the Global Financial Crisis (GFC) of 2007-2009 exacerbated these impacts. Using the parsimonious loanable funds model, Cebula, Angjellari-Dajci and Foley's (2014) found that the ten-year U.S. Treasury note's ex-post real interest rate yield is a cumulative function of

[13] VIX is an acronym for the Volatility Index and is used to gauge global expectations of market volatility in relation to the following one month ahead period. It is computed by the Chicago Board Options Exchange (CBOE) (Baele, Bekaert & Inghelbrecht, 2010).

[14] The fundamental component comprised of debt obligation capacities; levels of indebtedness; fiscal positions; global risk aversion levels; and financial contagion. Their non-fundamental counterparts included uncertainty, liquidity implications, and variables proxying a country's potential to exit the EU and attempt to re-dominate the region (Dewachter et al, 2015).

[15] Financial contagion is a notoriously relevant phenomenon for a currency and monetary union like the EU, who experienced a profound convergence of government bond yields following the creation of the EU in 1999. The residual countries who experienced yield differentials were perceived to be a product of their credit and liquidity risk differentials. Diverging bond yield spreads were also exacerbated by the 2011 sovereign debt crisis of the region (Dewachter et al, 2015).

the ex-post real interest rate yields on other instruments (Cebula, Angjellari-Dajci & Foley, 2014; Roley, 1981). Many countries attempt to fund their debt growth through short-term borrowing, making them particularly susceptible to threats of severe financial crises, and is likely to exert upward pressure on long-term bond yields (Reinhart & Rogoff, 2010; Naraidoo & Raputsoane, 2015). This can be related to Nakazato's (2011) findings, whereby substantial discrepancies between the interest rates of bonds can even be caused by credit rating agencies, current account balances and local outstanding amount ratios with respect to public subscription-type bond yields (Nakazato, 2011). Broos and de Haan (2012) find that while the growing trend of financial integration across the globe might be beneficial, foreign ownership of sovereign debt raises government bond yield elasticities with respect to the degree of state indebtedness. In the context of EME domestic-currency denominated government bonds, exchange rate volatility can exert upward pressure on yields because investors require appropriate compensation (Broos and de Haan, 2012; Gadanecz, Miyajima & Shu, 2014).[16] Monetary stimulus by advanced economies following the GFC enticed investors to hunt for larger yields, causing a greater degree of integration between EME and U.S. long-term government bond yields (Broos & de Haan, 2012; Gadanecz, Miyajima & Shu, 2014). Other forms of exchange rate volatility which impact EME sovereign bond yields relate to expectations of reductions in artificial monetary stimulus, such as the Fed's asset procurement program, as well as hedging exchange rate exposure (Gadanecz, Miyajima & Shu, 2014).

Against this backdrop, the various strands of literature can be used to formulate potential profitable tactical asset allocation strategies, in turn used to exploit arbitrage trading opportunities, portfolio management, rebalancing and risk management techniques. Brooks and Persand (2000) modified the Gilt-Equity Yield Ratio (GEYR) by blending it with the Markov regime switching model.[17] By forecasting with this model, an equity-bond profit-trading decision rule is formulated which yielded greater aggregate returns, coupled with reduced variability relative to a non-switching and static portfolio composed of arbitrary combinations of equities and bonds. While marginally better for the U.S. and Germany relative to the U.K., it was superior to naïve buy and hold strategies. Although this model can forecast signals that suggest when to divert financial capital away from equities into bonds (or vice-versa), on a net-basis, the profits generated through such trades were insufficient to offset its related transaction costs, which becomes relatively expensive when a switching-portfolio strategy is adopted (Brooks & Persand, 2000). In contrast to Brooks and Persand's (2000) findings, Krystalogianni and Tsolacos' (2004) strategies outperformed even when considering transaction costs. The papers by Brooks and Persand (2000) and Krystalogianni and Tsolacos (2004) are viewed as benchmark studies, and will hence be closely tracked. Market integration on a global scale bears salient implications for portfolio diversification and risk management techniques (Baele, Bekaert & Inghelbrecht, 2010; Broos & de Haan, 2012; Ilmanen, 2003; Zhou, 2011). Ilmanen (2003) suggests that stock-bond comovements severely effect long-term asset allocation, given that used to one's advantage, they might provide an effective hedge against threats of systemic risks, justifying lower government bond RPs. Despite evolving REIT research related to global linkages amongst returns, time scale elements are typically ignored (Zhou, 2011). Zhou (2011) observed that global return associations fluctuated over different time scales, with increasing returns in strength as the scale rises.[18] This indicates that portfolio diversification benefits exhibit decreasing marginal utility as time horizon lengthens, and hence optimal diversification would stem from smaller time intervals (Zhou, 2011). In terms of risk assessment techniques, investors who are concerned with time intervals should filter the non-constant nature of asset comovements into their analysis, which in turn could significantly improve the probability of obtaining superior performance (Asness, 2000; Andersson, Krylova & Vahamaa, 2008; Baele, Bekaert & Inghelbrecht, 2010; Ilmanen, 2003; Vaclavik & Jablonsky, 2012; Zhou, 2011).

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[16] Larger fiscal deficits and/or lacklustre economic growth tend to depreciate the value of EME currencies, thereby raising uncertainty regarding the stability of their currencies on a relative basis (Broos & de Haan, 2012; Gadanecz, Miyajima & Shu, 2014).

[17] The GEYR is the quotient of the earnings component of the yield on long-term government bonds to the dividend yield on stocks (Brooks & Persand, 2000). The Markov regime switching model is used to identify the state of yield discrepancies which emit signals in terms of when to shift capital funds amongst assets. The regime switching trading rules were based on exchange-traded real estate yield ratios, the bond-private real estate market yield ratio and to the yield ratio of exchange-traded to non-exchange traded real estate (Krystalogianni & Tsolacos, 2004).

[18] According to Zhou (2011), these markets are Australia, France, Hong Kong, Japan, Singapore, the U.S. and the U.K.

1.2. Problem Statement and Research Objectives

This paper zeroes in on narrowing the knowledge gap, and thus aims to enrich the literature by investigating why ten-year nominal government bond yields associated with EMEs exceed the trailing dividend yields (TDYs) on their corresponding REIT indices. This anomaly is the opposite scenario to what is observed in their advanced market counterparts, whereby their trailing dividend yields on REIT indices exceed their country's respective ten-year nominal government bond yields. This paper presents a first time application of a variant of the concepts underpinning the Fed Model, amalgamated with the BSEYD by applying it to the dividend yields of a particular asset class – namely, REITs. This model is labelled the REIT-Bond Yield Gap, and more specifically in relation to the EMEs that for part of this paper – the Reverse REIT-Bond Yield Gap. Thus the main contribution is to bolster the literature with respect to why EMEs government bonds out-yield their respective economy's trailing dividend REIT sector yields. A quantitative REIT-Bond Yield Gap is engineered, following which it is estimated in a Markov model framework. REITs replace conventional equity indices in this paper, as they are known to be high dividend yielding financial securities, and hence it is surmised and confirmed that the REIT-Bond Yield Gaps should be smaller than what would be the case if the trailing dividend yields of general equity market indices were used, except for the advanced economies. Thus, as illustrated in tables 1.2.1. and 1.2.2., this phenomenon is not unique to the REIT sector. This gave rise to the suspicion that the anomaly is likely emanating from another underlying variable. The graphs and tables presented on the subsequent page support these assertions.

Table 1.2.1.
Composite EME vs. Advanced REIT-Bond Yield Gaps

Time-Frame 2013/06/28-2015/11/30	EMEs	Advanced
Mean	-4.34	1.91
Spread	2.44	

Note.
Spreads are computed in absolute values. EME REIT-Bond Yield Gap spread is computed by taking the difference between the composite EMEs REIT sectors' trailing dividend yields less their composite EME ten-year nominal government bond yields.

Table 1.2.2.
Composite EME vs. Advanced Stock-Bond Yield Gaps

Time-Frame 2013/06/28-2015/11/30	EMEs	Advanced
Mean	-6.14	1.13
Spread	5.01	

Note.
Spreads are computed in absolute values. EME REIT-Bond Yield Gap spread is computed by taking the difference between the composite EMEs REIT sectors' trailing dividend yields less their composite EME ten-year nominal government bond yields.

Graph 1.2.1.
Composite EME vs. Advanced Generic 10-Y Nominal Government Bond Yields

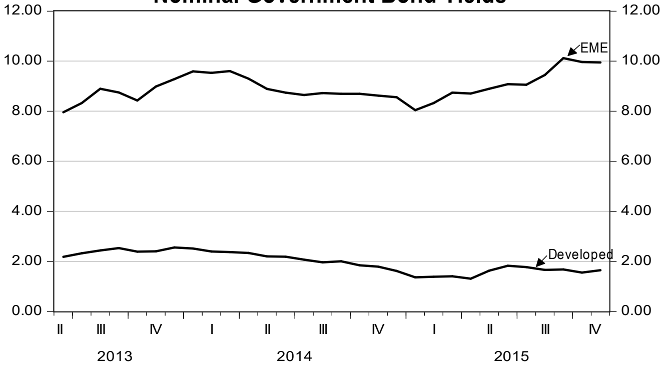


Table 1.2.3.
Composite EME vs. Advanced Generic 10-Y Nominal Government Bond Yields

Time-Frame 2013/06/28-2015/11/30	EMEs	Advanced
Mean	8.95	1.98
Spread	6.98	
Median	8.82	1.98
Maximum	10.12	2.56
Minimum	7.96	1.31
Standard Deviation	0.55	0.4

Graph 1.2.2. REIT-Bond Yield Gaps
EME vs. Advanced Economy REIT-Bond Yield Gaps

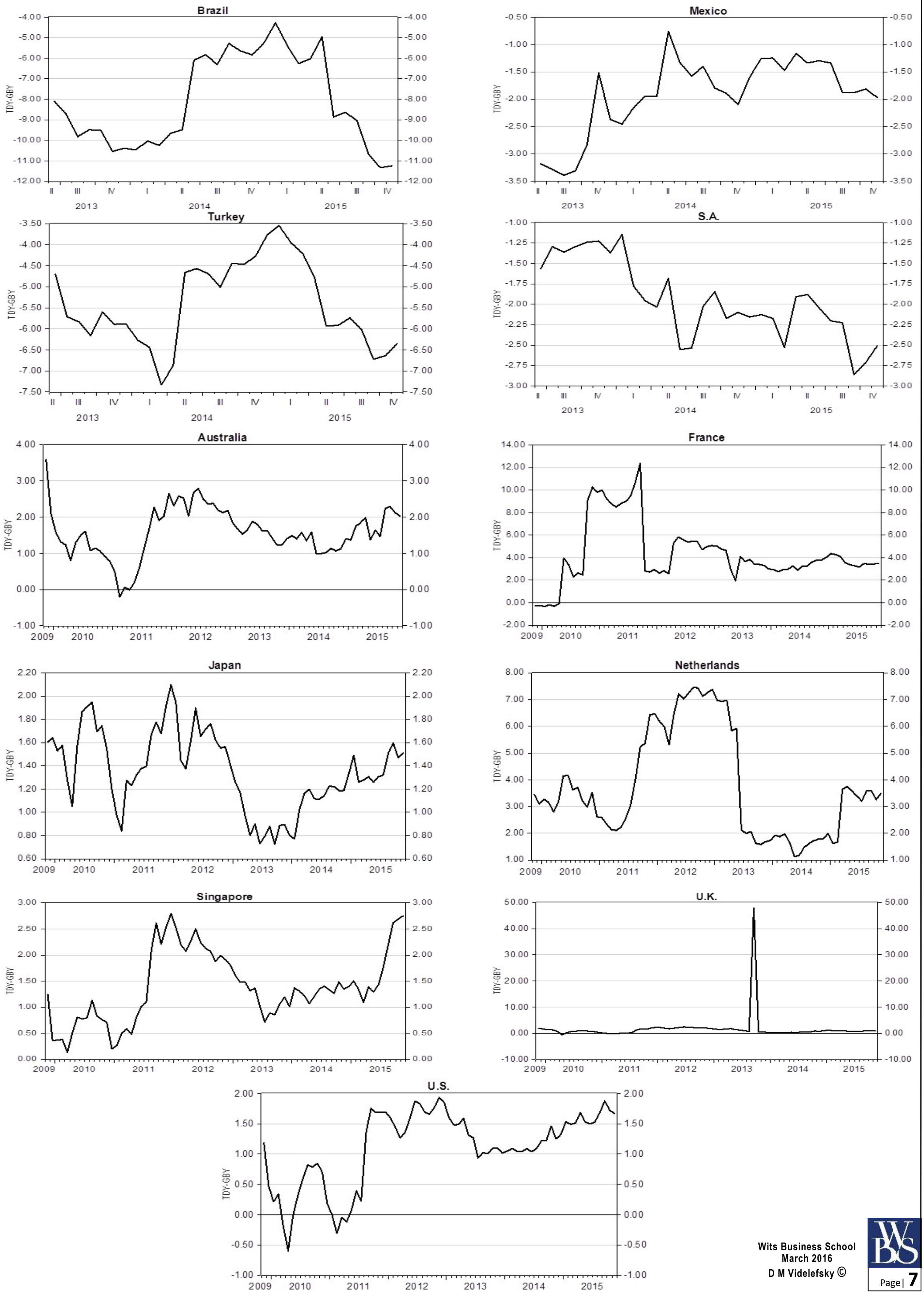
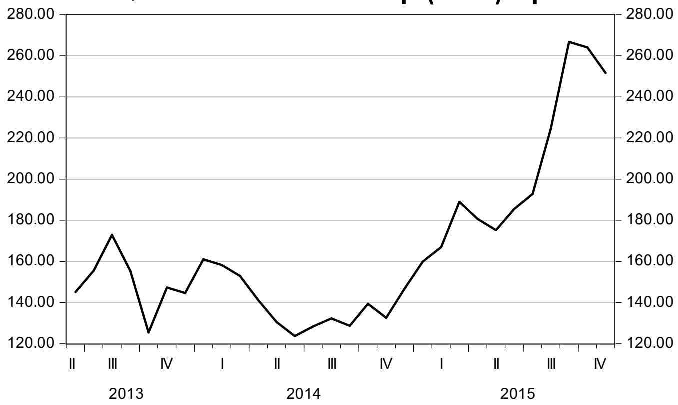


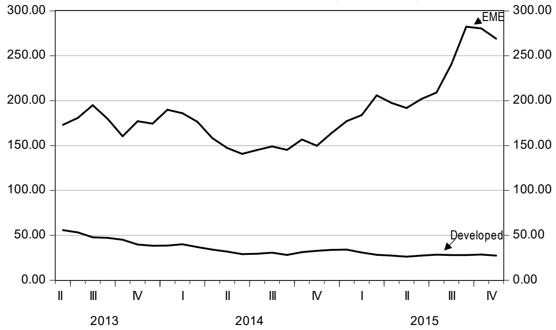
Table 1.2.4.
Composite EME vs. Advanced 5-Y Credit Default Swaps (CDSs) In US$

Time-Frame 2013/06/28-2015/11/30	EMEs	Advanced
Mean	186.3	34.61
Spread	151.68	
Median	178.46	31.57
Maximum	282.41	55.77
Minimum	140.65	26.23
Standard Deviation	38.29	8.11

Graph 1.2.3.
EME vs. Advanced 5-Y US$ Credit Default Swap (CDS) Spread



Graph 1.2.4.
Composite EME vs. Advanced 5-Y Credit Default Swaps (CDSs) In US$



The observed anomaly regarding the EMEs ten-year nominal government bond yields exceeding that of their corresponding REIT sectors trailing dividend yields, is clearly not unique to the REIT sector, as exhibited in table 1.1.1. Similarly, table 1.1.2. illustrates that the same holds true when this is examined in retrospection to the EMEs aggregated stock market indices. Additionally, EME REITs trailing dividend yields do not appear to be out of line relative to their advanced market counterparts, located in table A3.1 in the appendix. However, it is hypothesised and surmised, given the extensive literature review, that the REIT-Bond Yield Gap should be smaller than its corresponding stock-bond yield gap, on aggregate. This is because REITs are known to be high dividend yielding instruments, as examined and articulated concisely in the literature review. These assertions are reinforced in tables 1.1.1 and 1.1.2. More precisely, whereas the EMEs reverse REIT-Bond Yield Gap is estimated as -4.34, the EMEs reverse stock-bond yield gap is larger, as per a-priori expectations, documented as -6.14. This would suggest that EME REITs are technically less overvalued relative to their government bonds and to their stock market industry on a holistic basis. However, as for the advanced economies, an exception is found in that their REIT-Bond Yield Gaps are actually more positive (larger gaps) relative to their stock market indices as a whole. The latter might therefore suggest the opposite observation relative to the EMEs, in the sense that advanced economies REIT sectors might be more undervalued relative to government bonds and their stock market as a whole. A-priori expectations therefore suggest three central avenues that could be the driving forces underlying the EMEs reverse REIT-Bond Yield Gap anomalies. The EME reverse REIT-Bond Yield Gaps are surmised to be emanating from their relatively larger government bond yields (graph1.2.1 and table 1.2.3). This is against the observational backdrop that the trailing dividend yields on the EMEs REITs are approximately in line with their advanced market counterparts. The anomalies are thus assumed be reflective of the degree of sovereign risk associated with the EMEs, as evidenced by their relatively larger government bond yields. The larger degree of EME sovereign risk is illustrated in table 1.2.4, and graphs 1.2.3 and 1.2.4. The literature review, however, examines various perspectives of both REITs and government bonds, in order to ascertain a holistic understanding of what might be the likely drivers of the anomalies.

This paper encompasses a tri-fold research objective, and aims to accomplish them in a scientifically-based, objective and coherent fashion. Specifically, investigating what propels deviations in the REIT-Bond Yield Gaps spanning across four EMEs and seven advanced market counterparts. It encompasses a tilted focus towards why EME nominal government bond yields almost persistently exceed REIT dividend yields, even after time-series fluctuations, and therefore resulting in what the Fed Model would suggest as representative of EME REIT market over valuation (or expensive relative to their respective government bonds), whereas their advanced market counterpart REITs would thereby be considered undervalued (or cheap relative to their respective government bonds). It will also pay close attention to the implications for portfolio and risk management purposes, as the results might emit optimal timing signals in terms of when to shift capital funds from one asset class to the other, as well as attempting to identify and formulate profitable tactical asset allocation strategies from the empirical results that flag arbitraging of mispricing opportunities.

Meeting the above set of objectives would potentially provide useful information to academics, the REIT industry and various other economic agents. For example, it may settle certain disputes within the investment space in the context of why the identified empirical anomaly exists in the EME context, which forms the backbone of this study. Additionally, portfolio managers and investment strategists are likely to find the results beneficial as they could provide a 'market-timing' tool in terms of when to shift funds from one asset class to another, and aid in the development of profitable trading rules which would take advantage of possible arbitrage mispricing opportunities resulting from the identified anomaly.

1.3. Overview of Research Design

The sample data comprises of monthly REIT indices trailing dividend yields, the yields on ten-year generic government bonds, Credit Default Swaps (CDSs), inflation rates and the CBOE VIX.[19] The REIT indices trailing dividend yield and associated metrics are the Financial Times Stock Exchange/European Public Real Estate Association National Association of Real Estate Investment Trusts (FTSE/EPRA NAREIT) series, whilst their stock market counterpart indices are similarly of frequent use in empirical studies of this nature.[20] All data sets are calculated by and retrieved from Bloomberg Data Terminals. This paper examines 11 markets, of which four are EMEs - classified as Brazil, Mexico, Turkey and S.A., whereas the other seven are their advanced market counterparts - Australia, France, Japan, the Netherlands, Singapore, the U.K., and the U.S. The time-frame spans the period June 2013 until November 2015 for the EMEs, whilst their advanced market counterparts time-span covers the period November 2009 until November 2015. The time-frames were largely selected as a result of, and hence dictated by, data availability, specifically in relation to the REIT indices associated with the 11 separate economies. The main empirical results section abides by these strict time-frames, although a handful of additional supporting empirical calculations adopt the EMEs time-frames in order to facilitate certain inferences over congruent periods. The concepts underlying Connock and Hillier's (1987) Monetary Approach were used to construct an estimate of exchange rate (or currency) risk, which furthermore sheds light on anticipated inflation. Forward earning yields for both the stock market and REIT indices were computed by taking the reciprocal of their respective P/E ratios. Another measure of objective expected inflation was computed by subtracting from the ten-year generic nominal government bond yields their inflation-linked counterpart government bond yields (Lashgari, 2000).

In the same vein as Berge, Consigli, and Ziemba (2008) and Aubert and Giot (2007), the tenets and rationale embedded in both the Fed Model and the BSEYD are illuminated through mathematical expressions, following which their mechanical links with each other are made clear. It is then shown how they are modified in this paper to investigate the trailing dividend yields on REIT indices, in place of conventional equity market indices, in order to construct the REIT-Bond Yield Gap metric, which can then be quantified through the use of a tactical asset allocation multivariate Markov Regime Switching Model framework. Thus, after laying down the fundamentals, the system, based on the Markov switching model is placed in a steadfast path to be set together. In an analogous mode of operation to that set forth by Berge, Consigli, and Ziemba (2008), as well as Aubert and Giot (2007), this paper employs a variant of the Fed Model, and more precisely, the REIT-Bond Yield Gap, spanning 11 economies. This has been executed along the

[19] A salient limitation emerges with respect to the ten-year generic nominal government bonds. This relates to the unavailability of total return data, resulting in the inability to compute, compare and contrast actual, relative to hypothetical tactical asset allocation strategies, against a buy-and-hold technique.
[20] Kindly refer to appendix – tables A6, for additional information on the stock indices series.

lines of subtracting from each respective market's trailing dividend yields on their REIT indices their corresponding nominal government bond yields. The essential motivating idea behind this is for the purpose of capturing the reverse REIT-Bond Yield Gap in relation to the EMEs nominal government bond yields exceeding their respective market's trailing dividend yields on REITs. In order to capture the non-linearities of the joint distribution between each respective markets' trailing dividend yield on REITs less its corresponding nominal government bond yields – the so called 'reverse yield gap', or yield gap in the case of the advanced economies, Brooks and Persand (2001), Guidolin and Timmerman (2006), Krystalogianni and Tsolacos (2004), Li, Wang and Yang (2008) as well as Reinhart and Roghoff (2010) motivate the use of Markov-based regime switching regression models.

This paper adopts as the primary empirical mode of computation the Markov regime switching econometric regression model. Since there exists no formal financial econometric regression model to estimate the Fed Model, or relatedly the bond-stock yield gaps, the Markov regime switching regression model is appropriate (Brooks, 2014). Multivariate Markov models essentially test if and how multiple regressors influence the value of the transition probabilities during differing regimes (Krystalogianni & Tsolacos, 2004). In effect, the threshold value of the REIT-Bond Yield Gap is modelled to vary with fluctuations in the explanatory variables and unobservable state variables. The purpose of adopting it, in addition to the motivations by Brooks and Persand (2001) and Krystalogianni and Tsolacos (2004), is in order to generate statistical inferences of when switching in regimes occur between REIT and government bond markets, and therefore their underlying assets (or cash flows). The two distinguishable regimes are specified as under (or over) valuation, in relation to these two financial securities, spanning the 11 countries. The primary aim of this is an attempt to gauge which, or if any, of the three independent variables are driving deviations in, and why a larger REIT-Bond Yield Gap (more negative spread) exists between the EMEs REIT-Bond Yield Gaps, relative to those of their advanced market counterparts. The Markov model also computes the probabilities of being in a particular regime. Following this, it is intended to facilitate predictions regarding how long a given regime is expected to persist for, as well as whether or not profitable trading strategies, given the models empirical results, can be formulated in order to exploit the viable, salient findings (Brooks & Persand, 2001; Brooks, 2014; Krystalogianni & Tsolacos, 2004).[21]

According to Brooks (2014), entrenched within the Markov regime switching methodology, there exists a multiverse of potential manifestations, which are fragmented into *m* states of the world. These states are assigned the following notation: $s_{i,}$ i = 1, 2, …, *m,* in relation to *m* different regimes. In this paper, attention is constrained exclusively to the scenario where *m* = 2. The Markov model has embedded advantages, in that it is highly adaptive, robust, and has an extended use of applications (Brooks & Persand, 2001; Krystalogianni & Tsolacos, 2004). Markov models also encompass the ability of gauging fluctuations in the means and variances between different regimes, and are amongst the most widespread non-linear time series models (Brooks, 2014). A major advantage, which is also a crucial axiom of the model, is that the dependent variables are normally distributed subject to being in a specified regime, hence permitting some degree of variation in the means and variances (Brooks & Persand, 2001). It is an optimal procedure for articulating serially correlated data, which vary with the passage of time, and hence during different regimes (Brooks & Persand, 2001). Another pivotal axiom is that the dependent variable, y_t, experiences a shift in regime, which is regulated by a single (or set of) unobservable state variable(s), s_t (Brooks, 2014). For the purpose of this paper, and similarly to the modus operandi tracked by Brooks and Persand (2001) and Krystalogianni and Tsolacos (2004), the assumption adopted here is that there are two regimes – one corresponding to the scenario in which a given country or set of countries REIT sector(s) are undervalued (overvalued) relative to long-term government bonds, and in a strict financial and economic sense, a state of equilibrium between the two regimes. Thus, $s_{t=1}$ and $s_{t=2}$ implies that the system is either in regime one or two, at time t, respectively. It then follows that variations in the state variable between the two regimes are regulated by so-called Markovian properties (Brooks & Persand, 2001; Brooks, 2014; Krystalogianni & Tsolacos, 2004).

As illuminated by Brooks and Persand (2001), the Markov model is in effect, a statistical procedure used to partition the data samples, and thereby assigns each sample with an associated set of probabilities. In order to test the specification of the estimated fit of the models, and the hypothesis at its core, Brooks and Persand (2001) propose a viable, portmanteau hypothesis, structured around two separate null hypotheses. The first null espouses that the

[21] According to Brooks and Persand (2001) as well as Krystalogianni and Tsolacos (2004), the Markov models gives rise to a natural trading rule mechanism.

regimes exhibit stability with the passage of time, permitting disparities in their means and variances. Larger values of the probabilities of being in regimes one and two represent greater robustness in the regimes, thereby raising the chances of refuting the null (Brooks & Persand, 2001). The second null presupposes that the variances fluctuate under the different regimes, whereas the estimated mean values must differ substantially (Brooks & Persand, 2001). Combining the two sets of null hypotheses, a rejection of both would suggest that permitting regime switching is a value-enhancing method of gauging the desirable parameters of interest (Brooks & Persand, 2001).

The Markov convention adopted in this paper is expressed as follows: [22]

$$\left.\begin{array}{l} y_t = \boldsymbol{REIT\ Index}_{TDY,t\,(country\ x)} - \boldsymbol{Nominal}_{\ GBY,t\,(country\ x)} = \beta_{0,1} + \beta_{1,1}\textbf{Inflation} + \beta_{2,1}\textbf{Credit Default Swap} + \beta_{3,1}\textbf{CBOE VIX} + \varepsilon t \\ y_t = \boldsymbol{REIT\ Index}_{TDY,t\,(country\ x)} - \boldsymbol{Nominal}_{\ GBY,t\,(country\ x)} = \beta_{0,1} + \beta_{1,2}\textbf{Inflation} + \beta_{2,2}\textbf{Credit Default Swap} + \beta_{3,2}\textbf{CBOE VIX} + \varepsilon t \end{array}\right\} \begin{array}{l} s_t=1 \\ s_t=2 \end{array}$$

→ $\beta_{1,}$ Inflation > 0; $\beta_{2,}$ Credit Default Swap > 0; $\beta_{3,}$ CBOE VIX < 0

Justification for the theoretical (postulated) signs are indicated in table 1.3.1., whilst the relationship between the EMEs and advanced economies REIT-Bond Yield Gaps is depicted in figure 1.3.1. below.

Table 1.3.1.
Theoretical Expected Signs

Theoretical Expected Relation	State of REIT-Bond Yield Gap	REIT-Bond Yield Gap Expected Behaviour
+	↑ Inflation → ↓ TDY → ↑ GBY	Equities are cheap (or undervalued) relative to government bonds: ↑ P_E → ↓ TDY → ↓ P_{GBs} → ↑ GBY
+	↑ Credit Default Swap → ↓ TDY → ↑ GBY	Equities are cheap (or undervalued) relative to government bonds: ↑ P_E → ↓ TDY → ↓ P_{GBs} → ↑ GBY
-	↑ CBOE VIX → ↑ TDY → ↓ GBY	Equities are expensive (or overvalued) relative to government bonds: ↓ P_E → ↑ TDY → ↑ P_{GBs} → ↓ GBY

Figure 1.3.1.
Generic EME vs. Advanced Economies Postulated Anomalies

REIT-Bond Yield Gap = y_t = REIT Index, $_{TDY,t}$ (country x) – Nominal, $_{GBY,t}$ (country x)

EMEs: **reverse yield gap = negative spread**

Advanced Economies: **yield gap = positive spread**

[22] This model specification applies to nine out of the 11 countries. In the regressions for Australia and the Netherlands, AR(1) and AR(2) variables were incorporated into the regressions, as deemed necessary. More information is provided in the empirical results section – 4.2.

1.4. Outline of the Paper

The remainder of this paper is organised in the following order. Section II provides an extensive review of the literature, synthesising academic and analyst voices from multiple vantage points. The scene is set by comparing and contrasting portfolio and asset allocation theories, before exploring the place and evolution of government bonds and REITs. It then amalgamates an enriched and in-depth analysis of both REIT and government bond yield literature, zeroing in on and setting the scene for the potential factors that influence the observed EME statistical reverse REIT-Bond Yield Gap anomaly, in which EME ten-year nominal government bond yields on aggregate exceed their respective countries dividend yield on REITs, in comparison to this finding being almost non-persistent in nature when examining the EMEs advanced market counterparts. It begins with an investigation into the theories that weave together the Fed Model literature – the pivotal component of the puzzle. It is at this statistical juncture by which this paper creates its own uniqueness, by replacing aggregate equity indices dividend and/or earnings yields with those of the aggregate REIT sectors'. In order to provide the Fed Model literature with meaningful weight, an extensive discussion surrounding a short financial history on the correlation and cointegration between general stocks, REITs and government bonds is explored. Additionally, potential predictability attributes underlying the very epitome and nature of dividend yields and stock market indices is assessed. The remaining literature is then partitioned by examining in great depth various literatures covering a barrage of perspectives on both REITs and government bonds, in order to ascertain from which direction the anomaly is likely emanating from. The REIT literature entails an investigation into REITs dividend policies, capital structures, historical performance determinants, inflation analysis, lease contract structure analysis, their valuation, as well as shopping centre rent and expansion determinants, upon which REITs engage in contractually stipulated arrangements with their tenants to generate their rental cash flows. Subsequently, the government bond literature forms the blueprint framework for this financial eco-system analysis by beginning with the macroeconomic environment and its potential impacts on government bond yields. Following this, proposed methodologies utilised for term structure modelling and forecasting of government bond yields is assessed. Next, the fabrics that sow together the financial seeds propelling fluctuations in government bond yields are reviewed. At the country-wide level, government bond yields are examined from the perspective of national debt sustainability, fiscal rules and budget deficits as well as exchange rate risk. In the final section of the literature review, the two partitioned strands of literature are weaved back together, through an analytical tactical asset allocation framework, which aims to illustrate how a formulated and back-tested trading rule strategy by which the statistical anomaly of this paper could perhaps be exploited in order to generate profits. Section III then moves on to discuss an in-depth analysis of the data, its sources, variables that were constructed, limitations and the overall methodological framework used to compute the various metrics for estimating the empirical results. Section IV delivers the cross-literature review findings, presents and interprets the main empirical results, as well as the potential tactical asset allocation strategies that could be exploited, using the salient findings. Lastly, the paper concludes with section VI and recommends avenues for future research.

II. LITERATURE REVIEW

2.1 Portfolio and Asset Allocation Theories

In this section, modern portfolio theory (MPT), the brainchild of Harry Markowitz, forms the linchpin with the evolution of contemporary portfolio and asset allocation theories, many of which have MPT at the heart of their analytical foundations. It also tracks their statistical advances to post-modern portfolio theory (PMPT) with the passage of time. In addition to the evolution of their theoretical tenets, it elucidates upon their mechanics, advantages, caveats and empirical testing, as well as the concepts underpinning diversification, conventional and downside risks, and resampling methodologies. These form the cornerstone to and place all finance and investment literature studies in a steadfast path for further statistical advances. Understanding the concepts underlying these theories is also imperative to tracking new and unchartered statistical anomaly terrain, which is the undercurrent of this thesis.

2.1.1 Portfolio Theories

Harry Markowitz shaped the landscape upon which classic portfolio theories are based, and is the forefather of MPT.[23] Markowitz (1952) pioneered the concept of rational behaviour amongst investors and introduced the relationship between risk and return into financial modelling. The essence of Markowitz's portfolio theory entails selecting assets that conform to portfolio return maximisation, by optimally allocating capital to those assets with the greatest expected returns and minimum variance (Markowitz, 1952). Penny (1982) reinforces this from a different vantage point, by asserting that portfolio theory is grounded on the notion that the risk of an individual security should be reduced when combined with other securities in a portfolio of assets, suggesting that a well-constructed portfolio's risk should be less than the sum of its individual risks in isolation. Markowitz (1952) endorsed a quantitative framework to guide the portfolio selection procedure through the analysis of his 'anticipated returns – variance of returns rule'. However, this rule does not insinuate diversification in the conventional sense, but instead hypothesises that in maximising expected returns, all available funds should be allocated to the security exhibiting the largest present (discounted) value. Markowitz (1952) mathematically illustrated that diversification cannot be attained by simplistically selecting a range of assets to populate a portfolio.[24] Another rule exists which permits anticipated future return maximisation corresponding to the minimum variance, in which aggregate portfolio risk and return characteristics can be leveraged by optimally selecting assets with low, and specifically negative correlations, which forms the essence of diversification (Penny, 1982). This is against the backdrop that total portfolio variance is a function of the covariances of the assets that comprise a portfolio (Penny, 1982). From this, it is evident that low and/or inversely correlated combinations of assets would be congruent with portfolio return maximisation, whilst simultaneously minimising portfolio variance.

Penny (1982) therefore suggests that diversification may be attained by selecting at least 20 common stocks to populate a portfolio, or alternatively by computing individual securities' standard deviations. Measures of portfolio risk can then be subdivided into unsystematic (or idiosyncratic) and systematic components. However, not all variance can be eliminated, and neither does the portfolio generating the maximum expected returns necessarily correspond to the portfolio with the minimum variance. There is therefore a trade-off between reducing variance by sacrificing expected returns, and vice-versa. This iteration procedure ultimately results in a set of efficient portfolios, following which selection from this set is congruent with investors tolerable risks (Markowitz, 1952). Gauging the sensitivity of securities in response to market fluctuations (or systematic risk) is then measured with a security's beta coefficient, whilst aggregate portfolio performance is quantified through risk adjusted rates of return, factoring in inflation and its tendency of eroding portfolio returns in a nominal sense (Penny, 1982). Portfolio theory also resulted in the evolution of valuation models that assist in security price determination. Most valuation models employ a discount rate as the fundamental input variable, resulting in the price that should be paid for a given security today (Ilmanen, 2003; Penny, 1982). Tracking portfolio theory's evolution, Sharpe (1963) used as a platform Markowitz's (1952) MPT by extending its use of portfolio analysis. Sharpe (1963) simplified a MPT portfolio analysis convolution, by illustrating that any set of efficient portfolios can be reduced into 'corner portfolios'.[25] A further set of axioms – labelled the Diagonal Model, was

[23] MPT is also labelled mean variance optimisation (MVO) and mean variance efficient portfolios.

[24] Potential assets that can populate a portfolio may be confined by legal restrictions and budget constraints, however, they typically include common stocks, corporate and government bonds, other fixed-interest bearing securities and exchange and non-exchange traded real estate (Penny, 1982).

[25] Corner portfolios narrows attention to the set of portfolios that are most relevant (Sharpe, 1963).

then designed to reduce the volume of required computational comparisons relative to those required by MPT (Sharpe, 1963).[26] Another concept pivotal to portfolio theory is that of efficiency. Eugene Fama's (1965) Efficient Market Hypothesis (EMH) postulates that an efficient market is one in which securities are fairly priced – a state of equilibrium exists, free from the forces of excess demand or supply. Three pillars form the backbone of the EMH, and differ as to their strength and validity. The "strong" form advocates that asset prices instantaneously reflect all information, public, private and even inside. The "semi-strong" variant proclaims that all publicly available and relevant information is impounded into asset prices, and that new information results in immediate price correction. Lastly, the "weak" form of the EMH suggests that the prices of traded securities encapsulate all relevant historical and publicly available information. Proponents of the EMH believe that investors cannot consistently, on a risk-adjusted basis, achieve superior performance relative to a specified benchmark or market index. Prices thus respond exclusively to new information and/or changes in relevant policy (discount) factors. Empirical evidence suggests that salient global stock markets are relatively efficient. Consequentially, investors are unable to 'find bargains' by purchasing undervalued and/or selling overvalued stocks, because any divergence between price and value will be rapidly eroded through equilibrium mechanisms. This, in turn, renders the quest of outperformance relative to a benchmark index on a consistent risk-adjusted basis a spurious endeavour, irrespective of asset or fund managers' investment selectivity and/or market timing skills (Fama, 1965).

Flowing from the realms of the EMH, the Capital Asset Pricing Model (CAPM) is one of the most widely adopted models for quantifying excess returns (Videlefsky, 2014).[27] The CAPM has its foundations embedded in, and in which the central significance underlying it is the EMH. The conventional CAPM bases the premium for non-diversifiable risk on the application of a beta coefficient to the deviation between the stock market and RF rates of return. It thus attempts to capture the expected excess return generated by a security through market fluctuations. CAPM involves quantifying Jensen's alpha as a performance index. Jensen engineered a linear expression that permits a comprehensive yet elegant framework with which to estimate and analyse a capital asset(s) return performance, factoring in its systematic risk, relative to the returns realised on a passively managed conventional performance benchmark - the Security Market Line (SML). This analysis incorporates the RF rate of interest, plus a stochastic error term. Over the long-run, a security from a given market sector is expected to perform in line with the SML. CAPM is also frequently used for discount rate derivation (Videlefsky, 2014). Following the tenets of Markowitz's (1952) MPT, the Capital Market Line (CML) and the Diagonal Model were conceived (Rambaud, Perez, Granero, & Segovia, 2005). Concurrent to Markowitz's publication, a less well known paper was published by Andrew Donald Roy, which was based on identical properties to Markowitz's model. However, it defines risk as the probability of not attaining the anticipated reservation return. Although its proponents claim that it generates superior return estimates relative to the classic models, its caveats relate to the large volume of required estimates, and the resultant convoluted solution. Certain risk-return values might also render the model inoperable, ultimately preventing the attainment of the shape of the efficient frontier. It additionally prohibits the inclusion of zero-risk assets like government bonds. Rambaud et al (2005) extended Roy's model by introducing critical levels of risk and return, which was conducive to higher risk portfolios while generating greater expected returns, subject to investors maximum debt capacities (leverage). The CML may then be examined from a new perspective, in which the critical return is below the return of zero-risk assets, scenarios otherwise implausible through the use of classical models (Rambaud et al, 2005).

On the basis that Markowitz's (1952) original work was based on some theoretically inclined and inoperable axioms (Galloppo, 2010; Idzorek, 2006; Rasiah, 2012; Vaclavik & Jablonsky, 2012), this led to an evolution of further development and refining of his theories (Fama, 1965; Rambaud et al, 2005; Sharpe, 1963; Vaclavik & Jablonsky, 2012). Vaclavik and Jablonsky (2012) claim that market turbulence and its impact on sentiment tend to distort the correlations amongst financial asset prices, reducing the benefits of market risk diversification based on MPT, as witnessed during the GFC. Attempts to rectify distorted correlations generally produce impracticable solutions. MPT's stringent assumptions are the primary source of contention, and violations of these are required in order to appropriately reformulate an alternative operable and viable working model. Vaclavik and Jablonsky (2012) assert that

[26] Sharpe's (1963) Diagonal Model is an extended yet computationally simplified version of MPT. It contributed to the investment community by reducing both the computational time and required memory capacity for portfolio analysis problems (Sharpe, 1963).

[27] Excess returns are sometimes labelled rather crudely as alpha by investment communities (Videlefsky, 2014).

MPT's principal axioms and necessary violations are tracked below. One, financial asset returns are approximately normally distributed. The finance literature disputes this because they are log-normally distributed in reality, meaning they are asymmetric and leptokurtic (Galloppo, 2010; Vaclavik & Jablonsky, 2012). This assumption could systematically bias model testing. Two, financial security returns are constantly correlated through time. Correlations are closely linked to overall market sentiment, which in turn depends on overall economic and financial conditions – phenomena which do not remain constant. This could result in the erroneous application of diversification during market turbulence (Vaclavik & Jablonsky, 2012). Three and four require no modifications, and respectively state that investors exhibit rational, risk-averse behaviour and are price takers. Five, financial securities are homogenous. However, the range of securities available in the 21st century render this untrue, and failing to consider this might also lead to biased results. Six, only long (buy) positions may be undertaken. Modern financial assets like exotic derivatives permit long and/or short (sell) positions. Failing to consider this results in poor diversification. Seven, return deviations in either direction from expectations proxy market risk (Vaclavik & Jablonsky, 2012).

These defunct axioms subsequently led to the birth of PMPT, which is based on its own set of crucial assumptions, but typically examines asset pricing and the diversification process used to maximise portfolio returns. Vaclavik and Jablonsky (2012) suggest that PMPT mainly tackles MPT's assumptions one and seven, even though their analysis redressed assumption two by replacing covariance matrices with price scenarios and were found to be highly subjective and not an acceptable alternative. PMPT offers two refinements to the statistical tools employed by MPT, since they are all based on some variant of the standard deviation (Galloppo, 2010; Rasiah, 2012). Rasiah (2012) contrasts the preludes of MPT strands of literature with PMPT. Whilst MPT defines volatility as the fluctuation of an investment's return in either direction, as gauged by standard deviations, PMPT advocates that it is only those fluctuations below investors targeted returns which actually incur risk, in other words, risk should be relative to and linked with investors individual goals, as captured by the downside volatility or risk (DR) metric. Vaclavik and Jablonsky (2012) claim that MPTs assumption seven is improved by replacing standard deviations with DR metrics. Any returns above such targets generate ambiguity, which may be interpreted as the riskless segment of unexpected returns. Put differently, one might perceive the left tail of a return distribution as risk, whereas the right tail represents enhanced outlay opportunities (Rasiah, 2012). Whereas MPT deploys alpha to measure the excess return of a security relative to a benchmark index, beta to capture a security's risk relative to a benchmark's, and the Sharpe ratio to gauge excess return per unit of total risk. PMPT conversely uses omega to quantify a security's excess return, DR relative to a benchmark for comparing a security's return to that of a benchmark, and Sortino ratios to compute the excess return per unit of risk.[28] DR and asset returns do not assume normal distributions, allowing enhanced accuracy and adaptability. PMPT thus facilitates portfolio optimisation based on returns relative to DR by amalgamating downside magnitude and frequency, as well as aggregate downside deviation into one statistic (Rasiah, 2012).

Even though portfolio managers still draw on primitive portfolio theories such as MVO, it results in highly concentrated asset allocations (Dziwok, 2014; Idzorek, 2006) and therefore has not been fully embraced as the primary asset allocation tool of choice. Rasiah (2012) corroborates this, claiming that even though many still rely on outdated conventional methods, they simultaneously do not take advantage of statistical advances like DR frameworks and Sortino ratios, which pose questions as to which methodologies are predominantly being used in practice. Galloppo (2010), in a similar vein to Rasiah (2012), divides portfolio modelling into separate families based on their historical evolution, yet differs by tracking the cutting-edge advances in the portfolio theory field. The original set of conventional models, Markowitz's (1952) MPT and CAPM – rely heavily on standard deviations (Galloppo, 2010; Rasiah, 2012), whereas the newer generation PMPT models employ statistical advances like the Mean Absolute Deviation Minimisation (MADM), Tracking Error Minimisation Model (TEV), Elton-Gruber, and Shortfall Probability Models (SPMs) (Galloppo, 2010). The quantitative dynamics of the earlier generation were all based on the assumption that financial asset returns are normally distributed, even though they are asymmetric and leptokurtic in reality (Galloppo, 2010; Vaclavik & Jablonsky, 2012). Galloppo (2010) focused on plausible methods of diminishing estimation errors currently observed in practical implementations of portfolio modelling by using a resampling methodology for comparing MPT to the newer generation PMPT statistical frameworks.[29] Using blue-chip equities from the Italian Equity Market, the New

[28] Sortino ratios only penalise for deviations which fall below the target rate of return – the downside volatility, therefore capturing risk-adjusted returns more realistically than the Sharpe ratio, which penalises equally for deviations in either direction from the specified target return (Rasiah, 2012).

[29] Resampling amalgamates input parameters with estimation errors in order to enhance out-of-sample performance forecast results (Galloppo, 2010).

York Stock Exchange (NYSE), and the European Stock Exchange, Galloppo (2010) found no improvements through the application of resampling to MPT. However, with respect to the newer generation statistical frameworks, significantly enhanced results were obtained under all scenarios, excluding the TEV model. These were most striking for the SPM model, where performance results improved from 78% to 196%. The Sharpe Index improved in 100% of the tests, yet again, no such findings held true for MPT models. The Sortino ratios produced enhanced MPT results, yet none for the PMPT. When considering Sortino's DR measures and traditional standard deviations, resampling only tends to improve TEV-based models (Galloppo, 2010).

2.1.2 Asset Allocation Theories

With due credence given to the paradigm that investment diversification is executed across borders, industries, market capitalisations and asset classes in an attempt to maximise portfolio returns whilst minimising risks (Dzikevicius & Vetrov, 2012), it has been corroborated that the time-series variation in asset return performance is a product of a portfolio's general and strategic asset allocations (Booth & Broussard, 2002; Dzikevicius & Vetrov, 2012; Sharpe, 1992), and is therefore usually given prominence as one of the fundamental drivers of investment returns, accounting for roughly 93.6% of variation. The portfolio management process comprises of planning, execution, and control (or feedback) (Dziwok, 2014). The objective is to construct a suitable combination of assets that conform to investors' requirements and is also dual dimensioned, involving strategic and tactical asset allocation, which encompass market timing.[30] After identifying a set of potential asset classes, the exposures to each segment and the effective asset mix are determined (Sharpe, 1992). Subsequently, performance measurement is computed to determine whether or not active management styles have generated superior value relative to a passive benchmark index. Sharpe (1992) advocates that an effective method is an asset class factor-based model, given that it permits a separation and identification into the portion of returns which is either due to style or selection, similarly to the Quadratic-CAPM adopted by Videlefsky (2014), and can either be used in isolation and/or as a supplement to other methodologies. The critical line or gradient methods can also be used for these purposes. Dziwok (2014) presents a comparative analysis of contemporary asset allocation theories and provides next generation alternatives. Whereas, MVO seeks to determine optimal points on the efficient portfolio frontier that are congruent with investors risk tolerance, it fails to effectively diversify due to its construction of highly concentrated portfolios and is static in nature, resulting in risk underestimation (Dziwok, 2014; Idzorek, 2006). While its framework is intended for a single period optimisation, the majority of investors establish multi-period objectives, resulting in deficient robustness in terms of optimality varying with the passage of time (Dziwok, 2014). Contrastingly, Monte Carlo Simulation may be employed to generate a resampled efficient frontier by simulating historical returns on the basis of MVO, allowing portfolio managers to determine if rebalancing is required, and additionally to overcome the inherent caveats of traditional MVO by formulating well-diversified and robust asset allocation strategies (Dziwok, 2014; Galloppo, 2010; Idzorek, 2006). While Dziwok (2014) asserts that resampling is superior to MVO due to its superior diversification and time-series stability, Galloppo (2010) conversely refutes this, claiming that resampling is only useful for improving returns, but not the proportional stability of these returns, and hence the actual benefits derived from resampling still remain ambiguous to some degree. Galloppo (2010) also contrastingly found no improvements through the application of resampling to MPT, even though enhanced results for PMPT models were attained. However, the resampling method is a-theoretical and thus its usage is rarely justifiable (Galloppo, 2010).

By combining investment of stocks with Treasury bills in an effort to minimise the risks inherent in equity portfolios, Howe and Pope's (2014) empirical resampling framework using dynamic long-run asset allocation strategies including constant mix, buy and hold, and Constant Proportion Portfolio Insurance (CPPI) indicates that leveraged terminal risk and return tends to emanate from greater proportions of common stock that populate a portfolio. However, an exception is in relation to the CPPI strategies, in which the probability of the portfolio wealth relative being below that of the Treasury bill wealth relative diminishes as the percentage of common stock populating the portfolio rises (Howe & Pope, 2014). However, on the back of the reasons listed above, Galloppo (2010) would refute Howe and Pope's (2014)

[30] Strategic (policy) asset allocation assigns funds to asset classes which will strike an optimal balance between anticipated returns and investor's degrees of risk tolerance over long horizons. Tactical asset allocation complements this by seeking to identify shorter-term opportunities which bridge the time-gap between the strategies and in effect generates incremental returns by observing trends, fluctuations in variances and/or correlation properties of asset classes. It assigns larger weights to undervalued asset classes and smaller weights to overvalued asset classes (Dziwok, 2014).

findings. Another asset allocation method, labelled the Black-Litterman Model, uses expected return series based on CAPM to enhance performance (Dziwok, 2014; Idzorek, 2006). It can subsequently be augmented with proprietary research, and used for either strategic or tactical asset allocation that results in a set of diversified portfolios, thereby overcoming highly clustered and under-diversified asset allocation schemes. Its objective is to establish a stable, mean-variance efficient portfolio which does not suffer from parameter sensitivities of expected returns, as is the case with resampling techniques (Galloppo, 2010). If there are no specified expected returns, the portfolio weights will be identical to those produced by CAPM. On the other hand, Idzorek (2006) provides a first time empirical amalgamation of resampled MVO with Monte Carlo Simulation that successfully derives a powerful, robust and forward-looking asset allocation framework. In light of modern advances in asset allocation frameworks, Dziwok (2014) and Booth and Broussard (2002) acknowledge that the consequences of the GFC, as well as general epochs of dismal global stock market performance have resulted in a paradigm shift in asset allocation techniques that now focus more on risk itself, in which Vaclavik and Jablonsky (2012) suggest that relaxing MPT's stringent assumptions have been the catalyst for this shift. Booth and Broussard (2002) claim that focus has also been shifted towards reviewing asset allocation strategies that incorporate larger weightings of real estate. Four popular risk-based asset allocation strategies have since evolved. Method one is termed naïve diversification (or heuristic portfolio). In this technique, asset weightings are equal and risk-return elements are ignored (Dziwok, 2014). Jacobs, Muller and Weber (2014) claim that as long as a portfolio is not clustered around a single asset class, diversification benefits may even be gained through naïve constant-weight allocation strategies. Method two is referred to as global minimum variance, and it constructs portfolios of high risk assets whilst striving to minimise volatility (Dziwok, 2014). For global stock diversification, Jacobs, Muller and Weber (2014) argue that mainstream optimisation methods are not superior to heuristic diversification strategies.[31] Instead, momentum effects, global values, size premiums, and well-balanced fund disbursement over multiple asset classes generate incremental benefits that fuel portfolio performance. Method three is labelled the most diversified portfolio, whose objective is to maximise a so-called diversification ratio, in turn implying that the most diversified portfolio has been attained. Method four is known as equal risk contribution, and it zeroes in on determining a risk-balanced portfolio by assigning risky portfolio assets with congruent weights (Dziwok, 2014).

Holistically and in contrast to findings by Sing and Ling (2003), Jacobs, Muller and Weber (2014) state that because trivial value is created through mainstream optimisation techniques, it relays hopeful news to the individual investor: asset allocation based on simplistic rules of thumb substantially enhances the performance of a portfolio composed of singular asset classes, and does not reduce the risk-adjusted returns relative to advanced portfolio selection methods. Sing and Ling (2003) analysed a straight-forward asset allocation strategy that focused on the inclusion of Singaporean and Australian REITs in a mixed-asset portfolio populated by stocks and government bonds. An outward shift of the efficient portfolio frontier was attained by adding office and industrial Hypothetical Property Trusts (HPTs), justified by their relatively low degrees of correlations with stocks, and hence their ability to diversify the idiosyncratic risk component of mixed-asset portfolios. A value-unlocking asset allocation strategy was thus found which generated enhanced yields relative to investing in diversified REITs. This entailed adding property-type specific REITs to a diversified mixed-asset portfolio. Therefore, the ubiquitous paradigm of "not placing all eggs in the same basket" is not necessarily efficient and profit maximising (Sing & Ling, 2003). Hence, as corroborated by Jacobs, Muller and Weber (2014), Sing and Ling's (2003) simplistic strategy hypothesis could not be refuted, whereas their diversification hypothesis was.

Since asset allocation forms the primary challenge faced by investors, and given that different asset classes risk and return attributes vary over business cycles, knowledge of different prospects over the business cycle can therefore be a powerful and profitable tool to bolster return maximisation (Dzikevicius & Vetrov, 2012). Macroeconomic factors tend to influence stock prices through their effect on anticipated future cash flows, while stock prices have been used as leading indicator gauges, successfully predicting business cycle peaks and/or troughs. During expansions, the return on equity is elevated, while during downturns, debt instruments of a fixed nature like bonds perform well, since bond returns are impacted through interest rate cycles which covary inversely with business cycles (Dzikevicius & Vetrov, 2012). Encompassed within these two extremes, however, a wide-array of cyclically linked risk-return attributes exist, as determined by the distinctive risk premiums (RPs) and cash flow determinants of different financial assets. With

[31] Heuristic diversification strategies might include Market-value weighting, GDP weighting, and simple 1/N heuristic strategies (Howe & Pope, 2014).

respect to the performance of natural resources over business cycle conditions, gold tends to stir the most controversy. It does not pay dividends, has minimal industrial applications, and yet offers potential as a diversification tool against currency weakness, inflation and wide-spread financial turmoil. Commodities are also an inflationary hedge and benefit diversification. On the other hand, portfolios comprising of real estate and its exchange-traded counterpart like REITs dominate common stock portfolios (Friedman, 1971; Lee, 2010). These benefits are primarily driven by its low correlation with alternative asset classes, and hence suggests that adding real estate to a mixed-asset portfolio can enhance its returns whilst reducing risk levels (Friedman, 1971; Lee, 2010). Booth and Broussard (2002) claim that REITs and bonds may not only enhance aggregate portfolio return performance, but might even be relative substitute instruments. Conversely, while Hui and Yu (2010) find direct real estate to be superior to that of its securitised counterpart, they do not find evidence that real estate adds any incremental diversification benefits to the mixed-asset portfolio. Importantly, the evolving and dynamic benefits of REITs and their potential to form a component of a mixed-asset portfolio first need to take cognisance of their historical structural changes since their inception, as well as examining how REITs weather-in varying business cycle conditions (Dzikevicius & Vetrov, 2012; Lee, 2010).

In line with the maturing REIT industry, while REITs have provided a variety of benefits to the spectrum of asset classes at the mixed-asset portfolio level, they have varied with the passage of time and evolving business cycle conditions (Lee, 2010). REITs used to provide substantial diversification benefits to large-capitalisation value and growth stocks, but prior to the GFC, a relationship emerged of inverse return benefits that were actually generated by return enhancements and not through diversification. To small-capitalisation growth stocks, inverse return benefits were generated through diversification and return enhancements in the post 1999 period (Dzikevicius & Vetrov, 2012). Despite these apparent benefits, findings suggest that real estate and its exchange-traded REIT counterpart tends to be underrepresented as an important component of a portfolio, in which a common band of between 10-20% aggregate portfolio asset exposure is endorsed (Booth & Broussard, 2002; Waggle & Aggrawal, 2006). This contrasts markedly with the three % rate typically observed (Booth & Broussard, 2002). Booth and Broussard's (2002) established benchmark mean-variance analysis incorporating REITs into a DR statistical framework using lower partial moments (LPMs) and extreme value theory (EVT) suggests a 10% exposure. On the contrary, LPMs and EVTs suggest a portfolio REIT-inclusion band ranging between 40-100% (Booth & Broussard, 2002). Waggle and Agrrawal (2006) observe that for portfolio decisions, REITs expected returns are actually more essential than REIT-stock correlations. For investors of varying degrees of risk aversion, a one percentage point variation in REIT returns profoundly impacts optimal asset allocations. For intermediate risk-averse investors, a one percentage point decline in REIT expected returns decreases optimal REIT weights by more than 13%. Conversely, less profound is a 0.1% variation in REIT-stock correlations and thus would only be less than a two % adjustment in optimal REIT weights. However, in reality, optimal asset allocations will not be affected at all (Waggle & Aggrawal, 2006). Investors favour constrained optimisation given the sensitivity of the structural instability of the parameters of mean-variance efficient portfolios. Marginal swings in REIT returns and/or that of REIT-stock correlations are thus too trivial to sway recommended exposure weights. However, Waggle and Agrrawal's (2006) study employed non-stationary estimates for their optimal mixed-asset portfolios and therefore their results might be erroneously biased. To conclude, mixed-asset portfolios provide benefits based on the short-run variations in return patterns spanning across asset classes, and the long-run competitive asset class pricing structure through varying business cycle conditions (Dzikevicius & Vetrov, 2012).

2.2 The Place and Evolution of Government Bonds and REITs

This section details the archaeological task of unearthing and tracing the earliest known roots of public debt all the way back to 12th century Republic of Venice, and attempts to fill voids between sovereign debt's empirical literature and its data (Hamilton, 1947; Munro, 2003; Tomz & Wright, 2013).[32] It then describes the first types of financial instruments used by sovereigns to borrow, largely out of the prerequisite to obtain sufficient finance to engage in ancient wars and thus to protect its citizens. It continues by reporting how the Dutch Republic was the first nation to establish a working capital market, incorporating the world's first stock exchange in 1613, following which financial instruments began trading domestically and abroad (Homer, 1975; Munro, 2003). The Dutch financial system soon gained global momentum, and was mirrored elsewhere, first by the U.K., then the U.S., before dispersing around the globe. The prerequisites underpinning modern and effective capital markets, state borrowing and the pivotal role played by intermediaries' reputation in marketing government debt is espoused upon (Homer, 1975; Munro, 2003). Historical examples are provided in relation to long-term government bond issuances, sovereigns main motivations and strategies for their issuance, their auction and trading systems, as well as the establishment of global bond exchanges. In contrast to the mainstream government bond literature, Wray (1998) contributes the final piece to the section by offering an alternative, eclectic vantage point. The following subsection then tracks the place and evolution of REITs back to the U.S. state of Massachusetts in the 1850s, but notes how contemporary REITs were only ratified into U.S. law in 1960 (Bailey, 1966; Packer, Riddiough & Shek, 2014; Schulkin, 1971; Videlefsky, 2014). In a similar vein, the birth of REITs was also mirrored elsewhere, first by the Netherlands and subsequently Australia, following which a discussion illuminating the global REIT markets relevant to this paper are scrutinised extensively, tracing their structure, unique regulatory environments and other salient statistics and characteristics.

2.2.1 The Place and Evolution of Government Bonds

The roots of national debt marks the historical juncture by which old principles were applied in new ways to fund sovereign expenditures (Hewins,1888). Long before public expense management was subsumed under parliamentary control, there are many examples of debt contracted under the auspices of sovereign states, notably under British royal helms and monarchical linage. King Richard II was persuaded into extortion under the pretence of borrowing. King Henry VIII entered into loan agreements under the privilege of the royal helms. Queen Elizabeth had also borrowed money from parts of continental Europe, and later periods of alternative funding schemes were even entered into by sovereigns and their domestic goldsmiths. However, an important piece of this financial history alludes to May 1670, in which King Charles unconstitutionally attempted to raise funds for Spain against its war with Holland by seizing from the bankers of the nation's security supplies nearly 1.5 million British Pounds (£), following which all payments by the exchequer were accordingly suspended for one year. He then attempted to appease the peoples' consensus discontent by promising to pay accumulating interest at a rate of six % during this expropriation period. Until the year prior to his passing, this agreement was upheld with regular payments. However, for many years after, creditors fought head on against the state in various bouts of legal action. The principal was in fact never repaid and was instead consolidated into later established general funds of public debt, which forms part of Britain's current national debt (Hewins,1888). Public borrowing was thus made trivial by the monarchical rulers of ancient times, primarily due to the volatility caused by wars and the implications that they imposed on cycles of wealth accumulation, asset and resource expropriation and the imposition of significantly large taxes (Hamilton, 1947). Additionally, accumulation of public debt was often prevented by the predominant inclination of ruling monarchs to default on their royal obligations, and the often legal-encompassing battles that followed between states and lenders, rendering monarchical lines of credit worthless (Hamilton, 1947; Hewins, 1888; Homer, 1975). Thus, national debt was neither necessary nor viable due to factional federal states, ambiguity surrounding state succession rules, and effectively non-existent public services. Financial history suggests that confidence and trust between a nation's citizens, creditors and their monarchical and/or federal borrowing counterpart's ability and desire to service its periodic interest and principal obligations is the prerequisite underpinning modern and effective capital markets (Homer, 1975; Munro, 2003). Against the backdrop that medieval Europe's economic and structural linchpins were weaker than other international regions, it is paradoxical

[32] Sovereign bonds, akin to government bonds, are issued by a country's government. Strictly, government bonds are denominated in a country's domestic currency, whereas sovereign bonds can also be, but are sometimes denominated in a foreign currency. The terms 'sovereign debt' and 'bonds' are used interchangeably, as in this thesis, yet the former is typically used to depict a country's total stock of government debt (Flandreau & Flores, 2009).

that the emergence of general long-term national debt found its roots there. Stasavage (2013) notes the prerequisites for the successful emergence of national debt. The first and foremost concerns a state's revenue requirement based on a monetary source, which in turn, can be used to settle contracted debt obligations. Secondly and relevant to medieval times was a state's ability to be confronted with macroeconomic expenditure shocks, specifically war finance, whilst simultaneously harnessing the capacity to respond appropriately to economic crises. This might explain why national debt did not originate from sovereigns who were conflict neutral and/or kept external threats at bay (Stasavage, 2013). A third condition entailed the expectation that prevailing monarchical rulers and/or states had the desire to actually extinguish their debts, which was based on public confidence in the system, state policies and the establishment of quality and trusted institutions given the mandate of managing public debt (Carlos, Neal & Wandschneider, 2005; Flandreau & Flores, 2009; Hamilton, 1947; Hewins, 1888; Homer, 1975; Munro, 2003). This goes against the instantaneous advantages of defaulting, thus, certain bounds had to be imposed to reduce default incentives (Stasavage, 2013). Reputation was suggested as pivotal in this respect, since defaulting and the resultant tarnished reputation made it unlikely that future lines of credit could be acquired. However, reputation is not an exclusively sufficient and binding constraint during times of financial distress induced by war or turmoil (Stasavage, 2013).

Hamilton (1947) shares Munro's (2003) perspective that the earliest roots of contemporary techniques of issuing and transmitting public debt obligations can be traced back to 12th century Italian city states, such as the Republic of Venice.[33] Homer (1975) contextualises this by proclaiming that these primordial forms of 12th century credit were actually provided by Italian bankers. Even though Hewins (1888) does not claim that national debt emerged in 12th century Venice, and instead traces its roots back to England, he does agree with Homer (1975) in relation to the only forms of national debt existing prior to the 1688 Revolution being provided by a nation's bankers. However, both Hewins (1888) and Homer (1975) agree that the credit provided by the bankers of northern European cities, notably that of Italy, were more creditworthy relative to their monarchical counterparts. By the mid-13th century, emerging Western European sovereigns also began to borrow, although these sums were still trivial (Hamilton, 1947). Public debt was customarily backed by state pledges linked to real estate, specific revenue streams, or jewellery. England and France's line of royal monarchs began public borrowing by either debasing their country's coinage, or through debt-overhang incurred by their royal ancestors. France's modern era of public debt came to fruition during the reigns of King Francis I. These funds were sourced from the merchants of Paris at a rate of 12.5%, with the intended use of stepping up the war against Charles V of Spain (Hamilton, 1947). While credit existed prior to the 1550s, it was illegal in most of Europe. A series of capital market reforms subsequently altered the world of credit, making it legal at so called 'modest rates', hovering around five % (Homer, 1975). The new little Dutch Republic was the first nation-state that established a working model capital market (Homer, 1975; Munro, 2003). At the prevailing time, it was seeking to obtain war funds, following which the Bank of Amsterdam was established to receive deposits. The provinces of the Dutch Republic began long-term borrowing by selling perpetual annuities in the early 1600s (Blommestein & Wehinger, 2007; Homer, 1975; Munro, 2003).[34] The Amsterdam Stock Exchange then emerged in 1613, where trade commenced in perpetual annuities and regular stocks in both domestic and internationally domiciled markets.[35] The Dutch financial system was soon mirrored elsewhere (Homer, 1975). King William III of Dutch origins exported so called "Dutch finance" to England (Homer, 1975; Munro, 2003). Not long after this, the Bank of England materialised. Initially, English perpetual annuities, known as CONSOL's, were sold at rates of eight, seven and then finally four %, reflecting England's progressiveness as a pioneering creditworthy sovereign debtor relative to other nations (Carlos, Neal & Wandschneider, 2005; Hamilton, 1947; Homer, 1975). Carlos, Neal and Wandschneider (2005) claim that this was especially true in the manner in which England engaged in its negotiations with war related finance.[36] The British enhanced Dutch annuities by creating uniformity amongst their CONSOL version, making them interchangeable and allowing them to become more actively traded on an exchange, as well as enforcing transparent disclosure on public

[33] The Venetian state issued interest-bearing debt, backed by earnings from its state-owned salt monopoly business. This led to the development of a system by which tax revenues of future salt production were auctioned to issue new debt (Hamilton, 1947).

[34] Even though perpetual annuities (also titled Losrenten' - akin to their pre-historic Italian forefathers, called 'Venetian Prestitis') had no fixed maturity, they were redeemable at some future date (Blommestein & Wehinger, 2007; Homer, 1975; Munro, 2003).

[35] Homer (1975) claims that the Dutch people of the 16th century pioneered most modern stock-trading techniques, including bulls, bears, auctions, margins, options and short sales.

[36] CONSOL's sold at big discounts during war and small premiums during peace time, and became the most popular investment vehicle of the prevailing era (Carlos, Neal & Wandschneider, 2005).

finance matters (Carlos, Neal & Wandschneider, 2005; Homer, 1975; Munro, 2003). These enhancements enabled the British to float large sums of debt over the following two centuries, allowing them to finance the acquisition of an entire empire and even their own industrial revolution (Carlos, Neal & Wandschneider, 2005). Conversely, Hamilton (1947) argues that England's modern era of national debt began in 1689 with the ruling of William and Mary. The prevailing wars caused national debt to fluctuate and accumulate vehemently (Carlos, Neal & Wandschneider, 2005; Hamilton, 1947). England's credit lines were so severely strained towards the end of its major wars that their prevailing three and four % bonds had to be sold at strikingly low prices to yield almost five %. Eventually in 1749, a reduction in British policy rates facilitated a relatively inexpensive means of refunding debt at a rate of 3.5%, and after seven years at 3%. Despite William Pitt's proposal to reform the use of sinking funds in 1786, England was only able to settle a fraction of its outstanding national debt, which seemingly paralleled and fuelled price inflation since the 1688 revolution (Hamilton, 1947; Hewins, 1888).[37]

The War of the Spanish Succession from 1702 to 1713 left many European states like Austria, Britain, France, the Netherlands and Spain with exceptional burdens of government debt. During the eighteenth-century, many individuals then acquired long-term British government debt, reflecting England's revolutionary public debt advancements (Carlos, Neal & Wandschneider, 2005; Hamilton, 1947; Homer, 1975). These individuals were then persuaded to retain their dues against the government, since institutions endorsed individuals to trade these amongst each other, rather than forced direct state obligatory redemption. This was one of the primary innovations deployed by Britain following the two wars succeeding the 1688 revolution. This debt was subsequently consolidated into simplified-transferable claims, and then passed onto a handful of chartered institutions (Carlos, Neal & Wandschneider, 2005).[38] A secondary innovation entailed the refinancing of alternative classes of government debt into the South Sea Company's capital stock. Carlos, Neal and Wandschneider (2005), Homer (1975) and Munro (2003) are in agreement that these were the ways in which the British actually enhanced Dutch annuities. Even though the South Sea Company's equity was restructured, its finances collapsed in 1720, but British government debt was nonetheless able to maintain its liquidity.[39] Through this, as well as the rise and growth of the London Stock Exchange (LSE), emerging as a consequence of its appealing nature to an expanding pool of investors who were interested in trading British government debt, Britain successfully instilled marketability into its government debt, lasting nearly one century until the conclusion of the Napoleonic Wars (Carlos, Neal & Wandschneider, 2005).

Eighteenth-century British national debt, built on the foundations of the Dutch finance model comprised of six core components (Homer, 1975; Munro, 2003). First, national debt had a timeless nature, in that it comprised of perpetual annuities (or 'rentes').[40] Second, debt obligation issues were deemed as national and public, or at minimum provincial. Third, both annual disbursements and periodic redemptions of the annuities had to be authorised by representative parliamentary institutes or even legislative congregation, who funded these issues through levying taxes. Fourth, the procedure of the state's sales and annuity creation were not undermined by any latent form of state coercion, such as arbitrary transformations of high-interest bearing short-term debt into lower-yielding perpetual annuity instruments (Munro, 2003). Fifth, the prerequisite underpinning a modern capital market is for a state's citizens to trust their federal borrowing counterparts (Carlos, Neal & Wandschneider, 2005; Flandreau & Flores, 2009; Hamilton, 1947; Hewins, 1888; Homer, 1975; Munro, 2003). Sixth, financial intermediaries were permitted to negotiate liberally in their dealings of annuities in secondary markets. The argument is somewhat obscured surrounding the birth of national debt being born out of annuity sales (or rentes), because these instruments were not loans. Hence, there are striking dissimilarities between debentures and bonds that commonly existed in medieval Europe, which reverberated through to twentieth-century European and North American markets. These anomalies are best contextualised by several obstacles on international financial transactions and borrowing terms imposed by both prevailing Churches and the rulers of nation-states (Munro, 2003).[41] In 1853, British government debt accounted for 70% of the securities listed on the LSE, whilst

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[37] A sinking fund is the provision made in a bond indenture necessitating its issuer to periodically reserve funds for the purpose of redemption at its stipulated maturity date, in order to prevent abrupt financial constraints on the issuer (Hamilton, 1947).

[38] These were consolidated into the Bank of England, the South Sea Company during 1723, and the East India Company (Carlos, Neal & Wandschneider, 2005).

[39] By subdividing its equity into segments of perpetual annuities and shares of stock, it facilitated the transferal of the British government's periodic interest disbursements to the company itself (Carlos, Neal & Wandschneider, 2005).

[40] While perpetual annuities were technically redeemable at any time, they were subject to the discretion of the issuing authority (Munro, 2003).

[41] Churches banned 'usury', meaning no interest could be levied that exceeded a loan's principal value. However, segmented groups of academics and historians advocate that such bans did not impede medieval trade and financial systems (Munro, 2003).

its comparable foreign counterparts an additional six %. However, World War II halved the London market's figure (Tomz & Wright, 2013). With the progression of time, and more specifically in 1919, the British government issued two ultra-long gilts.[42] During this low-inflation and stable growth era, perpetual annuities were still integral component of state issuance programmes (Blommestein & Wehinger, 2007).

The Dutch-British finance model eventually gained global momentum (Homer, 1975; Munro, 2003). Alexander Hamilton exported the system to the U.S., in which original bond issues were all perpetual in nature, however, they could be redeemed at the discretion of the state. Modern day financial markets have since evolved from perpetual to fixed maturity bond issues. The U.S. used this credit system to win two world wars, and helped finance rapid economic growth and development (Homer, 1975). Siegel (1992) postulates that U.S. municipal bonds are actually more representative of the 19th and 20th centuries U.S. bond market. Epochs of U.S. budget surpluses between 1835 to 1841 extinguished all outstanding federal government debt. During the 1812 and Civil Wars, the default risk on federal government bonds increased, boosting their yields above comparable high-quality municipal bonds, such as those of the Commonwealth of Massachusetts and the City of Boston's municipal bond issues. In contrast to the so-called "bimetal" option, these municipal bonds promised interest and principal exclusively in gold.[43] Another reason for their partial substitution was over the Civil War period until 1920, in which banks had the right to issue bank notes proportionately to government bonds held as reserves, reducing the yields on federal government bonds.[44] However, these rights were eliminated in 1920, causing federal government bond yields to shift back in line with the yields on high-quality municipals, resulting in a relatively active market with a few long-term government bond issues through the remainder of the 1900s. (Siegel, 1992). The creation by sovereign states of new financial instruments marks a prominent event, usually requiring new marketing schemes, accounting systems, industry and state consulting, and sometimes even the establishment of new constitutional authority (Garbade, 2008). Since the establishment during World War I of a liquid, well-functioning sovereign market for Treasury securities, the U.S. has therefore only created a handful of new instruments. In 1918, Savings Bonds Single-payment instruments were created, which were in essence medium-term non-marketable with redemption options based on a pre-determined price. In 1935, Separate Trading of Registered Interest and Principal of Securities (STRIPS) emerged, which are single-payment instruments that disentangle interest and principal that are usually bundled together in traditional Treasury instruments. In 1985, Foreign-Targeted Treasury Notes were created, which were intended to be opaque instruments in the sense of providing vague reporting of ownership when acquired by "U.S. Aliens" (or foreigners). In 1997, the Treasury Inflation-Protected Securities (TIPS) were introduced. TIPS are interest-bearing notes and bonds whose interest and principal disbursements are linked to an exogenous price index, such as the CPI. Similarly, one of the U.S. Treasury's newest additions is the Treasury inflation-indexed bond, which aims to hedge the impacts of inflationary effects from eroding returns by providing a fixed real rate of return, coupled with higher flexible income in nominal terms over the duration of the bond (Lashgari, 2000). A minimum face value of US$1000 at maturity is assured to shield against deflation (Lashgari, 2000). Subsequently, in an effort to overcome numerous structural defects in the operations of the U.S. Treasury's financing in 1929, largely caused by its post-war configuration, another financial instrument emerged, known as Treasury bills (Garbade, 2008).[45]

In contrast to other African and EMEs, S.A. has historically depended more heavily on its domestic bond market relative to borrowing abroad, largely a function of S.A.'s previous Apartheid regime ruling government (Mboweni, 2006).[46] During the 1970s and 80s, various embargos, sanctions and financial restrictions to international markets were progressively enforced on S.A. Simultaneously, imprudent fiscal management resulted in cumulatively large budget deficits, sometimes breaching six % of GDP. However, a positive by-product was its contribution towards the domestic bond market as a means by which to fund the ever-inflating deficit (Mboweni, 2006). Nonbank financial institutions like pension funds and insurance companies provided a steady flow of demand for government bonds, given their predefined asset holding requirements and the stringent exchange control regulations that were in place (Blommestein

[42] Gilts is an alternative name for British government bonds (Blommestein & Wehinger, 2007).
[43] The bimetal option was the right to redeem principal payments in either silver or gold, which supposedly raised federal government bond yields (Siegel, 1992).
[44] These rights were known as 'circulation privileges' and incentivised banks to bid federal bond prices up, reducing their yields (Siegel, 1992).
[45] These included the oversubscription of new under-priced debt issuances in the 1920s, borrowing in advance of requirements, amongst others (Garbade, 2008).
[46] The bulk of South African government bonds are denominated in S.A.'s domestic currency - the Rand (international ticker code 'ZAR'). The Rand is traded under a flexible exchange rate regime, and given its volatile position in global markets, domestic borrowers rarely have incentives to issue alternative currency denominated liabilities (Hassan, 2013).

& Wehinger, 2007; Davey & Firer, 1992; Mboweni, 2006).[47] Since the prices of fixed income instruments are derived through both inherent risks and prevailing and expected interest rates, S.A.'s historical bouts of double digit inflation resulted in negative real interest rates on fixed-income instruments, which was non-conducive to the establishment of effective bond markets (Davey & Firer, 1992; Hassan, 2013). However, the late 1980s and 90s witnessed the amalgamation of government bonds into more appropriate benchmark indices, the creation of a regular yield curve, and bond sales occurring through conventional auction mechanisms. The South African Reserve Bank (SARB) acted in capacity of the National Treasury for these auctions, and additionally facilitated the development of a more liquid, marketable and improved-turnover secondary bond market, essentially becoming a market maker by 1990. The establishment of the Bond Market Association (BMA) was seen as a key driver in formalising the bond market, with SARB as the founding member (Hassan, 2013; Mboweni, 2006). The BMA was awarded an exchange license and subsequently transformed into the Bond Exchange of South Africa (BESA) in 1996 (Hassan, 2013; Mboweni, 2006). The National Treasury then began rolling out a series of new bond issues.[48] The Johannesburg Securities Exchange (JSE) later acquired and merged BESA into its trading platform in 2009, hence secondary market transactions occur through the JSE (Hassan, 2013; Mboweni, 2006). In 2006, enhanced prudent fiscal policy began reducing budget deficits, and thus the state's dependence on the domestic bond market (Mboweni, 2006). Higher aggregate demand for South African bonds then induced a shrinkage of yields to record lows, whilst the JSE Africa All Share Index simultaneously breached record high levels. This paradoxically rejects the flight-to-quality phenomenon.[49] The contractionary monetary policy adopted by SARB in mid-2006 re-stabilised bond yields, and was additionally reinforced by the global investment communities' adjustment of EMEs risk, which both culminated in rising yields (Mboweni, 2006). As of 2012, S.A.'s bond market value was estimated at US$181 billion, of which highly liquid government bonds accounted for approximately 64% (Hassan, 2013). The majority of South African government bond turnover emanates from repurchase (repo) transactions. The 2003 to 2008 period witnessed a significant rise in non-resident trading of S.A.'s government bond market, breaching 30% of ownership by 2012. Rising ownership of foreign debt typically corresponds with greater volatility and lower bond yields (Hassan, 2013).

An alternative vantage point on the birth of sovereign debt is provided by Flandreau and Flores (2009), who espouse its emergence by departing from conventional economic history. During the early 19th-century, capitalists shifted their focus towards the reputation of intermediaries' to help pave the way for the development of sovereign bond markets. When state-debtors used reputable underwriters to gain access to international capital markets, investors were willing to pay premiums. Prominent and reputable branded banks therefore possessed the requisite intangible asset that facilitated market entry with advantageous terms. Banks generated income through their reputational delivery of trustworthy products and services, meaning their market share and ultimately profits were at stake, and hence their reputations were cautiously guarded. Additionally, because banks possessed an oligopoly share of entry to liquidity, borrowers' incentives were aligned with those of the intermediaries' credibility, creating incentives to abstain from defaulting. They also retained their market dominance because switching costs were high. This began to form a hierarchical and highly clustered international sovereign bond market, in turn sustained by its own monopolisation of the sector. When less prestigious intermediaries tried gaining market access, higher risk signals were emitted, following which the market for sub-grade debt collapsed for some time. Intermediaries may therefore offer solutions to public debt without state intervention (Flandreau & Flores, 2009).

At this juncture, Blommestein and Wehinger (2007) contextualise contemporary strategies and motivations underlying sovereign borrowing. Subject to tolerable risk levels, most governments follow a set framework-strategy for issuing bonds, guided by the minimisation of long-term strategic borrowing requirements that is congruent with cost management (Blommestein & Wehinger, 2007). Both pension funds and insurance companies are some of the most salient investors of long-term government bonds (Blommestein & Wehinger, 2007; Davey & Firer, 1992; Mboweni, 2006). Fuelled by tighter system-wide regulations surrounding asset-liability matching that governs pension funds, the convergence of new global accounting standards, and additionally updated risk-based policies for insurance

[47] Prior to 1992, S.A.'s Public Investment Commissioner (PIC) - a state owned entity (SOE) had to hold a minimum of 75% of its pension fund portfolio in government bonds. Similarly, a third of insurance companies' portfolios had to be populated by government bonds, but were eventually lowered to 10% (Blommestein & Wehinger, 2007; Davey & Firer, 1992; Mboweni, 2006).

[48] These included inflation-linked bonds, retail bonds, floating-rate notes and STRIP instruments (Hassan, 2013; Mboweni, 2006).

[49] The 'flight-to-quality (or safety)' phenomenon refers to when stock market shocks cause investors to shift their capital from stocks to bonds (Baele, Bekaert & Inghelbrecht, 2010).

companies, the demand for long-term bonds has been amplified. In response, governments have raised their supply of bonds by issuing and re-introducing long-term bonds. However, the development of a liquid long-term bond market requires continuous issuance, given that pension funds and insurance companies typically pursue buy-and-hold strategies, inducing illiquidity if the supply drops below a certain level. In terms of government bond sales and marketability, auction-type procedures are usually preferred over syndication methods (Blommestein & Wehinger, 2007).[50] While information on historical sovereign debt may appear unbounded, Tomz and Wright (2013) assert that many historians, political scientists and economists have had the archaeological task of unearthing, synthesising and narrowing the knowledge gap between sovereign debt's empirical literature and its data from various sources. On the back of sovereign debt being one of the most primitive financial assets, it comprises a significant proportion of traded global financial assets. Globally, government bonds accounted for 22% of total financial assets in 1950, yet half of this figure was shed by 1978. This decline represented the reduction of international capital flows under the auspices of the Bretton-Woods system, and domestic development strategies by EMEs. By 2012, the figure rose marginally to 19%, largely a function of the post-war dismantling of impediments to capital flows. Technical features have also caused measurement issues. The stock of sovereign debt is usually quantified through government bond's face values, which themselves create bones of contention.[51] Tomz and Wright (2013) suggest computing the par value of a common portfolio of debt that parallels the cash flows emitted by its original counterpart can resolve many issues. One method that does this is termed the 'zero-coupon equivalent' (ZCE) face value.[52] Methods that adjust for timing discrepancies also exist. Two prominent techniques to analyse the maturity of sovereign debt are the 'contractual maturity' and the 'Macaulay duration', although both tend to yield sub-optimal results. Other setbacks relate to financial statutes, for example, 66% of government bonds were regulated by New York law, approximately 25% by London law, and the residual by either Japanese or German laws. Problems also emerge due to infrequent issuances in illiquid markets, inducing volatility and missing price data, in turn resulting in sub-optimally measured coupon yields, through obliviousness to capital gains (losses).[53] Some older generation bonds even have embedded and outdated sinking fund and redemption clauses, resulting in yield to maturity measurement convolutions (Tomz & Wright, 2013). In contrast to the mainstream government bond literature, Wray (1998) offers an alternative and largely eclectic vantage point. He contends that the real purpose of government bonds is not to 'finance' government spending. Instead they are used to drain excess liquidity from the monetary system, resulting in the creation of central bank reserves, which are in turn created through government expenditure in the first place. If excess reserves are not drained, then interest rates in the market for reserves would converge upon zero, severely disrupting the flow of the monetary and banking system, potentially bringing an economy to a halt. In a similar vein to money, bonds are a form of liabilities to both the government and its central bank. Thus, issuing government bonds reflects the states preference to denominate these liabilities in the form of interest-bearing limited-maturity instruments, instead of non-interest bearing and unlimited-maturity instruments, such as money (Wray, 1998).

[50] The auction system aims at unifying the operation for primary dealers. In scenarios where demand cannot be gauged accurately, syndications are sometimes used to secure guaranteed allotments via a formal 'book-building process' (Blommestein & Wehinger, 2007).

[51] Face (or par) values are undiscounted future cash flows, and are therefore comparable-sized disbursements that are separated through the passage of time. They represent the future value of a bond at its maturity date. Since they only account for face value repayments, partitioning interest and principal cash flows in varying magnitudes will result in different face values. Regarding CONSOL's, par values are akin to a bond's face value at infinity (Tomz & Wright, 2013).

[52] The ZCE face value is computed by treating each disbursement as a zero-coupon bond that is about to mature (Tomz & Wright, 2013).

[53] Coupon yields quantify the proportion of a bond's coupon payment to its price (Tomz & Wright, 2013).

2.2.2 The Place and Evolution of REITs

The first REIT structure materialised in Massachusetts in the 1850s, as an extension of the business trust form of organisation (Bailey, 1966). However, in 1924, the U.S. Supreme Court ruled that business trusts must pay federal income tax in the same manner as corporations, and hence at corporate rates. Another major impediment to business trusts was in 1935 with the dismantling of their remaining tax advantages. Given these hurdles, most business trusts investing in real estate vanished, with only a few remaining by 1960. In 1936, Congress then overturned the 1935 Supreme Court ruling, and with amendment the 1936 act evolved into the "regulated investment company act". The year of 1955 then involved concerted lobbying efforts to allow specialised tax treatment for real estate investment vehicles. Subsequently in 1956, Congress passed a bill to expedite this, however, the prevailing U.S. President – Eisenhower, vetoed this bill. It was not until 1960 under the auspices of the 'Real Estate Investment Trust Act' which facilitated the fruition of REITs, finally ratified into U.S. law on the 1st of January, 1961 (Bailey, 1966; Packer, Riddiough & Shek, 2014; Schulkin, 1971; Videlefsky, 2014). However, the actual establishment and implementation of REITs after the 1960 Act was not all smooth sailing at first.[54] Nonetheless, this early era witnessed the majority of REIT shares being traded over-the-counter, whilst only a handful were listed on a formal exchange. Thus, the market for REIT shares was thinly traded and limited to regional parameters. The first REIT index was then created in 1962 by a brokerage house. Following this inception, REITs began to perform more a less in tandem, and become integrated with the general stock market (Bailey, 1966; Eichholtz & Hartzell, 1996; Leone, 2011; Sebehela, 2008; Sing & Ling, 2003).[55] Sing and Ling (2003) find mixed results of REIT and general stock market integration in the Singaporean and Australian context, given their sector-specific REIT and other listed property vehicle analysis. Lee (2010) also warns against erroneous inferences of REIT and stock market integration, suggesting that REITs historical structural breaks and changes should be scrutinised cautiously before making inferences. In the late 1960's, REITs became a prominent capital provider for construction and development loans, equity-based real estate funds and long-term mortgages (Schulkin, 1971; Lee, 2010). REITs grew rapidly in both assets under management and in terms of their volume of listings, largely fuelled by the prevailing contractionary monetary policies and state restrictions on conventional capital providers to real estate (Schulkin, 1971; Packer, Riddiough & Shek, 2014). These elements fused to create an environment of a shortfall vis-à-vis mortgage funds, boosting their yields and resulting in a profitable climate with which to establish new REIT entities (Schulkin, 1971).

Following the birth of REITs in the U.S. in the 1960's, the subsequent period was characterised by commercial property market boom-bust cycles approximately every 15 years (Bailey, 1966; Packer, Riddiough & Shek, 2014; Schulkin, 1971; Videlefsky, 2014).[56] Lee (2010) and Videlefsky (2014) are in agreement with Leone (2011) that the motivation behind the establishment of REITs was to demolish financial barriers to entry of small-scale investors, allowing them to begin tapping into larger-scale income producing real estate assets. Many individual and institutional investors might have effectively been frozen out of the real estate market to an extent prior to their creation, with initial capital outlays for direct real estate acquisition the main culprit (Videlefsky, 2014). Videlefsky (2014) elaborates further and asserts that REITs offer enhanced liquidity and superior diversification benefits relative to non-exchange traded real estate and alternative asset classes, as well as future dividend stream stability, tax certainty and transparency, and a share in expertly managed diversified property portfolios. Since their inception, the U.S. REIT market has undergone substantial structural changes in line with their evolving tax laws and legislation (Bailey, 1966; Lee, 2010). During the 1960s, only 10 REITs of any market capitalisation-size existed, increasing to approximately 50 by mid-1970. Additionally, the majority of these REITs were mortgage-based, engaged in land and related development and financing activities, and hence their high return elasticity to interest rates (Bailey, 1966; Lee, 2010; Schulkin, 1971). Consequently, the global oil price shock of 1972 and the resultant interest rate hikes that followed caused inverted yield curves, forcing many REITs into bankruptcy, with their total assets declining more than 50%, from US$20 to US$9.7 billion (Lee, 2010; Packer, Riddiough & Shek, 2014). On a relative basis, REITs therefore performed dismally

[54] Several initial impediments related to the lack of attorneys' and state authorities familiar with business trusts; areas of ambiguity caused by underdeveloped business trust laws; vagueness surrounding the new tax law itself; and lengthy durations between the law's enactment and ratification, amongst others (Bailey, 1966).

[55] The notion of integration in the context of financial markets implies that the relation between RPs and systematic risk are the same in two different markets. This means that the cost per unit of exposure corresponding to risk elements must be identical, irrespective of the market in which those risk elements are priced (Ling & Naranjo, 1999).

[56] This cyclicality was caused by excess supply and relatively inexpensive construction finance supplied by mortgage REITs, amongst others (Bailey, 1966; Packer, Riddiough & Shek, 2014; Schulkin, 1971; Videlefsky, 2014).

compared to alternative asset classes over this tumultuous period. A milestone year in REIT history was achieved in 1986 following the Tax Reform Act, which encompassed the REIT Modernisation Act (Packer, Riddiough & Shek, 2014). Deregulation then allowed REITs to manage various categories of income-producing commercial real estate with enhanced management flexibility and tax regulations, and furthermore updated allowances for depreciation treatment. Consequentially, greater REIT diversification was conducive to greater streams of rental revenue income, reinforced by shrinking construction and financing loans below five % of aggregate industry assets, inducing strong growth in dividends. As a result, institutional, corporate and individual investors began to unlock latent intrinsic REIT value. However, by the end of the 1980s, REIT performance had once again turned dismal. The establishment of the Umbrella Partnership REIT (UPREIT) structure and the Revenue Reconciliation Act of 1993, by far the largest legislative milestone, resulted in more fundamental shifts for the REIT industry.[57] Due to the UPREIT structure, institutional ownership of REITs increased more than two-fold, from an estimated 12-30% (Packer, Riddiough & Shek, 2014).

From the early to the mid-1990's, certain economic factors were also conducive to the exponential growth in REITs (Lee, 2010; Packer, Riddiough & Shek, 2014). These included tight capital market access and opportunities to recapitalise financially distressed REITs, both culminating in a REIT Initial Public Offering (IPO) boom in the U.S. Equity capitalisation subsequently ballooned from US$10 to US$100 billion plus. Some REITs that currently exist listed during this period, and over the last two decades, Packer, Riddiough and Shek (2014) share Lee's (2010) viewpoint that REITs on aggregate outperformed the Standard and Poor's (S&P) indices' and their non-exchange traded commercial real estate market counterpart, even when considering leverage differentials, with a beta coefficient below unity. Additionally, low interest rate environments resulted in capital searching for higher yields, whereas REITs were ideal candidates since they are known to be high dividend yielding instruments. This is also one of the reasons why aggregate REIT sector indices were selected as part of this paper. This, coupled with the tanking of commercial real estate prices culminated in large spreads between the yields that could be earned through direct commercial real estate, and the dividend cost of funds raised by REITs. This positive funding spread also resulted in a profitable incentive for new REIT start-ups (Packer, Riddiough & Shek, 2014). The U.S. REIT Modernisation Act of 1999 further bolstered this positive sentiment by reducing the minimum dividend distribution requirements from 95-90%, allowed a 100% REIT ownership share of a taxable REIT subsidiary (TRS) without modifying REITs tax exempt status, and facilitated a greater incorporation of REITs into the S&P market indices given their shift from operating as fund-like vehicles to firms. In 2014, the U.S. accounted for over 50% of the total global REIT market capitalisation, with 180 listed REITs and a market capitalisation exceeding the US$500 billion mark, whilst global REIT market capitalisation surpassed the US$1.1 trillion mark (Packer, Riddiough & Shek, 2014). The U.S. dominated the global REIT market landscape for many years, including their non-exchange traded commercial property market counterparts, primarily driven by their unique regulatory and operating environments. Whilst the U.S. still maintains its dominance in terms of size, Asian REIT market IPOs have surpassed many European REIT market IPOs, which had closely tracked the U.S. and Australia's lead for many years.

The next few sections track in a systematic method the chronological emergence of the remaining REIT market terrain that are relevant to this paper. The Dutch adopted the REIT investment vehicle structure in 1969, making them the second country after the U.S. and the first in Europe (Boshoff & Bredell, 2013). The Dutch REIT structure is said to be the most stringent amongst global REIT markets, thereby acting as an impediment towards their growth and investor participation. Some research even suggests that its stringent regulations cause them to lose investment opportunities to less rigid REIT markets. Dutch REIT authorities were also the creators of REIT leverage constraints, amongst their other rigidities (Boshoff & Bredell, 2013). Dutch REITs are faced with leverage constraints of 60% of their total assets under management, which is the same as S.A. but less than the U.K., with a 65% constraint, in contrast to the U.S., Australia, Brazil and Japan who are unrestricted in this sense. Dutch REITs are the only REIT structure besides Australia forming part of this paper that are required to distribute 100% of their net-taxable fiscal earnings as dividends, meaning that they are the complete opposite to Turkish REITs, who have no minimum payout requirements and can retain their internally generated equity for expansion purposes (Boshoff & Bredell, 2013; Erol & Tirtiroglu, 2011). Dutch

[57] The UPREIT is a hybrid structure between REITs and Real Estate Limited Partnerships. Following its approval by the U.S. Internal Revenue Service (IRS), it gained popularity, as observed by the 43 REIT IPOs in 1993 and 38 in 1994 adopting this new structure, allowing REITs to become mainstream investment alternatives (Packer, Riddiough & Shek, 2014).

REITs are also forced to adopt the internal management structure, and unlike their global counterparts who are typically required to invest a minimum of 50-75% in real estate, Dutch REITs can only invest in real estate (Boshoff & Bredell, 2013).[58]

Turning to the Australian market, Australian Listed Property Trusts (LPTs) may essentially undertake either an 'equity-stand-alone trust structure', or a 'stapled security structure' (Sing & Ling, 2003).[59] Although property trusts were in existence for some time, it was only in 1971 which witnessed the first IPO of an LPT instrument. However, trade in LPTs only gained momentum following the dismal performance of non-exchange traded property trusts, and hence the actual establishment of LPTs on the Australian Stock Exchange (ASX). A substantial boom in LPTs occurred since 1994, having been one of the ASX's best performing sectors. In line with U.S. REIT markets, the Australian market went through significant transformations, encompassing shifts from diversified to specialised, sector-specific property trusts. However, as the industry began to mature, consolidation of the sector began shifting back towards diversified trusts (Sing & Ling, 2003).[60] Whilst trailing far behind the U.S. yet exceeding other prominent markets, in 2014, Australia had an US$80 billion REIT market capitalisation and 57 listed REITs – thought to compose ten % of the total global REIT market capitalisation (Packer, Riddiough & Shek, 2014). Australian REIT legislation requires that 95% of taxable earnings must be distributed in order to obtain tax exempt status at the corporate level, in line with Brazil, Mexico and France (EPRA, 2015; PWC, 2015). Hence, dividends compose a large amount of LPTs total returns (Sing & Ling, 2003).

On the Americas, under the auspices of Brazil's version of the U.S. Securities and Exchange Commission (SEC), called the Comissao de Valores Mobiliarios (CMV), Brazilian REITs were introduced in 1993 (da Rocha Lima & Tavares de Alencar, 2008; Gabriel, de Sousa Ribeiro Post & Rogers, 2015). Brazilian REITs fall under the FII structure, which is Brazil's market for real estate mutual funds. The Brazilian REIT industry has recently begun consolidating through mergers and acquisitions similarly to both Australia and S.A., but nonetheless has experienced phenomenal growth rates exceeding 1100% since 2009. Although Brazilian REITs share similar governance structures with the global REIT model, Brazilian REITs must be administered by their respective financial institutions, relative to conventional practice in which REITs fall under the directorship of its own executives (da Rocha Lima & Tavares de Alencar, 2008; Gabriel, de Sousa Ribeiro Post & Rogers, 2015). These fund managers are tasked with the mandate of both distributing and collecting REITs rental income, and additionally are in charge of negotiating rental rates and updating them approximately every five years (da Rocha Lima & Tavares de Alencar, 2008). This is surprising given Brazil's historical epochs of hyperinflation, and contrasts markedly with S.A., whose lease contracts are structured with annual embedded escalation rates which are usually tied to a consumer price index (CPI), and even impose an additional premium over and above the CPI (Ambrose, Hendershott & Klosek, 2002; Crosby, Gibson & Murdoch, 2003; Grenadier, 2003). These will be investigated in relation to Brazil and S.A.'s observed aggregate REIT sectors' dividend yields in greater depth in both the final section of this literature review and in the main findings of this paper. However, da Rocha Lima and Tavares de Alencar (2008) may therefore be criticised on the basis of not elaborating on Brazilian lease contract structures, since they do not state if they are upwards-only adjusting, and moreover whether or not they contain these embedded annual escalation rates tied to Brazil's CPI. Brazilian REITs, in line with the U.S., U.K., Singapore and S.A. are required to invest a minimum of 75% of their total assets under management in real estate or related assets, and in an identical manner to France and Mexico must distribute 95% of their net taxable earnings in the form of dividends to shareholders (EPRA, 2015; Gabriel, de Sousa Ribeiro Post & Rogers, 2015; PWC, 2015). In stark contrast to both the European Public Real Estate Association's (EPRA) "Global REIT Survey 2015" and Price Water House Cooper's (PWCs) "Worldwide REIT Regime – 2015", who claim that Brazilian REITs have no leverage constraints, da Rocha Lima and Tavares de Alencar (2008) assert that the FII structure is prohibited from employing any leverage in their financial structure, and therefore must be composed of 100% equity. da Rocha Lima and Tavares

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[58] The internal REIT management structure directly employs personnel to manage a REITs portfolio. Contrastingly, the external management structure 'outsources' this function, and remunerates the external manager on both a predetermined fixed management and performance incentivised fee basis. Conflicts of interest emerge in the external management structure, shifting favouritism towards internal structures (Sing & Ling, 2003).

[59] Australian LPTs were renamed to Australian-REITs (A-REITs) in 2008 (Boshoff & Bredell, 2013). A 'stand-alone trust structure' gives investors pure exposure to the intrinsic real estate portfolio. A 'stapled security structure' gains investors entry to a trust's management and/or real estate development entity, and additionally to a portfolio of real estate assets, however, they are prohibited in Singapore (Sing & Ling, 2003).

[60] Australian REIT-sector consolidation, similarly to S.A. and Brazil, are being driven by mergers and acquisitions in an attempt to decrease management expense ratios and to acquire REITs that trade at discounts relative to their Net Asset Values (NAVs) (Sing & Ling, 2003).

de Alencar (2008) estimate Brazilian REITs NAVs were US$900 million during September 2007, in turn representing nearly 60% of the FII's entire market value. Furthermore, Brazilian REITs are dwarfed by their U.S. counterparts, in which da Rocha Lima and Tavares de Alencar (2008) contextualise this by claiming that an average-sized U.S. REIT entity is approximately 1.6 times the entire Brazilian REIT market's size.

Switching to one of the most attention-grabbing REIT markets, Turkey's legal REIT structure framework was adopted in 1995, with the first IPO commencing on the Istanbul stock exchange in 1997 (Onder, Tas & Hepsen, 2014).[61] Turkish REITs legal framework differs considerably relative to the other global REIT markets (Erol & Tirtiroglu, 2011). Unlike other REIT markets and the very epitome of REITs being a dividend yielding financial instrument, Turkish REIT regulation does not stipulate any dividend payout requirement, yet they are still conferred with the advantageous tax exempt status for institutional investors (Erol & Tirtiroglu, 2011). According to Erol and Tirtiroglu (2011), Turkish REITs are therefore technically free to preserve and accumulate their internally generated equity through profit plough-backs in order to fund expansion and growth, and as such, they should turn to external capital markets to raise funds far less than their global counterparts. However, Erol and Tirtiroglu (2011) suggest that this very degree of freedom provided by its legal framework tends to become conducive to profligate expenditure – the so-called "free cash flow problem". Turkish REITs focused ownership, described by Erol and Tirtiroglu (2011) as being dominated by "leader entrepreneurs", effectively determines their financial, dividend and debt policies, in turn driven by their own wealth maximising interests. These observations should be congruent with the pecking order hypothesis, in that instead of borrowing, Turkish REITs should be able to employ their relatively inexpensive internally generated equity for expansion.[62] However, these "leader entrepreneurs" exhaust both their tax-free dividends and internally generated equity, both culminating in Turkish REITs forced reliance on external capital markets to engage in long-term borrowing in order to fund both their operations and expansion far more than their global counterparts. These findings are therefore inconsistent with the pecking order hypothesis (Erol & Tirtiroglu, 2011).

Ooi, Newell and Sing (2006) propound that the emergence of REITs in the Asian markets coincided with a lacklustre property market, induced by Japan's protracted recession and coupled with the 1997 Asian financial crisis, later corroborated by Hui and Yu (2010). Followed by a series of reforms in the financial sector, REITs were expected to inject needed liquidity and capital to revive Asia's ailing real estate sector. Asian REITs emerged in 2001, with Singapore and Japan at the forefront. Japan specifically was the pioneering developer of the Asian REIT markets. During November 2000, Japan amended its Investment Trust and Investment Corporation Laws which permitted investment trusts to deploy capital for real estate purposes. Japan was the first Asian country to launch REITs when trading began in September 2001. These REITs offered appealing annual dividends in the range of four to five %, relative to Japan's zero-bound bank deposit-based interest rates. The latter may also be interpreted as reflective of Japan's relative sovereign creditworthiness, in culmination with its stagnant low inflationary environment. These two aspects will be illuminated by examining Japan's government bond yield, as well as its CDS in the empirical findings section of this paper.[63] As of June 2005, the Japanese REIT market capitalisation had grown nearly nine-fold since its inception in 2001. In 2014, Japan had 34 REITs, making up five % of the global total (Packer, Riddiough & Shek, 2014). From the time of their IPOs, Singaporean and Japanese REITs delivered aggregate price appreciation of 65.5% and 52.1%, respectively. Hence, Ooi, Newell and Sing (2006) are of the opinion that REITs outperformed Asian equity markets, and offered less volatility relative to and lower correlations with equity markets (Bailey, 1966; Leone, 2011; Sebehela, 2008; Sing & Ling, 2003; Videlefsky, 2014).

Sing and Ling (2003) provide backbone to the Singaporean REIT market. Listed property stocks and privately held real estate investments were the exclusive vehicles until 2001 by which investors could tap into their share of Singapore's real estate markets. The Monetary Authority of Singapore (MAS) released broad guidelines in 1999 to facilitate the establishment of domestic property trusts and funds, based on the Australian LPT model. Singaporean REITs was the initial conception of the Property Market Consultative Committee in 1986, and finally evolved into reality

[61] Turkey's REITs are also labelled Real Estate Investment Companies (REICs) (Onder, Tas & Hepsen, 2014).
[62] According to Erol and Tirtiroglu (2011), "leader entrepreneurs" are required to hold a minimum of 25% of a particular REITs shares. These are well-informed institutional parent holding companies from the financial sector, who in Turkey are not faced with taxation on dividends. On the other hand, 'Pecking order theory' espouses that in an asymmetric information environment, corporate management opt in chronologically selecting retained income, then debt and only lastly equity as financing layers (Feng, Ghosh & Sirmans, 2007).
[63] CDSs represent the cost of insuring foreign owners of domestic government bonds against default, and are often gleaned by analysts as proxies for the credit rating of domestic debt. They are thus utilised as gauging country specific risk.

in 2002 following the successfully oversubscribed launch of the CapitaMall Trust (CMT) REIT (Sing & Ling, 2003). Ooi, Newell and Sing (2006) claim that CMTs launch followed three years of successful lobbying efforts, the passing of relevant laws by the MAS, as well as a failed attempt due to the insufficient subscription of the SingMall Property Trust (SPT) in October 2001. Following CMTs launch, a state owned subsidiary established their own REIT – Ascendas (or A-REIT). One of the key factors bolstering their successful launch was the attainment of tax transparency at the corporate level by the Inland Revenue Authority of Singapore (IRAS). Ooi, Newell and Sing (2006) state that this was reinforced by Singaporean REITs minimum dividend payout requirement reduction from 100-90% in December 2002. Australian and Singaporean REIT markets share akin institutional structures, and therefore their performance is likely to be fuelled by similar economic elements (Sing & Ling, 2003). In 2014, Singapore had 24 REITs, making up four % of the global total, and as mentioned above, the Singaporean REIT sector delivered robust price appreciation since its first IPO (Packer, Riddiough & Shek, 2014).

Diverting away from Asia towards Europe, during November 2002, the French Finance Commission ratified into law their own version of REITs, under the title 'Sociétés d'Investissements Immobiliers Cotées' (SIICs)', called French REIT/SIIC, with the first IPO taking place the following year (Uwase, 2008). According to Newell, Adair and Nguyen (2013), its market capitalisation in March 2013 was US$35 billion, thus comprising over four % of the global REIT market and nearly 39% of the European REIT market. The French SIIC structure has been subject to frequent regulatory amendments, including the imposition of advantageous capital gains tax for the transformation of previously listed property vehicle holdings of real estate into the new SIIC structure, permitting SIICs to be listed directly in EU exchange-traded markets without necessitating an additional secondary listing on the French stock exchange, as well as defining additional categories of real estate that will be allowed to populate SIICs portfolios (Newell, Adair & Nguyen, 2013). These regulatory amendments were aimed at stimulating investor attractiveness and to foster growth in the SIIC market. Even though SIICs performed dismally due to the aftermath of the GFC, they recovered relatively rapidly, and subsequently began to outperform both other European REIT markets as well as France's other salient asset classes. While SIICs may adopt either the internal or external management structure, in practice, the former is the prevailing popular choice. SIICs also have no constraints on their use of financial leverage, and they are required to distribute a minimum of 85% of their taxable earnings generated through rental income to shareholders (Newell, Adair & Nguyen, 2013). However, both EPRA (2015) and PWC (2015) claim that SIICs regulations have recently been updated and they are now required to distribute 95% of their net taxable earnings. Additionally, their 50% realised capital gains distribution has been raised to 60%, whilst 100% distribution requirement of the dividends received through the 95% ownership of a French subsidiary has remained unchanged (EPRA, 2015; PWC, 2015).

Continuing with European REITs, Leone (2011) sheds light on the emergence of REITs in the U.K. Following the ratification of the U.K.'s legislation in January 2007 allowing all property companies listed on the LSE to convert into REIT structures, Leone (2011), in agreement with Bailey (1966) and Sebehela (2008), found that U.K.'s REIT returns rapidly acquired typical attributes of both stocks and commercially-backed real estate assets. Two primary factors attracted the relatively primitive property companies to pursue the conversion into REITs, which in addition, was expected to unlock latent value (Leone, 2011; Packer, Riddiough & Shek, 2014). The first related to the advantageous tax status of REITs – encompassing lower tax burdens at the corporate income level (Bailey, 1966; Lee, 2010; Leone, 2011; Packer, Riddiough & Shek, 2014; Videlefsky, 2014). Second and similarly to U.S. practices, U.K. REITs must distribute a minimum of 90% of their taxable profits (Leone, 2011). Hence, the combination of these two advantages were more appealing to real estate investors relative to primitive property company structures (Leone, 2011). In 2014, U.K. REITs accounted for five % of the total global REIT market capitalisation, and had 18 exchange-traded REITs (Packer, Riddiough & Shek, 2014).

Back to the Americas, Mexican REITs were created in March 2011 (Arellano & Pedro, 2012). Mexico's first REIT was subsequently launched on its stock exchange one year later, being both the first Mexican and Latin American REIT in existence (Arellano & Pedro, 2012).[64] As is the case in many other markets, FIBRAs provided the Mexican real estate market with a much-needed pricing reference, often encumbered by insufficient and lagged data on market transactions (Arellano & Pedro, 2012). Even though Mexican REITs are similar to their U.S. counterpart, Mexican

[64] Mexican REITs are known locally as Fideicomiso de Inversión en Bienes Raíces (FIBRAs), while its stock exchange goes by the designation of 'Bolsa Mexicana de Valores' (Arellano & Pedro, 2012).

financial authorities implemented additional regulations and enhanced extant REIT model policies in order to encourage investment participation, but similarly to other international REIT markets, several initial impediments were experienced. These impediments were largely a product of Mexico's tax system itself, allegedly being highly convoluted and opaque, and thus required cohesive support from both public authorities as well as highly experienced real estate professionals to overcome (Arellano & Pedro, 2012; Testa, 2010). In a similar vein to Brazilian, British and French REITs, FIBRAs must distribute 95% of their net taxable earnings to shareholders annually, and have to deploy a minimum of 70% of their total assets to leasing or related activities, in line with Japanese REIT regulations (Arellano & Pedro, 2012). While many global REIT markets are permitted to distribute dividends in the form of shares, FIBRAs have to strictly adhere to dividend disbursements in the form of cash. Arellano and Pedro (2012) claim that this discrepancy bears salient implications upon FIBRAs use of financial leverage, although EPRA (2015) claims that Mexican FIBRAs do not have conventional financial leverage constraints, but are instead regulated by 'thin capitalisation rules'.[65] Arellano and Pedro (2012) furthermore assert that a long-run positive aspect of the non-share payment of dividends will be conducive towards the development of a liquid and robust Mexican FIBRA sector.

Switching to the African market, the mid-1990's witnessed a significant rise in real estate investment in S.A. (Sebehela, 2008). These were initially in the direct-private real estate market, however, capital was increasingly being channelled into exchange-traded real estate. In contrast to financial assets whose values are driven by market sentiment and perceptions, real estate is a real asset, and hence its values should be derived from macro-level fundamentals. S.A.'s listed real estate sector was however becoming highly integrated with the general stock market, in line with global REIT market observations (Bailey, 1966; Eichholtz & Hartzell, 1996; Leone, 2011; Sebehela, 2008; Sing & Ling, 2003), and thus its values were being driven by both fundamentals and market perceptions applicable to regular stocks. Sebehela (2008) surmises that S.A.'s listed real estate sector was unrepresentative of its underlying value, since the majority of investment evaluators were erroneously applying 'Traditional Valuation Techniques' (TVTs) to derive the sector's intrinsic value.[66] S.A. introduced the new general umbrella REIT regime structure in 2013 (Boshoff & Bredell, 2013).[67] While this transition was relatively slow-paced in terms of international best practice, it was simultaneously regarded as an advantage, given that S.A. was able to avoid major hurdles experienced by other REIT market implementation. South African REITs intended to create a level platform by standardising S.A.'s extant listed property vehicles like Property Unit Trusts (PUTs) and Property Loan Stock Companies (PLSs) across the board.[68] Following world-renowned leaders in this respect, S.A. extracted 'best-of-breed' elements from the U.S. and other pioneering REIT markets, as well as from S.A.'s extant forms of listed property vehicles - PUTs and PLSs. The South African government strongly encourages investment in REITs by virtue of the fact that investments in REITs are tax exempt, if they form part of a pension and/or provident fund for a South African citizen. Under each broad category of REITs are sub-categories, in which REITs may be pure-equity based, whereas others are mortgage-like and some are even hybrid in nature (Schulkin,1971). Against the backdrop that S.A.'s REITs are still in their infancy stage, equity REITs are the only category currently available (Boshoff & Bredell, 2013; Schulkin, 1971). S.A.'s real estate sector's market capitalisation was estimated at ZAR5 billion in the year 2000. Based on the industry's robust performance, in turn being a product of enhanced liquidity, this figure surpassed ZAR200 billion by 2013 (Boshoff & Bredell, 2013). It appears to be growing exponentially, valued at ZAR649 billion in February, 2016 (Bloomberg, 2016). In fact, the South African listed property sector, in which most listed instruments have conformed to requirements and subsequently converted from PUTs and PLSs into REITs, outperformed alternative asset classes like government bonds and the FTSE/JSE Africa All Share Index in 2004; 2005; 2007; 2010; 2012 and 2014 (SA REIT Association, 2014).[69]

With the exception of REIT establishments in the Netherlands in 1969 and Australia in 1971, most other markets are clearly still in their infancy stage. For example, the U.K., France and S.A. adopted the REIT structure as late as 2007

65 Thin Capitalisation Rules impose threshold restrictions on how much of a REITs capital structure can be comprised of debt, relative to equity (EPRA, 2015).
66 Traditional Valuation Techniques (TVTs), used by non-exchange traded property appraisers, inaccurately compute exchange-traded property asset values (Sebehela, 2008).
67 Major advantages of adopting the REIT structure in S.A. include tax certainty, additional regulatory layers and therefore enhanced investor protection, and improved certainty in terms of dividend pay-out stability, amongst others (Boshoff & Bredell, 2013).
68 PUTs pay capital gains tax (CGT) on the disposal of assets, whereas PLSs do not. REITs can invest directly in other listed companies, and therefore in other REITs, whereas PUTs are prohibited from such activity. REITs are taxed in the hands of end-investors, whereas PUTs and PLSs are taxed at the corporate level. PUTs and PLSs also possess tax loopholes, which allowed profits to be distributed as if they were earmarked as interest paid on units linked to debentures. This did not play down well with the tax authority – South African Revenue Service (SARS) (Boshoff & Bredell, 2013).
69 The SA REIT Association is the independent body that governs and provides sector-wide oversight of South African REITs (SA REIT Association, 2014).

2003, and 2013, respectively. Interestingly, in 12 out of the 14 countries across the various REIT market jurisdictions spanning North America, Asia Pacific and Europe, minimum REIT dividend payout requirements range between 90-100%, excluding two outliers, namely France and S.A., whose dividend payout requirements are 85% and 75%, respectively (Packer, Riddiough & Shek, 2014). Although as mentioned above, both EPRA and PWC claim that France's minimum payout ratio has recently been adjusted upwards to 95% (EPRA, 2015; PWC, 2015). Barring the U.S., many REIT markets have caps imposed on their use of financial leverage, typically in the neighbourhood of 60% (Packer, Riddiough & Shek, 2014). Most jurisdictions requirements in terms of the proportion of total investments that must be in real estate were relatively similar, between 75-100%. U.S. and Asian REITs have prominent levels of institutional holdings, ranging in the neighbourhood of 40% in Singapore to 60% in Japan, compared to 25% for its French REIT market counterpart. Significant under-pricing of U.S. and continental European REITs have been documented relative to Asian-Pacific REITs, and is assumed to be a product of each REIT market's management structure. The U.S. and Europe adopted the internal management structure, whereas the majority of Asian REITs are more fund-like because they opted for the external structure, and hence outsource this function, except for Australia (Packer, Riddiough & Shek, 2014).

Table 2.1
Comprehensive Global REIT Market Microstructure Analysis[71]

REIT Market and Year established	Minimum Dividend Distribution	Minimum Investment in Real Estate	Leverage Restrictions	Closed-ended Fund [70]	Management Structure
U.S.: 1960	90% + of net taxable earnings (after depreciation)	75%	Unrestricted	Yes	Internal/External
Netherlands: 1969	100% of fiscal earnings, no capital gains distribution if plough-back into reinvestment reserve account	100%	60%	Yes	Internal
Australia: 1971	100% of net taxable earnings (after depreciation)	50%	Unrestricted	Yes	Internal/External
Brazil: 1993	95% of net taxable earnings (after depreciation)	75%	Unrestricted	Yes	Internal
Turkey: 1997	None	50%	Shor-term funding limited to five times NAV	Yes	Internal
Japan: 2000	90% + of net taxable earnings (after depreciation)	70%	Unrestricted	Yes	External
Singapore: 2002	90% + of net taxable earnings (excluding depreciation)	75%	45%	Yes	External
France: 2003	95% of rental revenue + 60% of realised capital gains+100% of dividends from French subsidiary	50%	(None) Thin Capitalisation Rules	Yes	Internal/External
U.K.: 2007	90% + of net taxable earnings (after depreciation)	75%	65%		Internal/External
Mexico: 2011	95% + of net taxable earnings (after depreciation)	70%	(None) Thin Capitalisation Rules	Yes	External
S.A.: 2013	75% + of net taxable earnings (after depreciation)	75%	60%	Yes	Internal/External

[70] A closed-ended mutual fund (CEF), of which REITs are a sub-category, issue a set volume of shares which can only be traded in secondary markets and not redeemed from the fund (EPRA, 2015).
[71] The ordering of the REIT market countries in table 2.1. is according to the year of its inception.

2.3 The Reverse REIT-Bond Yield Gap Anomaly

This concluding subsection comprehensively examines the fundamental research questions at the core of this paper. By amalgamating an enriched and in-depth analysis of both REIT and government bond yield literature, it zeroes in on and sets the scene for the potential factors that influence the observed statistical reverse REIT-Bond Yield Gap anomaly, in which EME ten-year nominal government bond yields on aggregate exceed their respective countries dividend yield on REITs, in comparison to this finding being almost non-persistent in nature when examining the EMEs advanced market counterparts. It begins with an investigation into the theories that weave together the Fed Model literature – the pivotal component of the puzzle which suggests a relative comparison between long-term government bond yields and the dividend and/or earnings yields on aggregate equity indices, through the use of ratio analysis, or the closely related 'traditional model', which subtracts from government bond yields the dividend and/or earnings yields on the aggregate equity indices, or vice-versa. It is at this statistical juncture by which this study creates its own uniqueness, by replacing aggregate equity indices dividend and/or earnings yields with those of the aggregate REIT sectors'. In order to provide the Fed Model literature with meaningful weight, an extensive discussion surrounding a short financial history on the correlation and cointegration between general stocks, REITs and government bonds is explored. Additionally, potential predictability attributes underlying the very epitome and nature of dividend yields and stock market indices is assessed. The remaining literature is then partitioned by examining in great depth various literatures covering a barrage of perspectives on both REITs and government bonds, in order to gauge from which direction the anomaly is likely emanating from, although a-priori expectations and preliminary data analysis are indicative that government bond yields – also reflective of sovereign risk, are the culprits. The REIT literature entails an investigation into REITs dividend policies, capital structures, historical performance determinants, inflation analysis, lease contract structure analysis, their valuation, as well as shopping centre rent and expansion determinants, upon which REITs engage in contractually stipulated arrangements with their tenants to generate their rental cash flows. Subsequently, the government bond literature forms the blueprint framework for this financial eco-system analysis by beginning with the macroeconomic environment and its potential impacts on government bond yields. Following this, proposed methodologies utilised for term structure modelling and forecasting of government bond yields is assessed. Next, the fabrics that sow together the financial seeds propelling fluctuations in government bond yields are reviewed. At the country-wide level, government bond yields are examined from the perspective of national debt sustainability, fiscal rules and budget deficits as well as exchange rate risk. In concluding, the two partitioned strands of literature are weaved back together, through an analytical tactical asset allocation framework, which aims to illustrate how a formulated and back-tested trading rule strategy by which the statistical anomaly of this paper could perhaps be exploited in order to generate profits.

2.3.1. The Fed Model

The Fed Model is the informal product of market practitioners, following former Fed chairman Allan Greenspan's conference regarding irrational exuberance in November, 1996 (Berge, Consigli, & Ziemba, 2008). It was initially purported to act as a tool to help understand and forecast fluctuations in the ERP. Asness (2003) believes that it is likely to have been popularised by its simplicity, attractiveness, and its bullish nature on the market relative to more mainstream stock-valuation models. The Fed Model in its original 1996 form postulates that the equilibrium price level of stocks should be equated to expected corporate earnings, discounted by the current ten-year RF rate (Berge, Consigli, & Ziemba, 2008; Asness, 2003; Aubert & Giot, 2007). The model then compares the dividend (or earnings) yields on aggregate equity indices with the nominal yield on long-term government bonds. This forms the cornerstone link in attempting to explain the tri-fold research objectives of this paper. Specifically, investigating what propels the deviations underlying the REIT-Bond Yield Gaps spanning the 11 markets, with a tilted focus towards why EME nominal government bond yields almost persistently exceed REIT dividend yields, even after time-series fluctuations, and therefore resulting in what the Fed Model would suggest as representative of EME REIT market over valuation (or expensive relative to their respective government bonds), whereas their advanced market counterpart REITs would simultaneously be considered undervalued (or cheap relative to their respective government bonds). These objectives subsequently culminate in the light of whether or not arbitrage profit opportunities can be exploited through an effective formulation of a tactical Markov regime switching asset allocation strategy-based trading rule. Resuming with the Fed Model literature, Aubert and Giot (2007) postulate that stocks are then said to be over (under) valued when their dividend (or earnings) yield is less (greater) than the yield on long-term government bonds, and in equilibrium when the two yields are equal. However, Asness (2003) disputes this, claiming that at best, this comparison is practically a toxic blend involving an inappropriate benchmark, and hence labels the Fed Model as a simplistic and deceptive stock selling tool.

Asness (2003) also claims that although no consensus exists as to what the model is insinuating, it is generally accepted that the two yields should be compared to each other, and that low (high) inflationary and/or interest rate environments are conducive with relatively low (high) earnings (or dividend) yields. This statement appears in line with the preliminary data analysis of this paper. Conversely, Berge, Consigli, and Ziemba (2008) claim that its theoretical tenets suggest that optimal asset allocations between equity and bonds is interconnected via their relative yields. If the yield on either instrument deviates from the other, a market correction may be expected in the form of shifting capital from the asset class with the lower to the higher yield. This is also related to Koivu, Pennanen and Ziemba's (2005) and Durre and Giot's (2007) notion that stocks and bonds are substitutes that compete with each other for capital flows in the so-called 'flight to quality' phenomenon. Durre and Giot (2007) expand on this point with reference to the existence of constant arbitraging within stock and bond markets. A low interest rate environment is likely to attract capital inflows to the stock market (specifically if dividend yields are high) and vice-versa. Hence, there is a substitution effect (rebalancing of portfolios) between stocks and bonds which is driven by the relation of the dividend yield to the bond yield. Durre and Giot's (2007) assertions are therefore directly related to the undercurrent of this paper, except in relation to EMEs which have relatively high interest rates, and yet whose aggregate REIT sector dividend yields appear in line with and in comparison to their advanced market counterparts. Arbitrage is also executed through so-called 'carry trade' (Durre & Giot, 2007).[72] However, these corrections and rebalancing strategies may result in overshooting, thereby causing short-term negative ERP's (Berge, Consigli, & Ziemba, 2008). Contrastingly, other researchers support the notion of the Fed Model. Durre and Giot (2007) offer an insightful explanation, suggesting that the present value tenets embedded in the Fed model articulates the use of discounted cash-flow valuation by linking the causality of rising (falling) discount rates to rising (falling) yields on ten-year government bonds, which in turn decreases (increases) the present value of discounted future cash flows – stock prices. On the other hand, Aubert and Giot (2007) endorse the Fed Model by suggesting that its literature is based on three arguments. One, stocks and bonds are close substitutes; two, disaggregating the Gordon Growth (Dividend Discount) Model of stock valuation illustrates that equities' P/E ratios' are inversely related to long-term government bond yields; and three, historically high correlations between fluctuations in long-term government bonds and the earnings yield on equity indices have been observed. Perhaps the latter appears to correlate strongly with government bond yields given that they are the reciprocal of P/E ratios, whereby this is influenced through companies who use credit to finance their operations in order to generate revenue, impacted by the cost of borrowing – the base borrowing rate which is set from both monetary policy interest rates and government bond yields. Koivu, Pennanen and Ziemba (2005) even suggest that the Fed Model has been used a market-timing tool in terms of when to enter and exit the market, which has been illustrated as superior to mainstream buy and hold strategies.

Asness (2003) asserts that while the Fed Model may portray an image of reality, it lacks a coherent foundation. Its caveats begin at the most basic level, in that it suggests a comparison between real and nominal metrics, the earnings (or dividend) yields on aggregate equity indices and the nominal yield on long-term government bonds, respectively (Asness, 2003; Aubert & Giot, 2007; Berge, Consigli, & Ziemba, 2008). However, Aubert and Giot (2007) claim that even though this fallacious comparison results in 'money illusion', they agree with Asness (2003) that it is against the backdrop that corporate profits already covary with inflation, and hence earnings (or dividend) yields are therefore a sufficient Fed Model input.[73] Conversely, Bekaert and Engstrom (2009) argue that money illusion is shown to have very limited ability at

[72] Carry trade exploits low interest rates by buying stocks when they are inexpensive using margin provided by brokerage firms, and subsequently shorting when interest rates rise (Durre & Giot, 2007).
[73] Money illusion relates to earnings and wealth misconceptions, in that their true values might be distorted by inflation. In this regard, Svensson (2005) found that countries with high interest rates corresponded to lower earnings yields. Earnings yields are computed by taking the inverse (or reciprocal) of the P/E ratios (Aubert & Giot, 2007).

explaining the observed strong correlation between equity and bond yields, and a large proportion is actually ascribed to protracted stagflation periods. [74] The Fed Model therefore tends to 'work well' in those countries experiencing significant stagflation. The correlation coefficients between the dividend yields on REITs and nominal government bond yields as well as Fed Model findings will therefore be examined and illuminated for those countries with high rates of stagflation, which appears to be the collective EMEs of this paper. Some strands of literature even argue that the discount factor used in the Fed Model is unadjusted for risk, since the relationship focuses exclusively on the contemporaneous linkages between the variables (Durre & Giot, 2007). Others criticise its oblivion to the time-varying nature of RPs at the portfolio selection level, even though it employs as a discount factor a country's long-term government bond yield (Berge, Consigli, & Ziemba, 2008; Durre & Giot, 2007). However, a more severe bone of contention is that inflation expectations and its link with the stock market and bonds are ignored (Berge, Consigli, & Ziemba, 2008; Durre & Giot, 2007).[75] Thomas and Zhang (2008) also corroborate this by suggesting that analysts mistakenly employ the Fed Model to forecast uniform financial asset nominal growth rates, regardless of the inflationary environment. Since real interest rates, ERPs and the real growth rate of dividends are relatively inelastic with respect to inflation, it is puzzling to find that forward earnings (or dividend) yields have historically covaried with inflation, insinuating that investors suffer from inflation illusion.[76] Thus, stocks tend to be under (over) valued when inflation rates are high (low) (Asness, 2003; Hong & Lee, 2013; Ilmanen, 2003; Thomas and Zhang, 2008). Nonetheless, analysts erroneously confuse the Fed Model's descriptive ability regarding how P/E multiples are set with its use as an investment selection tool in isolation, and it should therefore rather be used as a complementary tool (Asness, 2003). Asness (2003) links all of these misconceptions of investor psychology to human behaviour, in that market participants continuously make errors and yet still advocate the models they used to arrive at such errors.

While Asness (2003) and Aubert and Giot (2007) agree that the Fed Model fails to empirically forecast long-horizon stock returns in real terms, Asness (2003) points out that its descriptive ability regarding how its sets standard P/E multiples in isolation can forecast long-horizon stock returns in real terms. However, Asness' results appear inconsistent. In an earlier paper, Asness (2000) proclaimed that the percentage of raw earnings and dividend yield data that were explained by his earlier model provided predictive power over long-horizons, whereas the unexplained proportion provided significant short-term forecasting power. Although his earlier paper never specified if the findings were in real or nominal terms. While the Fed Model can be computed using the ratio of the earnings (or dividend) yield over the long-term government bond yield, Aubert and Giot (2007) subtract the latter yield from the earnings yield on equity and illustrate that even though the Traditional Model's forecasts are marginally improved in this way, they are not robust through time (Aubert & Giot, 2007).[77] This paper focuses exclusively on the use of a modified variation of Berge, Consigli, and Ziemba (2008) and Aubert and Giot's (2007) BSEYD and Traditional Models, whereby aggregate REIT sector's trailing dividend yields are subtracted from its respective market's ten-year generic nominal government bond yield. Maio (2012) finds contrasting results to both Asness (2003) and Aubert and Giot (2007), but nonetheless contributes to the literature and in a similar vein to Aubert and Giot (2007), Maio (2012) employs the yield gap and its logged variant to predict aggregate equity risk premia.[78] At one-month horizons, the yield gap is found to forecast the equity premium more accurately than dividend and/or earnings yields in isolation, with the three-month and five year intervals not trailing far behind, and thus outperforming default spreads, term spreads and the dividend payout ratio (Maio, 2012). Additionally, by imposing positive constraints on the log yield gap to forecast variables in addition to the equity premia, for example, dividend growth and payout ratios, the model's predictive strength was reinforced for longer horizons. Maio (2012) furthermore claims that significant value-enhancements to Sharpe ratios linked to dynamic trading strategies have been recorded by employing the yield gap in applications of dynamic

[74] Stagflation is when simultaneously high inflation and unemployment rates are coupled with 'stagnating' economic growth rates (Bekaert & Engstrom, 2009).
[75] Bond yields are propelled by anticipated long-term inflation rates. For example, rising inflation reduces bond prices which raises their yields, since the nominal value of coupon payments are worth more. However, since stocks are the residual claims of corporate earnings, which are not fixed in a nominal sense, corporate earnings can fluctuate in tandem with inflation (Asness, 2003; Aubert & Giot, 2007; Berge, Consigli, & Ziemba, 2008; Durre & Giot, 2007).
[76] The inflation illusion hypothesis states that investors fail to appropriately factor the effects of inflation into nominal dividend growth rates, and erroneously base their forward-looking expectations of future dividend growth on historical observations, even during epochs of heightened inflation (Hong & Lee, 2013).
[77] Aubert and Giot (2007) obtain the traditional model by subtracting the rate of inflation from the dividend (or earnings) yield plus a constant growth rate of dividends in perpetuity.
[78] The yield gap is the deviation between dividend (or earnings) yields and long-term government bond yields. Maio (2012) developed two yield gap statistics. The first uses a dynamic accounting disaggregation incorporating earnings yields, future short-term interest and growth rates, and future dividend payout ratios, modelled as functions of expected ERPs. The second employs dividend yields and their correlation with anticipated future ERPs.

portfolio selection and optimisation investment strategies. Koivu, Pennanen and Ziemba (2005) developed a quantitative variant of the Fed Model by taking the natural logarithm of the ratio of the yield on long-term government bonds to the earnings yield on stocks as the dependant variable proxying the equilibrium correction term in a Vector Equilibrium Correction (VEC) model framework. This was in order to test for cointegrating relationships, and if the Fed Model can forecast equity prices, earnings and bond yields. Their results were more effective for the U.S. relative to the U.K. and German markets. The VEC model was found to be statistically superior in out-of-sample forecasts relative VAR models, justified by smaller and/or equal root mean squared errors (RMSEs).[79] The yield differential between long-term government bonds and stocks has also been successively used to gauge stock market volatility, for example, market collapses during 1948 and in 1989 in the U.S. and Japan (Koivu, Pennanen & Ziemba, 2005). Berge, Consigli, and Ziemba (2008) corroborate this by claiming that the model was successful at predicting the 1987, 2000 and 2002 U.S. market corrections, and for Japan in 1990.

Durre and Giot (2007) incorporated the Fed Model into a cointegrating VAR framework, since it can disentangle both long and short-term dynamic effects. Inflation rates are the main variable found to be propelling long-term government bond yields, following which the magnitude of the bond yield's effect on stock price variations are possibly linked to the respective country's inflation stabilisation history (Durre & Giot, 2007). A long-run cointegrating relationship is also found between earnings, stock prices and long-term government bond yields. However, long-term government bond yields do not have a large impact on stock market equilibrium in the long-run, yet might partially explain short-term variations. Long-term stock price determinants might therefore be corporate earnings, and not long-term government bond yields proxying discount factors as per prior literature. Robustness tests were performed by deflating relevant nominal variables and by using stock indices forward earnings yields to ascertain whether it possessed forecasting power. These test results were verified, and hence corroborated Durre and Giot's (2007) assertions. Similarly to the framework of this paper, Svensson (2005) created an adjusted Fed-model (AFed-model) to determine whether EMEs respective stock prices were in disequilibrium. Svensson (2005) found that bond and earnings yields on aggregate fluctuated in tandem, which in contrast to assertions by Bekaert and Engstrom (2009), supported the 'money illusion' conception. The AFed-model was however unsuccessful in applications of forecasting returns for the majority of countries considered, in line with findings by both Asness (2003) and Aubert and Giot (2007). Svensson (2005) considered these findings to be a product of the relative illiquidity and opaqueness surrounding both bond and equities in EMEs, with the exception of South Korea. As expected, the EMEs aggregate risk and return attributes were higher relative to their advanced market counterparts. This necessarily points to scrutiny regarding the Fed Model's suggested point of equilibrium, because emerging market (EM) stocks require larger equity premiums relative to their industrialised counterparts (Svensson, 2005). Conversely to extant literature, countries with greater returns corresponded to lower earnings yields, possibly due to the higher degree of uncertainty in EMEs. Improvements in stock market liquidity are believed to be driving down earnings yields, via the quotient of rising prices relative to earnings. Therefore, larger P/E ratios are justified by falling inflation. Incorporating the yields of government bonds into such equations did not enhance the statistical results, yet rising bond yields imposed negative implications for equity returns in most of the countries (Svensson, 2005).

The bond-stock yield ratio (BSYR) forms the nexus between the RF rate and equity yield. This is also linked to the bond-stock earnings yield differential (BSEYD).[80] The BSEYD was modified by Berge, Consigli, and Ziemba (2008) into an investment strategy, in which a hypothetical US$100 invested grew to US$4650 in the U.S. market and from US$8480 to US$10635 over 1975 to 2005, with a simultaneous significant reduction in portfolio variance. This was also successful in the Japanese market, where a hypothetical 100 Japanese Yen (¥) grew to ¥213.88 from 1985 to 2005. The majority of the BSEYD modified strategies out yielded buy and hold strategies in the U.K., yet were also outperformed by the market in some scenarios. Holistically, the BSEYD does possess some predictive power, especially over primitive buy and hold

[79] The stationarity properties of financial data used in Fed Model applications are often ignored. While the long-term government bond, stock price index and earnings were non-stationary, they were rendered stationary by differencing each series once (Koivu, Pennanen & Ziemba, 2005).
[80] The BSYR is the quotient of the current market value over its theoretically correct value. The BSEYD is computed by subtracting one from the BSYR and multiplying it by the equity yield. Both the BSEYD and BSYR may be used to identify arbitrage opportunities by predicting forthcoming corrections. Since the Fed Model assumes that market prices will fluctuate around their theoretical means, the BSYR is expected to converge upon unity and the BSEYD towards zero (Berge, Consigli, & Ziemba, 2008).

techniques, and notably for the U.S. and Japan, as agreed by Berge, Consigli, and Ziemba (2008) and Koivu, Pennanen and Ziemba (2005). However, the yield spread between bonds and equities are likely to enhance its success and robustness. The yield spread between bonds and equities can predict short-term corrections, albeit limited and exclusively to the U.S. and U.K. markets. By combining macro-variables like interest rates, their differentials, as well as stock market cyclicality, the BSEYD is capable of providing reliable forecasting signals in terms of when to enter and/or exit the market (Berge, Consigli, & Ziemba, 2008).

Thomas and Zhang (2008) provide a new paradigm by integrating the impacts of accounting rules and conservatism into a Fed Model analysis. They found that earning yields are bolstered by inflation, provided that the holding gains exacerbated by inflation form part of accounting income. However, given that holdings gains are not recognised in an accounting income sense for non-depreciable land, inflation bears little consequences. Since nominal returns expected from property investments and unrecognised holding gains coincide with increased inflation, the discrepancy between the two reflects income rental flows, which is recognised under accounting profit. Except for land, all other assets are impacted by the procedure of reporting holding gains in profits, which induces higher dividend payouts under inflationary scenarios. Earnings yields are found to decrease with accounting conservatism, and can be exacerbated when dividend payouts decline (or growth rises). The appropriate growth rate for nominal earnings yields is not the perpetual nominal dividend growth rate given current payout levels, but is instead the perpetual dividend growth rate under the auspices of a 'full payout policy'. The rules embedded in accounting earnings suggest that the latter growth rate is highly inelastic with respect to anticipated inflation. The U.S. is found to be inconsistent with the inflation illusion argument, in that lower (higher) growth in real terms is priced in for epochs of high (low) inflation, insinuating that stock values and corporate profits in real terms are impacted negatively by unanticipated inflation (Asness, 2003; Hong & Lee, 2013; Ilmanen, 2003; Thomas & Zhang, 2008). Relatedly, the deviation between the yields on government bonds and stocks is likely to increase with conservatism and growth rates in investments. Importantly, trailing earnings yields (TEYs) differ to trailing dividend yields in the sense that the former reflect corporations 'bottom line' earnings.[81] Hence, they are inclusive of the revenue (expenses) from discounted operations and extraordinary line items. Thomas and Zhang's (2008) evidence suggests that trailing dividend yields are thus not applicable to Fed Model applications due to dividend payout time variations. Nonetheless, given the nature of non-recurring items, coupled with the overly-optimistic perspectives of analysts at the ground level, this paper employs exclusively trailing dividend yields and the current ten-year nominal government bond yields as Fed Model inputs. Thomas and Zhang (2008) surmise that if the Fed Model is a descriptive tool of stock market behaviour, then fluctuations in equity prices may be explained by variations in interest rates and forward earnings. Contrastingly, these researchers' found that the Fed Model has proved unsuccessful when using trailing and forward dividend yield metrics (Thomas & Zhang, 2008). Thus, shifting to anticipated earnings drastically alters Fed Model inferences. Additionally, moving to micro-based firm level observations (where forecasts are actually made) suggests that long-term interest rates and forward earnings provides explanatory evidence of stock price behaviour. The uniformity amongst risk premia and full payout growth policies at the corporate level, as implied by the Fed Model, might help explain both variation and the levels of ERPs (Thomas & Zhang, 2008).

Returning to Bekaert and Engstrom's (2009) assertions, they illustrated that countries with one % greater stagflation relative to a benchmark have a 21 percentage point larger stock-bond yield correlation. During recessions, the risk averse behaviour of economic agents coupled with economic uncertainty might raise ERPs, which, ceteris paribus, raises the yields on equity. If, simultaneously, anticipated inflation tends to be high during recessions, then expected inflation and ERPs might bid bond yields up, and hence positive correlations between bond and equity yields will begin to emerge. The GFC is a prime example in which growing deviations between stock and bond yields emerged. In the U.S., the recession induced large ERPs but simultaneously coupled with low inflationary pressures, resulted in low anticipated inflation, causing a reduction in long-term government bond yields. These findings may cause distortionary equity market effects if the money illusion argument is believed, or, alternatively, monetary authorities should take cognisance that inflationary

[81] Forward yields generally exceed trailing yields. This is because trailing earnings yields include outflows that are unlikely to recur in the future, whereas forward earnings yields have impounded expected growth rates and tend to be reflective of the optimistic nature of analysts (Thomas & Zhang, 2008).

policies could have no implications for equity markets beyond their consequences for real economic activity. Other Fed Model applications and findings tend to be inconsistent. Faugere and Van Erlach (2009) find some empirical evidence which supports the Fed Model. They found the S&P 500 and Treasury future earnings yields in real tax-adjusted terms were stationary and fluctuated around positive means, insinuating that the ten-year Treasury yield and S&P 500 future earnings yield are jointly determined by the required yield. On the other hand, Breen, Glosten and Jagannathan (1989) found that the returns on one-month Treasury bills can forecast both the direction and variations in the distributions of the excess returns on equity indices, subject to the indices being value-weighted. Even though there is a statistically inverse association between equally weighted indices with Treasury bills, their Cumby-Modest and Henriksson-Merton model failed to adequately forecast statistically significant results. However, the excess returns on their equally weighted indices were leptokurtic, and therefore their results might spurious (Breen, Glosten & Jagannathan, 1989).

2.3.2. Stock-Bond Correlation and Cointegration Analysis

Central banks are increasingly using stock-bond comovements as a market barometer for inflation and growth expectations (Ilmanen, 2003). Theoretically, stock prices should equal the sum of discounted expected future cash flows, as proxied by anticipated dividends (Faugere & Van Erlach, 2009; Ilmanen, 2003). Ilmanen (2003) goes on to state that since discount rates encompass both the RF rate and ERPs, an increase in the RF rate fuelled by inflation expectations reduces equity prices, raising their yields, and a resultant positive comovement between stock and bond returns begin to emerge. For instance, mounting anticipated inflation raises discount rates, which is detrimental for bond markets. However, more ambiguous is the impact for stock prices because both expected future dividends and discount rates are impacted. Ilmanen (2003) states that inflationary expectations are one of the major driving forces behind the positive time-varying nature of stock-bond return comovements. The stronger (weaker) the inflation expectations are, the more (less) they tend to move in the same direction, which also causes a larger impact on discount rates relative to expected future dividends, thereby resulting in an inverse relation between equity prices and inflation expectations, and hence a positive relation between anticipated inflation and stock-bond comovements. Although during monetary policy tightening or easing, the latter tends to be beneficial as it stimulates both asset classes performance (Ilmanen, 2003). Whereas Ilmanen (2003) finds a straightforward linear relation between the level of inflation and its impact on stock-bond correlations, in that deflation (inflation) stimulates (depresses) real bond returns and causes a decline (rise) in required bond RPs, other researchers contrastingly assert that conventional linear models are unable to capture the vital elements of their joint return distributions (Guidolin & Timmermann, 2006; Jansen, Li, Wang & Yang, 2008; Reinhart & Rogoff, 2010), and instead advocate the use of regimes that are able to capture their joint distributions and correlations across time. Thus, regime switching models abilities of capturing the joint non-linear return distributions between stocks and bonds motivated the use of and is one of the reasons for the Markov regime switching model methodology deployed for analysing this paper's tri-fold research objectives.

In arguing that stock-bond comovements are state dependent, Ilmanen (2003) suggests that they covary weakly when real rates fall while simultaneously equity premiums rise. Stock-bond correlations have a high probability of being inversely related during periods of low inflation, weak growth, high equity market volatility, when future expansion prospects and RF assets outweigh inflation and discount rate uncertainties, and when causality stems from equities leading into bonds (Ilmanen, 2003). Directly related to the EMEs that form part of this paper, the preliminary empirical observations regarding EMEs nominal government bond yields being less than their respective rates of inflation will be investigated in greater depth in the empirical results section, with specific reference to whether Ilmanen's (2003) statement of this association inducing inverse stock-bond correlations. Ilmanen (2003) continues by asserting that inflation may however be pro- or counter-cyclical, with the same applying to monetary policy actions. Through a rise in required ERPs caused by epochs of heightened stock market uncertainty, stock-bond comovements may become temporarily distorted, supporting the 'flight-to-quality' phenomenon. Consequentially, anticipated economic growth bears no impact on stock-bond return comovements (Ilmanen, 2003).

Complementing Ilmanen's (2003) assertions, Guo, Zhou, Cheng and Sornette's (2011) 'thermal optimal path method' suggests that the S&P 500 index and Treasury security yields of several maturities covary in the same direction, with the stock market leading these yields. Long-term government bond yields are led by the yields of shorter maturity instruments, however, following the GFC, this relationship reversed itself (Guo, Zhou, Cheng & Sornette, 2011). In a similar tone, Li and Lei (2011) examine the associations between REIT indices and the S&P 500 index, where it was found that REITs actually tend to lead the S&P 500 index. In fact, REIT total return indices lead economic activity indicators by approximately six months, whereas REIT income indices lead by up to one year.[82] Hence, real estate income flows generated by REITs serve as a powerful forecasting tool regarding future real economic activity. This finding may be justified against the backdrop that land and buildings comprise a fundamental input base to any production process (Li & Lei, 2011). In another study examining the U.S., U.K. and Germany, positive stock-bond correlations are observed, yet protracted periods of negative correlation are also found (Baele, Bekaert & Inghelbrecht, 2010). Such correlations have also switched rapidly from positive to negative in the past, ranging from +60% in the mid 1990's, to -60% by the early 2000's (Asness, 2000; Baele, Bekaert & Inghelbrecht, 2010). Heteroscedasticity in market shocks is believed to have influenced these historically wild decoupling between stock-bond return comovements, such as the 'Great Moderation' period of the late 1980's, even though Baele, Bekaert and Inghelbrecht (2010) found positive stock-bond comovements until the end of the 1980's, but diminished thereafter. A rising VIX index is additionally believed to be associated with this type of decoupling.[83] Furthermore, some studies underestimate these correlations through the use of present value models, whereas others overestimate them by employing consumption-based asset pricing methodologies (Baele, Bekaert & Inghelbrecht, 2010). Models that are subject to constant variable exposure also tend to become impaired and are thus unable to generate negative comovements – potentially improved by relaxing the factor variables to be dependent on the variance premium, or by incorporating economic state variables into the models, instead of ascribing these gyrations to the 'flight-to-quality' phenomenon. Although Baele, Bekaert and Inghelbrecht (2010) find no evidence supporting the 'flight-to-quality' phenomenon, they do believe that it likely caused the inverse stock-bond return correlations in the post 2000 period. Irrespective of these observed inconsistencies, they found that the general time-series patterns were congruent across the markets, implying the growing implications of the degree of financial integration and globalisation, which might have also caused structural changes in financial asset pricing (Baele, Bekaert & Inghelbrecht, 2010; Ilmanen, 2003).

Asness (2000) sheds light on an alternative vantage point, hypothesising that the relative yield required on stocks compared to bonds is a function of the experience of each investor generation with different asset classes. Although low yields are generally accepted by short-term investors if they are linked with appropriate prevailing conditions, it articulates that those generations who experienced substantial volatility will tie it to their relative required yields. Specifically, Asness (2000) found that the dividend yield on stocks is a positive function of long-term government bond yields, stock volatility, and a negative function of bond volatility. Prior to the mid-1950s, bond market yields were persistently below stock market yields.[84] Investors of this era anecdotally postulated that given stocks are riskier than bonds, they should generate higher yields. However, since 1958, bonds began to out yield stocks. This is the same anomaly observed in the present context spanning the EMEs that form part of this paper. Asness (2000) goes on to state that this resulted in a new paradigm in which historical dividend yields are not consistently comparable with those of earlier eras. Prior to the 1950's, stocks out yielded bonds based on actual stock volatility relative to bonds. From 1927 until 1998, the correlation coefficients between the dividend and earnings yields on stocks and Yield-to-Maturity (YTM) on bonds were -0.28 and +0.08, yet later became highly positively correlated, documented as +0.71 and +0.69, respectively. Justifying these stock-bond yields stochastic comovements during the 1927 to 1998 period, and subsequent shift to strong positive comovements, Asness' (2000) argument is similar to Lee's (2010), in that omitting historical structural changes between the variables can produce erroneous inferences. Asness (2000) then factored in non-constant volatility, causing stock and bond yields to covary

[82] The S&P 500 returns exhibited significant skewness and kurtosis. Momentum effects (as evident through substantial serial correlation) is also documented for this index. Contrastingly, the returns on REITs did not exhibit serial correlation (Li & Lei, 2011).
[83] VIX is an acronym for the Volatility Index and is used to gauge global expectations of market volatility in relation to the following one month ahead period. It is computed by the Chicago Board Options Exchange (CBOE) (Baele, Bekaert & Inghelbrecht, 2010).
[84] Cognisance should be taken that during the deflationary recession in the 1930's and 40's, Treasury yields were pegged and hence maintained artificially low (Asness, 2000).

strongly over the entire sample period. As advocated by Ilmanen (2003), even portfolio returns can be improved by accounting for non-constant volatility, and hence omitting assumptions based on constant relations. Faugere and Van Erlach (2009) complement Asness' (2000) findings, in stating that bonds underperform (outperform) stocks during business cycle expansions (contractions) - reflecting their inverse elasticities in response to a change in growth. Business cycle risk determines equity premiums, which for long-term Treasuries are mostly zero or positive (Faugere & Van Erlach, 2009). Additionally, both business cycle and required yields are the main determinants of Treasury yields. Yield differentials are therefore a product of the long-run growth in book-value per share relative to that attainable in the short-run, thus raising the potential for inverted yield curves (Faugere & Van Erlach, 2009).

Prior to the 1993 U.S. Tax reforms, REITs and equity were not cointegrated, believed to be a product of the stringent regulations of holding REITs for institutional investors and pension funds that effectively froze economic agents out of the REIT market (Glascock, Lu & So, 2000; Videlefsky, 2014). Following tax reforms and deregulation, the REIT market exhibited a large capital influx, of which a consequence that is in line with global markets was that their structural characteristics changed, and REITs subsequently began to behave more like equities, particularly small-cap stocks, with their integration increasing markedly (Glascock, Lu & So, 2000; Niskanen & Falkenbach, 2010). Ling and Naranjo (1999) corroborate this, claiming that the extent of this integration was significantly bolstered during the 1990s through deregulation, technological advances and the rise of the real estate and other sector's securitisation. Eichholtz and Hartzell (1996) claim that a significant contemporaneous relation exists between the behaviour of property shares and common stocks, yet these relations tends to be country-specific, surmising that the factors explaining the international risk differences observed in property stocks might be the size of their underlying market, rent and lease contract discrepancies as well as different tax regime structures across the international markets. Contrastingly, Sing and Ling's (2003) Australian and Singaporean markets' REIT-stock integration study found mixed results, in that office and industrial HPTs were found to have relatively low degrees of integration with stocks, diversified trusts were highly integrated with stocks, and yet stocks and sector-specific HPTs were only marginally integrated with each other (Sing & Ling, 2003). In another study, Eichholtz and Hartzell (1996) found that property stock returns in Canada, the U.K. and the U.S. were closely integrated with those of common stocks for the stock market in which they traded. Ling and Naranjo (1999) advocate that despite real estate comprising a substantial proportion of wealth in the U.S. and its benefits known to be value-enhancing for a mixed asset portfolio, as corroborated by Friedman (1971) and Lee (2010), but refuted by Hui and Yu (2010) who found no evidence that real estate adds any incremental diversification benefits to the mixed asset portfolio, Ling and Naranjo (1999) felt as if the body of research on the integration between commercial real estate markets and alternative asset classes was thin. Nonetheless, Ling and Naranjo (1999), similarly to Glascock, Lu and So (2000), found that exchange-traded property stocks, including REITs, are integrated with exchange-traded non-property stocks in the U.S. One study (Niskanen & Falkenbach, 2010) elaborates further as to the benefits of holding REITs in a multi-asset portfolio, claiming that REIT correlation and equity market volatility are positively correlated. When volatility falls below aggregate levels, correlation follows suit in the same direction, and during high volatility, REITs begin to correlate more strongly with equities. Contrastingly, REITs correlation with fixed income securities remains negative during volatile market conditions, but becomes increasingly less correlated when volatility stems from the fixed income market. Thus, marginal diversification benefits of holding REITs in a multi-asset portfolio become dependent on prevailing volatility (Niskanen & Falkenbach, 2010). As mentioned, Ilmanen (2003) advocates that portfolio returns can be improved by appropriately factoring in stock-bond returns time-varying nature, additionally reinforced by taking cognisance of their non-constant volatilities, which is believed to be value-enhancing in the quest for attaining excess returns. Niskanen and Falkenbach (2010) also found that REIT and equity returns were integrated at both the European and global level, however, their correlation was relatively stronger with European stocks compared to their global counterparts.[85] Specifically, European REITs are inversely correlated with European stock indices and fixed income assets, but was the most prominent with respect to benchmark indices of the latter, compared to their U.K. and U.S. counterparts. European REITs exhibit positive correlations with each

[85] Niskanen and Falkenbach (2010), in agreement with Zhou (2011), employed the largest European REIT markets – France, the U.K. and the Netherlands as part of their study. A potential caveat relates to the deficient cohesive legislation amongst European REITs, in that their regulation occurs at the country-wide level. Therefore, different European REITs might not be comparable on a like-for-like basis (Niskanen & Falkenbach, 2010).

other, and while their respective U.S. REIT counterparts' also do, their correlations were far less prominent. This may be due to the differing maturity life-cycle phases of the European REIT market, relative to the more mature U.S. REIT market (Niskanen & Falkenbach, 2010).

In a paper by Glascock, Lu and So (2000), over the 1972 to 1996 period, all REITs and mortgage REITs were not cointegrated with the bond market, yet prior to 1992 they were. Over the same period, equity REITs were cointegrated with both the bond market and the non-securitised real estate market. Mortgage REITs thus share common characteristics with fixed-income instruments, whereas equity REITs are more like stocks. All, equity and mortgage REITs are cointegrated with inflation during both the full sample range and the pre-1992 sub sample. However, post-1992, only equity REITs were cointegrated with inflation, and hence inflation and securitised real estate shared a close relationship prior to 1992. Research indicates that the shift from REIT IPO overpricing during the 1970's and 80's to under-pricing in the 1990's might explain these observations. (Glascock, Lu & So, 2000).

2.3.3. Predictive Power of Dividend Yields and Stock Indices

Kallberg, Liu and Srinivasan (2003) claim that future dividends are often gleaned through the use of present value models by analysing current share prices and relating them to potential future earnings streams. By incorporating share repurchases into the West and Campbell-Shiller Dividend Pricing Model, REITs current dividend payouts are found to provide credible insights into their future prospects, and additionally this model is thought to be well suited to REITs given their unique operating environments, permitting a sanitised investigation into corporate dividend streams, relative to alternative asset classes with no-preconditioned non-discretionary minimum dividend payout requirements (Boudry, 2011; Eichholtz & Hartzell, 1996; Kallberg, Liu & Srinivasan, 2003). The latter was therefore one of the factors motivating the use of the dividend yields of REITs as part of this paper. Chiang (2015) corroborates Kallberg, Liu and Srinivasan's (2003) findings. By classifying the 1980 to 1992 period as the 'vintage REIT era', irrespective of the time horizon used, anticipated mean REIT dividend growth could be predicted from REITs dividend yields, specifically finding an inverse predictive relation (Chiang, 2015). Contrastingly, the 1993 to 2011 period is classified as the 'new REIT era', in which a positive predictive relation running from REIT dividend yields through to their mean returns is found (Chiang, 2015).

Conversely, although Goetzmann and Jorion (1993) do not focus on a specific sub-stock sector like REITs, as did Chiang (2015), Kallberg, Liu and Srinivasan (2003) as well as this paper, they still found opposing results in that dividend yields cannot predict the returns on equities over long-horizons. This is also in corroboration with Asness (2003) and Aubert and Giot (2007), even though they used the Fed Model as a predictive tool, but contrasts with Asness' earlier paper's proclamation, published in 2000. On the other hand, as mentioned, Asness (2003) claims that standard P/E multiples in isolation can forecast long-horizon stock returns in real terms. Importantly, Goetzmann and Jorion (1993) acknowledge that their bootstrap methodology suffered from the non-identification of lagged dependent variables which might have biased their results. Using general equity dividend yields should also not have drastically altered their findings, although REITs are known to be high-yielding instruments. On the converse, while Robertson and Wright (2006) share Goetzmann and Jorion's (1993) viewpoint, they still shed new light by constructing a dividend yield metric for the returns of aggregate U.S. equities, incorporating both dividend and non-dividend forms of cash flows to equity holders. However, this metric's forecast regression did not possess predictive ability. Many studies document stronger evidence for long-horizon equity return predictability relative to that of shorter-horizon periods (Boudoukh, Richardson & Whitelaw, 2008; Maio, 2012). For example, Maio (2012) found that by imposing positive constraints on the log yield gap to forecast dividend growth and payout ratios, the model's predictive strength was reinforced for longer horizons. Boudoukh, Richardson and Whitelaw (2008) contrastingly illustrate that the estimators in their study exhibit nearly perfectly correlated associations spanning both short and long horizons. For one and two-year horizon estimators, a 99% statistical correlation is attained for their dividend yields persistence levels. For the one and five-year horizons, this metric was 94%. Long-horizon persistent regressor estimates therefore do not predict equity returns better than short-horizon intervals. Instead, however, by varying samples, marginally improved predictability levels can be attained over shorter intervals. Amihud, Hurvich and Wang (2008) uniquely developed a multi-predictor augmented regression model (mARM) to empirically test the logarithm of dividend yields to predict stock returns, finding that it actually harnessed predictive power, whereas under OLS and bootstrapping procedures, no predictive power was found.

2.3.4. REIT Dividend Policy Analysis and Capital Structure

Dividend Policies

Since REITs operate under unique regulatory environments, their dividend policies are assumed to be determined exclusively by their respective tax and governing regulations, specifically encompassing minimum payout ratio requirements (Wang, Erickson & Gau, 1993). However, REITs tend to disburse larger dividends than regulation requires, which refutes these simplistic dividend policy assumptions frequently made. This assertion is additionally reinforced by examining the preliminary analysis findings of the 11 REIT markets relevant to this paper. Wang, Erickson and Gau (1993) instead suggest that REIT dividend policies are partially determined by agency costs. Hardin III and Hill (2008) corroborate Wang, Erickson and Gau's (1993) findings, asserting that dividend payments by REITs which are in excess of mandatory requirements are a function of agency cost minimisation, robust operating performance, share repurchases, and the capacity to tap into short-term debt, given that the latter offers REIT management flexibility in terms of administering their dividend policies. Specifically, REITs typically formulate dividend polices that minimise agency costs whilst simultaneously reducing the probability of future dividend reductions (Hardin III & Hill, 2008). Minimising agency costs is a prerequisite for REITs, since they have limited choice of raising capital through external markets in order to pursue long-term growth. Although REITs short-term credit acquisition provides liquidity and lowers agency costs, it is not used to disburse additional or larger than mandatory dividend payments. The latter must be sustained by current and anticipated future cash flows (Hardin III & Hill, 2008). These findings are consistent with conventional REITs in the global sense, however, as mentioned, Erol and Tirtiroglu (2011) assert that Turkish REITs dividend policies are in essence determined by the nature of their concentrated "leader entrepreneur" ownership, and in which Turkish REITs are confronted with no minimum dividend payout requirements.

Hardin III and Hill (2008) additionally surmise that REITs that accumulate retained earnings that exceed analyst expectations tend to disburse larger dividends than required, sometimes initiating share repurchases, in turn conducive to cost of capital reductions. These activities subsequently emit signals of requiring incremental future capital, whilst simultaneously illustrating that REITs wish to preserve their share prices in order to maintain future capital market access. Conversely, Boudry (2011) repudiates this, claiming that even if a REIT does accumulate additional retained earnings, they will generally not disburse excess or discretionary dividends, especially if its dividend payout ratio caused by the nondiscretionary element is already large. Boudry (2011) indicates that in this manner, discretionary dividends are used strategically by REITs in an effort to smooth their aggregate payout ratios, and hence REITs operate in a similar vein to their corporate non-REIT counterparts. Boudry (2011) used a new technique based on actual tax disclosures instead of Generally Accepted Account Principles (GAAP), in order to dissect REIT dividends into their discretionary and nondiscretionary parts. On the aggregate, discretionary dividends were found to comprise between 18-35% of a REIT's total dividend disbursement, yet these tend to fluctuate with the passage of time and across different REIT entities. Investigating the tax regulations of REIT dividends permits an accurate and sanitised quantification of their discretionary part, thereby enriching the literature by finding systematically-based explanations for discretionary dividend disbursements (Boudry, 2011; Kallberg, Liu & Srinivasan, 2003). Discretionary and nondiscretionary dividends were observed harbouring an inverse relation, in the sense that discretionary dividends are positively correlated with cash flows, whereas nondiscretionary dividends are inversely related to its discretionary counterpart (Boudry, 2011).

Hayunga and Stephens (2009) claim that REIT management administers dividend smoothing even when confronted with transaction costs and institutional constraints, which appears to be the main causal factor underlying discretionary dividend disbursements, whereas prior studies (Boudry, 2011) base a substitution effect with share repurchases as the driving force behind discretionary and nondiscretionary dividends.[86] Hayunga and Stephens (2009) found the presence of a high degree

[86] Dividend Smoothing is also called Dividend Stabilisation (Hayunga & Stephens, 2009).

of dividend smoothing in classifying so-called 'modern day' quarterly U.S. equity REITs, in line with their industrial-based corporate counterparts, and in a similar taxonomy to Chiang (2015), who classifies the 1980 to 1992 period as the 'vintage REIT era', whereas the 'new REIT era' spans from 1993 to 2011. Quarterly dividend smoothing is likely to be a function of the dividends paid in the previous quarter, which is then used as a future point of reference. REIT managers may also disburse the same dividend every quarter in order to meet their mandatory target annual payout ratio.[87] Shareholders also usually prefer larger dividend disbursements because they are used as a barometer for gleaning the potential future trajectory of corporate activity, as well as the state of an entity's financial health (Wang, Erickson & Gau, 1993). Furthermore, REIT dividend announcements also convey information, acting as a barometer as to the probable future performance of the underlying real estate market (Wang, Erickson & Gau, 1993). However, against this backdrop, Hayunga and Stephens (2009) found no evidence of REIT dividend announcements inducing superior share returns. REIT dividends do not possess the traditional informational value that is usually conveyed through corporate non-REIT dividend announcements, possibly due to the way in which REITs minimum payout mandatory requirements are structured, and hence are already accounted for (Hayunga & Stephens, 2009).

Ben-Shahar, Sulganik and Tsang (2011) shed new light on the topic, and found that while Funds from Operations (FFO) and net income actually share in common a non-cash (accrual) element which is highly correlated with the level of dividends disbursed by REITs, the incremental non-cash element in net income and not in FFO harbours no relation with dividends. Only with high quality reporting of depreciation does the non-cash portion of net income become substantially correlated with dividends. Hence, depreciation might distort the relevance of dividends in REIT net income, and accordingly FFO tends to beneficially outweigh net income for financial reporting purposes of the REIT industry. Additionally, by dissecting the accrual portion of net income into depreciation and non-depreciation revenue and expenditure elements, total dividend payouts begin to significantly correlate with expenditure items and with the nondiscretionary dividend portion (Ben-Shahar, Sulganik & Tsang, 2011).

Capital Structure

REITs tax-exempt status at the corporate level, subject to the distribution of the majority of their taxable profits, offers one explanation as to why REITs decisions to raise funds in the external capital markets differs to their non-REIT counterparts (Howton, Howton & McWilliams, 2003). This is interconnected with the decision to issue debt or equity instruments via two mechanisms. Firstly, it dismantles the tax advantage that non-REIT corporations would incur by issuing debt (Feng, Ghosh & Sirmans, 2007; Howton, Howton & McWilliams, 2003), and secondly, it results in REITs limited financing options against the backdrop of highly regulated payout requirements, leaving REITs with much lower levels of capital that can be generated internally relative to their industrial counterparts. The fusion of these two mechanisms results in REIT management being unable to time their issues if equity were to become overvalued (Howton, Howton & McWilliams, 2003). There is also an observed direct association between issuing equity over debt with anticipated costs of going bankrupt, and a negative association with asymmetric information. Such results are in line with the 'pecking order' hypothesis. Contrastingly, agency cost hypotheses applicable to non-REIT entities is refuted (Howton, Howton & McWilliams, 2003).

In examining traditional finance theory, the literature states that it rests on trade-off theory, pecking order theory, and market timing (Feng, Ghosh & Sirmans, 2007).[88] Accordingly, over the long-term, trade-off theory does not forecast any association between market-to-book and leverage ratios, pecking order theory finds an enduring positive association between these variables, and market timing observes an enduring negative association between them. Feng, Ghosh and Sirmans (2007) observed that in contrast to traditional trade-off theory, REITs with historically large market-to-book ratios generally have large and enduring leverage ratios. Giambona, Harding and Sirmans (2008) suggest that this might be because REITs that focus on the least (most) liquid assets employ lower (higher) levels of leverage and relatively shorter (longer) maturities, and tend to employ leverage and varying degrees of debt maturity as substitutes. This is also thought

[87] In addition to a prior periods dividend and contemporaneous sources of income, conventional non-REIT entity dividend determinants are economically insignificant in relation to leverage and the market value of assets, which typically explain the behaviour of dividends. This is a departure from pre-modern day REITs (Hayunga & Stevens, 2009).
[88] Trade-off theory proclaims that capital structure signifies a trade-off in relation to the costs and benefits underpinning debt finance. On the other hand, market timing proposes that under advantageous conditions, management will issue equity (Feng, Ghosh & Sirmans (2007).

to be a function of their unique regulatory environment, which cause REITs to raise finance in the external markets, despite no clear advantages for them of debt financing, as well as their large stipulated payout requirements forcing small holdings of retained income (Feng, Ghosh & Sirmans, 2007).[89]

2.3.5 REIT Performance Determinants and Inflation Analysis

In contrast to the Fisher relation, Hong and Lee (2013) agree with Thomas and Zhang's (2008) observations of negative associations between real stock returns and inflation in post-war U.S. data. These observations insinuate that stock prices tend to be over (under) valued when inflation is low (high), with the inflation illusion hypothesis again articulated as a potential cause (Asness, 2003; Hong & Lee, 2013; Ilmanen, 2003; Thomas & Zhang, 2008). Direct-private real estate is found to provide a partial hedge against inflation, while contrastingly, exchange-traded securitised real estate like REITs are generally cointegrated with the stock market, and thus do not provide an inflationary hedge, which might be outweighed by the inflation illusion effect irrespectively, supporting the notion that short-term REIT returns are inversely related to anticipated inflation (Bailey, 1966; Eichholtz & Hartzell, 1996; Hong & Lee, 2013; Leone, 2011; Sebehela, 2008; Sing & Ling, 2003). These assertions will be examined more closely in the empirical findings section of this paper. According to the inflation illusion hypothesis, REITs unique tax-exempt status at the corporate level permits a scientific opportunity to assess whether they provide inflationary hedges (Boudry, 2011; Eichholtz & Hartzell, 1996; Kallberg, Liu & Srinivasan, 2003). Monetary policy shocks are believed to cause REITs to have an inverse relation with inflation. Linked to this observation, REIT investors are believed to be less prone to suffer from inflation illusion, since REITS have transparent and consistent dividend stream structures (Hong & Lee, 2013; Videlefsky, 2014). Consistent with prior work, Hong and Lee (2013) find little evidence to support the inflation illusion hypothesis. REIT dividend yield variations are believed to be caused by discrepancies between objective and subjective anticipations of future discount rates, dividend growth expectations and anticipated inflation (Hong & Lee, 2013). However, a simple argument could be added on to the factors driving REIT dividend yield variations, for example, amongst other REIT-market unique characteristics, and as examined in-depth above, different REIT markets have their own unique minimum payout ratio requirements, and additionally different REIT management structures are adopted and in some cases even prohibited across REIT geographical regions.

2.3.6 Lease Contract Valuation

2.3.6.1 Lease Contract Structures

Crosby, Gibson and Murdoch (2003) argue that while U.K. commercial lease durations have been shortened and a range of enhanced options made available since the 1990's, corporate tenants still feel that they are deficient towards meeting their overall requirements. This contrasts with findings by Baum (2003), who claims that U.K. office and retail real estate segments are representative of equilibrium in lease contract terms, suggesting both tenant and landlords' mutual desires to preserve current lease structures status quo. Despite much scrutiny, long-term lease durations offer mutual benefits to both tenants and landlords in terms of trading security, which accordingly necessitate adequate compensation to be priced into tenant rent (Baum, 2003).[90] Crosby, Gibson and Murdoch's (2003) survey found that whilst exit and entry strategies are an issue for corporate tenants, commercial lease length is rigid and often exceeds ten years, which tops their concerns. These durations effectively lock tenants into leases that are beyond their companies' business planning horizons, preventing timeous and adequate responses to changes in the turbulent business environment, along with reviewing their own cost structures to preserve market share (Crosby, Gibson and Murdoch, 2003).

Although Ambrose, Hendershott and Klosek (2002) find the upward-only adjusting lease contract structure is commonly used in the U.K. and other Commonwealth nations, Crosby, Gibson and Murdoch (2003) found that this form of lease-embedded periodically upward-adjusting rent charges appeared more discerning for retail relative to office tenants.[91]

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[89] REITs unique regulatory environment dismantles their potential advantageous tax shield which arises from debt financing (Feng, Ghosh & Sirmans, 2007).

[90] From the vantage point of landlords', these factors include anticipated volatility in rents, the probability of tenants terminating their leases early with its associated costs, amongst others (Baum, 2003).

[91] Commonwealth nations span across Africa (including S.A), Asia, the Americas, Europe and the Pacific, of which there are 53 independent sovereign states. These were mostly colonised in the past by the British (Ambrose, Hendershott & Klosek, 2002).

Ambrose, Hendershott and Klosek (2002) explain that at a lease's commencement date, a fixed rental rate is imposed, which resets approximately every five years to adapt to prevailing market conditions.[92] This contrasts with variable-symmetric lease structures which adjust up or downwards. These findings may be contrasted with the case of both Brazil and S.A., in which it was mentioned that Brazilian lease contract structures, despite their historical bouts of hyperinflation, do not adjust more frequently than once in five years. Conversely, in the case of S.A. with relatively high inflation compared to its peer countries of this thesis, it is surmised that lease contracts adjust upwards in rent charges on an annual basis, typically in line with and sometimes exceeding domestic rates of inflation. Perhaps the latter is one of the factors fuelling S.A.'s REITs dividend yields, which are empirically observed to be the greatest out of all 11 markets over the sample period of this paper. Ambrose, Hendershott and Klosek (2002) suggest that the commencement rent level on upward-only adjusting leases should be set from a low base relative to adjustable lease contracts of either direction, especially when the floor on the base-rent is susceptible to volatile conditions. This is where Al sharif and Qin's (2015) 'double-sided price adjustment flexibility' lease contract structure with embedded pre-emptive rights to exercise might be useful. Al sharif and Qin's (2015) claim that it was designed to facilitate enhanced revenue management and/or cost control tools for volatile market conditions, whereas Grenadier (2003) states that it also serves as an effective hedging instrument for landlords against unanticipated inflation. It was aimed at deliberating over the impasse involving a one party exclusive price flexibility adjustment in lease terms whilst both parties desire such an option (Al sharif & Qin, 2015). Pre-emptive rights to exercise over the prevailing counterparty would permit a once-off price adjustment to the lease. These can be attained at a specified cost to allow enhanced flexibility under tumultuous market conditions. Such a clause would theoretically complement the risk management practices undertaken in conventional fixed rate contracts (Al sharif & Qin, 2015).

In contrast to national and private sector tenants' concerns, multinational tenants appeared more apprehensive about the actual lease process offered by U.K. landlords, but most disturbingly to them is lease duration (Crosby, Gibson & Murdoch, 2003). Current global leasing structures are becoming more flexible, diverse and innovative. Modern financing arrangements use long-term government bonds as their base-setting instrument for lease price structuring. This might be one of the fundamental linkages with respect to the EME REITs trailing dividend yields fluctuating persistently lower than their respective government bond yields. Continuing with Crosby, Gibson and Murdoch's (2003) findings, by effectively locking in tenants for long periods, this has facilitated large inflows of foreign capital into U.K. property investments. These flows are primarily attracted by the embedded 'upwards-only' rent lease clauses. While Crosby, Gibson and Murdoch (2003) acknowledge that their results may be biased due to their survey's low response rate, the general trend across lease structure literature is the growing demand for shorter lease durations.

2.3.6.2 Valuing Lease Contracts with Real Option Pricing Methodology

Grenadier (2003), in agreement with Clapp, Bardos and Zhou (2014), asserts that commercial real estate's value, proxying the price the market is willing to pay to occupy space over a specified time-frame, emanates from rental cash flows, however, Clapp, Bardos and Zhou (2014) state that the value of contractual lease embedded options should be added to this figure. Grenadier (2003) states that although an endless variety of real estate lease contracts exist, they can all be reduced into components of financial economics. Similarly, Stanton and Wallace (2009) advocate that because lease contracts and bonds are both debt-embedded instruments comprised of similar financial features, they can be analysed in analogous fashions. With bonds, the essential feature is the promise to undertake contractual payments and the repayment of the face value at expiration, whereas lease contracts entail an agreement to pay predetermined instalments over a stipulated period (Stanton & Wallace, 2009). Akin to the term structure of interest rates, there exists a term structure of lease rates; extension and termination options embedded in leases are paralleled with debt contracts with call and put options; fixed and variable debt instruments are akin to fixed and index-linked lease rates (Grenadier, 2003).

Whereas Grenadier (2003) models the equilibrium in the underlying real estate market using real options, in a similar modus operando, Stanton and Wallace (2009) modify the 'no-arbitrage lease valuation model' by developing a new metric,

[92] The most prominent of these conditions are usually both expected and current demand and supply for rental space, with the same applying to inflation (Ambrose, Hendershott & Klosek, 2002; Grenadier, 2003).

labelled a lease contract's Option Adjusted Lease Spread (OALS).[93] By varying the terms of the lease, the term structure of rental lease rates is derived (Grenadier, 2003). The impact of competing developers on the gradient of the term structure of lease rates, for example, a downward (upward) sloping curve would be reminiscent of a profoundly (thinly) concentrated market. 'Pre-leasing', akin to forward contracts, is a common prerequisite by project developers and/or financiers in an attempt to assign a building market value in the scenario of a default.[94] Although Cho and Shilling (2007) found that irrespective of the taxonomy of a tenant, leases based on attaining a percentage of tenant revenue do not persuade prospective lenders to give advantageous financing terms to shopping centre landlords, and hence are not valued any more than conventional leases. Cho and Shilling (2007) also found that rising sales volatility, reflecting underlying consumer sentiment in the macro economy, reduces shopping centre values.

Other common features of long-term lease contracts relate to embedded escalation rate clauses (Ambrose, Hendershott & Klosek, 2002; Grenadier, 2003). Grenadier (2003) suggests that comparing lease contracts with fixed and variable rental rates is respectively akin to the relation between fixed and variable mortgages. Several escalation variants exist, ranging from rental rates being set in line with real estate market averages, graduated leases which implement pre-specified rental rate increments across various points in time, and rental streams that are set to fluctuate with an exogenous, market-based index like the CPI and/or producer price index (PPI). This is surmised to be directly related to S.A.'s REIT lease contract structures, and as discussed, might impact REIT earnings which ultimately channels through to their respective dividend yields. This is also where Cho and Shilling (2007), using a modified real options methodology, found that percentage and base-rents are not inversely associated but rather fluctuate in tandem. While there have been significant innovations on theoretical lease-pricing models, on the grounds of unobservable market data, the lack of their empirical testing is a major restraint (Grenadier, 2003; Stanton & Wallace, 2009).

2.3.6.3 Retail Shopping Centre Rent and Expansion Determinants

Sirmans and Guidry (1993) examined architectural design, geographical location, general economic and market conditions, as well as salient features which attract passing foot-trade. These variables accounted for approximately 85% of the variation in inter-commercial shopping centre rent levels. Building designs account for the greatest variation in rent levels, while features that increase both clientele base, passing trade and traffic, along with enhanced convenience of locational aspects also entice landlords to demand higher rents. Additionally, a positive association is observed between economic and market conditions with rent level variations (Sirmans & Guidry, 1993).

On the back of approximately 70% of U.S. GDP being driven by consumption spending, where 40% of this is estimated to occur in shopping centres, shopping centres hence form a salient component of the U.S. economy (Clapp, Bardos & Zhou, 2014). Developers thereby face critical expansion and contraction decisions which should be formulated on the basis of future economic prospects. Clapp, Bardos and Zhou (2014) find that a reduction in revenue per square foot and increasing operating costs tend to raise the possibility of contraction. Small shopping centres are more inclined to alter their volume of shops whilst preserving their footprint relative to large shopping centres.[95] Large shopping centres are better equipped to absorb a simultaneous footprint reduction while expanding their volume of shops in line with varying demand conditions. Potential revenue is seen as the main driving force for smaller shopping centres to adjust their gross leasable area (GLA), whereas altering their volume of shops is a function of costs. Renovating shopping centre characteristics appears less likely for larger entities in metropolitan statistical areas (MSAs) who face higher degrees of variability in real estate values. On the other hand, small shopping centres tend to be inelastic with respect to revenue and costs, as they are likely to face

[93] The OALS facilitates the comparison of contract leases of different maturities and its underlying real estate assets on a like-for-like basis, thereby modifying lease terms to have the same duration. It is obtained by estimating the present value of the usage of tenant leased space and subtracting from this the present value of rental streams, which estimates the Net Present Value (NPV) of the lease. Annualising this NPV metric produces a lease contract's OALS, which is akin to an options adjusted spread (OAS). It may be interpreted as the lease equivalent to the yield on bonds (Stanton & Wallace, 2009).

[94] Pre-leasing is used during the process of shopping centre development, and entails locking in 'blue chip' tenants, in turn believed to be conducive towards marketing the remaining space available to smaller, less prominent tenants. Blue chip (or anchor) tenants typically have a national or international footprint, with multiple chain stores (Grenadier, 2003).

[95] Small shopping centres, as defined by Clapp, Bardos and Zhou (2014), are less than 600 000 square feet and 40 shops, or are considered large otherwise.

higher firm specific risk relative to their larger counterparts – insinuating that the option to delay redevelopment or renovation is likely to be more valuable for smaller shopping centres (Clapp, Bardos & Zhou, 2014).

2.4 Government Bonds and the Macroenvironment

2.4.1 Macroeconomic Factors Impact on Government Bond Yields

While bond markets impound past and present macroeconomic fundamental information into their prices, this process is non-uniform across different markets (Thenmozhi & Nair, 2014). D'Agostino and Ehrmann (2014) corroborate Thenmozhi and Nair's (2014) proclamation of non-uniformity, finding significant asymmetry in the G7 country fundamental variables and substantial time-gyrations in their risk determinants.[96] This non-uniformity in relation to the pricing of government bond risk is directly related to one of the fundamental tri-fold research questions of this paper, specifically regarding the EMEs government bond yields, and shall be alluded to accordingly in the empirical findings section. Relative to a 'safe-haven' government bond country like the U.S., the spread of the G7 country's intrinsic macroeconomic variables are likely to induce larger impacts on that country's determinants compared to its underlying fundamentals, which will be will be more symmetrical the more substitutable two countries bonds are, relative to a reference benchmark nation (D'Agostino & Ehrmann, 2014). Against the backdrop that France and the Netherlands form part of this paper, a contextualisation of their yield differentials forming part of sovereign bonds in the Eurozone region sheds valuable insight. Dewachter, Iania, Lyrio, and de Sola Perea (2015) dissected EU bond yield spreads into fundamental and non-fundamental economic components to determine the factors causing their yield differentials.[97] They found that shocks to fundamental economic variables influence government bond spreads, which gain prominence with the lapsing of time.[98] Conversely, shocks in non-fundamental risk sources cause fluctuations in bond yield spreads over short horizon forecasts, but diminish over time (Dewachter et al, 2015). For forecast horizons that exceed one year, shocks in non-fundamental risk sources caused the most prominent fluctuations in France's government bond spreads, which also exhibited the highest percentage of variation out of the EU countries analysed. Holistically, EU bond spreads are found to be fuelled by market liquidity, business cycles and risk tolerance - variables which are all linked to short-term interest rates (Dewachter et al, 2015; Thomas & Abderrezak, 1998). The impact of short-term interest rates will also be investigated as one of the set of potential factors driving government bond yield discrepancies spanning the 11 markets of this paper.

Since domestic short-term interest rates fluctuate roughly in line with their Treasury yield counterparts, they are prone to being elevated through supply shocks (Khan, Quazi & Ahmed, 2014). Khan, Quazi and Ahmed (2014) corroborate Bierwag and Grove's (1971) finding that U.S. Treasury yields are relatively inelastic in relation to variations in supply shocks emanating from foreign sources. Bierwag and Grove (1971) base this finding on empirical observations that the aggregate stock of Treasury securities occurs through mechanisms based on expectations. Regardless, price adjustments in the fixed-income market in response to supply variations occurs at such a rapid pace through these expectation mechanisms that they cannot even be observed using monthly frequency data. Against the backdrop of the monthly frequency data employed in this paper, supply shocks on government bond yields will therefore not be examined. Khan, Quazi and Ahmed (2014) hypothetically estimate that if China were to sell half of their U.S. Treasury securities, six-month and one-year yields are predicted to rise marginally by ten and seven basis points, respectively.[99] In contrast to Khan, Quazi and Ahmed (2014) and Bierwag and Grove's (1971) findings, Roley (1981) observed that variations in the relative and absolute supply of Treasury securities induces a contemporaneous impact on short-term yield curves, but varies with the passage of time. Roley (1981) and Cebula, Angjellari-Dajci and Foley (2014) found U.S. Treasury long-term bond yields are instead

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[96] G7 is the acronym for the "group of seven" of the world's most prominent advanced countries. These are Britain, Canada, France, Germany, Italy, Japan and the U.S. (D'Agostino & Ehrmann, 2014).

[97] The fundamental component comprised of debt obligation capacities; levels of indebtedness; fiscal positions; global risk aversion levels; and financial contagion. Their non-fundamental counterparts included uncertainty, liquidity implications, and variables proxying a country's potential to exit the EU and attempt to re-dominate the region (Dewachter et al, 2015).

[98] Financial contagion is a notoriously relevant phenomenon for a currency and monetary union like the EU, who experienced a profound convergence of government bond yields following the creation of the EU in 1999. The residual countries who experienced yield differentials were perceived to be a product of their credit and liquidity risk differentials. Diverging bond yield spreads were also exacerbated by the 2011 sovereign debt crisis of the region (Dewachter et al, 2015).

[99] This is against the backdrop that China holds in excess of US$1 trillion of U.S. Treasury securities (Khan, Quazi & Ahmed, 2014).

impacted by the yields of alternative securities, inflationary pressures, both stocks and flows of wealth, as well as stocks with lagged asset terms consistent with short-term adjustments in portfolios. Amongst other researchers' findings in this literature review, Roley (1981) and Cebula, Angjellari-Dajci and Foley's (2014) findings in relation to government bond yields being impacted by the yields of alternative securities as well as inflationary impacts will be compared and contrasted in the main empirical findings section. Thenmozhi and Nair (2014), using an Autoregressive Moving Average (ARMA) regression technique found that bond returns are inversely impacted by long-term interest rates in Germany, India, Japan, the U.S. and the U.K. However, Indian bond returns are impacted negatively by short-term rates.

Gurkaynak, Sack and Wright (2007) claim that the elementary building block of finance – the discount rate, helps ascertain the future value of all nominal streams of cash flows. Domestic interest rates form a vital fundamental base variable in discount rates, and are typically inferred from the yield curve on Treasury securities (Gurkaynak, Sack & Wright, 2007). On the other hand, Thenmozhi and Nair (2014) also examined the monetary stocks of Brazil, Germany and India and found that they positively influence their respective bond returns, whilst Brazilian and Indian bond returns are negatively associated with their foreign exchange holdings. The latter association is positively related to German bond returns. Whereas Brazilian bond returns are positively impacted by exchange rates, they conversely exert a negative influence over Indian bond returns. Thenmozhi and Nair (2014) also found that the London Interbank Offer Rate (LIBOR) is inversely associated with American, Brazilian, British, German and Indian bond returns. Thenmozhi and Nair (2014), amongst other researchers', also motivated the use of analysing the impact of fluctuations in exchange rates on government bond yields, a feat which according to a-priori expectations is surmised to induce a larger impact over the EMEs government bond yields relative to their advanced economy counterparts. This in large part due to the empirical fact that the exchange rates of most of the advanced economies that form part of this paper do not exhibit the large time-series swings in both sign and magnitude relative to their EME counterparts exchange rates. Since Japan also forms part of this paper, Akram and Das (2014) shed valuable light by finding that despite severe Japanese fiscal deficits resulting in inflated debt-to-GDP ratios over the past two decades, Japan's long-term nominal government bond yields have remained persistently low and stable. Such findings go against the grains of conventional theories, which postulate that persistently large government deficits cause an upward gravitation in nominal government bond yields. However, given Japan's monetary sovereignty status, its government and central bank have robust debt-servicing capacities, and thus its economy can maintain low short-term policy rates, which is thought to be preserving its low long-term nominal government bond yields (Akram & Das, 2014). The preliminary empirical analysis of this paper also reinforces Akram and Das' (2014) observations, in which it is found that Japan's nominal government bond yields are persistently the smallest out of all 11 markets studied.

2.4.2 Term Structure Modelling and Forecasting of Government Bond Yields

From a macroeconomic standpoint, short-term interest rates are adjusted periodically by central banks in an effort to attain internal and external macroeconomic objectives (Davey & Firer, 1992; Diebold, Piazzesi & Rudebusch, 2005; Hassan, 2013). On the other hand, Gurkaynak, Sack and Wright (2007) agree that the finance literature perceives short-term interest rates as the primary ingredient to the yields of Treasury securities of varying maturities, which may be denoted as risk-adjusted aggregates of anticipated future short-term rates. A new branch of research, amalgamating macro-finance models therefore aims to provide an enriched perspective on the term structure of interest rates (Diebold, Piazzesi & Rudebusch, 2005). Factor models are used for quantifying bond yields because they essentially summarise relevant bond price data across numerous traded instruments in a parsimonious manner. Unrestricted VAR models generate simple linear yields (Diebold, Piazzesi & Rudebusch, 2005). A more popular method is the 'Nelson-Siegel' framework, essentially representing a dynamic three-factor model and includes slope, curvature and level. However, Diebold and Li (2006) agree with Diebold, Piazzesi and Rudebusch (2005) that the 'Nelson-Siegel' framework tends to be limited by measurement errors and unrealistic constraints, further elaborating that whilst it generates valuable yield curve statistics, it does not convey information regarding the intrinsic economic elements that exert force over its gyrations. As such, researchers have begun integrating macro-variables into yield curve models of this nature (Diebold, Piazzesi & Rudebusch, 2005).

Diebold and Li (2006) modified the Nelson-Siegel method to quantify yield curves as a dynamically evolving, period by period, three-dimensional parameter, and found enhanced accuracy for long-horizon term structure out-of-sample forecasts, relative to conventional benchmark forecasting methods. However, the shorter interval forecasts are not superior to random walks. By imposing model structure ex-ante based on theoretical posits and parsimony, this circumvented any data mining and thus generated refined forecasting ability for out-of-sample testing. Ullah, Tsukuda and Matsuda (2013) used the dynamic Nelson-Siegel framework, blending slope, level and curvature elements of yields as well as exchange rate, aggregate economic activity, inflation rates and equity market indices as part of a series of macro-variables in order to forecast the Japanese sovereign bond market's term structure of interest rates. Their in-sample estimation suggests that the yields-only and yields-macro models provide a good explanation of the Japanese government bond market's historical trends, its evolution and its ability of extrapolating the term structure of interest rates. The yields-macro model, on the basis of the dynamically modified Nelson-Siegel model, overcame Diebold and Li (2006) and Diebold, Piazzesi and Rudebusch's (2005) findings related to the standard Nelson-Siegel model being limited by forecast errors, given that the modified variant generated reduced forecast errors and less residual serial-correlation. The dynamic Nelson-Siegel model also attained superior performance forecasting of term structures, relative to Autoregressive Integrated of order one (AR1) models, and to that of random walks (Ullah, Tsukuda & Matsuda, 2013). The short-term forecasts in the out-of-sample yields-macro model performed better than the yields-only model. Furthermore, the serial-correlation generated by the forecast errors of the yields-macro model is exponentially reduced relative to those of the yields-only model (Ullah, Tsukuda & Matsuda, 2013).

2.4.3 Government Bond Yield Determinants

By adjusting for restrictions on capital flows and the risk of default, the residual element which may account for variations in cross-country bond yields is that of exchange rate risk (Connock & Hillier, 1987). Thus, the international government bond yield differential literature is commonly viewed in light of exchange rate determination. Based on monetary and opposing portfolio-rebalancing approaches, Connock and Hillier (1987) examined inflation differentials to infer whether they induced cross-country discrepancies in long-term government bonds yields across OECD countries.[100] Connock and Hillier (1987) found a progressively steady relation cultivated between the variables proxying anticipated inflation and the yield metrics, which might be attributed to PPP conditions. Additionally, testing if large government budget deficits in relation to Gross National Product (GNP) drives long-bond yields were examined but their results are ambiguous. They are relatively more prominent for the U.S. In the U.S., policies over Connock and Hillier's (1987) study period were largely centred around periods that entailed deficit financing strategies, insinuating that markets commonly impose penalties for imprudent macroeconomic strategies of this nature through higher interest rates, reducing the demand for and ultimately raising government bond yields. Countries with GNPs which comprise a large share of foreign-based trade are more susceptible to the risks of fluctuating exchange rates that will ultimately drive up their bond yields. This might be in addition to bond-financed fiscal expansions (Connock & Hillier, 1987). Connock and Hillier's (1987) 'Monetary Approach' is therefore used to guide the construction of a set of metrics with which to investigate two out of the three core research questions of this paper. Specifically, variables will be created to proxy exchange rate (or currency) risk, in turn represented by expected exchange rate depreciations and appreciations. The latter is achieved by subtracting from a domestic country's ten-year nominal government bond yield its respective foreign counterpart, in which the U.S. is utilised as a reference nation. This variable then illustrates the rate by which a domestic nominal government bond yield is anticipated to depreciate over the subsequent ten years on a relative basis. It therefore is surmised to compensate investors in the bond market for expected exchange rate weakness, in the sense that what might be gained through larger yields is offset by exchange rate weakness. Additionally, these metrics might be considered to represent current and anticipated inflation

[100] The Monetary Approach assumes perfect substitutability between foreign and domestic bonds, subject to equivalent anticipated returns. Anticipated returns factor in gyrations in exchange rate movements, and therefore adjust with PPP. The latter insinuates that country A's exchange rate will depreciate in tandem with country A's inflation rate that exceeds that of country B's. Since investors required yields on bonds of different countries must be the same in real terms, anticipated exchange rate movements will be factored into bond yields. The intuition behind the monetary approach postulates that the bond yield discrepancy across countries will equate to the expected inflation rate deviation over a stipulated time period. The portfolio-rebalancing approach, based on the CAPM, advocates that investors wish to minimise their portfolio risk through effective diversification strategies. Higher yielding securities generated through CAPM are indicative of greater risk, and thus do not contribute to portfolio risk reduction (Connock & Hillier, 1987).

differentials spanning the 11 markets of this paper. The final variable constructed in relation to the Monetary Approach is termed the real government bond yield, which is computed in a rather crude manner by subtracting the rate of inflation from domestic countries' ten-year nominal government bond yields. These variables are intended to help answer the core questions regarding why EMEs government bond yields almost persistently out yield their respective countries trailing dividend yields on REITs, and additionally if they induce large influences in the REIT-Bond Yield Gaps. As mentioned, given that the government bond yields of the EMEs of this paper exceed their respective REIT markets' trailing dividend yields, this causes EMEs reverse REIT-Bond Yield Gaps to be larger (or more negative) than their advanced market counterparts, illustrating EME REIT market overvaluation. However, at this juncture of the literature review, it is becoming more apparent that EME REIT markets might in fact not necessarily be 'overvalued' as such, and instead the observed anomaly seems to be emanating from EME fundamental sovereign risk factors, in turn propelling their respective government bond yields and possibly causing them to be greater than their advanced market counterparts.

Poghosyan (2014) adopted a panel cointegration technique and found that 22 advanced economy's short-run sovereign bond yield determinants are short-term interest and inflation rates, whereas the long-run factors incorporate growth potential and debt-to-GDP ratios. In the short-run, government bond yields diverge from their levels determined by long-run fundamental factors. Contrastingly, in the long-run, the yields rise by approximately two basis points for every one percentage point rise in an economy's growth rate potential. Variations in real bond yields in the short-run diverge from their long-term equilibrium largely as a positive function of variations in the debt-to-GDP ratio and an inverse relation with inflation. Consequences of growth rate and primary balance ratio variations cause opposing impacts, although approximately 50 % of the divergence corrects itself within the space of one year (Poghosyan, 2014). Poghosyan's (2014) findings will be accordingly compared with the empirical findings of this paper.

2.4.4 Debt Sustainability Impact on Government Bond Yields

Naraidoo and Raputsoane (2015) examine the extent of S.A.'s debt sustainability against the backdrop of its tumultuous history of indebtedness, and the resultant susceptibility to financial crises. Consolidation of the South African fiscus is preserved when an approximate 56 % debt-to-GDP threshold level is attained. Adjustments by fiscal authorities are also seen to consider prior debt levels so as to permit corrective actions that are smooth and work in conjunction with the economy's current thrust. During epochs of financial crises, in addition to bolstering debt ceilings on an upward trajectory, fiscal consolidations are more efficient at larger debt-to-GDP ratios. Fiscal sustainability must be pursued when a threshold debt-to-GDP ratio is breached, which is then believed to prompt the need for greater fiscal consolidation. While S.A. has attained a status of relatively prudent fiscal stability, there are presently (in 2016) threats to its fiscal sustainability according to the credit rating agencies like S&P, Fitch and Moody's. These ratings agencies claim that these threats are emanating from macro-variable imbalances, like ailing domestic economic growth and labour-market tensions (Naraidoo & Raputsoane, 2015). Hatchondo, Martinez and Roch (2012) illustrate that governments would benefit substantially by implementing and maintaining a sequence of debt thresholds. These would sufficiently diminish their degree of indebtedness to reduce their sovereign default premium assigned by international bond holders to levels that are relatively trivial. This might confer positive contemporaneous benefits to both governments and their funding sources – lender or bond holders through the majority eradication of state default risk. Implementing fiscal rules are beneficial for governments who adopt both long and short-term outlooks on the nature and position of their indebtedness. Through reductions in debt levels, governments are granted enhanced flexibility with executing their fiscal policies, ultimately allowing for optimal countercyclical fiscal policy actions (Hatchondo, Martinez & Roch, 2012).

2.4.5 Fiscal Rules, Sovereign Debt and Yields

According to the mainstream view, if a government hypothetically reduces its tax revenue but maintains its current level of expenditure, thereby creating a budget deficit, the short-run impact will exert pressure on aggregate demand, with reductions in an economy's capital stock occurring in the long-run (Elmendorf & Mankiw, 1998). Even though large accumulated debt might impact monetary policy causing interest rate hikes, central banks can intervene in the short-run by reducing them. However, in the long-run, the real interest rate will be approximately the same, yet with both higher inflation and nominal interest rates (Elmendorf & Mankiw, 1998). Afonso and Guimaraes (2014) advocate that numerically-based fiscal rules assist in reducing accumulated budget deficits, specifically by implementing expenditure rules, which filter through to primary expenditure. Government bond yields can also be lowered through the use of fiscal rules. More precisely, investors assign premiums (discounts) to ten-year bond yields for those countries that implement and preserve their fiscal rules. This is because they emit signals of commitment and foster greater fiscal certainty. However, these assertions vary throughout the 27 EU nations examined by Afonso and Guimaraes (2014). Elmendorf and Mankiw (1998) find other potential factors that influence sovereign debt include a state's loss of tax revenue, and manipulating political mechanisms that regulate fiscal policies, mutually culminating in an international loss of confidence in an economy. These factors might result in gyrations of capital flows and thereby depreciate the value of a domestic currency (Elmendorf & Mankiw, 1998). By examining the influence on bond yield spreads induced by fiscal variables, Nickel, Rother and Ruelke (2011) found that fiscal variables differed markedly across various countries when employing the Seemingly Unrelated Regressions (SUR) specifications methodology.[101] Thus, government bond investors are assumed to assign differing weights of importance to different countries fiscal and macroeconomic variables. This is demonstrative of the lack of factors typically used in studies of the determinant variables that exert influence of sovereign risks, and is especially more prominent in EME contexts, for example, political risks (Nickel, Rother & Ruelke, 2011). Hence, prudent (imprudent) fiscal policies have premiums (discounts) attached to their respective sovereign bond yields, yet remains country dependant. Sometimes, fiscal imbalances are accepted by markets for certain countries, such as Czech Republic, Poland and Turkey, however, they do not appear tolerable for the likes of Hungary and Russia (Nickel, Rother & Ruelke, 2011). The latter proclamation might be explained by Asness' (2000) investor generation hypothesis, as well as variations in objective sovereign risk metrics attached to the relevant countries.

2.4.6 Fiscal Budget Deficits and Government Bond Yields

Salient changes have taken place over the past few decades in the factors driving government bond yields (Thomas & Wu, 2006). Mounting government expenditure and/or reductions in tax revenue induce larger budget deficits (Afonso & Guimaraes, 2014; Cebula, Angjellari-Dajci & Foley, 2014; Elmendorf & Mankiw, 1998; Gruber & Kamin, 2012; Thomas & Wu, 2006). This would have the effect of raising aggregate economic expenditure vis-à-vis elevated disposable income. In turn, this would stimulate economic activity in the short-run through increases in aggregate demand, bolstering inflation, causing central banks to raise their short-term policy rates. Subsequently, the long-term rate is likely to rise disproportionately more than the short-term rate when budget deficits are anticipated to increase. Finally, this would filter through to exerting upward pressure on long-term government bond yields (Afonso & Guimaraes, 2014; Cebula, Angjellari-Dajci & Foley, 2014; Elmendorf & Mankiw, 1998; Gruber & Kamin, 2012; Thomas & Wu, 2006). According to Thomas and Abderrezak (1998) and as corroborated by Carlos, Neal and Wandschneider (2005) as well as Hamilton (1947), accumulations of national debt and their resultant budget deficits are largely the result of previous wars, notably World War two. These budgetary deficits became persistent in nature and are believed to have altered their relation with interest rates (Thomas & Abderrezak, 1998). Thomas and Abderrezak (1998), and later agreed by Jaramillo and Weber (2013) state that government bond yields elasticity began rising approximately with the post-World War two era, and in line with epochs of persistent global inflation. Thomas and Wu (2006) also claim that the global implementation of inflation targeting regimes around the 1990s has altered government bond yield determinants. Jaramillo and Weber (2013) find that during epochs of relative tranquillity prevailing in global markets, EMEs domestic bond yields are not severely impacted by fiscal variables, but are instead affected by forecasts of real GDP growth and inflation. Contrastingly, during global turmoil, bond investors assign larger weights to fundamental fiscal variables, however, these tend to be country-level-specific and reflect greater alertness to the potential risks of sovereign default (Jaramillo & Weber, 2013). Additionally, the degree to which fiscal variables in EMEs impact the yields on their domestically issued bonds is highly elastic with respect to the prevailing and anticipated level of international risk aversion. Prudent fiscal policies should be accentuated in EMEs given their

[101] Nickel, Rother & Ruelke (2011) used U.S. Treasury bonds as a reference relative to the Czech Republic, Hungary, Poland, Russia and Turkey's government bonds.

susceptibility to rapid swings, which adversely impact their government bond yields and amount of debt outstanding (Hatchondo, Martinez & Roch, 2012; Jaramillo & Weber, 2013; Naraidoo & Raputsoane, 2015).

A large strand of literatures' empirical observations suggests that both larger and anticipated future budget deficits propel long-term government bond yields (Afonso & Guimaraes, 2014; Cebula, Angjellari-Dajci & Foley, 2014; Elmendorf & Mankiw, 1998; Gruber & Kamin, 2012; Thomas & Wu, 2006). Thomas and Abderrezak (1998) and as corroborated by Dewachter et al (2015) found that cyclical factors and anticipated budget deficits exert substantial influence on long-term government bond yield differentials. A robust and strong positive association is found by Thomas and Wu (2006) between five year forecasts of U.S. federal budget deficits and the spreads between short and long-term government bonds. Cebula, Angjellari-Dajci and Foley (2014) also claim that relative to GDP expressed in levels form, the federal budget deficit exerts a positive impact on the ex-post real interest rate yield assigned to ten-year Treasury notes. Elements that tend to escalate federal budget deficits result in elevated borrowing costs to both U.S. taxpayers and their respective Treasury (Cebula, Angjellari-Dajci & Foley, 2014). Thomas and Wu's (2006) findings of rising yield curve slopes in anticipation of higher future deficits contradicts the prevailing U.S. case in line with their study, in which irrespective of the outlook on persistently large deficits, long-term government bond yields were persistently low. Thomas and Wu's (2006) findings are thus similar to Akram and Das' (2014) observations on the Japanese sovereign bond market. Three hypotheses have been proposed to explain the anomaly in the U.S. (Thomas & Wu, 2006). One, numerous Asian countries that ran persistent trade surpluses that were contra to the U.S. heavily invested their excess proceeds in long-term U.S. treasury instruments. Two, global inflation rate normalisation cycles occurred since 1990 when various countries central banks implemented inflation targeting regimes. Three, the U.S. economy gained substantial stability over the prior two decades in terms of volatility in real GDP rates of growth, employment and inflation. Such events might have reduced the size of risk premia typically attached to long-term government bonds (Thomas & Wu, 2006). Gruber and Kamin (2012) also found that long-term government bond yields are impacted by fiscal conditions, in which expected deteriorations in fiscal conditions induced an approximate 60 basis point hike in the yields of U.S. bonds. However, these implications are marginally smaller for the bond yields of G7 members, excluding Japan. Another study by Thomas and Wu (2009) similarly found that Treasury bond yields are impacted by both perceived risks as well as anticipated future budget deficits. According to Thomas and Wu's (2009) estimations and similar to Gruber and Kamin's (2012) assertions, ceteris paribus, a one percentage point rise in the deficit to GDP ratio raises bond yields by between 30 to 60 basis points, for deficits forecasted to occur five years into the future. The future stability of an economy and its impact on yields is also shown to be positively associated with perceived risks in bond markets (Thomas & Wu, 2009). Gruber and Kamin (2012) additionally claim that the GFC exacerbated these impacts, making them more sensitive relative to the pre-crisis period. Thus, deteriorating fiscal positions on a global scale impose large effects on bond yields, channelled through perceptions of sovereign default risk. These G7 member states would therefore experience marginally smaller bond yields increments in scenarios where their respective fiscal positions deteriorate due to their relatively high sovereign creditworthy statuses. In contrast to Connock and Hillier's (1987) findings, no evidence is found linking anticipated inflation to the yields on government bonds, nor was there evidence of financial contagion during the GFC. Hence, government bond yields appear to adjust according to their own country's forces in isolation (Gruber & Kamin, 2012).

Using the parsimonious loanable funds model, Cebula, Angjellari-Dajci and Foley's (2014) autoregressive two stage least squares (2SLS) results indicate that the ten-year U.S. Treasury note's ex-post real interest rate yield is a cumulative function of the ex-post real interest rate yields on other instruments, including corporate bonds three-year Treasury notes and high quality municipal bonds (Cebula, Angjellari-Dajci & Foley, 2014; Roley, 1981). The role of fiscal policy and its impact on U.S. Treasury bonds are examined through the use of an adjustable semiparametric fluctuating coefficient model specification. While straightforward linear relations are found by Ilmanen (2003), and Jansen, Li, Wang and Yang (2008), Guidolin and Timmermann (2006) and Reinhart & Rogoff (2010) both enhanced prior literature by illustrating that linear modelling causes misleading results due to the oblivious assumption of linearity amongst fiscal policy impacts on Treasury bond yields. Thus, employing fiscal deficits as the exclusive variable to capture the impacts of the non-linear properties of Treasury bond yields is sufficiently enhancing (Guidolin & Timmermann, 2006; Reinhart & Rogoff, 2010). The effects of monetary policy actions on asset markets also vary according to prevailing fiscal surplus or deficit positions. Hence, there are substantial interrelations between fiscal and monetary policies (Gadanecz, Miyajima & Shu, 2014; Jansen, Li, Wang & Yang, 2008). Spanning both EM and advanced economies, large debt-to-GDP levels are correlated with lacklustre economic growth (Reinhart & Rogoff, 2010).[102] Sixty % debt-to-GDP levels usually go hand in hand with dismal growth for EMs. It is a very rare phenomenon for any country to experience sufficient growth to extinguish its debt, given that growth is a non-linear function of debt (Guidolin & Timmermann, 2006; Jansen, Li, Wang and Yang, 2008; Reinhart & Rogoff, 2010). When debt thresholds are breached, rapidly dramatic interest rate hikes induce detrimental equilibrium-correcting adjustments (Reinhart & Rogoff, 2010; Naraidoo & Raputsoane, 2015). Many countries attempt to fund their debt growth through short-term borrowing, making them particularly susceptible to threats of severe financial crises and is likely to exert upward pressure on long-term bond yields (Reinhart & Rogoff, 2010; Naraidoo & Raputsoane, 2015). Nakazato (2011) found substantial discrepancies between the interest rates of bonds, which were sometimes caused by credit rating agencies who assigned different creditworthy statuses to different bond series.[103] There is also a positive correlation between current account balance and local outstanding amount ratios with respect to public subscription-type bond yields (Nakazato, 2011). This insinuates that a deterioration of the financial environment induces larger deviations between local and national sovereign bond yields. Hence, this refutes claims that assert there are no differences between the credibility of various local government bonds, given that they are all guaranteed by the state (Nakazato, 2011).

2.4.7 Exchange Rate Risk and Government Bond Yields

Broos and de Haan (2012) find that while the growing trend of financial integration across the globe and specifically amongst EU members might be beneficial in terms of multi-lateral trade agreements, foreign ownership of sovereign debt raises government bond yield elasticities with respect to the degree of state indebtedness. At relatively low levels of government debt, foreign ownership of state debt can be beneficial for the issuing country since in effect, it assists in expanding the potential investor base. Contrastingly, at higher levels, the elasticity of the yields on government bonds with respect to external debt ratios will be raised (Broos & de Haan, 2012). In the context of EME domestic-currency denominated government bonds, exchange rate volatility can exert upward pressure on yields because investors require compensation for volatility (Broos and de Haan, 2012; Gadanecz, Miyajima & Shu, 2014).[104] Fiscal positions and interest rates are also drivers of EME government bond yields (Gadanecz, Miyajima & Shu, 2014; Jaramillo & Weber, 2013). Additionally, after the GFC, EME government bond yields have become heavily influenced by international monetary environments (Gadanecz, Miyajima & Shu, 2014; Jansen, Li, Wang & Yang, 2008). Monetary stimulus by advanced economies following the GFC enticed investors to hunt for larger yields. This has caused a greater degree of integration in terms of performance movements and similarities between EME and U.S. long-term government bond yields (Broos & de Haan, 2012; Gadanecz, Miyajima & Shu, 2014). Other forms of exchange rate volatility which impact EME sovereign bond yields relate to expectations of reductions in artificial monetary stimulus, such as the Fed's asset procurement program (Gadanecz, Miyajima & Shu, 2014). Finally, hedging exchange rates exposure raises associated volatility, prompting investors to demand larger premiums on those countries government bond yields (Gadanecz, Miyajima & Shu, 2014). Hence, the assertions made by Broos and de Haan (2012), Gadanecz, Miyajima and Shu (2014), as well as Jaramillo and Weber (2013) in relation to the factors influencing EMEs government bond yields that form part of this paper will be investigated empirically within the main findings section.

[102] Large debt-to-GDP levels are classified by Reinhart and Rogoff (2010) as 90% and higher.

[103] The creditworthy status of government bonds, as mentioned prior in this literature review, can be gleaned by examining the CDS assigned to a given country's government bond in isolation, which in turn proxies sovereign risk, as well the CDS spreads between comparable countries.

[104] Larger fiscal deficits and/or lacklustre economic growth tend to depreciate the value of EME currencies, thereby raising uncertainty regarding the stability of their currencies on a relative basis (Broos & de Haan, 2012; Gadanecz, Miyajima & Shu, 2014).

2.5 Implications for Tactical Asset Allocation

Brooks and Persand (2000) modified the GEYR by blending it with the Markov regime switching model.[105] By forecasting with this model, an equity-bond profit-trading decision rule is formulated which yielded greater aggregate returns, coupled with reduced variability relative to a non-switching and static portfolio composed of arbitrary combinations of equities and bonds. While marginally better for the U.S. and Germany relative to the U.K., it was superior to naïve buy and hold strategies. Although this model can forecast signals that suggest when to divert financial capital away from equities into bonds (or vice-versa), on a net-basis, the profits generated through such trades were insufficient to offset its related transaction costs, which becomes relatively expensive when a switching-portfolio strategy is adopted. However, under certain scenarios, perhaps relevant to market-makers who are faced with lower transaction costs, excess returns may be attained on a net-basis (Brooks & Persand, 2000).

Given the degree of integration between private and exchange-traded real estate markets with government bonds, any deviations from a long-run equilibrium level would emit arbitrage trading opportunities (Krystalogianni & Tsolacos, 2004). In contrast to Brooks and Persand's (2000) findings, Krystalogianni and Tsolacos' (2004) Markov regime switching trading rules generated enhanced risk-return attributes relative to naïve buy-and-hold strategies, even when considering transaction costs. However, it under-performed the naïve buy-hold strategies in relation to the gilt-direct real estate market portfolio but remained a profitable strategy in relation to the portfolio based on exchange-traded to non-exchange traded real estate. These results insinuate both an upper and a lower bound mean-reversion process such that the three pairs of asset classes are cointegrated, and therefore exhibit a 'shared' long-run trend (Krystalogianni & Tsolacos, 2004).

Market integration on a global scale bears salient implications for portfolio diversification and risk management techniques (Baele, Bekaert & Inghelbrecht, 2010; Broos & de Haan, 2012; Ilmanen, 2003; Zhou, 2011). Ilmanen (2003) suggests that stock-bond comovements severely effect long-term asset allocation, given that used to one's advantage, they might provide an effective hedge against threats of systemic risks, justifying lower government bond RPs. Importantly, bond prices are thought to act as the price discovery (or leading) variable that drives changes in stock prices, and hence, factoring these dynamics into asset allocation strategies, specifically acknowledging where impulse response functions emanate from and channel through to might assist in attaining superior returns (Ilmanen, 2003). Prior studies on global linkages are usually executed using simple correlation coefficients, as well as volatility spill-overs and integration across markets (Zhou, 2011). Despite evolving REIT research related to global linkages amongst returns, time scale elements, which are a salient feature of financial markets, are typically ignored (Zhou, 2011). This is erroneous given that investors set objectives over different time intervals. Zhou (2011) applies the maximum overlap discrete wavelet transform (MODWT) model for the first time to the REIT literature.[106] Spanning seven of the most prominent global REIT markets, global return associations are observed that fluctuate over different time scales, with increasing returns in strength as the scale rises.[107] This indicates that portfolio diversification benefits exhibit decreasing marginal utility as time horizon lengthens, and hence optimal diversification would stem from smaller time intervals (Zhou, 2011). In terms of risk assessment techniques, investors who are concerned with time intervals should filter the non-constant nature of asset comovements into their analysis, which in turn could significantly improve the probability of obtaining superior performance (Asness, 2000; Andersson, Krylova & Vahamaa, 2008; Baele, Bekaert & Inghelbrecht, 2010; Ilmanen, 2003; Vaclavik & Jablonsky, 2012; Zhou, 2011). Baele, Bekaert and Inghelbrecht (2010) go to the extent of warning that models that assume constant comovements tend to become impaired, in which Vaclavik and Jablonsky (2012) state this could result in erroneous applications of diversification during market turbulence. Conversely to classic portfolio theory tenets, the traditional

[105] The GEYR is the quotient of the earnings component of the yield on long-term government bonds to the dividend yield on stocks (Brooks & Persand, 2000). The Markov regime switching model is used to identify the state of yield discrepancies which emit signals in terms of when to shift capital funds amongst assets. The regime switching trading rules were based on exchange-traded real estate yield ratios, the bond-private real estate market yield ratio and to the yield ratio of exchange-traded to non-exchange traded real estate (Krystalogianni & Tsolacos, 2004).

[106] MODWT captures the time element dynamics of financial markets which are comprised of economic agents with differing investment horizons. MODWT is capable of handling both stationary and non-stationary financial data, and requires no assumed functional relationships (Zhou, 2011).

[107] According to Zhou (2011), these markets are Australia, France, Hong Kong, Japan, Singapore, the U.S. and the U.K.

correlation statistic does not capture the scale-like dependency amongst return associations, and it should thus not be applied universally across portfolios for asset allocation (Zhou, 2011).

The next section discusses the data and research design, in which it becomes apparent that this research paper tracks similar terrain to the research performed by Aubert and Giot (2007), Berge, Consigli, and Ziemba (2008), Brooks and Persand (2000) as well as Krystalogianni and Tsolacos (2004). However, this paper differs in the sense that it offers a unique fusion of employing conventional Fed Model tenets with aggregated REIT sector's trailing dividend yields, in place of aggregated stock market indices trailing dividend yields. Whereas Brooks and Persand (2000) and Krystalogianni and Tsolacos (2004) express the GEYR as quotient of the income yield component on a government bond to the dividend yield on equities, this paper engineers the REIT-Bond Yield Gap by subtracting from the trailing dividend yields associated with 11 countries REIT sectors their respective country's nominal ten-year government bond yields. This is primarily because of the observed anomaly regarding EME government bond yields exceeding their trailing dividend yield counterparts, resulting in the reverse yield gap. The yield gap convention adopted here is inversely related to conventional Fed Model ratios, in the sense that a widening yield gap would be associated with a shrinking Fed Model ratio, thereby implying REIT market overvaluation, relative to government bonds. Similarly to Brooks and Persand (2000) and Krystalogianni and Tsolacos (2004), it then adopts the Markov regime switching model in order to capture the joint return distribution of the constructed dependent variable - the REIT sectors' trailing dividend yields less their respective markets' ten-year generic nominal government bond yields. However, its true uniqueness emerges by incorporating into the Markov regime switching econometric regression models a set of economic state variables, whose inclusion are justified on the grounds of examining the literature extensively. This is in an attempt to explain the potential factors driving variations in the REIT-Bond Yield Gaps, assessing the factors that might be inflating EME government bond yields relative to their advanced market counterparts, and to test whether or not viable tactical asset allocation strategies can be formulated from the observations. Not taking cognisance of the EMEs relatively larger government bond yields might otherwise result in fallacious interpretations of EME REIT market overvaluation (relative to their government bonds), when considering in isolation the REIT-Bond Yield Gaps and/or Fed Model tenets at an arm's length 'simplistic' interpretation.

III. DATA AND RESEARCH DESIGN

This section lays the roadmap for the research design. It begins with a depiction of the data, its relevance to the paper, boundaries and limitations, the data samples time-frames, and justification for their selection. It then moves on to providing an overview of which variables were created from the data and their intended uses. The preliminary data analysis section begins by illuminating the empirical observations and how the anomaly that is the backbone to this paper is not unique to the REIT sector – also applicable to general equity indices. It then graphically and statistically investigates the REIT-Bond Yield Gaps spanning the 11 markets, performing various analyses. This is executed along the lines of their volatility, where it is observed that on aggregate, most series appear to drift from their long-run trend for substantial periods, whilst simultaneously being subjected to erratic swings on route. The global-yield gap correlation coefficients are then presented, in which only two EMEs exhibit substantial correlation with each other, whilst the remaining markets are relatively mixed, yet largely correlated with the U.S. The properties of the financial data are then dissected accordingly into their mean values, following which an array of diagnostic tests are performed, including the Jarque-Bera normality test, Augmented Dickey Fuller unit root test, as well as a set of Ljung-Box Q*-statistics joint test of significance for detecting auto (serial) correlation. This part is succeeded by graphical histogram frequency distribution plots of the raw REIT-Bond Yield Gap data series relative to their theoretical density normal distributions, for both the EMEs and advanced economies. The frequency distribution plots furthermore reinforce the statistical inferences examined in the prior section. The second last section presents the so-called 'fundamentals', whereby dividends are contextualised in the corporate and investment spheres. Subsequently, the conceptual foundation underlying the Fed Model and its conduit with both the Traditional Model and BSEYD, as proposed by Berge, Consigli and Ziemba (2008) is discussed. This discussion is then solidified through a set of mathematical equation derivation which highlights the three models empirical links and mechanics. The final section is the research design component itself. By building up to this section, it becomes clear how the Markov regime switching models, its salient axioms, conceptual framework and mechanics all fit together when engineering and deploying the REIT-Bond Yield Gap convention of this paper. The latter statistics is then adopted in a Markov model framework to estimate and generate this paper's core empirical inferences. The research design section is then closed by illustrating tabulated theoretical expected signs of the REIT-Bond Yield Gaps, as well as a figure depicting the generic EME vs. advanced economies postulated anomaly.

3.1 Data Description

The sample data in this paper comprises of the monthly REIT and stock market indices trailing dividend yields, the yields on ten-year generic government bonds, CDSs, inflation rates and the CBOE VIX.[108] Given that the observed phenomenon regarding the EMEs ten-year government bond yields exceeding the trailing dividend yields on their corresponding countries REIT indices is not unique to the REIT sector, and hence similarly applies to EMEs general stock market indices, after extensive literature review and analysis, these variables were selected to form the primary model inputs. This is against the backdrop that it is surmised that the phenomenon appears to be emanating not from any international cross-border discrepancies in REITs, but rather from the degree of sovereign risk, as impounded in and reflected by the yields of the EMEs long-term (ten-year) government bonds. This is also supported by the empirical observation that the trailing dividend yields on REIT indices appear to be approximately in line with each other, on aggregate, implying that there is no uniqueness and/or observable outliers associated with the trailing dividend yields on REITs spanning across both the EMEs and their advanced market peer economies. It is for this reason that the entire focus and thrust of this paper has now been narrowed down to a relatively portmanteau quantitative model with just three explanatory regressor variables, which seeks to explain what drives the larger reverse REIT-Bond Yield Gaps associated with the EMEs of this study, relative to their advanced market counterparts.[109] While the selection of government bond yields employed in this study

[108] A salient limitation emerges with respect to the ten-year generic nominal government bonds. This relates to the unavailability of total return data, resulting in the inability to compute, compare and contrast actual, relative to hypothetical tactical asset allocation strategies, against a buy-and-hold technique.

[109] Variables like debt-to-GDP ratios, current account balances, exchange rate fluctuations and other prominent state variables were originally also going to be incorporated as explanatory variables. However, these data sets are only available on lower frequencies – mainly on a quarterly frequency basis. Econometric frequency conversion techniques

are of a generic nature, this is because not all countries have ten-year government bonds outstanding. Justifying the inclusion of the three variables selected to assist in explaining the reverse REIT-Bond Yield Gaps of the EMEs, inflation as a core underlying driver behind government bond yields is prominently discussed throughout credible and vast sources of literature (Bailey,1966; Cebula, Angjellari-Dajci & Foley, 2014; Eicholtz & Hartzell, 1996; Hong & Lee, 2013; Ilmanen, 2003; Leone, 2011; Roley, 1981; Sebehela, 2008; Sing & Ling, 2003). Inflation is surmised to have a larger impact on EMEs REIT-Bond Yield Gaps relative to their advanced counterparts, since they have a higher probability of their returns being eroded in a nominal sense, as linked to their higher and more variable rates of inflation, amongst other EME risk-variable sensitivity. This is the theoretical perspective, although in the appendix, section A1, it is observed that on aggregate, the EMEs relative to their advanced market counterparts' standard deviation of inflation is actually greater for the advanced countries, 1.17, compared to 0.89 for the EMEs.

Gunduz and Kaya (2013) surmise that CDSs are useful proxy variables for quantifying an objective barometer of the degree of sovereign risk, as encompassed in government bond yields. They found that CDSs are positively associated with nominal government bond yields. This makes intuitive sense, given that CDSs measure the cost of insuring foreign holders of domestic government bonds against sovereign default, an anticipated rise in the risk of sovereign default induces, ceteris paribus, a rise in this associated insurance cost. Whilst the government bond yields deployed in this paper are of a generic and more precisely ten-year nature, the CDS variables employed in this study are only of a five-year horizon. These CDSs are therefore imperfect proxy variables, given that they would not fully reflect the larger degree of sovereign risk as impounded into the longer-term ten-year government bonds, and additionally are all measured in US$ except for the CDS associated with the U.S. itself – measured in Euros (€), whilst no data was available for Singaporean CDSs, but are nonetheless surmised to be sufficient proxy variables. Their choice of selection was largely as a result of data availability spanning the 11 markets studied in this paper.

Baele, Bekaert and Inghelbrecht (2010) suggest that variations in and specifically a rising CBOE VIX is typically associated with a decoupling between stock-bond comovements. The latter is therefore intended to serve as a proxy variable for and model the so-called 'flight-to-quality' phenomenon, although in a strict financial sense, the CBOE VIX is associated with the volatility on the options traded on the U.S. market's S&P 500 index, it is therefore also an imperfect proxy measure of aggregate global stock market volatility, especially given that Europe has stock-market volatility barometers of its own, but nonetheless, given the degree of financial globalisation and integration, as well as the fundamental conduits and key correlations spanning across global financial markets, it is believed to be a sufficient proxy variable for all of its intents and purposes. The REIT indices trailing dividend yield and associated metrics are the FTSE/EPRA NAREIT series pertaining to each relevant country, whilst their stock market counterpart indices are similarly of frequent use in empirical studies of this nature. Greater detail regarding each data series as well as the additional variables used for supporting empirical calculations, their ticker (or symbol), data source and method of computation (where applicable) is located in the data appendix section – (A6) of this paper. All data sets are calculated by and retrieved from Bloomberg Data Terminals.[110] The EMEs are classified as Brazil, Mexico, Turkey and S.A., whereas their advanced market counterparts are Australia, France, Japan, the Netherlands, Singapore, the U.K., and the U.S. Given that the crucial focus of this paper targets the underlying reasons for, variations in and potential trading profitability of the EMEs reverse REIT-Bond Yield Gaps, some of the most prominent advanced economies' REIT markets were deployed in order to compare and analyse the salient differences underlying the factors driving their REIT-Bond Yield Gaps. [111] The time-frame spans the period June 2013 until November

were tested, but were unsuccessful. This was in the sense that the higher frequency set of these variables, ex-post conversion, induced substantial autocorrelation. Nonetheless, it is surmised that both inflation and CDS data already have impounded some degree of anticipated exchange rate movements.

[110] All Bloomberg data are Grade Point average (GPA). Stock market and REIT indices forward earning yields were computed by taking the inverse (or reciprocal) of their P/E ratios.

[111] Zhou (2011) suggests that Australia, Belgium, Canada, France, Hong Kong, Japan, the Netherlands, Singapore, the U.K. and the U.S. constitute the ten major global REIT markets. They represented approximately 96.12% of the global REIT market capitalisation as at December 2009. In a similar fashion to Zhou (2011), the REIT indices are from the Financial Times Stock Exchange (FTSE)/European Public Real Estate Association (EPRA)/ National Association of Real Estate Investment Trusts (NAREIT) Real Estate Indices series pertaining to each relevant country. These series have a reputable academic and institutional reputation as the forefront global real estate leader, thereby setting a global benchmark for publicly traded real estate indices (Zhou, 2011). Barring the use of Belgium, Canada and Hong Kong, the remaining seven markets place this study in a steadfast path and conformability with that of globally published real estate literature in terms of variable quality and relevance.

2015 for the EMEs, providing a total of 30 observations per country, whilst their advanced market counterparts time-span covers the period November 2009 until November 2015, thereby giving 72 observations. While a long-time span of data is desirable in order to capture as much information as possible, as well as to conduct a comprehensively credible study, the time-frames utilised in this paper were largely selected as a result of, and hence dictated by, data availability, specifically in relation to the REIT indices associated with the 11 separate economies. The main empirical results section abides by these strict time-frames, although a handful of additional supporting empirical calculations adopt the EMEs time-frames in order to facilitate certain inferences over congruent periods.[112]

3.2 Variable Construction

Connock and Hillier's (1987) paper alluded to two main bodies of knowledge which attempt to explain why nominal government bond yield differentials exist. These are the Monetary and Portfolio Rebalancing Approaches. While both have their merits and deserve attention, the concepts underlying their depiction of the Monetary Approach has been adopted in this paper. Specifically, exchange rate risk variables have been constructed on the grounds of the Monetary Approach. A crude measure of computing a country's currency risk is suggested by Connock and Hillier (1987) as subtracting from a domestic nominal government bond yield a specified foreign reference country's equivalent nominal government bond yield. This variable can then objectively proxy both expected exchange rate depreciations (for positive spreads), and likewise expected exchange rate appreciations (in relation to negative spreads). Stated differently, this spread is a rough approximation illustrating currency risks, and the rate by which a country's exchange rate is expected to either appreciate or depreciate –according to the maturity of the government bond outstanding. Therefore, in the context of this research paper, this spread would represent anticipated exchange rate movements for a country over the subsequent ten-year time-frame. The central concept underpinning this same spread may furthermore be utilised to proxy how a given country's inflation rate is expected to fluctuate and evolve with the passage of time. Expectations of depreciating (appreciating) currencies – as gleaned through a domestic country's nominal government bond yield less that of a foreign reference country must necessarily bring with it higher (lower) inflation, respectively. Thus, the above spreads are required in order to compensate investors for expected exchange rate weakness in the bond market. Thus, what is gained in terms of larger yields across border is neutralised by anticipated exchange rate weakness in the relevant market.

Forward earning yields for both the stock market and REIT indices were computed by taking the reciprocal of their respective P/E ratios. Another measure of objective expected inflation was computed by subtracting from the ten-year generic nominal government bond yields their inflation-linked counterpart government bond yields (Lashgari, 2000). It should be noted that for most countries, these variables time-frames were mostly congruent, however, the Netherlands inflation-linked government bond's time-frame was not ten-years, whereas all of the EMEs inflation-linked bonds were of an eight-year nature. No data was available for Singaporean inflation-linked bonds. Expected inflation, forward earnings and dividend yields were only used in a handful of supporting empirical calculations, and not for the main empirical results section.

3.3. Preliminary Data Analysis

3.3.1. Global REIT-Bond and Stock-Bond Yield Gap Spread Analysis

As discussed above, the observed phenomenon regarding the EMEs ten-year nominal government bond yields exceeding that of their corresponding REIT sectors trailing dividend yields, is not unique to the REIT sector. The same holds true when this is examined in retrospection to the EMEs aggregated stock markets. Additionally, EME REITs trailing dividend yields do not appear to be out of line relative to their advanced market counterparts. This can be observed by investigating the individual country-wide REIT sectors trailing dividend yields, located in the empirical findings section 4.3 – table 4.3.2. However, it is hypothesised and surmised, given the extensive literature review, that the REIT-Bond Yield Gap should be

[112] These time-frames are aptly illuminated either in table titles or by their stated time-frames.

smaller than its corresponding stock-bond yield gap, on aggregate. This is because REITs are known to be high dividend yielding instruments, as examined and articulated concisely in the literature review. These findings are confirmed in tables 3.3.1 and 3.3.2 below. More precisely, whereas the EMEs reverse REIT-Bond Yield Gap is estimated as -4.34, the EMEs reverse stock-bond yield gap is larger, as per a-priori expectations, documented as -6.14. This would suggest that EME REITs are technically less overvalued relative to their government bonds and to their stock market industry on a holistic basis. However, as for the advanced economies, an exception is found in that their REIT-Bond Yield Gaps are actually more positive (larger gaps) relative to their stock market indices as a whole. The latter might therefore suggest the opposite observation relative to the EMEs, in the sense that advanced economies REIT sectors might be more undervalued relative to bonds and their stock market as a whole.

Table 3.3.1.
Composite EME vs. Advanced REIT-Bond Yield Gaps

Time-Frame 2013/06/28-2015/11/30	EMEs	Advanced
Mean	-4.34	1.91
Spread	2.44	

Note.
Spreads are computed in absolute values. EME REIT-Bond Yield Gap spread is computed by taking the difference between the composite EMEs REIT sectors' trailing dividend yields less their composite EME ten-year nominal government bond yields.

Table 3.3.2.
Composite EME vs. Advanced Stock-Bond Yield Gaps

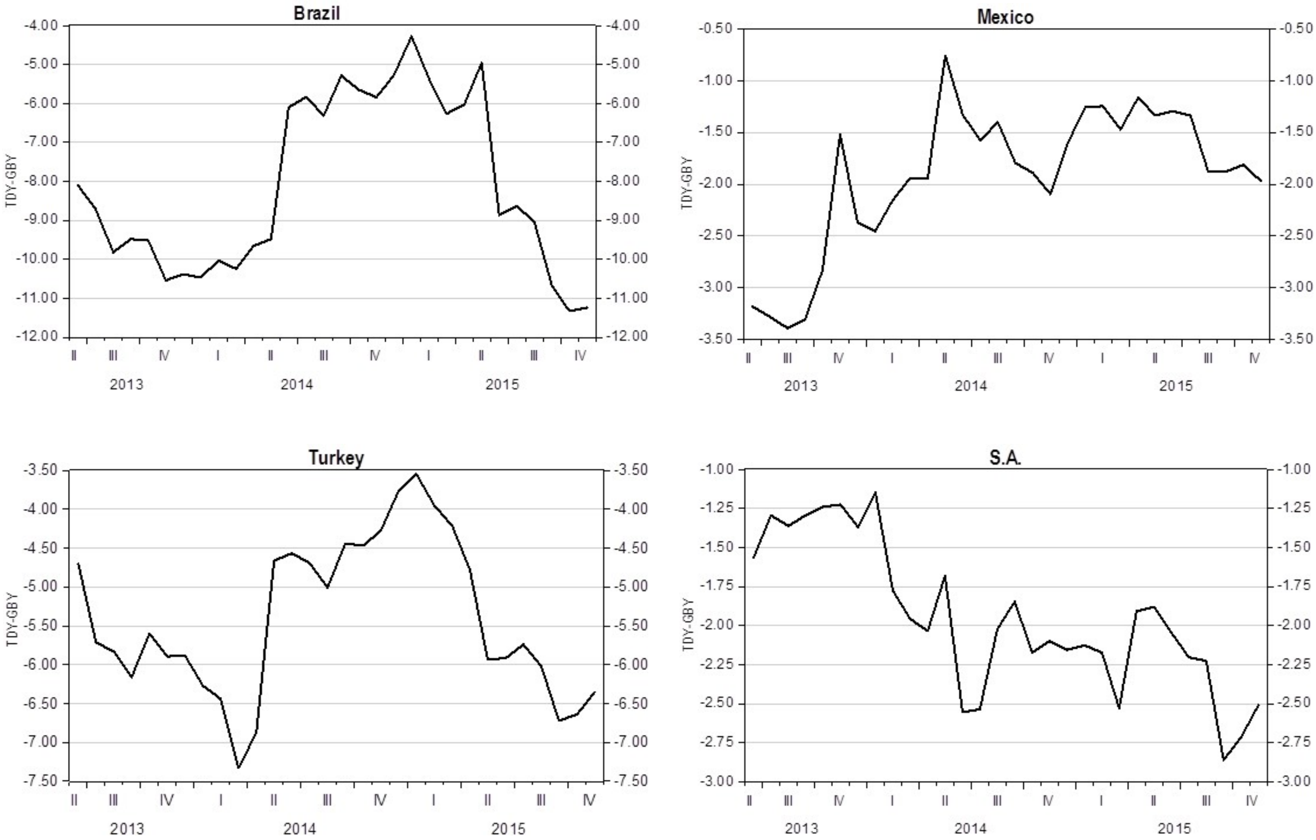
Time-Frame 2013/06/28-2015/11/30	EMEs	Advanced
Mean	-6.14	1.13
Spread	5.01	

Note.
Spreads are computed in absolute values. EME REIT-Bond Yield Gap spread is computed by taking the difference between the composite EMEs REIT sectors' trailing dividend yields less their composite EME ten-year nominal government bond yields.

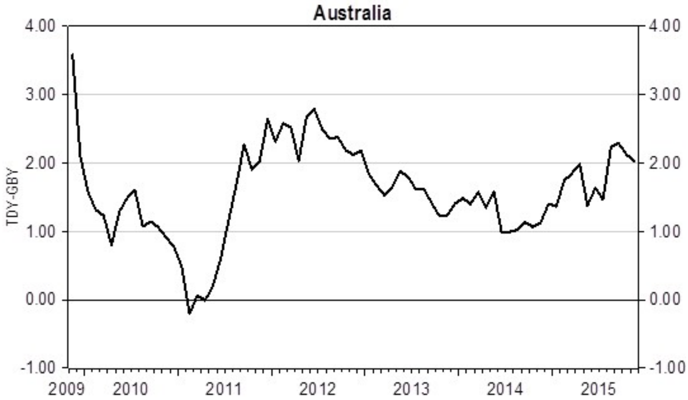
Graphs 3.3.1 and 3.3.2 depict the time-series plots of the raw data series reverse and conventional REIT-Bond Yield Gaps for the EMEs and advanced economies, respectively. Whilst the EMEs reverse REIT-Bond Yield Gaps exhibit greater volatility relative to the advanced economies – most notably Brazil and Turkey, the advanced economies like France, the Netherlands and the U.K.'s REIT-Bond Yield Gaps similarly display high degrees of volatility and erratic swings. These volatilities are inferred through graphical inspection as well as formal standard deviation metrics, as set out in table 3.3.4 below. On aggregate, these countries REIT-Bond Yield Gaps erratic behaviour appears to drift away from a type of long-run equilibrium trend for relatively substantial periods of time. Specifically, Brazil spiked from a minimum of -11.33 during the fourth quarter of 2014, only to reach a maximum high value of -4.27 one year later.

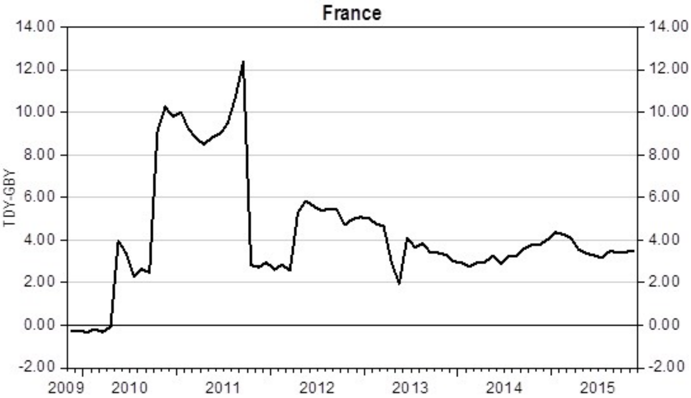
In the same vein Turkey, only in the space 2014, reached minimum and maximum values of -7.33 and -3.55. Contrastingly, France was even more volatile than both Brazil and Turkey – breaching a high of 12.38 in late 2009, whereas approximately one year later it had shrunk into marginal reverse yield gap territory, documented as -0.32. On the other hand, whilst not breaching the reverse yield gap territory, the Netherlands yield gap reached a turning point high of 7.45 in the early period of 2012, only to fall to 1.14 two and a half years later. The most substantial volatility is witnessed in the context of the U.K.'s REIT-Bond Yield Gap, although this appears to be a once-off temporary blip. More precisely, the U.K.'s REIT-Bond Yield Gap, similarly to that observed in France, mildly breached the reverse yield gap territory, -0.61 at the beginning of 2010, peaking at a high of 47.75 at 2012's year end. As for the other countries REIT-Bond Yield Gaps, and in comparison to the substantial volatility exhibited across Brazil, Turkey, France, the Netherlands, and the U.K., relative stability in terms of distinguishable trends is exhibited over their respective time-frames, with far less variation. Only Australia and the U.S. marginally breach the negative REIT-Bond Yield Gap territory, respectively observed as -0.21 and -0.60. S.A. is the only country in the sample exhibiting a persistent downward trend over the sample period, implying that its reverse REIT-Bond Yield Gap is beginning to expand. On the contrary, both Singapore and the U.S.'s REIT-Bond Yield Gaps appear to be inflating in the opposite direction to that of S.A.'s, climbing steadily upwards over the sample period, thereby implying a widening positive REIT-Bond Yield Gap spread.

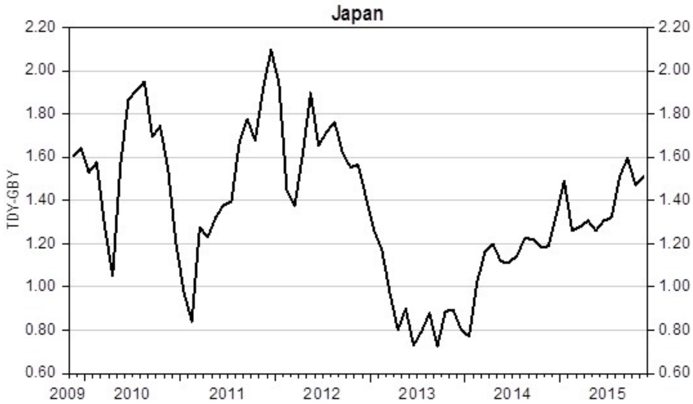
Graph 3.3.1.
EME Reverse REIT-Bond Yield Gaps

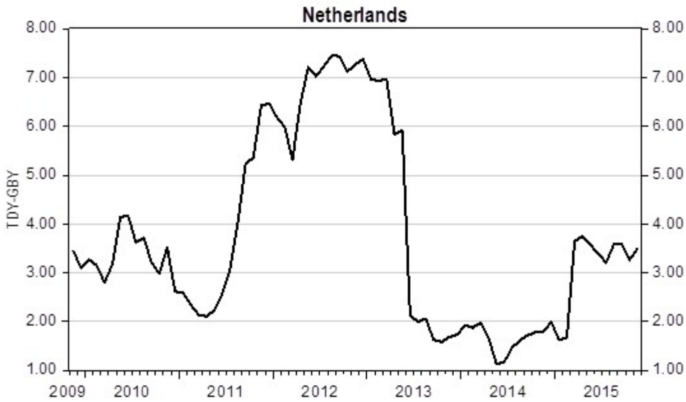


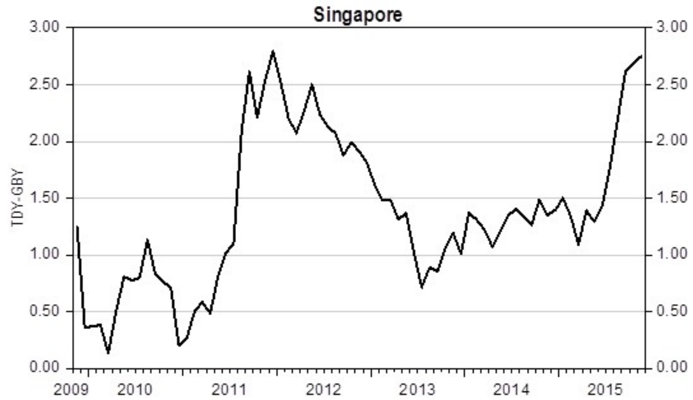
Graph 3.3.2.
Advanced Economies REIT-Bond Yield Gaps

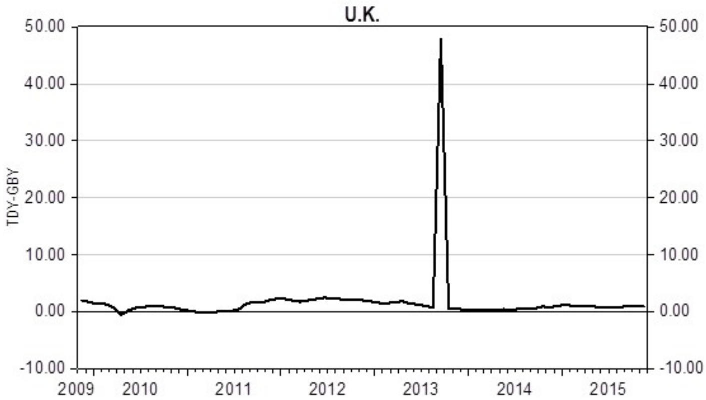












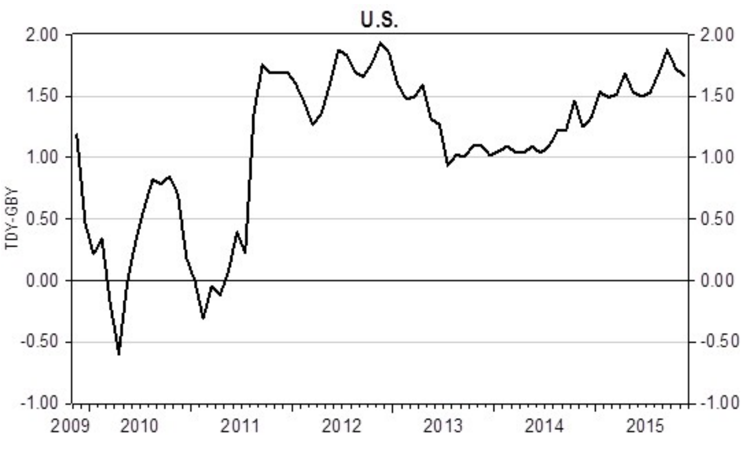


Table 3.3.3.
Global REIT-Bond Yield Gap Correlation Coefficients

Time-Frame: 2013/11/30 - 2015/11/30	Trailing Dividend Yields – Government Bond Yields										
Correlation	Brazil	Mexico	Turkey	S.A.	Australia	France	Japan	Netherlands	Singapore	U.K.	U.S.
Brazil	1										
Mexico	0.4	1									
Turkey	***0.83***	0.33	1								
S.A.	-0.25	-0.55	-0.14	1							
Australia	-0.43	-0.05	-0.34	-0.27	1						
France	0.52	-0.04	0.67	-0.12	0.21	1					
Japan	0.23	***0.66***	0.09	***-0.84***	0.39	0.2	1				
Netherlands	-0.14	0.18	-0.29	-0.42	***0.73***	0.1	0.56	1			
Singapore	-0.25	0.32	-0.25	***-0.7***	0.56	-0.03	***0.76***	0.57	1		
U.K.	-0.11	-0.38	-0.13	0.25	-0.03	0	-0.31	-0.12	-0.2	1	
U.S.	0.14	0.44	0.07	***-0.67***	0.64	0.37	***0.82***	***0.79***	***0.77***	-0.19	1

Relatedly, table 3.3.3 illustrates the simple correlation coefficients between all 11 markets REIT-Bond Yield Gaps. Most notably, and as conforming with the above, Brazil and Turkey's REIT-Bond Yield Gaps are highly positively associated, estimated as 0.83. Interestingly, these are the only two EMEs that exhibit any strong form of correlation with each other. On the other hand, S.A. appears to be strongly negatively correlated with both Japan and Singapore, as evident by their correlation coefficients, respectively found to be -0.84 and -0.7. Australia and the Netherlands REIT-Bond Yield Gaps appear to share a strong positive correlation of 0.73. Similarly, Japan shares a strong positive correlation with Singapore, 0.76, and the U.S., 0.82. The Netherlands and Singapore additionally correlate strongly with the U.S., 0.79 and 0.77 respectively.

The summary statistics spanning all 11 markets REIT-Bond Yield Gaps are presented in table 3.3.4 below.[113]

The mean values of the actual REIT-Bond Yield Gap series range from a high of -8.11 for Brazil, to a low of 1.09 for the U.S. at the opposite end of the spectrum. These gaps, whilst computed in a different method to that of Brooks and Persand (2001), would still necessarily imply a far wider range if these values were calculated according to either the GEYR or Fed Model method. Viewing this from a static vantage point, and of course with the value of retrospection, it would be simple to claim that all of the EMEs REIT sectors were overvalued relative to their government bonds.

The Jarque-Bera test statistics reveal that all of the series - both EME and advanced economies, exhibit both substantial skewness and leptokurtic properties.[114] The EMEs reverse REIT-Bond Yield Gaps are intuitively negatively skewed, whilst those of their advanced market counterparts are all positively skewed. The U.K. specifically exhibits a significant amount of leptokurtosis. From this, it may be concluded that the Jarque-Bera test of normality is strongly refuted for all 11 countries.

[113] Please refer to the appendix - section A1, for the summary statistics of the independent variables. The independent variables exhibited similar characteristics and data feature properties to the dependent variable in table 3.3.4.

[114] The Jargue-Bera test of departures from normality examine whether the coefficients of skewness and kurtosis are jointly zero. The null hypothesis of normality is then compared to the alternative hypothesis of non-normality in the residual terms. The tests statistic follows a Chai-squared distribution with two degrees of freedom. Salient Drawbacks of the Jarque-Bera test relate to its estimating ability and accuracy being relatively low and over-sensitive for small samples. Since the test relies on the chi-square distribution to infer critical values, it might be an inefficient method of testing for normality, and specifically if a given distribution has a relatively short tail its ability of testing for normality is likely to be deficient (Brooks, 2014).

Summary Statistics: Table 3.3.4.

Time-Frame	EMEs				Advanced						
	Brazil	Mexico	Turkey	S.A.	Australia	France	Japan	Netherlands	Singapore	U.K.	U.S.
	2013/06/28 - 2015/11/30				2009/01/31 - 2015/11/30						
Statistic	**Trailing Dividend Yield – Government Bond Yield [REIT Bond Yield Gap]**										
Mean	-8.109990	-1.913530	-5.413223	-1.930528	1.582825	4.342670	1.355402	3.755758	1.370889	1.644210	1.094244
Median	-8.786250	-1.812900	-5.728350	-2.022900	1.576500	3.495100	1.321750	3.235250	1.322450	0.919350	1.238050
Maximum	-4.268900	-0.755700	-3.547400	-1.145200	3.581600	12.37780	2.096100	7.450800	2.794900	47.74900	1.930900
Minimum	-11.32490	-3.393270	-7.331700	-2.861100	-0.211000	-0.323500	0.724800	1.137900	0.133100	-0.612600	-0.594700
Standard deviation	**2.231290**	0.709340	**1.014330**	0.474578	0.684163	**2.766730**	0.340517	**2.003401**	0.673062	**5.556477**	0.623456
Skewness	0.214682	-0.801450	0.104287	0.016857	-0.112180	0.906255	-0.007893	0.623665	0.294521	8.095352	-0.859454
Kurtosis	1.510440	2.727488	1.945152	2.179609	3.562264	3.618383	2.247961	1.986641	2.315599	67.70408	2.791125
Jarque-Bera Nomrality Test	3.003928	3.194293	1.445258	0.814633	1.114704	11.15559	1.697436	7.748192	2.446124	13346.27	8.994823
Probability	(0.222692)	(0.202473)	(0.485474)	(0.665434)	(0.572724)	(0.003781)	(0.427963)	(0.020773)	(0.294328)	(0.000000)	(0.011138)
Ljung-Box Q*-Statistic	103.79	40.830	95.235	44.927	147.89	149.44	165.81	316.12	192.36	0.1326	231.93
	(40.830)	(40.830)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(1.000)	(0.000)
Augmented Dickey Fuller (ADF) Test statistic [levels]	**-1.062650**	**-2.335812**	**-1.610181**	**-1.749489**	**-3.590511**	**-2.806760**	**-2.277399**	**-1.397157**	**-2.456896**	**-8.486143**	**-1.623044**
1%	-3.679322	-3.679322	-3.679322	-3.679322	-4.090602	-3.524233	-3.524233	-3.524233	-3.528515	-3.524233	-3.524233
5%	-2.967767	-2.967767	-2.967767	-2.967767	-3.473447	-2.902358	-2.902358	-2.902358	-2.904198	-2.902358	-2.902358
10%	-2.622989	-2.622989	-2.622989	-2.622989	-3.163967	-2.588587	-2.588587	-2.588587	-2.589562	-2.588587	-2.588587
Augmented Dickey Fuller (ADF) Test [differenced series]	**-5.651359**	**-6.343593**	**-4.488596**	**-5.234382**	**-8.886185**	**-8.716334**	**-7.246034**	**-7.672264**	**-12.97421**		**-7.319706**
1%	-4.323979	-4.323979	-4.323979	-4.339330	-4.092547	-4.092547	-4.092547	-4.092547	-4.096614	-	-4.092547
5%	-3.580623	-3.580623	-3.580623	-3.587527	-3.474363	-3.474363	-3.474363	-3.474363	-3.476275		-3.474363
10%	-3.225334	-3.225334	-3.225334	-3.229230	-3.164499	-3.164499	-3.164499	-3.164499	-3.165610		-3.164499

Note.

[a] U.K.: TDY-GBY stationary in levels, however, model performed more accurately with differenced series. [b] Singapore: 2nd difference of TDY-GBY, I(2) process. Max lag length: [EMEs: 7], [Advanced: 11] automatic, determined by Schwartz Information Criterion (SIC). All ADF tests include both intercept and trend in equation. Below the ADF Test statistics for both levels and differenced series are their respective critical values. Ljung-Box Q-Statistic at lag 12 (monthly, levels series).

The Augmented Dickey-Fuller (ADF) tests were used to perform diagnostic analysis in order to investigate the presence of unit roots, and therefore whether each individual series were stationary or not.[115] The generated ADF test statistics were then compared to their corresponding ADF test critical values to make inferences regarding the set of each country's series.[116]

The ADF test is based on the following null and alternative hypothesis, as suggested by Brooks (2014):

H_o: $\Phi = 1 \equiv H_o: \Psi = 0 \rightarrow$ Implying the series contains a unit root (is non-stationary)
H_1: $\Phi < 1 \equiv H_1: \Psi < 0 \rightarrow$ Implying the series is stationary

The ADF unit root test decision rule is to reject the null hypothesis if the test-statistic is more negative than its corresponding critical value, at the one, five and ten % levels of significance, and not to reject otherwise. Specifically, unit roots were tested for in each individual series (dependent and independent variables) in their level forms, and also by including trends and an intercept in each test equation. The ADF test results reveal that for nine out of the eleven countries, the REIT-Bond Yield Gap series contain a single unit root and are therefore all Integrated of order one ($I(1)$) processes.[117] On the other hand, Singapore is an $I(2)$ process, whereas the U.K.'s REIT-Bond Yield Gap was stationary in its levels form, yet enhanced results were achieved by computing its first difference. The ADF test statistics are more negative than their corresponding critical values, strongly rejecting the alternative hypothesis that the series are unit-toot stationary. However, as presented directly below the ADF test statistics in their levels form are their differenced series. In a similar vein to Koivu, Pennanen and Ziemba (2005), these reveal that first differencing (second differencing for Singapore) have successfully rendered the relevant series stationary, as supported by the empirical observations that their ADF test statistics are now more negative than their associated critical values. It should also be noted that the unit roots present in the data series are believed to be caused by an intrinsic long-run trend, specifically with respect to the REIT-Bond Yield Gaps data series (table 3.3.4.). Advantages of differencing series in this way emerges. One relates to rendering the relevant series stationary, whilst the second advantage tends to eliminate most (if not all) serial (auto) correlation in each series. Should these diagnostic analyses not performed on levels form time-series data, then generated regression results have a high probability of being spurious (meaningless), given that test statistics will be inflated and thus have no genuine statistical grounding with which to draw and compare inferences from. Furthermore, as suggested by Krystalogianni and Tsolacos (2004), whilst rendering a series stationary by first (or higher order) differencing is an effective and appropriate method, the Hodrick-Prescott filter has the built-in advantage of not eliminating the salient long-run information from the original series in its levels form.[118] This method was attempted, but did not render the data series stationary. Therefore, differencing the data was the optimum option selected in this paper for eliminating both unit roots and auto (serial) correlation.

In relation to testing whether the series exhibit auto (serial) correlation, the joint test of significance is given by the Ljung-Box Q* statistics (Brooks, 2014). These statistics reveal whether all 12 autocorrelation coefficients are jointly zero, and are subsequently compared to their corresponding Chi-squared critical values.[119] The following null and alternative hypothesis is in order:

H_o: $\tau_1 = 0 = \tau_2 = 0 = \ldots = \tau_{12} = 0$
H_1: $\tau_1 \neq 0 \neq \tau_2 \neq 0 \neq \ldots \neq \tau_{12} \neq 0$

The Ljung-Box Q* statistics present clear evidence that series are strongly autocorrelated up to lag 12. This is remedied by first differencing the data, or computing higher order differences where applicable. According to Brooks and Persand

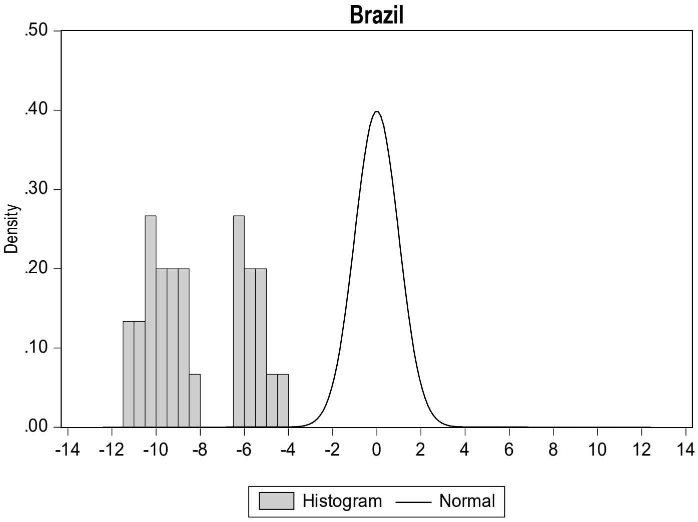
[115] It may be stated that in applying the ADF test, the lagged dependant variable of the regression would absorb any of the non-contemporaneous nature of the dependant variable itself, so as to ensure that the disturbance term is not auto (serially) correlated.
[116] Kindly refer to tables A1.1 - A1.3 in the appendix section A1 for a detailed decomposition regarding the explanatory variables which were stationary and/or rendered stationary by accordingly taking their first (or higher order) differences.
[117] An $I(1)$ series integrated of order one, thus containing one unit root.
[118] The HPF seeks to dissect a series into its long-run trend component, as well as shorter-term cyclical variations in the trend. Krystalogianni and Tsolacos (2004) applied the cyclical variations component to the Markov regime switching model with successful findings.
[119] The 12 lags are justified on the grounds that the tests are performed on the data's series in levels, and are monthly, hence the testing of 12 month successive lags.

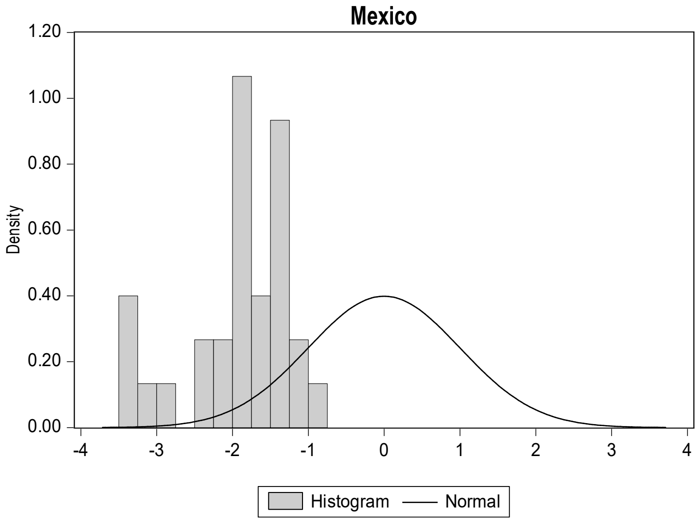
(2001), the set of statistics presented in table 3.3.4 offer motivation for the use of a regression model which permits an element of time-variation, whereby the values of the means and their corresponding variances can, to a certain degree, depend on their own lagged values.

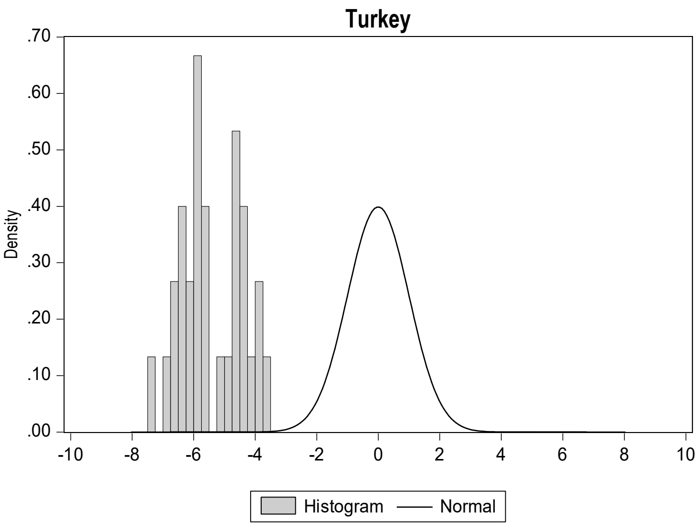
Graphs 3.3.3 and 3.3.4 respectively plot the EMEs and their advanced counterparts unconditional reverse and regular REIT-Bond Yield Gaps. As discussed above and as is evident from the graphical inspection below, the EMEs reverse REIT-Bond Yield Gaps exhibit significant negative skewness, whereas their advanced counterparts are all positively skewed, except for the U.K. which is highly leptokurtic. These findings confirm the summary statistics and their inferences that were made in the discussion above. These statistical properties provide further justification for the use of a regression model which is able to usefully quantify and separate the data series at hand into different regimes. This concept specifically relates to the structure of a quantitative model which is able to partition the data into high and low mean REIT-Bond Yield Gap regimes. This is also against the backdrop that there exists no formal econometric quantitative test for the Fed Model that can be used to valuably draw statistical inferences from, as espoused upon in both Brooks and Persand (2001) and Brooks (2014).

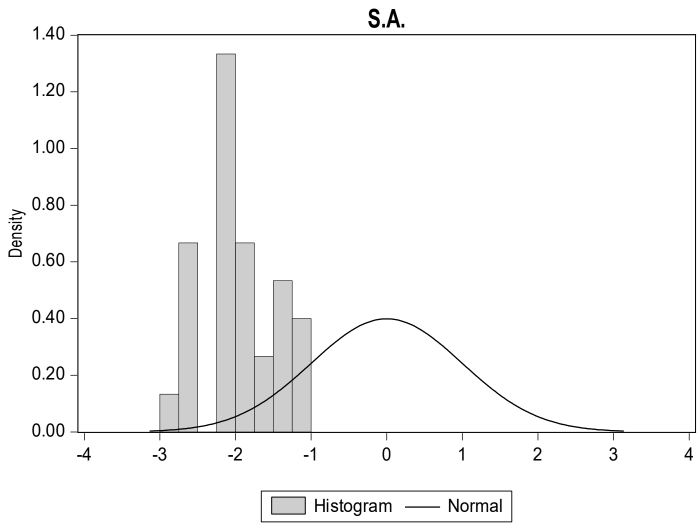
Graph 3.3.3.

EME Histogram Frequency Distribution Plots of the Unconditional Reverse REIT-Bond Yield Gaps Relative to Theoretical Density Normal Distributions (μ=0, σ=1)



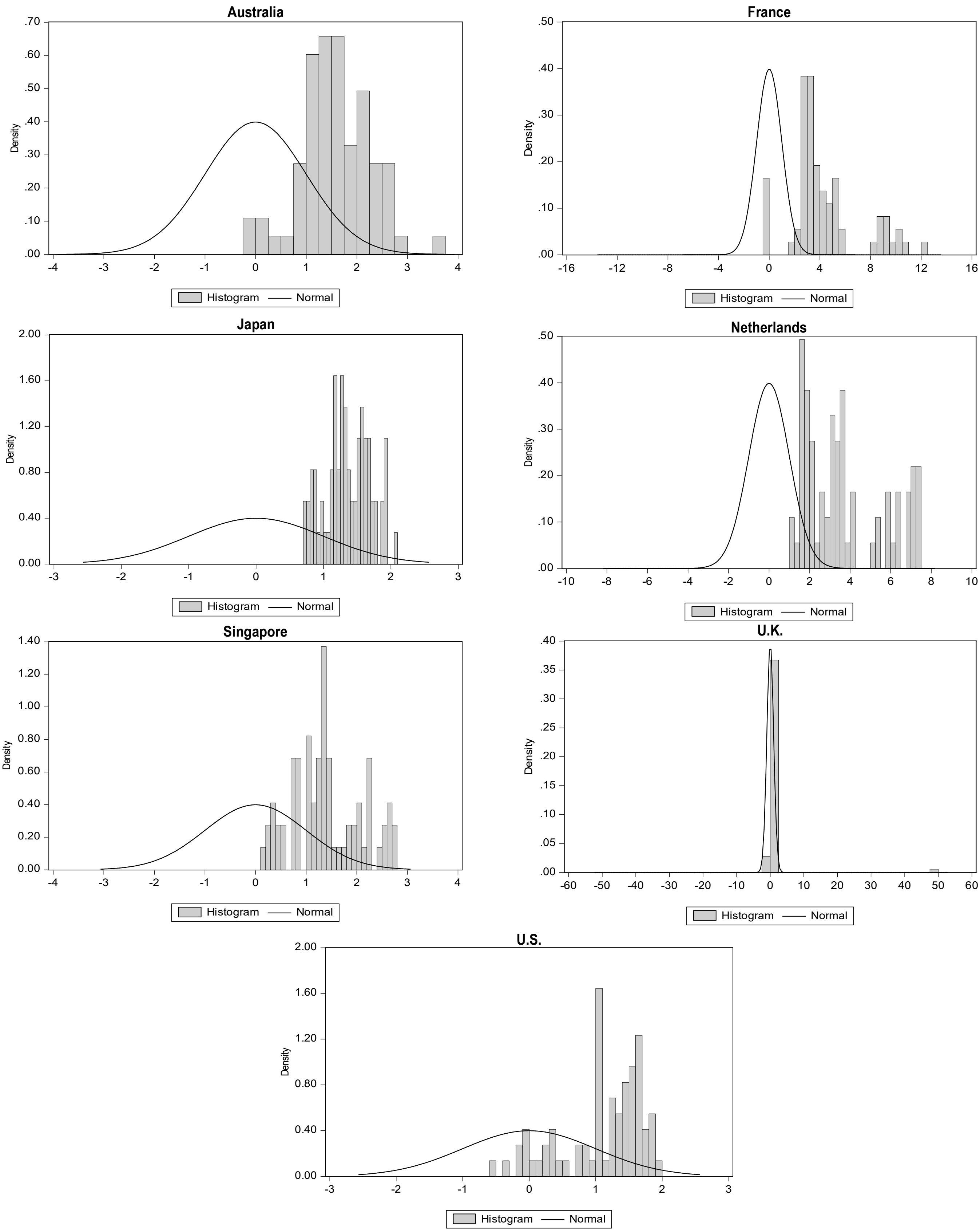






Graph 3.3.4.

Advanced Economy Histogram Frequency Distribution Plots of the Unconditional REIT-Bond Yield Gaps Relative to Theoretical Density Normal Distributions (μ=0, σ=1)



3.4. The Fundamentals

As defined by Firer, Ross, Westerfield and Jordan (2012), a dividend is the residual claims on the equity portion of a corporation. More precisely, dividend disbursements are the payments of an entity to its shareholders, and thereby reflect the return that was generated by a company on its capital through its regular course of operations over a stipulated time-frame. This form of return on capital signifies that portion of funds which was either directly and/or indirectly injected into the company by its shareholders (Firer, Ross, Westerfield & Jordan, 2012). Thus, dividend yields are simply the quotient of the monetary value of dividends disbursed by a corporation to the equity market capitalisation of the corporation, expressed as a percentage. The latter can be expressed more concisely by stating that dividend yields are the quotient of a one-unit stock dividend paid divided by a one-unit share price for the relevant corporation (Firer, Ross, Westerfield & Jordan, 2012). As Thomas and Zhang's (2008) point was noted in the literature review, dividends may either be historical – labelled trailing dividends, or forward (expected) dividends. Thomas and Zhang (2008) also illustrated how trailing earning yields differ to trailing dividend yields, and concluded by explaining why trailing dividend yields are not strictly applicable to Fed Model applications.[120] Nonetheless, given the nature of non-recurring items, coupled with the overly-optimistic perspectives of analysts at the ground level, this paper employs exclusively trailing dividend yields and the current ten-year nominal government bond yields as Fed Model inputs. On the other hand, a government bond yield is simply expressed as the quotient of a government bond's present value of its coupon payments over the face (or par) value of the bond, typically denoted as a percentage. It is this government bond yield which forms the RF rate, or discount rate, which is used in the present value computations of stock prices, thereby forming a highly crucial nexus with the Fed Model.

The Fed Model in its original 1996 form postulates that the equilibrium price level of stocks should be equated to expected corporate earnings, discounted by the current ten-year RF rate (Berge, Consigli, & Ziemba, 2008; Asness, 2003; Aubert & Giot, 2007). The model then compares the dividend (or earnings) yields on aggregate equity indices with the nominal yield on long-term government bonds. This forms the cornerstone link in attempting to explain the tri-fold research objectives of this paper. Specifically, investigating what propels deviations in the REIT-Bond Yield Gaps spanning the 11 markets mentioned, with a tilted focus towards why EME nominal government bond yields almost persistently exceed REIT dividend yields, even after time-series fluctuations, and therefore resulting in what the Fed Model would suggest as representative of EME REIT market over valuation (or expensive relative to their respective government bonds), whereas their advanced market counterpart REITs would thereby be considered undervalued (or cheap relative to their respective government bonds).

In the same vein as Berge, Consigli, and Ziemba (2008) and Aubert and Giot (2007), it can be illustrated that the original Fed Model in its 1996 form may be expressed as follows:

$$P_{E,t} = \frac{E[E_{,t}]}{RF_{,t}} \qquad (1)$$

Equation (1) implies that the quotient of the equilibrium level of stock prices at time t, $P_{E,\,t}$, is obtained by discounting expected corporate earnings, $E[E_{,t}]$ by the current ten-year RF rate, $RF_{,t}$, as proxied by the yields on long-term nominal government bonds. This is the present value discount relation discussed in the literature review, and is typically conducted for t periods into the future, meaning t = 1, 2, ...∞

Earnings per share, $EPS_{\ t}$, are then computed as shown in equation (2) below, for a specified unit investment in a stock, $S_{,t}$.

$$EPS_{,t} = \frac{E[E_{,t}]}{S_{,t}} \qquad (2)$$

[120] Thomas and Zhang (2008) argued that this is due to dividend payout time variations.

Equation (3) states that a stock's current market value $S_{,t}$, is obtained by dividing expected corporate earnings by earnings per share, $EPS_{,t}$, holding true for periods t=1, 2, …∞

$$S_{,t} = \frac{E[E_{,t}]}{EPS_{,t}} \quad \ldots\ldots (3)$$

As pointed out by Berge, Consigli, and Ziemba (2008), there exists a direct conduit between the equity yield component of equation (2), with that of the RF rate, as denoted in the denominator of equation (1). This is the pivotal link between a stock's present market value and its so-called theoretical, fundamental value. Thus, equation (4) illustrates what Berge, Consigli, and Ziemba (2008) refer to as the bond-stock yield ratio $BSYR_{,t}$. The $BSYR_{,t}$ is thus simply the quotient of a stock's (or the fund value of its indices) market value, $S_{,t}$, expressed over its theoretically correct value, $P_{E,t}$, at time t.

$$\frac{S_{,t}}{P_{E,t}} = \left(\frac{E[E_{,t}]}{EPS_{,t}}\right) \Big/ \left(\frac{E[E_{,t}]}{RF_{,t}}\right) = \frac{RF_{,t}}{EPS_{,t}} = BSYR_{,t} \quad \ldots\ldots (4)$$

The bond-stock earnings yield differential $BSEYD_{,t} = RF_{,t} - EPS_{,t}$, is then interconnected with the current market value, $S_{,t}$, over its theoretically correct value, $P_{E,t}$, as well as the equity yield component of (2). This is presented in equations (5) and (6) below. The deviation (or yield gap) between the variables in (4) is then intended on representing the differential between a stock's current market value $S_{,t}$ and its value obtained through present value fundamental calculations, $P_{E,t}$ at time t (Berge, Consigli, & Ziemba, 2008). However, Berge, Consigli, and Ziemba (2008) also claim that a more theoretically inclined and solid argument for assessing the predictive ability is the Gordon Growth (Dividend Discount) Model, which corroborates with the illustration provided by Aubert and Giot (2007). These are depicted in a similar manner in equations (7) – (9) below.

$$\frac{S_{,t}}{P_{E,t}} - 1 = \frac{BSEYD_{,t}}{EPS_{,t}} \quad \ldots\ldots (5)$$

$$BSEYD_{,t} = \left[BSY_{\ ,t} - 1\right] EPS_{,t} \quad \ldots\ldots (6)$$

This method simply replaces the (expected) corporate earnings component adopted by Berge, Consigli, and Ziemba (2008), and replaces it with corporate dividends. Thus, it may be stated that the Fed Model expressed as the quotient of dividend yields over nominal government bond yields shares an inverse relation with the REIT-Bond Yield Gap. According to Aubert and Giot (2007), as well as Firer, Ross, Westerfield and Jordan (2012), the axiom of a constant growth rate in corporate dividends is commonly the starting point for many stock valuation fundamental-based analyses. This gives equation (7), which is the Gordon Growth (Dividend Discount) Stock Valuation Model. In equation (7), $RF_{,t}$ represents the RF discount rate, expressed as a percentage per annum. The $RF_{,t}$ rate is also used as a proxy variable for the anticipated rate of return. Contrastingly, $P_{E,t}$ is used to represent either a single-unit of a stock's price, or that of its entire index at time t. This is applicable as long as the discount rate $RF_{,t}$ is assumed to be less than the anticipated growth rate of corporate dividend streams (Aubert & Giot, 2007).

$$P_{E,t} = \frac{D_{0,t}(1+G)}{RF_{,t} - G} \quad \ldots\ldots (7)$$

It then follows that by setting the present value of the most recently disbursed corporate dividend equal to its anticipated stream of corporate dividends, $D_{0,t}(1+G)$, then equation (8) is obtained. Equation (8) therefore insinuates that the $RF_{t,}$ rate – also proxying the anticipated future rate of return, is obtained by the taking the summation of the quotient of the dividend yield and the subjectively determined rate of growth of anticipated future dividend streams (Aubert & Giot, 2007).

$$\mathrm{RF}_{,\mathrm{t}} = \frac{\mathrm{D}}{\mathrm{P}_{\mathrm{E,t}}} + G \text{..........} (8)$$

Lastly, forming the fundamental linkage between Berge, Consigli, and Ziemba (2008) and Aubert and Giot's (2007) arguments, dividends are interconnected with earnings vis-à-vis the payout ratio. The payout ratio is represented in the equation by γ.[121]

$$\mathrm{RF}_{,\mathrm{t}} = \gamma \frac{\mathrm{E}_{,\mathrm{t}}}{\mathrm{P}_{\mathrm{E,t}}} + G \text{..........} (9)$$

It is now evident that equation (9) mirrors that of equation (8), in the sense of corporate earnings. Ignoring the payout ratio component, γ, in equation (9), the ratio expresses the earnings yield on a stock, or equivalently, its index.

3.5. Research Design

From the fundamentals in 3.4, to the Markov switching model, the system is now in a steadfast path to be set together.

In an analogous mode of operation to that set forth by Berge, Consigli, and Ziemba (2008), as well as Aubert and Giot (2007), this paper employs a variant of the Fed Model, and more precisely, the bond-stock yield gaps. This has been executed along the lines of subtracting from each respective market's trailing dividend yields on their REIT indices their corresponding nominal government bond yield s. The essential motivating idea behind this is for the purpose of capturing the reverse REIT-Bond Yield Gap in relation to the EMEs nominal government bond yields exceeding their respective market's trailing dividend yields on REITs. In order to capture the non-linearities of the joint distribution between each respective markets' trailing dividend yield on REITs less its corresponding nominal government bond yields – the so called 'reverse yield gap', or yield gap in the case of the advanced economies, Brooks and Persand (2001), Guidolin and Timmerman (2006), Krystalogianni and Tsolacos (2004), Li, Wang and Yang (2008) as well as Reinhart and Roghoff (2010) motivate the use of Markov-based regime switching regression models.

This paper adopts as the primary empirical mode of computation the Markov regime switching econometric regression model. Since there exists no formal financial econometric regression model to estimate the Fed Model, or relatedly the bond-stock yield gaps, the Markov regime switching regression model is appropriate (Brooks, 2014). Multivariate Markov models essentially test if and how multiple regressors influence the value of the transition probabilities during differing regimes (Krystalogianni & Tsolacos, 2004). In effect, the threshold value of the REIT-Bond Yield Gap is modelled to vary with fluctuations in the explanatory variables and unobservable state variables. It is adapted in this paper to signify tactical asset allocation strategies, and is henceforth employed to draw inferences as a Tactical Asset Allocation Multivariate Markov Regime Switching Model (but will be used interchangeably with the Markov model where deemed necessary throughout this paper). The purpose of adopting it, in addition to the motivations by Brooks and Persand (2001) and Krystalogianni and Tsolacos (2004), is in order to generate statistical inferences of when switching in regimes occur between REIT and government bond markets, and therefore their underlying assets (or cash flows). The two distinguishable regimes are specified as under (or over) valuation, in relation to these two financial securities, spanning the 11 countries. The primary aim of this is an attempt to gauge which, or if any, of the three independent

[121] Therefore, the payout ratio, as discussed at various junctures of this thesis, can be computed as the quotient of dividend over earnings, or, equivalently, dividend yields over earning yields. Thus, it may be stated that $\gamma = \frac{D}{E}$ $or\ \gamma = \frac{DY}{EY}$.

variables are driving deviations in, and why a larger REIT-Bond Yield Gap (more negative spread) exists between the EMEs REIT-Bond Yield Gaps, relative to those of their advanced market counterparts. The Markov model also computes the probabilities of being in a particular regime. Following this, it is intended to facilitate predictions regarding how long a given regime is expected to persist for, as well as whether or not profitable trading strategies, given the models empirical results, can be formulated in order to exploit the viable, salient findings.[122]

Markov models are capable of dissecting the nature of time-series data in order to determine when a specified series might be subject to a discrete change in a particular regime (Brooks, 2014). The Markov model enables this analysis by extracting statistical inferences from an observable sample of time series data sets, in order to draw from the series, the nature of an unobservable (discrete) state variable, which is likely driving the variations underlying changes in the two separate regimes. From a different vantage point, it attempts to capture the statistical determination in the turning points of the time series data. The conventional Markov model therefore utilises all available information to quantify the relationship between a set of exogenous variables, and the state of the dependent variable (the REIT-Bond Yield Gap in the context of this paper). However, this paper is unique in that it endogenises the three selected independent variables – inflation, CDSs, and the CBOE VIX. The regime switching process quantified by the Markov model is a deterministic process, and is therefore modelled explicitly. It is built on the underlying premise that there exists no reliable and credible variable that can indicate the presence of a regime change. Therefore, a regime change during a given period is the result of an unobserved process (Brooks & Persand, 2001; Brooks, 2014; Krystalogianni & Tsolacos, 2004).

According to Brooks (2014), entrenched within the Markov regime switching methodology, there exists a multiverse of potential manifestations, which are fragmented into *m* states of the world. These states are assigned the following notation: s_i, i = 1, 2, …, *m,* in relation to *m* different regimes. In this paper, attention is constrained exclusively to the scenario where *m* = 2. The Markov model has embedded advantages, in that it is highly adaptive, robust, and has an extended use of applications. These have been adopted in finance and economics to model regime changes in business cycles, asset and volatility pricing, interest and exchange rates, and has even added significant value in fields such as speech recognition and its synthesis (Brooks & Persand, 2001; Krystalogianni & Tsolacos, 2004). Markov models also encompass the ability of gauging fluctuations in the means and variances between different regimes, and are amongst the most widespread non-linear time series models (Brooks, 2014).

A major advantage, which is also a crucial axiom of the model, is that it rests on the premise that the dependent variables are normally distributed subject to being in a specified regime (Brooks & Persand, 2001). The latter therefore motivates the use of the data and its empirical properties as analysed above in section 3.3. It therefore does not require the entire set of observations from a data set to be normally distributed, permitting some degree of variation in the means and variances across the sample period. It is an optimal procedure for articulating serially correlated data, which vary with the passage of time, and hence during different regimes (Brooks & Persand, 2001). Another pivotal axiom is that the dependent variable, y_t, experiences a shift in regime, which is regulated by a single (or set of) unobservable state variable(s), s_t (Brooks, 2014).

For the purpose of this paper, and similarly to the modus operandi tracked by Brooks and Persand (2001) and Krystalogianni and Tsolacos (2004), the assumption adopted here is that there are two regimes – one corresponding to the scenario in which a given country or set of countries REIT sector(s) are undervalued (overvalued) relative to long-term government bonds, and in a strict financial and economic sense, a state of equilibrium between the two regimes. Thus, $s_{t=1}$ and $s_{t=2}$ implies that the system is either in regime one or two, at time t, respectively. It then follows that variations in the state variable between the two regimes are regulated by so-called Markovian properties, as expressed in equation (10) below (Brooks & Persand, 2001; Brooks, 2014; Krystalogianni & Tsolacos, 2004).

$$\text{Pr. [state } 1 < y_t \leq \text{ state } 2 \mid y_1, y_2, \ldots, y_{t-1}] = \text{Pr. [state } 1 < y_t \leq \text{ state } 2 \mid y_{t-1}] \quad (10)$$

[122] According to Brooks and Persand (2001) as well as Krystalogianni and Tsolacos (2004), the Markov models gives rise to a natural trading rule mechanism.

Equation (10) insinuates that the probability distribution of the state, irrespective of the time, is influenced exclusively by the contemporaneously prior state at time t-1, and not on any other state that it might have channelled through in alternative periods. This also indicates that Markov processes are path independent (Brooks, 2014).

At the core of the Markov model's framework, the system consists of a latent state variable, which Brooks (2014) expresses as z_t. Accordingly, z_t is hypothesised to evolve with the passage of time as a first order Markovian process, as illustrated in the following system of equations:

$\Pr.[z_t = 1 \mid z_{t-1} = 1] = p_{11}$..........(11)
$\Pr.[z_t = 2 \mid z_{t-1} = 1] = 1 - p_{11}$..........(12)
$\Pr.[z_t = 2 \mid z_{t-1} = 2] = p_{22}$..........(13)
$\Pr.[z_t = 1 \mid z_{t-1} = 2] = 1 – p_{22}$..........(14)

It should be noted that p_{11} (p_{22}) denotes the probability of being in regime one (two), on the basis of the system being in regime one (two) in the contemporaneously prior period (Brooks, 2014). It follows that $1 - p_{11}$ ($1 – p_{22}$) expresses the probability that the dependent variable, y_t, will switch from state one (two) in the prior period to its alternative state in the subsequent period. This implies that the latent state variable, z_t, progresses with the passage of time as an Autoregressive integrated of order one [AR(1)] process (Brooks, 2014).

$z_t = (1 - p_{11}) + \rho z_{t-1} + U_t$..........(15)

In equation (15), $\rho = p_{11} + p_{22} – 1$. Following this background, the returns series progresses as stated in equation (15). It is then formally in order to express equation (16) (Brooks, 2014).

$y_t = \mu_1 + \mu_2 z_t + (\sigma_1^2 + \Phi\, z_t) \cdot (0.5)\, u_t$..........(16)

Where U_t is assumed to be approximately normally distributed with a zero mean and standard deviation of one. The means and variances are respectively denoted as μ_1 and σ_1^2 (or μ_2 and σ_2^2) in states one and two (Brooks, 2014). The model uses Hamilton's EM algorithmic numerical search function maximum likelihood method to estimate the parameters of interest, assigned the following notation: $\Phi = \mu_1, \mu_2, \sigma_1^2, \sigma_2^2, p_{11}, p_{22}$ (Brooks & Persand, 2001; Brooks, 2014).[123] Provided with both a contemporary period's probability and set of probabilities, the system can subsequently be deployed to forecast the probability that it will shift regimes in the subsequent period. The estimated parameter probabilities would then represent forecasts of the intrinsic condition of the REIT-Bond Yield Gap - the dependent variable, y_t , in the immediately successive periods (Krystalogianni & Tsolacos, 2004). Brooks and Persand (2001), Brooks (2014), and Krystalogianni and Tsolacos (2004) all illustrate that the transition probabilities for the system are most concisely expressed using a matrix. These transition probabilities are then used to estimate the expected duration of a regime (Brooks & Persand, 2001; Brooks, 2014; Krystalogianni & Tsolacos, 2004).

$P = \begin{bmatrix} P_{11} & P_{21} \\ P_{12} & P_{22} \end{bmatrix}$..........(17)

P_{ij} denotes the probability of shifting from regime *I* to *j*, and where the probabilities intuitively sum to unity for all relevant states. More precisely, the row one, column one vector denotes the probability that state one will be followed by state one. As illuminated by Brooks and Persand (2001), the Markov model is in effect, a statistical procedure used to partition the data samples, and thereby assigns each sample with an associated set of probabilities.

In order to test the specification of the estimated fit of the models, and the hypothesis at its core, it would be optimal to formally test whether the Markov's estimated results have generated distinct mean and variance parameters, corresponding to the two different regimes (Brooks & Persand, 2001). However, this is not statistically viable in the

[123] The original Markov model was proposed by Hamilton in 1989 (Brooks & Persand, 2001; Brooks, 2014; Krystalogianni & Tsolacos, 2004).

straightforward convention. This is because the derivative of the EM algorithm maximum likelihood function with respect to regime one and two's means would be naught, whereas other statistical irregularities of conventional hypothesis testing would also be rendered invalid (Brooks & Persand, 2001).[124]

Brooks and Persand (2001) propose a viable, more portmanteau substitute hypothesis, whereby the two null hypotheses subsume the following nature:

$$H_{o,1}: \begin{cases} P_{11} = 1 - P_{22} \\ \mu_1 \neq \mu_2 \\ \sigma_1 \neq \sigma_2 \end{cases} \quad \text{and, } H_{o,2}: \begin{cases} \mu_1 \neq \mu_2 \\ \sigma_1 \neq \sigma_2 \end{cases}$$

The two null hypotheses formulated above are interpreted as follows:

The first null espouses that the regimes exhibit stability with the passage of time, permitting disparities in their means and variances. Larger values of the probabilities of being in regimes one and two represent greater robustness in the regimes, thereby raising the chances of refuting the null (Brooks & Persand, 2001). On the other hand, the second null presupposes that the variances fluctuate under the different regimes, whereas the estimated mean values must differ substantially (Brooks & Persand, 2001). Combining the two sets of null hypotheses, a rejection of both would suggest that permitting regime switching is a value-enhancing method of gauging the desirable parameters of interest (Brooks & Persand, 2001).

The Markov convention adopted in this paper is expressed in equation (18) below: [125]

$$\left.\begin{aligned} y_t &= \textbf{\textit{REIT Index}}_{TDY,t\,(country\ x)} - \textbf{\textit{Nominal}}_{\ GBY,t\,(country\ x)} = \beta_{0,1} + \beta_{1,1}\textbf{Inflation} + {}_{2,1}\textbf{Credit Default Swap} + \beta_{3,1}\textbf{CBOE VIX} + \varepsilon t \\ y_t &= \textbf{\textit{REIT Index}}_{TDY,t\,(country\ x)} - \textbf{\textit{Nominal}}_{\ GBY,t\,(country\ x)} = \beta_{0,1} + \beta_{1,2}\textbf{Inflation} + \beta_{2,2}\textbf{Credit Default Swap} + \beta_{3,2}\textbf{CBOE VIX} + \varepsilon t \end{aligned}\right\} \begin{aligned} &\textit{if } s_t = 1 \\ &\textit{if } s_t = 2 \end{aligned} \quad (18)$$

The postulated theoretical signs for equation (18) are as follows:

β_1, Inflation > 0; β_2, Credit Default Swap > 0; β_3, CBOE VIX < 0……………………………………………………..……….(19)

Justification for the theoretical (postulated) signs are indicated in table 3.4.1., whilst the relationship between the EMEs and advanced economies REIT-Bond Yield Gaps is depicted in figure 3.5.1. below.

Table 3.5.1.
Theoretical Expected Signs

Theoretical Expected Relation	State of REIT-Bond Yield Gap	REIT-Bond Yield Gap Expected Behaviour
+	↑ Inflation → ↓ TDY → ↑ GBY	Equities are cheap (or undervalued) relative to government bonds: ↑ P_E → ↓ TDY → ↓ P_{GBs} → ↑ GBY
+	↑ Credit Default Swap → ↓ TDY → ↑ GBY	Equities are cheap (or undervalued) relative to government bonds: ↑ P_E → ↓ TDY → ↓ P_{GBs} → ↑ GBY
-	↑ CBOE VIX → ↑ TDY → ↓ GBY	Equities are expensive (or overvalued) relative to government bonds: ↓ P_E → ↑ TDY → ↑ P_{GBs} → ↓ GBY

Figure 3.5.1.
Generic EME vs. Advanced Economies Postulated Anomalies

REIT-bond yield gap = y_t = REIT Index, $_{TDY,t}$ (country x) – Nominal, $_{GBY,t}$ (country x)

EMEs: **reverse yield gap = negative spread**

Advanced Economies: **yield gap = positive spread**

[124] This relates to a violation of asymptotic statistical properties (Krystalogianni & Tsolacos, 2004).
[125] This model specification applies to nine out of the 11 countries. In the regressions for Australia and the Netherlands, AR(1) and AR(2) variables were incorporated into the regressions, as deemed necessary. More information is provided in the empirical results section – 4.2.

IV. Empirical Evidence and Interpretational Analysis – the Nuts and Bolts

This section comprehensively examines the empirical findings of this paper. It is subdivided into three main sections, beginning with a comparison between this paper's empirical findings relative to those discussed extensively in the literature review. This process guided the decision with which variables and econometric model to employ in order to best capture and explain this paper's tri-fold research questions. As becomes evident, each sub-section is strategically partitioned into two main display sets of results - EME relative to the advanced markets, in order to allow for like-for-like comparisons. It should also be noted that whilst the time-frames of this study are shorter for the EMEs (2013/06/28-2015/11/30) relative to the advanced economies (2011/11/30-2015/11/30), various supporting empirical analyses (of a non-primary nature) are conducted over congruent periods, in order to establish level comparisons. These are illuminated by the time-frame depicted in the presentation of each studies empirical findings. This is followed by the empirical results of the multivariate Markov regime switching regression models. The final section delivers a tabulated depiction of the potential strategies which investors could adopt in order to profit from the observations, or even to simply enhance risk management techniques, hedging strategies and portfolio management practices. It highlights the relations among the state of the anomalies at the beginning of the sample, thus in a static manner, and what chain of economic events are likely to follow suit. It ends by describing the ways in which investors could position themselves in order to make arbitrage profits from the findings.

4.1. Cross-Literature Review Findings

Asness (2000) factored into his analysis of stock-bond yield comovements a measure of non-constant volatility, specifically the comovements between dividend yields and nominal government bond yields. On average, the correlation coefficients yielded positive results of approximately 0.71. While this research paper did not account for non-constant volatility and additionally replaced general stock market dividend yields with those of various markets REIT sector's, it similarly found positive comovements between the dividend yields on REITs and nominal government bond yields – albeit the positive correlations are much stronger for the advanced economies of this study. These correlation coefficients ranged from a miniscule 0.06% for Singapore, to a maximum value of 0.77 for Japan. The EMEs depict a different story. Whereas Turkey's correlation coefficient is -0.14, S.A.'s is surprisingly the largest out of the EME sample – documented as 0.35. On average however, the EMEs correlation coefficient was also a miniscule 0.02, whereas the advanced market equivalent metric is 0.36.

According to various researchers (Bailey, 1966; Eicholtz & Hanzell, 1996; Hong & Lee, 2013; Leone, 2011; Sebehela, 2008; Sing & Ling; 2003), REIT returns, and therefore their dividend yields, are inversely associated with anticipated inflation. This research paper therefore corroborates these findings. To be more precise, all countries dividend yields covaried negatively with anticipated inflation, except for the Netherlands and the U.K., whose correlation coefficients are 0.38 and 0.17, respectively.[126] Overall, it is observed that spanning both EMEs and advanced economies, these correlation coefficients on aggregate are -0.39 and -0.02, respectively. Hence, this is a clear signal that EMEs dividend yields covary almost 20 times stronger with anticipated inflation relative to the advanced economies. In a similar vein, Ilmanen (2003) found that the quotient of dividend yields over nominal government bond yields commove positively with both inflation and expected inflation. Specifically, Ilmanen (2003) observed that the larger the inflation expectations are, the stronger and more prevalent are the positive correlations. However, an interesting point to note is that this relation becomes inverted in scenarios where inflation exceeds its country's respective nominal government bond yield. In contrast to Ilmanen's (2003) assertions, this research paper finds the quotient of REIT trailing dividend yields to nominal government bond yields covaried on average inversely with both inflation and expected inflation. The EMEs trailing dividend yields over government bond yields were the only metric on aggregate that conforms with Ilmanen's (2003) observations. The EMEs correlation coefficient is recorded as 0.18., which is actually relatively small and weak in the context of positive comovements between a set of variables. Additionally, while all the EMEs exhibited the largest inflation expectations correlation with Ilmanen's (2003) suggested ratio, on average found to be -0.58, both the Netherlands and Australia are outliers relative to their peer economies, respectively documented as -0.64 and -0.73.[127] These inverse and larger inflation expectations relative to their comparable markets clearly do not appear to drive any

[126] This association remains unanswered for Singapore, since the computation of its anticipated inflation was not possible due to data constraints.

[127] This is likely why their empirical regressions included AR(1) and AR(2) terms. Please consult section 4.2. for additional information regarding these specific details.

positive comovement influence over the ratio of dividend yields to government bond yields. Lastly, in relation to Ilmanen's (2003) findings that those countries whose rates of inflation are greater than their respective government bond yields, this paper refutes such proclamations given the entire sample's inverse correlations with respect to both inflation and its expectations with the ratio of dividend yields over government bond yields. This is in despite of the empirical fact that the Netherlands, Singapore and the U.K.'s inflation rates exceed their country's nominal government bond yields on aggregate over the duration of the sample period. Perhaps such findings tend to be elastic with respect to either country data set and/or time-frame specific.

Connock and Hillier's (1987) Monetary Approach in relation to exchange rate risk motivated the comparison of the correlations between expected exchange rate movements with their associated REIT-Bond Yield Gap. An interesting picture emerges – barring Brazil, Turkey, S.A. and Australia, all the remaining seven markets exhibit positive associations between their anticipated exchange rate movements with their corresponding REIT-Bond Yield Gaps. Investigating this empirical finding in greater depth, Table A3.2. in the appendix section suggests that Brazil, Tukey, S.A. and Australia's currencies are expected to depreciate relative to the US$ by approximately 10.28%, 6.64%, 5.67% and 0.96%, over the next ten-years, respectively. This contrasts with the anticipated movements in the currencies of the alternative markets, whom are all expected to appreciate relative to the US$ somewhat over the subsequent ten-year period. It is thus surprising that this same phenomenon is not observed in the case of Mexico, given that it also exhibits a positive expected exchange rate spread of 3.59%, thereby implying that its currency should depreciate in a similar manner to the other markets with positive spreads. Furthermore, this also suggests that Mexico's REIT-Bond Yield Gap should correlate inversely with its related anticipated exchange rate depreciation. Perhaps there is another, unobservable underlying factor at play which exhibits a greater, and specifically positive comovement with Mexico's REIT-Bond Yield Gap. Other researchers also espouse on nominal government bond yields being propelled by volatility in exchange rates, with this relation being more prevalent for EMEs (Broos & de Haan, 2012; Gadanecz, Miyajima & Shu, 2014). Accordingly, this paper corroborates – with exception to Australia and Mexico, the findings by Broos and de Haan (2012) as well as Gadanecz, Miyajima and Shu (2014). This is against the backdrop that the EMEs exchange rates on aggregate are expected to depreciate relative to the US$ over the subsequent ten-years. Gadanecz, Miyajima and Shu (2014) suggest that countries nominal government bond yields are more susceptible to gyrations in exchange rate movements when their GDPs comprise a large proportion of foreign trade, and hence is related to economies who are classified as relatively open. EMEs are often dependent on the flow of trade in foreign goods and services. As alluded to by Thenmozhi and Nair (2014), both EMEs and their advanced market counterparts' nominal government bond yields are impacted by both their domestic and foreign counterparts' general exchange rate fluctuations, as well as their anticipated movements. This is justifiable given the well-known observations in the finance literature relating to capital seeking the largest yields – subject to returns when converted into a common currency, a feat clearly impacted by the present value of exchange rates and forecasts of their future values.

Nakazato (2011) studied an alternative statistical terrain, finding that a country's current account balance is positively associated with movements in nominal government bond yields. This may be elaborated by the literature's well-known documentation that when a country runs persistent current account deficits, should this imbalance not be rectified vis-à-vis inflows through its financial (or capital) account, then investors factor into nominal government bond yield values the likelihood of that country's exchange rate depreciating accordingly. By the same token as Poghosyan (2014), Gadanecz, Miyajima and Shu (2014), they also note the impact of fiscal positions, as well as central bank interest (policy) rates on EME nominal government bond yields. The correlation analysis of this paper points to the empirical observations that all of the markets central bank's interest rates covary positively with nominal government bond yields – not just for the EMEs in isolation.[128] Gadanecz, Miyajima and Shu's (2014) results were ambiguous when examining fluctuations in nominal government bond yields, caused by government budget deficits. Overall though, they point to the observation that government budget deficits had a larger influence over the U.S., relative to the EMEs that formed part of their study. Perhaps this is because investors typically use the U.S. as a reference country – such as this study. This might also be due to the US$ being adopted universally as a global reserve currency.

[128] This does not take into account Singapore – given their Sharia finance laws, there is no interest rate in the conventional finance sense. Additionally, as for the U.K. and U.S., their central bank interest rates exhibited zero variation over the sample period – in other words, they remained constant. The consequence is that no correlation coefficients could be computed using their central bank interest rates.

Baele, Bekaert and Inghelbrecht (2010) found increasing increments in the CBOE VIX are associated with a decoupling between stock and bond comovements. While not directly related to the assertions by Baele, Bekaert and Inghelbrecht (2010), a captivating empirical finding relates to the correlation coefficients between the CBOE VIX and each market's REIT-Bond Yield Gap. In relation to the EMEs, all reverse REIT-Bond Yield Gaps are inversely associated with the CBOE VIX. Contrastingly, all but two of the advanced economies REIT-Bond Yield Gaps are positively associated with the CBOE VIX.[129] These observations therefore corroborate the findings by Baele, Bekaert and Inghelbrecht (2010) in the EME context. More precisely, increasing increments to the CBOE VIX are likely to drive a larger REIT-Bond Yield Gap in EMEs, relative to what is experienced across the advanced markets. This is against the backdrop that investors are assumed to glean from the CBOE VIX the aggregate level of stock market volatility, in which increases might induce the so-called 'flight-to-quality' phenomenon.[130] A secondary investigation regarding the CBOE VIX in this paper is with respect to its use as a proxy variable for the 'flight to quality' phenomenon in the tactical Markov regime switching model. Accordingly, this will be explored in greater depth and alluded to in section 4.2.

Table 4.1.1.
5-Y Credit Default Swaps (CDS) in US$

Time-Frame	EMEs				Advanced						
2013/06/28-2015/11/30	Brazil	Mexico	Turkey	S.A.	Australia	France	Japan	Netherlands	Singapore [b]	U.K.	U.S. [a]
Mean	218.21	108.61	211.67	206.69	38.75	47.16	48.53	29.16		23.72	20.36
Median	189.62	109.06	207.9	204.84	38.35	46.48	46.17	26.24		20.3	17.17
Maximum	441.62	154.33	290.52	269.32	53.77	75.13	80.91	53.38		47.44	34.93
Minimum	139.59	69.14	173.13	173.74	31.79	28.3	34.99	15.84		15.7	15.65
Standard Deviation	82.44	24.91	30.75	25.31	6.42	12.5	11.54	11.67		7.67	5.54

Note.
[a] U.S. CDS denominated in €. [b] No data available for Singaporean CDS.

Gunduz and Kaya (2013) suggest that CDSs are useful proxy variables for modelling sovereign risk. They found that CDSs are positively associated with nominal government bond yields. Gunduz and Kaya's (2013) findings come as no surprise, given that CDSs measure the cost of insuring foreign owners of domestic government bonds against sovereign default. The correlation coefficients between five-year US$ denominated CDSs and their respective country's government bond yields confirm Gunduz and Kaya's (2013) findings, spanning across all markets - except for Australia. This paper furthermore found that the REIT-Bond Yield Gap's correlation coefficients between themselves and their respective CDSs are negative for all of the EMEs, and additionally for the U.K. and the U.S. All other markets associations are positive. These findings also conform with a-prior expectations in that the EMEs reverse REIT-Bond Yield Gaps are more elastic with gyrations in their corresponding CDSs, relative to the advanced economies. This is a valid point, given the initial suspect behind the EMEs reverse REIT-Bond Yield Gaps being their degree of sovereign risk, relative to their advanced economy peers. As is evident from table 4.1.1., the EMEs CDSs experience the greatest degree of standard deviation – with Brazil far outweighing all other markets, including its own peer EME economies, documented as 82.44, while Turkey has far less than half of Brazil's standard deviation, found to be 30.75, and its two remaining EME peers following closely suit. A similar pattern emerges when examining each market's mean value CDS of the sample period. Table 4.1.2 below depicts the aggregate CDS spread as well as standard deviation between the composite EME CDS mean values relative to its advanced markets' counterpart, whereas graph 4.1.1. graphically depicts this relation.

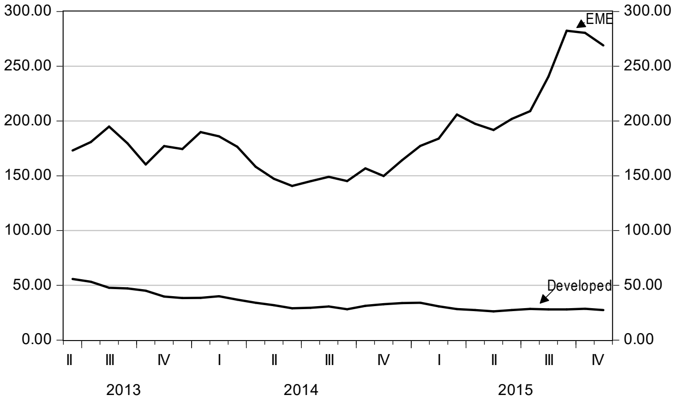
[129] It should be noted that the two advanced markets whose correlation coefficients between their REIT-bond yield gaps and the CBOE VIX are the U.K. and the U.S. Furthermore, all of these various market's correlation coefficients are only marginally associated with the CBOE VIX – excluding S.A. and Japan. The latter market's coefficients are respectively -0.80 and 0.67.
[130] Despite the CBOE VIX in a strict technical sense only being applicable to the volatility on options traded on the S&P500 index, investors appear to scrutinise and monitor its movements closely – suggesting some definitive truth in the flight-to-quality phenomenon.

Table 4.1.2.
Composite EME vs. advanced 5-Y Credit Default Swaps (CDS) in US$

Time-Frame 2013/06/28-2015/11/30	EMEs	Advanced
Mean	186.3	34.61
Spread	151.68	
Median	178.46	31.57
Maximum	282.41	55.77
Minimum	140.65	26.23
Standard Deviation	38.29	8.11

Graph 4.1.1.
EME vs. advanced 5-Y US$ Credit Default Swaps (CDS) spread

Graph 4.1.2.
Composite EME vs. Advanced 5-Y Credit Default Swaps (CDS) in US$



Graph 4.1.3.
Global 5-Y Credit Default Swaps (CDS) in US$

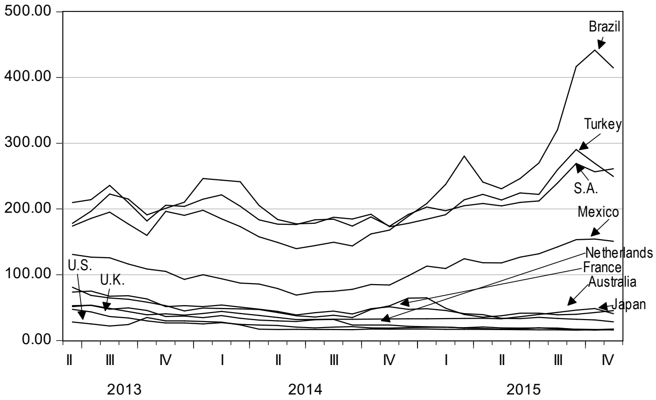


Table 4.1.3.
EME vs. Advanced REIT Sector Payout Ratios and their Corresponding Minimum Stipulated Payout Ratio Requirements

	EMEs				Advanced						
Time-Frame	Brazil	Mexico	Turkey	S.A.	Australia	France	Japan	Netherlands	Singapore	U.K.	U.S.
	2013/06/28 - 2015/11/30				2009/01/31 - 2015/11/30						
Calculated payout ratios	150.08	57.41	20.37	75.69	79.21	96.91	57.45	-25.36	36.37	42.73	247.55
Minimum payout requirements	75%	95%	0	75%	100%	95%	90%	100%	90%	90%	90%

Note.
Firer, Ross, Westerfield and Jordan (2012) recommend dividing the DY by its corresponding EY in order to arrive at the desired payout ratio of a particular stock and/or sector.

Wang, Erickson and Gau (1993) suggest that REITs pay larger dividends relative to what regulation requires. Hardin III and Hill (2008) corroborated Wang, Erickson and Gau's (1993) findings, furthermore suggesting that this observation is a function of agency cost minimisation; robust operating performance; share repurchases, as well as REITs capacities to tap into short-term debt. As per table 4.1., this paper has found that on aggregate, five out of the 11 markets REIT sectors distribute greater dividends relative to what regulation requires. Specifically, these five markets calculated payout ratio metrics and their corresponding minimum requirements are as follows: Brazil - 150.08%, relative to the 75% stipulated minimum; Turkey – 20.37% relative to their zero minimum payout policy; S.A., albeit marginally - 75.69% vs. 75%; France – 96.91% vs. 95%, and the U.S. REIT sector - a whopping 247.55% vs. the 90% requirement. Other interesting findings are in relation to the Netherlands, whose REITs minimum payout ratio requirement was not only far off of its target, it was also negative. According to Firer, Ross, Westerfield and Jordan (2012), a negative payout ratio implies that even though a company incurred losses over a given period, it nonetheless maintains its dividend payment – either by raising funds through a combination of cash from retained earnings and/or reserve accounts, issuing new debt and/or equity instruments, or even by liquidating some of its assets in order to meet its dividend payment. As discussed extensively in the literature review section, the outlier observation found in the context of the Netherlands might also be due to REIT managers' executions of dividend smoothing.

4.2. Multivariate Markov Regime Switching Regression Models Empirical Results

This section evaluates the estimated tactical multivariate Markov regime switching regression models empirical results. The estimated parameters for the EME regression models are provided in tables 4.2.1. and 4.2.3, while those for the advanced economies are given in tables 4.2.2. and 4.2.4. The time-frame for the EMEs empirical results spans from 2013/06/28-2015/11/30, whereas their advanced market counterparts ranges from 2009/11/30-2015/11/30.

Table 4.2.1.

EMEs Reverse REIT-Bond Yield Gaps Empirical Results

Statistic	Brazil			
	μ1	μ2	Probability st=1	Probability st=2
TDY-GBY	0.043533	0.310377	0.7241	0.3152
	(0.123318)	(0.309015)		
Inflation	0.643121	-0.562981	0.0784	0.6293
	(0.365384)	(1.166351)		
Credit Default Swap	-0.019212	-0.088070	**0.0000*** **	**0.0000*** **
	(0.003948)	(0.018405)		
CBOE Volatility Index	0.091900	-2.554303	**0.0128** **	**0.0000*** **
	(0.036916)	(0.333704)		
Durbin-Watson	**2.027891**			

Note.
Statistically significant levels (probability st=1 and st=2): ***=P<0.001, **=P<0.05, *=P<0.01, respectively denoting the one, five and ten % levels of significance. Bolded entries denote statistically significant variables and Durbin-Watson statistics that are indicative of no auto (serial) correlation. Standard Errors in parentheses below relevant variables.

Statistic	Mexico			
	μ1	μ2	Probability st=1	Probability st=2
TDY-GBY	0.058834	0.077173	0.5137	0.4592
	(0.090092)	(0.104273)		
Inflation	-0.342923	2.403607	0.0621	**0.0000*** **
	(0.183790)	(0.535323)		
Credit Default Swap	0.030600	-0.061233	**0.0123** **	**0.0000*** **
	(0.012221)	(0.013879)		
CBOE Volatility Index	-0.084243	-0.014748	0.1074	0.6155
	(0.052331)	(0.029364)		
Durbin-Watson	**2.533026**			

Note.
Statistically significant levels (probability st=1 and st=2): ***=P<0.001, **=P<0.05, *=P<0.01, respectively denoting the one, five and ten % levels of significance. Bolded entries denote statistically significant variables and Durbin-Watson statistics that are indicative of no auto (serial) correlation. Standard Errors in parentheses below relevant variables.

Statistic	Turkey			
	μ1	μ2	Probability st=1	Probability st=2
TDY-GBY	1.298806	-0.175090	**0.0042** **	**0.0359** **
	(0.453373)	(0.083474)		
Inflation	0.448308	-0.500650	0.4517	**0.0032** **
	(0.595627)	(0.169595)		
Credit Default Swap	0.040382	-0.001448	**0.0076** **	0.7345
	(0.015135)	(0.004268)		
CBOE Volatility Index	-0.119480	0.005380	0.6996	0.8702
	(0.309692)	(0.032913)		
Durbin-Watson	**1.949476**			

Note.
Statistically significant levels (probability st=1 and st=2): ***=P<0.001, **=P<0.05, *=P<0.01, respectively denoting the one, five and ten % levels of significance. Bolded entries denote statistically significant variables and Durbin-Watson statistics that are indicative of no auto (serial) correlation. Standard Errors in parentheses below relevant variables.

Statistic	S.A.			
	μ1	μ2	Probability st=1	Probability st=2
TDY-GBY	-0.078686	-0.143749	**0.0046** **	**0.0010** **
	(0.027751)	(0.043820)		
Inflation	-0.313140	1.520123	**0.0000*** **	**0.0000*** **
	(0.065250)	(0.125081)		
Credit Default Swap	-0.002634	-6.82E-05	0.1663	0.9880
	(0.001903)	(0.004520)		
CBOE Volatility Index	-0.030195	-0.011141	**0.0032** **	0.7376
	(0.010249)	(0.033253)		
Durbin-Watson	**1.757953**			

Note.
Statistically significant levels (probability st=1 and st=2): ***=P<0.001, **=P<0.05, *=P<0.01, respectively denoting the one, five and ten % levels of significance. Bolded entries denote statistically significant variables and Durbin-Watson statistics that are indicative of no auto (serial) correlation. Standard Errors in parentheses below relevant variables.

Table 4.2.2. Advanced Economies REIT-Bond Yield Gap Empirical Results

Statistic	Australia			
	μ1	μ2	Probability st=1	Probability st=2
TDY-GBY	-0.121572	0.155416	**0.0141****	**0.0163****
	(0.049504)	(0.064700)		
Inflation	-0.090270	0.077606	0.4954	0.7887
	(0.132394)	(0.289627)		
Credit Default Swap	-0.008665	0.038157	0.1839	**0.0062****
	(0.006520)	(0.013931)		
AR(1)	-0.429516		**0.0351****	
	(0.203879)			
AR(2)	0.077022		0.5622	
	(0.132884)			
CBOE Volatility Index	0.024895	-0.003072	0.0929	0.8371
	(0.014816)	(0.014935)		
Durbin-Watson	**2.006212**			

Note.
Statistically significant levels (probability st=1 and st=2): ***=P<0.001, **=P<0.05, *=P<0.01, respectively denoting the one, five and ten % levels of significance. Bolded entries denote statistically significant variables and Durbin-Watson statistics that are indicative of no auto (serial) correlation. Standard Errors in parentheses below relevant variables. AR terms are common to both regimes (they are non-switching regressors).

Statistic	France			
	μ1	μ2	Probability st=1	Probability st=2
TDY-GBY	0.190513	-3.453536	0.1565	0.1522
	(0.134459)	(2.411967)		
Inflation	-0.418170	1.145893	0.5667	0.9250
	(0.729873)	(12.17349)		
Credit Default Swap	0.009544	0.267237	0.3832	0.2826
	(0.010944)	(0.248729)		
CBOE Volatility Index	0.083764	1.568726	**0.0412****	0.0964
	(0.041040)	(0.943441)		
Durbin-Watson	**2.027128**			

Note.
Statistically significant levels (probability st=1 and st=2): ***=P<0.001, **=P<0.05, *=P<0.01, respectively denoting the one, five and ten % levels of significance. Standard Errors in parentheses below relevant variables.

Statistic	Japan			
	μ1	μ2	Probability st=1	Probability st=2
TDY-GBY	-0.105864	0.033079	**0.0054****	0.1053
	(0.038043)	(0.020424)		
Inflation	0.091559	0.000664	0.3738	0.9890
	(0.102954)	(0.047948)		
Credit Default Swap	-0.011048	0.007518	**0.0164****	**0.0026****
	(0.004604)	(0.002496)		
CBOE Volatility Index	0.011534	0.016613	0.5871	**0.0015****
	(0.021238)	(0.005245)		
Durbin-Watson	**1.908471**			

Note.
Statistically significant levels (probability st=1 and st=2): ***=P<0.001, **=P<0.05, *=P<0.01, respectively denoting the one, five and ten % levels of significance. Standard Errors in parentheses below relevant variables.

Statistic	Netherlands			
	μ1	μ2	Probability st=1	Probability st=2
TDY-GBY	0.101559	-1.306652	0.0773	**0.0000*****
	(0.057495)	(0.316527)		
Inflation	0.052446	-3.059024	0.8223	**0.0120****
	(0.233455)	(1.217980)		
Credit Default Swap	0.020725	-0.019300	**0.0210****	0.5802
	(0.008980)	(0.034895)		
AR(1)	0.026131	0.001601	0.8598	0.9992
	(0.147913)	(1.513093)		
CBOE Volatility Index	0.034962	-0.562456	**0.0328****	**0.0000*****
	(0.016378)	(0.114829)		
Durbin-Watson	**1.987926**			

Note.
Statistically significant levels (probability st=1 and st=2): ***=P<0.001, **=P<0.05, *=P<0.01, respectively denoting the one, five and ten % levels of significance. Standard Errors in parentheses below relevant variables. AR(1) term is set as a switching-regressor.

Statistic	Singapore			
	μ1	μ2	Probability st=1	Probability st=2
TDY-GBY	0.351904	-0.127885	**0.0000*****	**0.0024****
	(0.080385)	(0.042106)		
Inflation	0.226361	0.046480	**0.0267****	0.4800
	(0.102131)	(0.065803)		
CBOE Volatility Index	0.025310	0.016312	0.1313	0.1269
	(0.016773)	(0.010687)		
Durbin-Watson	**2.456557**			

Note.
Statistically significant levels (probability st=1 and st=2): ***=P<0.001, **=P<0.05, *=P<0.01, respectively denoting the one, five and ten % levels of significance. Standard Errors in parentheses below relevant variables.

Statistic	U.K.			
	μ1	μ2	Probability st=1	Probability st=2
TDY-GBY	39.06493	-0.031072	0.9975	0.4694
	(12626.50)	(0.042947)		
Inflation	166.4288	-0.331651	0.9980	**0.0104****
	(66035.03)	(0.129399)		
Credit Default Swap	-1.113713	0.016304	0.9995	**0.0141****
	(1699.261)	(0.006642)		
CBOE Volatility Index	-12.53287	-0.015245	0.9997	0.1139
	(28924.80)	(0.009644)		
Durbin-Watson	**2.447053**			

Note.
Statistically significant levels (probability st=1 and st=2): ***=P<0.001, **=P<0.05, *=P<0.01, respectively denoting the one, five and ten % levels of significance. Standard Errors in parentheses below relevant variables.

Statistic	U.S.			
	μ1	μ2	Probability st=1	Probability st=2
TDY-GBY	0.081592	-0.147648	**0.0090****	**0.0080****
	(0.031233)	(0.055685)		
Inflation	-0.050540	-0.365539	0.4169	**0.0004*****
	(0.062259)	(0.102498)		
Credit Default Swap	0.005470	-0.011001	0.2126	0.1840
	(0.004389)	(0.008280)		
CBOE Volatility Index	0.031499	0.073498	**0.0000*****	**0.0000*****
	(0.004508)	(0.006349)		
Durbin-Watson	**1.921286**			

Note.
Statistically significant levels (probability st=1 and st=2): ***=P<0.001, **=P<0.05, *=P<0.01, respectively denoting the one, five and ten % levels of significance. Standard Errors in parentheses below relevant variables.

The means (μ_1 and μ_2) for each of the two regimes and their associated probabilities for the differenced values of the REIT-Bond Yield Gaps are provided in columns one to four of tables 4.2.1 and 4.2.3, whilst their corresponding standard errors are located in parentheses below each variable. The Durbin-Watson test statistics are situated in the bottom south westerly corner of each table. The computed Durbin-Watson test statistics for each country suggests that there is no presence of auto (serial) correlation in the residuals of the models, with exception to Mexico, whose statistic – 2.53, marginally breaches the 'upper-band range' of 2.5, thus suggesting a trivial hint of negative autocorrelation (Brooks, 2014). Differencing the multiple sets of data series therefore successfully eliminated in one foul swoop both the unit roots, and autocorrelation associated with each particular series, as alluded to in the methodology section. The AR(1) and AR(2) terms included in the Australian Markov regime switching models regressions are common to both regimes.[131] This contrasts with the AR(1) term included in the Netherlands Markov regime switching regression results, which are distinct to both regimes one and two.[132]

The Markov regime switching model has distinctly split the data samples into two separate regimes for all countries, except for Mexico – whose estimated high and low mean values are respectively documented as 0.06 and 0.08.[133] Regarding the sample series that were distinctly split into two regimes, their high mean values range from 0.31; 1.30; -0.08; 0.16; 0.19; 0.03; 0.10; 0.35; 39.06, and 0.08, whereas their corresponding low mean value counterparts are 0.04; -0.18; -0.14; -0.12; -3.45; -0.11; -1.31; -0.13; -0.03, and -0.15, respectively for Brazil, Turkey, S.A., Australia, France, Japan, the Netherlands, Singapore, the U.K. and the U.S. The latter set of results were expected and conform with the findings as per the frequency distribution plots of the unconditional REIT-Bond Yield Gaps. Given that the sample range of the entire set of variables (dependent and independent) were non-stationary, and mostly *I*(1) processes, the mean values associated with all variables in both the high and low regimes are not mean values as such in a strict econometric sense, but are rather the change in mean values from t_{-1} to t. It should also be noted that in comparison to the papers by both Brooks and Persand (2001) and Krystalogianni and Tsolacos (2004), these regression results display the probabilities associated with each regimes dependent and independent variables, as suggestive of the statistical significance underlying both the high and low regimes' mean values. These results therefore provide a sense of clarity as to the statistical significance when interpreting the results, which points to some degree of scrutiny that may be levelled towards Brooks and Persand (2001) and Krystalogianni and Tsolacos (2004), who did not display such statistics. The high and low mean values for the two regimes exhibiting statistical significance are only achieved in five out of the 11 markets (Turkey, S.A., Australia, Singapore, and the U.S.), whereas an additional two markets (Japan and the Netherlands) are somewhat ambiguous, in the sense that only one of each of their two high and low mean values corresponding to the two regimes are statistically significant. Immediately noticeable is the standard errors associated with the U.K.'s mean values related to its high mean regime (μ_1). These standard errors are astronomically inflated relative to their mean values, and as such, the U.K.'s high mean regime appear highly unstable. This is also evident when examining the U.K.'s frequency distribution plot of its unconditional REIT-Bond Yield Gap – which exhibits substantial leptokurtic properties. Additionally, examining the U.K.'s raw REIT-Bond Yield Gap data series, the empirical evidence illustrates a large spike towards the end of September, 2013. To be more precise, the U.K.'s REIT-Bond Yield Gap spiked from a marginal positive spread of 0.72 during the prior month of August, to a highly inflated 47.75 in September, only to return to an even lower positive spread of 0.54 the subsequent month. This will be investigated in greater depth when analysing the constant Markov transition probabilities and expected durations empirical results for the U.K.

In a similar finding to that discovered by Brooks and Persand (2001), the values of the reverse REIT-Bond Yield Gaps for Brazil, Mexico, Turkey, and the regular REIT-Bond Yield Gaps for Australia, Singapore and the U.K. exhibit greater variability when they are in their high mean regimes, as evidenced by their associated standard errors. This same finding also holds true with respect to each countries associated independent variables. This variability is indicative of larger changes from period t_{-1} to t resulting in the respective yield gaps becoming unstable. Investors are likely monitoring the current levels and variations in stock vs. bond volatility, in which larger yield gaps have a high probability of emanating from the stock market – specifically, REITs, and consequentially their underlying property market assets.[134] Investors might therefore be positioning themselves to flee to quality (or safe-haven) investment instruments, such as government bonds. This is also against the backdrop that larger yield gaps, and more precisely, larger variations in these yield gaps are associated with either falling dividend yields and/or

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[131] The commonality of the AR terms to Australia's high and low regimes are estimated as non-switching regressors.

[132] The Netherlands AR(1) terms differ to Australia's in the sense that its Markov regime switching AR(1) is estimated as a switching regressor, alongside the explanatory variables included in the regression.

[133] These values are rounded off to two decimal places to facilitate interpretational convenience.

[134] The logic underlying this proposition relates to the fact that government debt is technically meant to be RF, and additionally that stocks are empirically observed to exhibit greater fluctuations relative to their RF counterparts.

rising government bond yields. The latter is also by virtue of convention related to declining Fed Model ratios, thereby implying that equities are becoming expensive (or overvalued) relative to government bonds. Market equilibrium mechanisms subsequently should begin the process of rectifying this imbalance. This would typically occur via a reduction in the demand for equities, reducing their prices. Given the definition of dividend yields, this automatically results in an increase in dividend yields. Simultaneously to this chain of economic events, the literature states that the demand for government bonds is likely to rise, which results in a reduction in its yields, relative to equities. The latter is however strongly dependent on the state of yield gaps, and subject to the current level of stock (REIT market) volatility. Asness (2000) would also claim that it depends on the investor generation which has different tolerance threshold levels – being a function of their prior market experiences. These findings will be alluded to in greater depth in section 4.2.

The impacts of the regressors on the state of the various countries yield gaps during the distinctive high and low mean regimes are investigated next. Holistically, the results vary substantially across the 11 markets, with no apparent clear-cut and concise patterns emerging.

Examining Brazil's empirical results, whilst a one-unit change in inflation on the reverse REIT-Bond Yield Gap is statistically insignificant (SI) for both the high and low mean regimes, both its CDS and CBOE VIX are statistically significant (SS). Specifically, a one-unit change in Brazil's CDS, ceteris paribus, results in a -0.09 change when Brazil is in its high regime reverse REIT-Bond Yield Gap. Similarly, a marginally larger one-unit change in its CDS induces a -0.02 reduction in its reverse REIT-Bond Yield Gap. This finding is strange, given the postulated positive relation between a country's proxy for its degree of sovereign risk. Stated differently, a rise in sovereign risk should induce, ceteris paribus, an expanding yield gap, which in Brazil's case, and similarly applicable to the other EMEs, would imply a larger reverse yield gap. Perhaps this phenomenon may be explained by virtue of the fact that corporate equity prices are typically discounted by a country's ten-year RF rate, therefore, a rise in sovereign risk might in fact result in one of three factors coming into play: one, dividend yields may be rising given that the present value of equity prices are falling; two, investors might divert their capital away from government bonds and towards equities, further exacerbating the effects of one; or three, investors could simply switch their holdings of a particular country's government bond to that of an acceptable foreign substitute. A similar pattern emerges with Brazil's reverse REIT-Bond Yield Gap and the CBOE VIX. An inverse impact of -2.55 change is caused by a one-unit change in its reverse yield gap during the low mean regime, whereas a marginal positive impact of 0.09 is experienced by a one-unit change during its high mean regime. Rising stock market volatility – as gleaned through an increasing CBOE VIX should theoretically induce the flight-to-quality phenomenon. The latter implies that a rising CBOE VIX should lead to a shrinking reverse yield gap, given that the demand for government bonds bolsters their prices, and consequentially reduces their yields. This therefore conforms with what is exhibited during the low mean regime, meaning that during the low mean regime - a small change in the reverse REIT-Bond Yield Gap, possibly induced by a rising CBOE VIX, will cause the gap to narrow marginally. On that note, as mentioned above, neither of Brazil's high and low mean values of its reverse REIT-Bond Yield Gap regimes are SS.

In relation to Mexico, neither of its reverse REIT-Bond Yield Gap regimes are SS. A one-unit variation in inflation appears to induce a 2.40 change in its reverse REIT-Bond Yield Gap, when it is in the high mean regime. The results are SI with respect to inflation's impact on its low mean regime. Similarly, variations in the CBOE VIX on its reverse yield gap are SI. However, a one-unit change in Mexico's CDS is associated with a -0.06 change to its reverse yield gap when it is in the high mean regime, with a marginally smaller but positive change of 0.03 during the low mean regime. This latter effect is thus the opposite of what Brazil's reverse yield gap experiences from its CDS variations during its low mean regime.

Turkey's results are mixed. A one-unit increment in inflation only causes a marginally negative change in its reverse yield gap of -0.50 during the low mean regime, whereas inflation's impact is SI in its high mean regime. In contrast to its EM peer economies, a one-unit rise in Turkey's CDS, ceteris paribus, leads to a marginal 0.04 change in its reverse REIT-Bond Yield Gap. This is in-line with a-priori expectations regarding a rise in sovereign risk's impact on the state of a yield gap. The impact of fluctuations in the CBOE VIX is SI, both with respect to Turkey's high and low mean regimes, and therefore no meaningful statistical inferences can be drawn from this variable.

S.A.'s results shed an interesting perspective. A one-unit change in inflation in the high mean regime, ceteris paribus, induces a marginally negative -0.31 unit change on the state of its reverse yield gap. Contrastingly, when S.A.'s reverse yield gap is in the low mean regime, a one-unit variation in inflation causes a corresponding 1.52 unit change. S.A.'s CDS does not exhibit any SS impact on the state of its reverse yield gap. Interestingly, S.A. is the only country whereby a SS one-unit rise in the CBOE VIX induces a negative, albeit marginal -0.03 unit-change on its reverse yield gap. This Implies that funds are likely to be diverted away from equities into bonds, reducing equity prices and raising their associated dividend yields, whereas bond prices rise and consequentially their yields fall. These should have the effect of shrinking the reverse REIT-Bond Yield Gap.[135]

Moving away from the EM economies to their advanced market counterparts, the only SS variables for Australia is its own lagged values – its AR(1) term, as well as its CDS during the high mean regime. More specifically, variations in the AR(1) term, induces a marginal -0.43 unit-change in its REIT-Bond Yield Gap, which is common to both its high and low mean regimes as explained above. This implies that its one period prior's yield gap (in t_{-1}) has a marginal impact on its subsequent period REIT-Bond Yield Gap. This is a surprising finding, given that Australia's data series for it yield gap was already differenced in order to eliminate both unit roots and residual autocorrelation. Identical to the impact of Turkey's CDS on the state of its yield gap, and in-line with a-priori expectations, a unit-change in Australia's CDS also results in a 0.04 unit-change in its yield gap.

The Tactical Markov regime switching model failed to adequately capture the dynamic properties of France's REIT-Bond Yield Gap. This is evidenced by the empirical observation that only one variable in one regime is SS. This relates to a one-unit change in the CBOE VIX inducing a marginal 0.08 unit-change in the state of its yield gap, exclusively in its high mean regime. Perhaps the latter may be related back to the fact that the CBOE VIX strictly gauges the level of volatility on the options underlying the S&P500 index. Europe has its own counterpart equivalent to the U.S.-based CBOE VIX.[136] Although global stock market indices are believed to be highly correlated given the degree of financial market integration, and general level of globalisation, perhaps Europe's volatility barometer would better capture these underlying relations.

Examining Japan's REIT-Bond Yield Gap, inflation appears to bear no SS impact on its REIT-Bond Yield Gap. However, in both of Japan's high and low mean regimes, a one-unit gyration in its CDS induces marginal impacts of 0.08 and -0.01, respectively. The impact of a unit-change in the CBOE VIX only resulted in a marginal positive change in the state of its high mean regime REIT-Bond Yield Gap, estimated by the regression model as 0.02.

The Netherlands shares a mildly similar pattern with Brazil. This is specifically in relation to models ability of capturing their dynamics relatively well, as supported by the volume of SS variables, relative to the other nine countries that form part of the sample study. Whereas the Netherland's AR(1) term is SI, in contrast to Australia's, one should also take cognisance of the statistical fact that it was set as a switching regressor, whilst Australia's AR(1) and AR(2) terms were not. Captivatingly, variations in Dutch inflation induce a negative 3.06 impact on the state of its low mean regime REIT-Bond Yield Gap. This is a striking finding for an advanced economy, in which a-priori expectations would suggest that inflation would induce a larger impact on the EMEs REIT-Bond Yield Gaps. Additionally, this one-unit variation in Dutch inflation appears to have the largest coefficient attached to it, relative to all other countries and all other variables in this study. It may thus be surmised that the Netherlands REIT-Bond Yield Gap is either susceptible to inflation in general, inflation might have been experiencing fluctuations over the sample period, or, as discussed in the cross-literature findings section, that the state of Dutch REITs was not financially healthy, on aggregate, over its entire sample period studied. This relates back to the observation that Dutch REITs, over the sample period, exclusively had negative payout ratios, despite Dutch REITs harbouring some of the most stringent regulations in the world, not simply relative to the other REIT markets encompassed in this study.[137] Investors have clearly been paying close attention to this, in which gyrations in Dutch inflation are likely to cause a shift of funds away from fixed capital market instruments and into equities, given that the latter's earnings are, according to the literature, meant to keep abreast with inflation, thereby acting as a partial hedge during periods of the declining value in purchasing power, relative to non-inflation linked government bond instruments. Continuing with the analysis, a unit-change in the Netherlands CDS appears to have only a very marginal impact on the state of its yield gap, documented as 0.02 for its high mean regime. Variations in the CBOE VIX also induces a mild 0.04 unit-change on its yield gap during the Netherlands high mean regime, whereas this relation is inverted during the high mean regime period, observed as -0.56.

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[135] This merits attention. The literature is peppered with underlying assumptions regarding the 'flight-to-quality' phenomenon. During volatile equity market periods, investors might not simply switch their holdings in a one-to-one ratio from stocks to that of government or any other fixed-interest bearing instruments. This phenomenon definitely holds its weight in that it is likely to occur - albeit in a less than a one-for-one manner relative to what is commonly assumed.

[136] Europe's stock market implied volatility barometers are known as the VSTOXX and VCAC, amongst others.

[137] This phenomenon was aptly explained in the cross-literature findings section.

Singapore's Tactical Multivariate regime switching regression model's results are somewhat obscured relative to those observed for all of the other countries, and thus this serves as a forewarning in terms of 100% comparability relative to the ten alternative markets.[138] Nonetheless, Singapore's results establish themselves in a unique way. Fluctuations in Singaporean inflation is witnessed to induce positive impacts on its REIT-Bond Yield Gap during both of its high and low mean regimes. Specifically, a unit-change in Singapore's inflation induced an estimated 0.23 unit-change in the state of its high mean yield gap regime, whereas this impact shrinks to a marginal 0.05 unit-change with respect to its low mean yield gap regime. Given the nature of Singapore's non-conventional, Sharia financial system, perhaps investors and other market pundits return to the fundamentals, being inflation as the salient undercurrent driver of government bond yields. This is also especially relevant, given that gyrations in the CBOE VIX do not appear to induce any SS impact on the state of Singapore's yield gap.

In a similar vein to the Tactical Markov regime switching models empirical results for France, it also failed to adequately capture the dynamic properties of the U.K.'s REIT-Bond Yield Gap. As noted above, the U.K.'s standard errors associated with its high mean regime's empirical results are inflated more than 300-fold for its mean value of its REIT-Bond Yield Gap, with similar findings in relation to its regressors. As such, only two of its regressor exhibited SS. These relate to the U.K.'s variation in its rate of inflation, and its CDS. These are respectively documented as -0.33 and 0.02, with both being associated with their corresponding low mean regimes. It might however be erroneous to draw statistical inferences from a set of estimated results with such large standard error bands associated with their coefficient value counterparts, although as noted above, the temporary one-month spike in the U.K.'s REIT-Bond Yield Gap is likely the culprit underlying the variability of the model's estimated parameter instability (high mean regime) and their associated standard errors.

Lastly, gyrations in the U.S. inflation rate is observed to induce a marginal -0.37 impact in the state of its yield gap during its low mean regime, with no SS with respect to its equivalent in its high mean regime. The latter is similar to the effect of a unit-change in inflation in the context of the U.K. Inflation inducing a mild inverse effect on the state of the U.S. and the U.K.'s low mean regimes' yield gaps might be a product of another underlying, unobservable force at work. It may also be interpreted in the following way: a unit-change in inflation during the low mean regimes, corresponding to the advanced economies REIT-Bond Yield Gaps, might induce a shift away from government bond instruments into REITs.[139] Investors might be basing such moves on the belief that REITs act as a partial hedge against the adverse impacts of inflation eroding nominal returns, such as those generated by government bond instruments. With regards to the U.S.'s CDS, no variations are observed to induce any SS impact on the state of either its high and/or low mean regimes. Marginal positive and statistically significant (PSS) impacts are found to be caused by variations in the CBOE VIX on the state of the U.S.'s high and low mean regimes. Specifically, a unit-change in the CBOE VIX resulted in, ceteris paribus, a 0.03 and 0.07 unit-change in its REIT-Bond Yield Gap, relating in that order to its high and low mean regimes.

The number of observations associated with the probabilities of being in a particular regime, as well as their associated transition probabilities of switching from either high to low regimes or vice-versa are presented in tables 4.2.3. (EMEs) and 4.2.4 (advanced economies), following which the results are dissected and are briefly reviewed below.

[138] As duly noted in the methodology section as well as at various junctures throughout this thesis, no data is available for Singaporean CDSs.
[139] This same phenomenon was exhibited in the case of Turkey – classified in this paper as an EME.

Table 4.2.3.

EMEs Constant Markov Transition Probabilities and Expected Durations Empirical Results

	EMEs							
Time-Frame: 2011/11/30-2015/11/30	Brazil		Mexico		Turkey		S.A.	
	Constant transition probabilities							
Regime	Low	High	Low	High	High	Low	High	Low
	1	2	1	2	1	2	1	2
1	0.83	0.17	0.29	0.71	0.41	0.59	0.82	0.18
2	1	0	0.87	0.13	0.06	0.94	0.45	0.55
	Constant expected durations							
Regime	1	2	1	2	1	2	1	2
Months	5.9	1	1.4	1.15	1.69	16.54	5.49	2.2
% of full sample reverse yield gap spent in st=1 and st=2	21.07%	3.57%	5.19%	4.26%	6.04%	59.07%	20.33%	8.15%
No. of observations after adjustments	28		27		28		27	

Note. The % of the full sample spent in a particular regime is computed by dividing the number of months in a regime by the total number of observations (post adjustments), and multiplying this value by 100 to obtain a percentage.

Table 4.2.4.

Advanced Economies Constant Markov Transition Probabilities and Expected Durations Empirical Results

	Advanced Economies													
Time-Frame: 2009/11/30-2015/11/30	Australia		France		Japan		Singapore		Netherlands		U.K.		U.S.	
	Constant transition probabilities													
Regime	Low	High	High	Low	Low	High	High	Low	High	Low	High	Low	High	Low
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
1	0.72	0.28	0.98	0.02	0.86	0.14	0	1	0.94	0.06	0.49	0.51	0.89	0.11
2	0.38	0.62	1	0	0.05	0.95	0.41	0.59	0.9	0.1	0.02	0.98	0.31	0.69
	Constant expected durations													
Regime	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Months	3.63	2.61	43.11	1	7.4	19.94	1	2.44	16.04	1.11	1.97	55.55	8.8	3.23
% of full sample yield gap spent in st=1 and st=2	5.19%	3.73%	60.72%	1.41%	10.43%	28.08%	1.43%	3.49%	22.91%	1.59%	3.40%	95.78%	12.57%	4.61%
No. of observations after adjustments	70		71		71		70		70		58		70	

Note. The % of the full sample spent in a particular regime is computed by dividing the number of months in a regime by the total number of observations (post adjustments), and multiplying this value by 100 to obtain a percentage.

The number of observations from the full sample period for which the probability that the REIT-Bond Yield Gaps are in their high mean regime state is relatively high for both Mexico and S.A. – 0.71 and 0.82, respectively. This corresponds to the implication that Mexico is likely to be in its high mean REIT-Bond Yield Gap regime around 4% of the total sample duration, whilst this metric is found to be marginally greater than 20% of the time for S.A. Brazil and Turkey contrastingly have relatively high probabilities of being in their low mean REIT-Bond Yield Gap regimes. The latter probabilities are respectively estimated as 0.83 and 0.59, implying that they are likely to be in their low mean regimes 21% and 59% of the time. Investigating the advanced economies counterpart metrics, it is evident that only France, the Netherlands and the U.S. have high probabilities attached to their high REIT-Bond Yield Gap regime values, documented as 0.98, 0.94 and 0.89 respectively. The latter set of probabilities furthermore correspond to the empirical observations that they are likely to be in their high mean REIT-Bond Yield Gap regimes 61%, 23% and 13% of the entire sample duration, respectively in relation to France, the Netherlands and the U.S. This contrasts markedly with Australia, Japan, Singapore and the U.K., in that they have greater probabilities of being in their low REIT-Bond Yield Gap regimes. More precisely, these probabilities are estimated as 0.72; 0.86; 0.59, and 0.98, respectively. This bears the implication that their low mean regimes are experienced 5%; 10%; 3.5% and 96% out of the total full sample period.

It may thus be deduced holistically that the REIT-Bond Yield Gap is retrospectively likely to be in in the low mean regime for Brazil, Turkey, Australia, Japan, Singapore and the U.K., whereas it is likely to be in its high mean regime for Mexico, S.A., France, the Netherlands and the U.S. One finding at this juncture can therefore corroborate the findings by Brooks and Persand (2001), in that they also observed the U.K. has a higher probability of being in its low mean regime, although they found the same was applicable to the U.S., which is not congruent with the findings of this paper. Additionally, these results conform with what was observed in methodology section, which graphically presented the unconditional frequency distribution plots for the 11 markets. These plots illustrated that the EMEs exhibited significant negative skewness, while their advanced market counterparts were all on average positively skewed, except for the U.K., which exhibited substantial volatility clustering, and hence leptokurtic properties, as evidenced by the bulge at the top of its distribution.

The entries relating to the constant transition probabilities denote the Tactical Markov regime switching models estimated p_{11} and p_{22} parameters. These parameters are respectively utilised as barometers to glean the probability of remaining in regime/state one, given that the REIT-Bond Yield Gap was in regime/state one the contemporaneously prior period (in this case the prior month), and by implication that the REIT-Bond Yield Gap will remain in regime/state two, given that it was in regime/state to the immediately preceding month. On average, the EMEs high estimated parameter values suggest that they have an 84% probability of remaining within its current regime, and by implication this implies only a marginal 16% chance of moving from its current regime/ state to a high/low regime/state. The advanced economies equivalent parameter counterparts do not trail far behind, and have been estimated on aggregate as an 82% probability of remaining within its prior periods regime. Therefore, it may be concluded that the estimated regimes exhibit substantial parameter stability, implying that the Tactical Markov regime switching regression models results are, on an all-encompassing basis, a relatively good fit of the REIT-Bond Yield Gaps. These annotations are also depicted in graphs 4.2.1. and 4.2.2. These graphs plot the values of the differenced REIT-Bond Yield Gap series (the black lines) relative to their estimated probabilities of being in their high/low mean regime states (the grey lines). Smoothed, filtered and one step-ahead regime probabilities are also estimated and displayed graphically below, and in the appendix section, A4.[140]

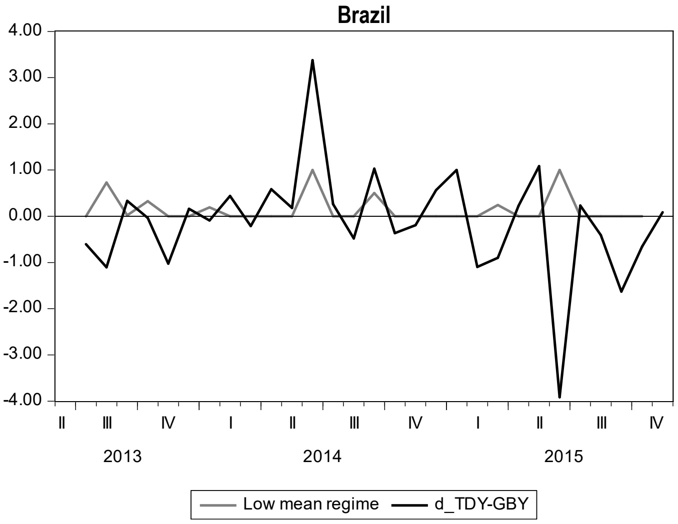
The two null hypotheses, as recommended by Brooks and Persand (2001), may therefore be refuted, given the models estimated parameters, except for Mexico, whose estimated Markov model failed to adequately compute two clearly distinctive sets of both means and variances (or standard deviations when converted accordingly).

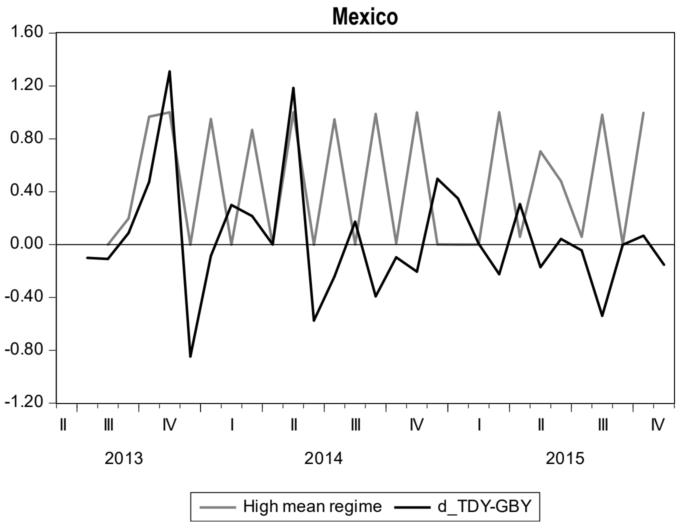
Bekaert and Engstrom (2009) found that in spite of what prior research suggests, the so-called 'money illusion' phenomenon is unlikely to drive strong comovements between stocks and bonds. Instead, they find that this fallacious perspective is actually propelled by countries with high incidents of stagflation. Bekaert and Engstrom (2009) additionally assert that Fed Model investigations have a greater probability of generating superior results for those countries currently experiencing stagflation. The empirical evidence of this paper therefore refutes Bekaert and Engstrom's (2009) findings, given that no superior results were found in relation to the EMEs results, relative to their advanced market counterparts.

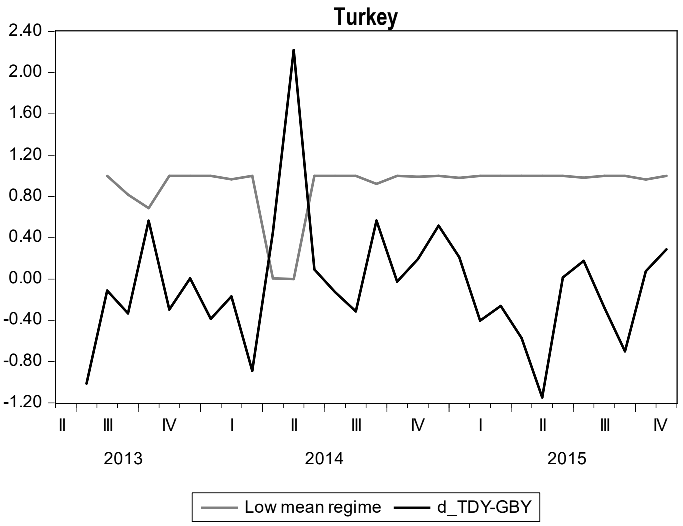
[140] Whereas smoothed probabilities utilise the entire data sample, the filtered probabilities utilise both historical and present information available at, and including time t (Krystalogianni & Tsolacos, 2004).

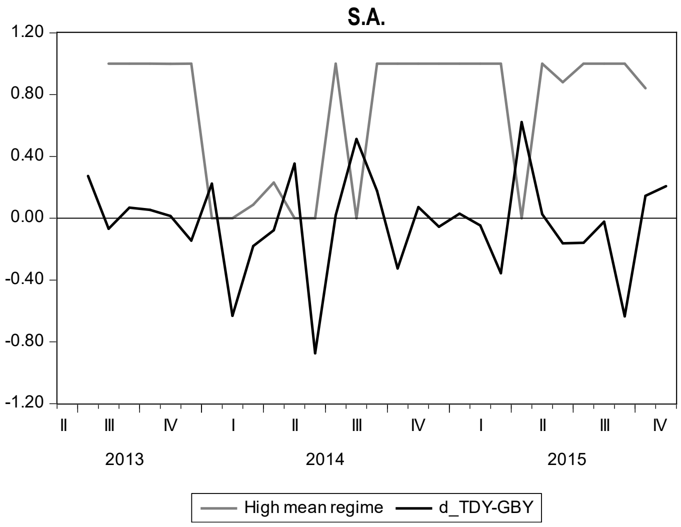
Graph 4.2.1.

Values of the EME Differenced Reverse REIT-Bond Yield Gap Series and their Corresponding Smoothed Probabilities that they are in their Dominant High/Low Mean Regime States



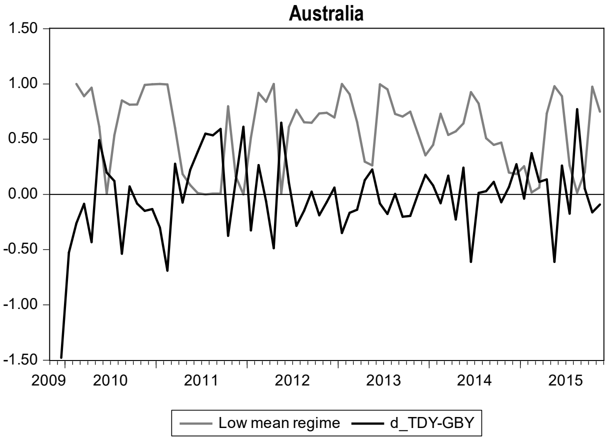


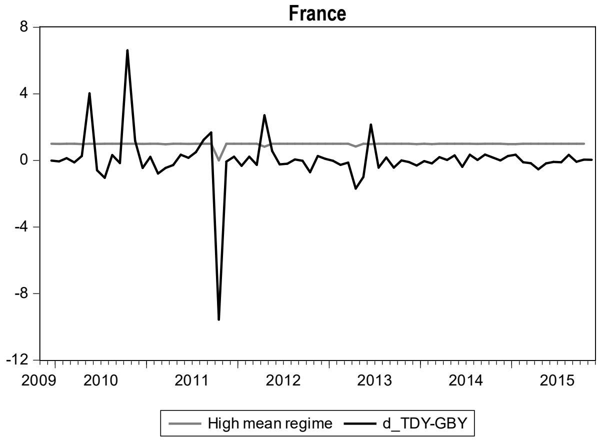


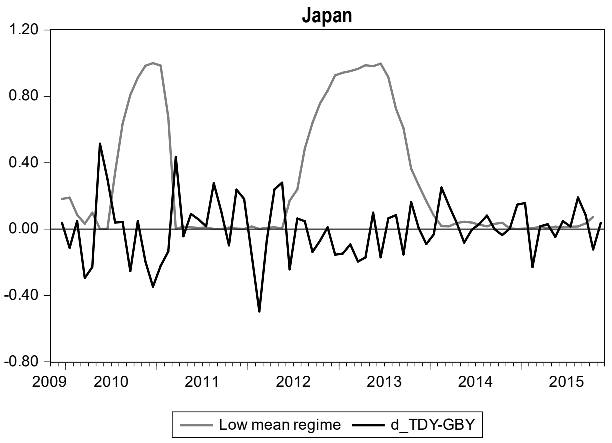


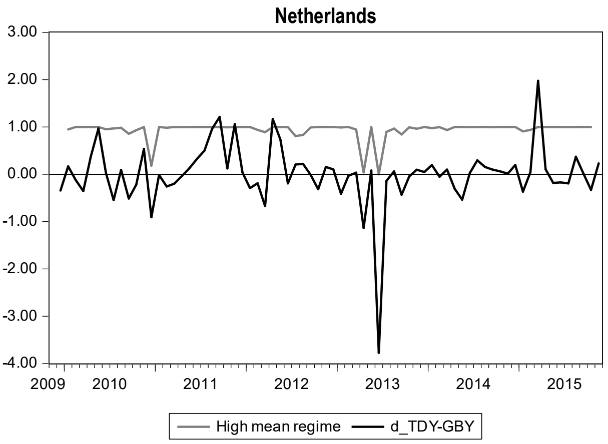
Graph 4.2.2.

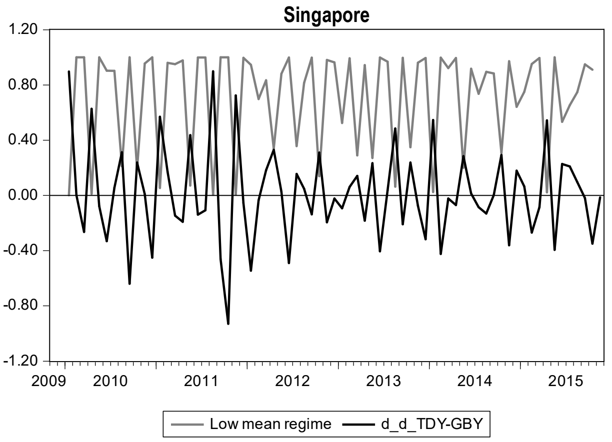
Values of the Advanced Economies Differenced REIT-Bond Yield Gap Series and their Corresponding Smoothed Probabilities that they are in their Dominant High/Low Mean Regime States

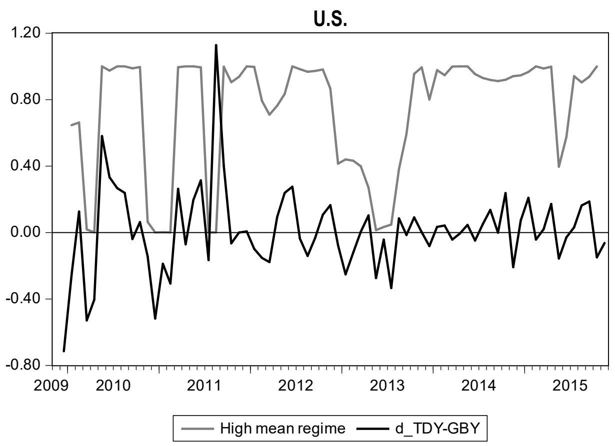












4.3. Potential Tactical Asset Allocation Multivariate Markov Regime Switching Trading Strategies Based on Static t=0 Yield Gap Conditions.

Table 4.3.1.
Time t=0 Static Tactical Markov Switching Trading Strategies.

Markets	State of Yield Gap	Chain of Events Likely to Occur	Recommended Tactical Trading Strategy
Advanced	When TDY-GBY=Positive Yield Gap: Implies ↔ TDY/GBY High	Equities are cheap (or undervalued) relative to government bonds: $\uparrow P_E \rightarrow \downarrow TDY \rightarrow \downarrow P_{GBs} \rightarrow \uparrow GBY$	Long equities, short government bonds.
EMEs	When TDY-GBY=Reverse Yield Gap: Implies ↔ TDY/GBY Low	Equities are expensive (or overvalued) relative to government bonds: $\downarrow P_E \rightarrow \uparrow TDY \rightarrow \uparrow P_{GBs} \rightarrow \downarrow GBY$	Short equities, long government bonds.

Note.
The recommended tactical trading strategies ignore related transaction costs. Brooks and Persand (2001) suggest that a modest all-inclusive transaction cost metric per trade is approximately 1.7%. This figure is the typical cost per sale/purchase when trading on the U.K. FTSE-100 index. The 1.7% is estimated to encompass commission fees, stamp duties as well as bid/ask trading spreads, which respectively comprise 0.4%, 0.5% and 0.8% (Brooks & Persand, 2001).

Table 4.3.2. REIT Sector Trailing Dividend Yields/Government Bond Yields

Time-Frame 2013/06/28 -2015/11/30	EMEs				Advanced						
	Brazil	Mexico	Turkey	S.A.	Australia	France	Japan	Netherlands	Singapore	U.K.	U.S.
Mean	0.36	0.68	0.41	0.76	1.48	3.99	3.55	3.67	1.59	1.87	1.56

In retrospection, the Tactical Markov regime switching regression results suggest that by positioning an investment strategy accordingly, investors, portfolio managers, hedging and risk management techniques, could align themselves so as to exploit any potential arbitrage profits that exist in the EME and advanced market REIT-Bond Yield Gaps – albeit table 4.1.3. above suggests this in a static manner. Their objectives could also be streamlined using the findings and recommended tactical trading strategies that are depicted in table 4.3.1. Table 4.3.2 furthermore could be employed in conjunction with the REIT-Bond Yield Gaps, which could be used to infer whether a particular market is over or undervalued. Additionally, portfolio rebalancing techniques, targeted, tactical and strategic asset allocation strategies could be formulated by being aware of the chain of economic events that are likely to occur, following the present condition of a particular REIT-Bond Yield Gap. This could be performed by running regressions of the Markov regime switching models with the REIT-Bond Yield Gaps as dependent variable threshold parameters, following which, subject to the models estimated transition probability parameters exceeding a predetermined subjective minimum, such as 0.5, as suggested by Brooks and Persand (2001) and Krystalogianni and Tsolacos (2004), then it is highly probable that profitability, and excess returns could be achieved. This is before trading costs, whereby Brooks and Persand's (2001) results, on a gross basis outperformed buy and hold strategies, yet not on a net basis. Contrastingly, Krystalogianni and Tsolacos' (2004) study managed to outperform even on a net basis. The REIT-Bond Yield Gap is however considered a highly contentious model, yet it encompasses the potential for significant reward. These could then be back-tested using Sortino ratios, tracking errors, or even using the Black-Litterman model, as described in the literature review. Lastly, variations in REIT-Bond Yield Gaps could even be used to establish confidence factors, that accordingly signal when reversals and/or shifts in regime are likely to occur (Brooks & Persand, 2001).

VI. CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

Even though inflation, and especially sovereign risk were hypothesised as the underlying variables inducing reverse REIT-Bond Yield Gaps (negative spreads between the trailing dividend yields on REITs and their respective government bond yields) in the context of EMEs, the Markov models were unable to generate clear-cut, definitive reasons regarding why EMEs experience this anomaly. Thus, while the first research question - also the main contribution of the paper, were not met with certainty, and hence remains relatively ambiguous to a certain degree, it is still surmised that both EMEs relatively higher rates of inflation, their variability, in conjunction with CDSs, are the likely culprits of this. On the other hand, objectives two and three – what drives fluctuations in the REIT-Bond Yield Gaps and whether or not it is possible to formulate profitable hypothetical tactical asset allocation strategies, respectively, have been achieved with a relatively high degree of confidence, except for France and Mexico. These assertions are solidified through a cross-border evaluation, spanning both the EMEs and their advanced market counterparts, whereby fluctuations in the high and low mean values of the REIT-Bond Yield Gap regimes appear to be influenced by the set of the three explanatory regressors – variations in inflation rates, CDSs, as well as the CBOE VIX Volatility Index. This is because the Markov models appear to have captured and split the dynamic properties of the data series relatively well, again excluding France and Mexico, whereby the Markov model was unable to generate significant and distinguishable values concerning their means and variances across their two regimes. The third objective – the formulation of hypothetical tactical asset allocation trading rules to exploit the static time t=0 arbitrage mispricing opportunities by examining and drawing inferences from the main empirical findings, has been met.

Some important caveats also merit attention and critique. While the CDS data employed in this paper were of a five-year time-frame, the generic government bond yields were all ten-year series. Thus, they were acknowledged as imperfect proxy variables. Future studies are likely to be enhanced by employing CDS time-frame data that are congruent with the respective instruments that they insure. Additionally, the generic bonds have no available total return series which could be meaningfully used to compute and contrast with naïve buy-and-hold strategies, in order to infer concretely whether or not the Markov models suggested results would realistically generate superior performance. Another salient boundary of the paper was the non-stationarity of the data series, both in relation to the dependent and independent variables. While all data series were non-stationary and serially (auto) correlated in their raw, levels form, these diagnostic caveats were remedied by appropriately first (or higher order) differencing them accordingly. The computed Durbin-Watson test statistics for each country reinforced the remedial actions, suggesting that there is no presence of auto (serial) correlation in the residuals of the models, with exception to Mexico, whose statistic marginally breaches the ‘upper-band range’ of 2.5, suggesting a trivial hint of negative autocorrelation. Differencing the multiple sets of data series therefore successfully eliminated in one foul swoop both the unit roots, and autocorrelation associated with each particular series. Thus, alternative methods besides from differencing the data could be explored in the future, such as the Hodrick-Prescott Filter, which would separate the data into a long-run trend and cyclical component (deviations from the trend) – unsuccessful in this paper, in order to generate, in a strict sense, high and low mean regimes, and not changes encompassed within these.

The REIT-Bond Yield Gaps static conditions have high probabilities of continuing in the same direction and magnitude into the future. It may be deduced holistically from the empirical observations that the REIT-Bond Yield Gap is retrospectively likely to be in in the low mean regime for Brazil, Turkey, Australia, Japan, Singapore and the U.K., whereas it is likely to be in its high mean regime for Mexico, S.A., France, the Netherlands, and the U.S. The entries relating to the constant transition probabilities denote the parameters that are utilised as barometers to glean the probability of remaining in regime/state one, given that the REIT-Bond Yield Gap was in regime/state one the contemporaneously prior period (in this case the prior month), and by implication that the REIT-Bond Yield Gap will remain in regime/state two, given that it was in regime/state to the immediately preceding month. On average, the EMEs high estimated parameter values suggest that they have an 84% probability of remaining within its current regime, and by implication this implies only a marginal 16% chance of moving from its current regime/ state to a high/low regime/state. The advanced economies equivalent parameter counterparts do not trail far behind, and have been estimated on aggregate as an 82% probability of remaining within its prior periods regime. Therefore, it may be concluded that the estimated regimes exhibit substantial parameter stability, implying that the Markov regime switching results are, on an all-encompassing basis, both robust and are a relatively good fit of the REIT-Bond Yield Gaps. The two null hypotheses related specifically to the Markov models may therefore be refuted, given the models estimated parameters, except for Mexico, whose estimates failed to adequately compute two clearly distinctive sets of both means and variances (or standard deviations when converted accordingly).

Further reinforcing the main empirical results are the supporting/cross-literature empirical findings. This paper found positive comovements between the dividend yields on REITs and nominal government bond yields – albeit the positive correlations are much stronger for the advanced economies. Many researchers have found that REIT returns, and therefore their dividend yields, are inversely associated with anticipated inflation. This paper corroborates such findings. To be more precise, all countries dividend yields covaried negatively with anticipated inflation, except for the Netherlands and the U.K. Additionally, the EMEs dividend yields covaried almost 20 times stronger with anticipated inflation relative to the advanced economies. In contrast to various literatures assertions, this paper found the quotient of REIT trailing dividend yields to nominal government bond yields covaried on average inversely with both inflation and expected inflation. The EMEs trailing dividend yields over government bond yields were the only metric on aggregate that conforms with the literatures general observations. These inverse and larger inflation expectations relative to their comparable markets clearly do not appear to drive any positive comovement influence over the ratio of dividend yields to government bond yields. This paper found that over the entire sample period, inflation and its expectations commoved inversely with the ratio of dividend yields over government bond yields. This is in despite of the empirical fact that on aggregate, over the duration of the sample period, the Netherlands, Singapore and the U.K.'s inflation rates exceeded their respective nominal government bond yields. Perhaps such findings tend to be elastic with respect to either country data sets and/or are time-frame specific. Examining the comovements between anticipated exchange rate fluctuations with REIT-Bond Yield Gaps, an interesting picture emerges. Barring Brazil, Turkey, S.A. and Australia, all the remaining seven markets exhibit positive associations between their anticipated exchange rate movements with their corresponding REIT-Bond Yield Gaps. It is observed that Brazil, Tukey, S.A. and Australia's currencies are expected to depreciate relative to the US$ by approximately 10.28%, 6.64%, 5.67% and 0.96%, over the next ten-years, respectively. This contrasts with the anticipated movements in the currencies of the alternative markets, whom are all expected to appreciate relative to the US$ somewhat over the subsequent ten-year period. It is thus surprising that this same phenomenon is not observed in the case of Mexico, given that it also exhibits a positive expected exchange rate spread of 3.59%, thereby implying that its currency should depreciate in a similar manner to the other markets with positive spreads. Furthermore, this also suggests that Mexico's REIT-Bond Yield Gap should correlate inversely with its related anticipated exchange rate depreciation. Perhaps there is another, unobservable underlying factor at play which exhibits a greater, and specifically positive comovement with Mexico's REIT-Bond Yield Gap. Nominal government bond yields are highly influenced by volatility in exchange rates, with this relation being more prevalent for EMEs. Accordingly, this paper corroborates – with exception to Australia and Mexico, the findings by Broos and de Haan (2012) as well as Gadanecz, Miyajima and Shu (2014). This is against the backdrop that the EMEs exchange rates on aggregate are expected to depreciate relative to the US$ over the subsequent ten-years.

A captivating empirical finding relates to the correlation coefficients between the CBOE VIX and each market's REIT-Bond Yield Gap. In relation to the EMEs, all reverse REIT-Bond Yield Gaps are inversely associated with the CBOE VIX. Contrastingly, all but two of the advanced economies REIT-Bond Yield Gaps exhibit the same phenomenon. This paper furthermore found that the REIT-Bond Yield Gap's correlation coefficients between themselves and their respective CDSs are negative for all of the EMEs, and additionally for the U.K. and the U.S. All other markets associations are positive. These findings also conform with a-prior expectations in that the EMEs reverse REIT-Bond Yield Gaps are more elastic with gyrations in their corresponding CDSs, relative to the advanced economies. The EMEs CDSs experience the greatest degree of standard deviation – with Brazil far outweighing all other markets, including its own peer EME economies, documented as 82.44, while Turkey has far less than half of Brazil's standard deviation, found to be 30.75, and its two remaining EME peers following closely suit. A similar pattern emerges when examining each market's mean value CDS of the sample period.

Salient composite REIT sector metrics also emerge. This paper has found that on aggregate, five out of the 11 markets REIT sectors distribute greater dividends relative to what regulation requires. Specifically, these five markets calculated payout ratio metrics and their corresponding minimum requirements are as follows: Brazil - 150.08%, relative to the 75% stipulated minimum; Turkey – 20.37% relative to their zero minimum payout policy; S.A., albeit marginally - 75.69% vs. 75%; France – 96.91% vs. 95%, and the U.S. REIT sector - a whopping 247.55% vs. the 90% requirement. Other interesting findings are in relation to the Netherlands, whose REITs minimum payout ratio requirement was not only far off of its target, it was also negative. In addition to reflecting losses over a given period, it is likely also due to REIT managers' executions of dividend smoothing.

This paper refutes assertions regarding that superior Fed Model findings should be generated for countries experiencing stagflation, given that no superior results were found in relation to the EMEs, who are each currently experiencing stagflation to some degree. The value derived from what was learned in this paper may be summed up as follows: In retrospection, the Markov results suggest that by positioning an investment strategy accordingly, investors, portfolio managers, hedging and risk management techniques, could align themselves so as to exploit any potential arbitrage profits that exist in the EME and advanced market REIT-Bond Yield Gaps – albeit in a static manner. Their objectives could also be streamlined using the findings and recommended tactical trading strategies that have been aptly illuminated. The results could also be used in conjunction with the REIT-Bond Yield Gaps to infer whether a particular market is over or undervalued. Additionally, portfolio rebalancing techniques, targeted, tactical and strategic asset allocation strategies could be formulated by being aware of the chain of economic events that are likely to occur, following the present condition of a particular REIT-Bond Yield Gap. This could be performed by running regressions of the Markov regime switching models with the REIT-Bond Yield Gaps as dependent variable threshold parameters, following which, subject to the models estimated transition probability parameters exceeding a predetermined subjective minimum, such as 0.5, as suggested by Brooks and Persand (2001) and Krystalogianni and Tsolacos (2004), then it is highly probable that profitability, and excess returns could be achieved. The REIT-Bond Yield Gap is however considered a highly contentious model, yet it encompasses the potential for significant reward. These could then be back-tested using Sortino ratios, tracking errors, or even using the Black-Litterman model. Lastly, variations in REIT-Bond Yield Gaps could even be used to establish confidence factors, that accordingly signal when reversals and/or shifts in regime are likely to occur (Brooks & Persand, 2001).

Both South Africa and Brazil – at the time this paper was written, find themselves between a rock and a hard place – strangely enough for very similar reasons. For example, they are both presently being marred by political upheaval; both countries presidents find themselves in situations whereby they could be impeached due to corruption and related charges alleged against them; their economies are ailing and their future prospects are rather bleak. Prominet credit rating agencies have already taken the steps and have accordingly downgraded Brazilian debt to junk status, further exacerbating their economic, political and other woes. South Africa appears to be on a similar trajectory, also rocked by political instability, a fledgling economic climate, and all of this against the backdrop of major electricity and power supply constraints, amongst others. At this rate, it is only a matter of time that South Africa's debt will be downgraded, in a similar fashion to Brazil, to sub-investment grade (or junk status). The latter would also most certainly amplify its already tumultuous situation. These are putting the South African Rand and Brazilian Real on the ropes. Amongst the other emerging markets, Turkey has recently been experiencing a wave of terrorism, it is also saddled with its own set of economic and political woes, including a state capture of the main news media outlets, and is thus predicted to face a similar economic path to that of its peer emerging economies like South Africa and Brazil. Contrastingly, the advanced market counterparts, most notably those belonging to the European Union, are facing their own set of domestic woes. While Britain is debating whether or not to exit the European Union - the so-called Brexit, France and the Netherlands have been saddled with a human migration crisis, regarding the huge influx of foreign refugees from Syria, Afghanistan, and other other Middle Eastern countries who are being faced with prolonged civil wars, are plagued by terrorism, amongst other woes. This, in conjunction with the European Central Bank's fruitless efforts to bolster inflation in the Eurozone, is not expected to play down well. More precisely, it may be expected, from my vantage point, that should these multiple phenomena not normalise within the near future, which I believe will remain intact for a protracted period of time, then volatility in equity markets, further reinforced by a global oil supply glut, a global reduction in demand – notably from China, filtering through to lacklustre growth in the world's powerhouse economy – the United States, then there is a high probability that bond markets are likely to experience a miniature rally, thereby boosting their associated yields. A flight-to-quality will therefore reduce the demand for equity in the advanced economies, bolstering their yields. These assertions have the implications of further exacerbating the EMEs reverse REIT-Bond Yield Gaps, and conventional REIT-Bond Yield Gaps in the advanced economy context. Following the tenets derived in this paper, investors, portfolio managers and the like could position themselves accordingly to reap the arbitrage profits that await them. This could be achieved by simply being aware of the chain of economic and financial events that are likely to unfold over the course of 2016 and over the medium-term. As for the advanced economies, should oil prices continue to plunge due to the current global glut, with no concrete consensus solution attained as yet, the flight-to-quality phenomenon is likely to kick into full gear. Thus, positioning an international portfolio in accordance with these findings, and taking cognisance of the principles derived in this paper, furthermore in conjunction with anticipated exchange rate movements across the globe, a host of profitable opportunities exist and are waiting to be exploited!

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Appendix A1. Summary Statistics

Table A1.1

Inflation

Time-Frame	EMEs				Advanced						
	Brazil	Mexico	Turkey	S.A.	Australia	France	Japan	Netherlands	Singapore	U.K.	U.S.
	2013/06/28 - 2015/11/30				2009/11/31 - 2015/11/30						
Statistic	Inflation										
Mean	7.081379	3.514828	8.169000	5.448276	2.406723	1.186111	0.420833	1.716667	2.588889	2.511111	1.731944
Median	6.520000	3.500000	8.020000	5.500000	2.390438	1.150000	0.100000	1.600000	2.650000	2.700000	1.700000
Maximum	9.930000	4.480000	9.660000	6.600000	3.549061	2.500000	3.700000	3.100000	5.700000	5.200000	3.900000
Minimum	5.590000	2.480000	6.810000	3.900000	1.209677	-0.400000	-1.900000	0.000000	-0.800000	-0.100000	-0.200000
Standard deviation	1.337564	0.593769	0.793275	0.798043	0.684783	0.780088	1.356044	0.834300	2.132152	1.396530	1.009089
Skewness	0.914343	-0.164555	0.356082	-0.323802	-0.151610	-0.108383	0.919281	-0.014345	-0.126243	-0.341162	0.105573
Kurtosis	2.451447	1.840936	2.039151	1.925834	1.827216	1.845013	3.037736	1.708022	1.648462	2.435300	2.733765
Jarque-Bera Nomrality Test	4.404374	1.754191	1.788009	1.900977	4.463233	4.142950	10.14520	5.010093	5.671218	2.353354	0.346390
Probability	(0.110561)	(0.415989)	(0.409015)	(0.386552)	(0.107355)	(0.126000)	(0.006266)	(0.081672)	(0.058683)	(0.308302)	(0.840974)
Ljung-Box Q*-Statistic	81.761	53.220	72.187	66.092	211.17	505.30	341.29	368.86	400.35	433.54	223.29
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Augmented Dickey Fuller (ADF) Test statistic [levels]	**-2.163567**	**-2.424934**	**-3.030413**	**-2.254033**	**-3.085585**	**-3.729938**	**-1.266777**	**-1.641591**	**-3.321114**	**-3.366823**	**-2.145614**
1%	-4.323979	-4.339330	-4.416345	-4.339330	-4.096614	-4.092547	-4.092547	-4.092547	-4.092547	-4.092547	-4.094550
5%	-3.580623	-3.587527	-3.622033	-3.587527	-3.476275	-3.474363	-3.474363	-3.474363	-3.474363	-3.474363	-3.475305
10%	-3.225334	-3.229230	-3.248592	-3.229230	-3.165610	-3.164499	-3.164499	-3.164499	-3.164499	-3.164499	-3.165046
Augmented Dickey Fuller (ADF) Test [differenced series]	**-4.552443**	**-6.184150**	**-4.511171**	**-5.484533**	**-8.321274**	**-8.650800**	**-6.686273**	**-8.078201**	**-8.333967**	**-8.592275**	**-6.753559**
1%	-4.339330	-4.356068	-4.323979	-4.356068	-4.092547	-4.094550	-4.094550	-4.094550	-4.094550	-4.094550	-4.094550
5%	-3.587527	-3.595026	-3.580623	-3.595026	-3.474363	-3.475305	-3.475305	-3.475305	-3.475305	-3.475305	-3.475305
10%	-3.229230	-3.233456	-3.225334	-3.233456	-3.164499	-3.165046	-3.165046	-3.165046	-3.165046	-3.165046	-3.165046

Note.
Mexico and S.A.: 2nd difference of inflation, I(2) processes. Max lag length: [EMEs: 7], [Advanced: 11] automatic, determined by Schwartz Information Criterion (SIC). All ADF tests include both intercept and trend in equation. Below the ADF Test statistics for both levels and differenced series are their respective critical values. Ljung-Box Q-Statistic at lag 12 (monthly, levels series).

Table A1.2. Credit Default Swaps (CDS)

Time-Frame		EMEs				Advanced						
		Brazil	Mexico	Turkey	S.A.	Australia	France	Japan	Netherlands	Singapore	U.K.	U.S.
		2013/06/28 - 2015/11/30				2009/11/31 - 2015/11/30						
Statistic		Credit Default Swap (CDS)										
Mean		218.2062	107.1577	211.6693	204.8101	48.83185	83.26990	71.02861	49.49251		49.13092	33.22368
Median		189.6220	108.6500	207.9045	204.7300	44.49000	70.94600	68.64600	44.16500		47.28250	35.05000
Maximum		441.6180	154.3300	290.5200	269.3190	84.86500	215.4980	142.1640	122.9710		95.87600	54.42700
Minimum		139.5910	69.14100	173.1280	173.7390	31.78900	25.18400	34.98900	16.71000		15.69800	15.64800
Standard deviation		82.43712	24.02181	30.74926	23.51837	15.00120	52.77119	25.70269	29.05608		24.75807	12.15027
Skewness		1.562612	0.224620	0.778255	0.932393	1.018609	1.273629	0.687482	1.221174		0.158961	-0.134223
Kurtosis		4.527280	2.105384	2.817732	3.747802	3.041530	3.468056	3.032772	3.558878		1.638787	1.694105
Jarque-Bera Nomrality Test		15.12452	1.210938	3.069934	4.877600	12.62896	20.40228	5.674804	18.83222		5.861927	5.332271
Probability		(0.000520)	(0.545818)	(0.215463)	(0.087265)	(0.001810)	(0.000037)	(0.058578)	(0.000081)		(0.053346)	(0.069520)
Ljung-Box Q*-Statistic		54.612	100.98	54.258	48.241	322.73	333.50	372.39	296.17	-	464.13	494.64
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)
Augmented Dickey Fuller (ADF) Test statistic [levels]		**-1.590057**	**-1.465878**	**-2.396543**	**-1.308118**	**-2.542159**	**-2.462781**	**-2.065079**	**-2.620905**		**-2.986550**	**-3.474121**
	1%	-4.323979	-4.309824	-4.323979	-4.309824	-4.092547	-4.092547	-4.090602	-4.092547		-4.092547	-4.092547
	5%	-3.580623	-3.574244	-3.580623	-3.574244	-3.474363	-3.474363	-3.473447	-3.474363		-3.474363	-3.474363
	10%	-3.225334	-3.221728	-3.225334	-3.221728	-3.164499	-3.164499	-3.163967	-3.164499		-3.164499	-3.164499
Augmented Dickey Fuller (ADF) Test [differenced series]		**-4.474845**	**-5.557157**	**-5.614284**	**-4.386666**	**-6.244168**	**-5.017655**	**-6.876452**	**-4.763173**		**-5.665714**	**-7.933610**
	1%	-4.394309	-4.323979	-4.394309	-4.374307	-4.094550	-4.092547	-4.092547	-4.094550		-4.094550	-4.096614
	5%	**-3.612199**	-3.580623	-3.612199	-3.603202	-3.475305	-3.474363	-3.474363	-3.475305		-3.475305	-3.476275
	10%	-3.243079	-3.225334	-3.243079	-3.238054	-3.165046	-3.164499	-3.164499	-3.165046		-3.165046	-3.165610

Note.
Mexico and S.A.: 2nd difference of inflation, I(2) processes. Max lag length: [EMEs: 7], [Advanced: 11] automatic, determined by Schwartz Information Criterion (SIC). All ADF tests include both intercept and trend in equation. Below the ADF Test statistics for both levels and differenced series are their respective critical values. Ljung-Box Q-Statistic at lag 12 (monthly, levels series).

Table A1.3.
Chicago Board Options Exchange (CBOE) Volatility Index (VIX)

	EMEs	Advanced
Time-Frame	Brazil Mexico Turkey S.A.	Australia France Japan Netherlands Singapore U.K. U.S.
	2013/06/28 - 2015/11/30	2009/11/31 - 2015/11/30
Statistic	**Chicago Board Options Exchange (CBOE) Volatility Index (VIX)**	
Mean	15.15367	18.36726
Median	14.34500	16.91000
Maximum	24.38000	36.53000
Minimum	11.54000	11.54000
Standard deviation	2.577227	5.555530
Skewness	1.711438	1.538952
Kurtosis	6.704895	5.009676
Jarque-Bera Nomrality Test	31.80291	41.09987
Probability	(0.000000)	(0.000000)
Ljung-Box Q*-Statistic	14.524	122.36
	(0.268)	(0.000)
Augmented Dickey Fuller (ADF) Test statistic [levels]	**-3.837709**	**-3.443623**
1%	-4.309824	-4.090602
5%	-3.574244	-3.473447
10%	-3.221728	-3.163967
Augmented Dickey Fuller (ADF) Test [differenced series]	**-6.265645**	**-8.403043**
1%	-4.323979	-4.092547
5%	-3.580623	-3.474363
10%	-3.225334	-3.164499

Note.
Mexico and S.A.: 2nd difference of inflation, I(2) processes. Max lag length: [EMEs: 7], [Advanced: 11] automatic, determined by Schwartz Information Criterion (SIC). All ADF tests include both intercept and trend in equation. Below the ADF Test statistics for both levels and differenced series are their respective critical values. Ljung-Box Q-Statistic at lag 12 (monthly, levels series).

A2. Cross Correlation Analysis of Salient Metrics

Table A2.1. EMEs

Time-Frame: 2013/06/28 - 2015/11/30	Brazil											
Correlation	TDY	GBY	TDY/GBY	Inflation	E[inflation]	CBOE VIX	E[exch. rate depr]	CDS	CDS spread	Interest Rate	Interbank rate	TDY-GBY
TDY	1.000000											
GBY	0.023771	1.000000										
TDY/GBY	0.986054	-0.137856	1.000000									
Inflation	0.360085	0.565288	0.252591	1.000000								
Expected inflation	-0.583811	0.621513	-0.676702	-0.103378	1.000000							
CBOE VIX	0.104219	0.465557	0.021652	0.439909	0.234616	1.000000						
E[exch. rate depr]	0.206009	0.969618	0.043907	0.695330	0.469235	0.538841	1.000000					
CDS	0.109942	0.830030	-0.037876	0.838637	0.398742	0.618137	0.893922	1.000000				
CDS spread	0.157745	0.824563	0.010619	0.862656	0.349627	0.611191	0.896887	0.997576	1.000000			
Interest Rate	0.539668	0.658366	0.423779	0.876427	-0.148047	0.354507	0.768861	0.711757	0.745843	1.000000		
Interbank rate	0.324686	0.764106	0.184846	0.935788	0.152495	0.565202	0.865468	0.948235	0.961454	0.872672	1.000000	
TDY-GBY	0.871888	-0.468841	0.938738	0.041244	-0.820260	-0.135969	-0.292946	-0.309447	-0.264534	0.154318	-0.087422	1.000000

Time-Frame: 2013/06/28 - 2015/11/30	Mexico										
Correlation	TDY	GBY	TDY/GBY	Inflation	E[inflation]	CBOE VIX	E[exch. rate depr]	CDS	CDS spread	Interest Rate	TDY-GBY
TDY	1.000000										
GBY	0.051425	1.000000									
TDY/GBY	0.970345	-0.189091	1.000000								
Inflation	-0.199431	0.150795	-0.233141	1.000000							
Expected inflation	-0.489748	0.623307	-0.627846	0.532968	1.000000						
CBOE VIX	-0.128508	-0.055617	-0.115572	-0.384729	-0.292107	1.000000					
E[exch. rate depr]	0.409025	0.209120	0.349148	-0.544881	-0.515837	0.536493	1.000000				
CDS	-0.229636	0.019402	-0.235991	-0.762164	-0.260448	0.584078	0.612036	1.000000			
CDS spread	-0.108776	-0.083479	-0.091441	-0.820497	-0.438209	0.591313	0.664203	0.974102	1.000000		
Interest Rate	-0.708036	0.343914	-0.781475	0.254654	0.822497	-0.156962	-0.475706	0.055160	-0.115348	1.000000	
TDY-GBY	0.938257	-0.297232	0.993219	-0.242905	-0.684146	-0.103597	0.318618	-0.226269	-0.075081	-0.796063	1.000000

Time-Frame: 2013/06/28 - 2015/11/30	Turkey											
Correlation	TDY	GBY	TDY/GBY	Inflation	E[inflation]	CBOE VIX	E[exch. rate depr]	CDS	CDS spread	Interest Rate	Interbank rate	TDY-GBY
TDY	1.000000											
GBY	-0.142317	1.000000										
TDY/GBY	0.843059	-0.646034	1.000000									
Inflation	0.399817	-0.000811	0.293912	1.000000								
Expected inflation	-0.142317	1.000000	-0.646034	-0.000811	1.000000							
CBOE VIX	-0.087241	0.098665	-0.088786	-0.362723	0.098665	1.000000						
E[exch. rate depr]	-0.103535	0.938007	-0.573433	-0.099072	0.938007	0.289834	1.000000					
CDS	-0.301097	0.743057	-0.612239	-0.475334	0.743057	0.514916	0.862952	1.000000				
CDS spread	-0.211215	0.712561	-0.523437	-0.426149	0.712561	0.525051	0.871186	0.984358	1.000000			
Interest Rate	0.459451	0.216654	0.275747	0.377746	0.216654	-0.028158	0.320308	0.060482	0.162456	1.000000		
Interbank rate	0.206426	0.385475	-0.005592	-0.101267	0.385475	0.292387	0.604859	0.515550	0.620057	0.777893	1.000000	
TDY-GBY	0.594308	-0.880631	0.928458	0.192041	-0.880631	-0.121926	-0.811698	-0.747867	-0.680065	0.043895	-0.214391	1.000000

Time-Frame: 2013/06/28 - 2015/11/30	S.A.										
Correlation	TDY	GBY	TDY/GBY	Inflation	CBOE VIX	E[exch. rate depr]	CDS	CDS spread	Interest Rate	Interbank rate	TDY-GBY
TDY	1.000000										
GBY	0.354880	1.000000									
TDY/GBY	0.864292	-0.162102	1.000000								
Inflation	0.551406	0.309403	0.424086	1.000000							
Expected inflation	-0.360748	-0.015096	-0.366510	-0.471113	1.000000						
CBOE VIX	-0.364856	0.631212	-0.729509	-0.332210	0.353657	1.000000					
E[exch. rate depr]	-0.008986	0.225580	-0.122005	-0.412642	0.633347	0.363345	1.000000				
CDS	-0.152238	0.274636	-0.301405	-0.458800	0.644889	0.521643	0.972500	1.000000			
CDS spread	-0.642409	0.306515	-0.850117	-0.467868	0.343010	0.871459	0.125522	0.321015	1.000000		
Interest Rate	-0.648639	0.276006	-0.841167	-0.443561	0.289774	0.839734	0.039986	0.242204	0.993947	1.000000	
TDY-GBY	0.774192	-0.317008	0.986528	0.349903	-0.355741	-0.797469	-0.161837	-0.340372	-0.859209	-0.844873	1.000000

Table A2.2. Advanced Economies

Time-Frame: 2009/11/30 - 2015/11/30	Australia											
Correlation	TDY	GBY	TDY/GBY	Inflation	E[inflation]	CBOE VIX	E[exch. rate depr]	CDS	CDS spread	Interest Rate	Interbank rate	TDY-GBY
TDY	1.000000											
GBY	0.564474	1.000000										
TDY/GBY	-0.090560	-0.864356	1.000000									
Inflation	0.028398	0.641404	-0.781299	1.000000								
Expected inflation	-0.058265	0.584017	-0.730179	0.503491	1.000000							
CBOE VIX	0.469413	0.263090	-0.064856	0.342765	-0.208135	1.000000						
E[exchange rate depr]	0.436186	0.764021	-0.690800	0.573129	0.383073	0.495693	1.000000					
CDS	-0.065871	-0.368856	0.422676	-0.238984	-0.261374	0.446296	-0.028686	1.000000				
CDS spread	-0.029511	-0.479409	0.572212	-0.481157	-0.340505	0.318798	-0.172316	0.911276	1.000000			
Interest Rate	0.283989	0.672714	-0.635233	0.558361	0.456340	0.524967	0.862753	0.310411	0.127994	1.000000		
Interbank rate	0.328460	0.648595	-0.575822	0.487100	0.394824	0.541986	0.846751	0.362201	0.191221	0.992802	1.000000	
TDY-GBY	0.258738	-0.651291	0.928223	-0.724469	-0.736983	0.123657	-0.493081	0.371084	0.533879	-0.526145	-0.457041	1.000000

Time-Frame: 2009/11/30 - 2015/11/30	France											
Correlation	TDY	GBY	TDY/GBY	Inflation	E[inflation]	CBOE VIX	E[exch. rate depr]	CDS	CDS spread	Interest Rate	Interbank rate	TDY-GBY
TDY	1.000000											
GBY	0.457714	1.000000										
TDY/GBY	0.214106	-0.650088	1.000000									
Inflation	0.576659	0.798322	-0.409871	1.000000								
Expected inflation	0.577159	0.910402	-0.490565	0.815434	1.000000							
CBOE VIX	0.291600	0.444905	-0.131861	0.488176	0.296972	1.000000						
E[exchange rate depr]	0.472549	0.733704	-0.447511	0.905574	0.722609	0.449073	1.000000					
CDS	0.396827	0.426296	-0.155350	0.788731	0.430235	0.465232	0.844876	1.000000				
CDS spread	0.302115	0.276457	-0.084729	0.680951	0.286225	0.391177	0.748175	0.979586	1.000000			
Interest Rate	0.579450	0.871732	-0.397962	0.886721	0.862233	0.636728	0.847232	0.625069	0.475599	1.000000		
Interbank rate	0.684128	0.756888	-0.195433	0.767540	0.722281	0.629241	0.654379	0.539141	0.414435	0.848260	1.000000	
TDY-GBY	0.958272	0.184458	0.445693	0.380786	0.345303	0.179301	0.286474	0.301606	0.245083	0.360268	0.512907	1.000000

Time-Frame: 2009/11/30 - 2015/11/30	Japan											
Correlation	TDY	GBY	TDY/GBY	Inflation	E[inflation]	CBOE VIX	E[exch. rate depr]	CDS	CDS spread	Interest Rate	Interbank rate	TDY-GBY
TDY	1.000000											
GBY	0.776346	1.000000										
TDY/GBY	-0.275661	-0.747620	1.000000									
Inflation	-0.641834	-0.671543	0.356697	1.000000								
Expected inflation	-0.872184	-0.887077	0.447204	0.755084	1.000000							
CBOE VIX	0.731829	0.491635	-0.068654	-0.449861	-0.613777	1.000000						
E[exch. rate depr]	0.192593	-0.161812	0.185407	-0.161650	0.098372	0.182252	1.000000					
CDS	0.694096	0.594955	-0.356869	-0.505962	-0.511513	0.608850	0.531249	1.000000				
CDS spread	0.499557	0.332955	-0.127979	-0.261112	-0.241852	0.503561	0.558088	0.906039	1.000000			
Interest Rate	0.699477	0.692002	-0.351385	-0.719671	-0.819941	0.451893	-0.014374	0.354943	0.143405	1.000000		
Interbank rate	0.756976	0.879548	-0.738969	-0.634090	-0.777608	0.458607	0.161183	0.707802	0.457479	0.659440	1.000000	
TDY-GBY	0.817867	0.272264	0.261680	-0.366768	-0.521659	0.668392	0.441730	0.516468	0.458666	0.436088	0.352655	1.000000

Time-Frame: 2009/11/30 - 2015/11/30	Netherlands											
Correlation	TDY	GBY	TDY/GBY	Inflation	E[inflation]	CBOE VIX	E[exch. rate depr]	CDS	CDS spread	Interest Rate	Interbank rate	TDY-GBY
TDY	1.000000											
GBY	0.388752	1.000000										
TDY/GBY	0.169887	-0.640789	1.000000									
Inflation	0.664568	0.303621	-0.061981	1.000000								
Expected inflation	0.379313	0.999741	-0.641636	0.289080	1.000000							
CBOE VIX	0.385311	0.398902	-0.135419	0.098931	0.403396	1.000000						
E[exch. rate depr]	0.811025	0.728482	-0.295083	0.738129	0.719396	0.468494	1.000000					
CDS	0.717081	0.267930	-0.004044	0.629652	0.256647	0.406485	0.737050	1.000000				
CDS spread	0.506327	-0.045369	0.116413	0.475609	-0.055979	0.220748	0.450214	0.915034	1.000000			
Interest Rate	0.717673	0.810373	-0.303263	0.571771	0.805621	0.636728	0.920407	0.610489	0.278845	1.000000		
Interbank rate	0.389569	0.667047	-0.343192	0.369880	0.663584	0.646421	0.706561	0.530636	0.259875	0.830504	1.000000	
TDY-GBY	0.911244	-0.025223	0.470784	0.585346	-0.035349	0.239752	0.554331	0.658280	0.569660	0.416433	0.124503	1.000000

Time-Frame: 2009/11/30 - 2015/11/30	Singapore						
Correlation	TDY	GBY	TDY/GBY	Inflation	CBOE VIX	E[exchange rate depreciation]	TDY-GBY
TDY	1.000000						
GBY	0.061597	1.000000					
TDY/GBY	0.449285	-0.850169	1.000000				
Inflation	-0.238065	-0.528378	0.399607	1.000000			
CBOE VIX	0.186800	-0.110929	0.226522	0.366788	1.000000		
E[exchange rate depr]	0.640921	-0.054871	0.314706	-0.496495	-0.297635	1.000000	
TDY-GBY	0.737770	-0.628326	0.925187	0.171806	0.220623	0.536664	1.000000

Time-Frame: 2009/11/30 - 2015/11/30	U.K.											
Correlation	TDY	GBY	TDY/GBY	Inflation	E[inflation]	CBOE VIX	E[exch. rate depr]	CDS	CDS spread	Interest Rate	Interbank rate	TDY-GBY
TDY	1.000000											
GBY	0.110116	1.000000										
TDY/GBY	0.977081	-0.096732	1.000000									
Inflation	0.089375	0.503242	0.007968	1.000000								
Expected inflation	0.167661	0.504035	0.054038	0.059740	1.000000							
CBOE VIX	-0.017168	0.246559	-0.061123	0.507237	-0.320450	1.000000						
E[exch. rate depr]	0.094492	0.659703	-0.027119	0.813451	0.041493	0.535958	1.000000					
CDS	0.026059	0.456958	-0.040426	0.833588	-0.075419	0.689601	0.748817	1.000000				
CDS spread	0.049235	0.458894	-0.026561	0.651636	-0.019688	0.674131	0.611637	0.920021	1.000000			
Interest Rate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Interbank rate	-0.043754	0.074677	-0.040108	0.643898	-0.382779	0.564382	0.439174	0.735477	0.662560	NA	1.000000	
TDY-GBY	0.991313	-0.021565	0.995631	0.023308	0.101949	-0.049896	0.007751	-0.034257	-0.011200	NA	-0.053894	1.000000

Time-Frame: 2009/11/30 - 2015/11/30	U.S.											
Correlation	TDY	GBY	TDY/GBY	Inflation	E[inflation]	CBOE VIX	E[exch. rate depr]	CDS	CDS spread	Interest Rate	Interbank rate	TDY-GBY
TDY	1.000000											
GBY	0.156480	1.000000										
TDY/GBY	0.032694	-0.958302	1.000000									
Inflation	-0.176996	0.226028	-0.231495	1.000000								
Expected inflation	-0.311396	0.187695	-0.187623	0.566200	1.000000							
CBOE VIX	0.110992	0.105859	-0.045468	0.402835	-0.248122	1.000000						
E[exch. rate depr]	0.111927	-0.436545	0.424482	-0.635136	-0.411522	-0.535958	1.000000					
CDS	-0.360922	0.151530	-0.140597	0.660062	0.443868	0.547214	-0.747410	1.000000				
CDS spread	0.071280	-0.333323	0.286713	-0.521089	-0.080139	-0.674131	0.611637	-0.602001	1.000000			
Interest Rate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Interbank rate	-0.260376	0.216305	-0.187689	0.247787	0.041833	0.639233	-0.606472	0.650846	-0.786722	NA	1.000000	
TDY-GBY	0.230736	-0.924924	0.956657	-0.290796	-0.304762	-0.061567	0.473143	-0.288196	0.355810	NA	-0.313310	1.000000

Table A2.3.
Cross Correlation Analysis: EME vs. Advanced 10-Y Generic Nominal Government Bond Yields

Time-Frame: 2013/06/28 - 2015/11/30	EME				Advanced						
Correlation	Brazil	Mexico	Turkey	S.A.	Australia	France	Japan	Netherlands	Singapore	U.K.	U.S.
Brazil	1										
Mexico	0.37	1									
Turkey	0.56	0.76	1								
S.A.	0.52	0.54	0.82	1							
Australia	-0.34	0.55	0.34	0.15	1						
France	-0.33	0.53	0.34	0.08	0.95	1					
Japan	-0.56	0.31	0.12	-0.09	0.84	0.92	1				
Netherlands	-0.35	0.51	0.31	0.06	0.95	1,00	0.92	1			
Singapore	0.46	0.65	0.8	0.66	0.14	0.21	0.11	0.21	1		
U.K.	-0.3	0.54	0.41	0.26	0.97	0.92	0.79	0.91	0.22	1	
U.S.	-0.23	0.67	0.48	0.29	0.96	0.92	0.8	0.92	0.36	0.97	1

A3. Composite EME vs. Advanced REIT Sector Metrics and Government Bond Spread Overview

Table A3.1.

Time-Frame	EMEs					Advanced				
2013/06/28-2015/11/30	TDY	TEY	FWD DY	FWD EY	Payout Ratios	TDY	TEY	FWD DY	FWD EY	Payout Ratios
Mean	4.61	5.24	8.79	4.69	18.92	3.89	6.53	3.67	4.21	84.05
Median	4.59	6.49	7.88	4.72	17.66	3.71	6.36	3.68	4.23	79.49
Maximum	5.38	14.02	14.95	5.53	24.3	10.64	9.05	4.05	4.7	195.31
Minimum	3.57	-19.61	6.54	3.34	14.09	3.2	4.78	3.23	3.67	62.39
Standard Deviation	0.57	8.22	2.38	0.51	3.21	1.3	1.13	0.21	0.28	25.55

Graph A3.1.
Graphical plot of the composite EME vs. Advanced REIT sector metrics

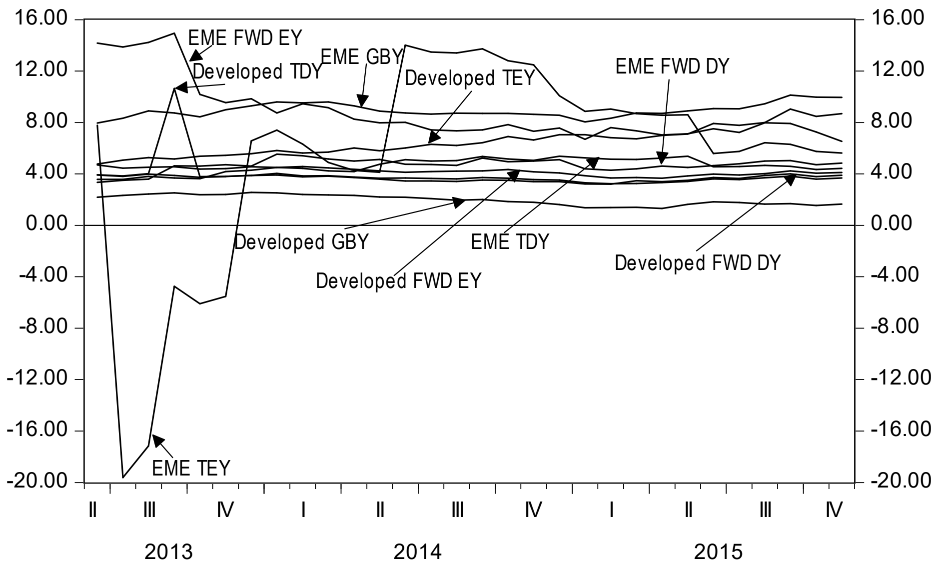
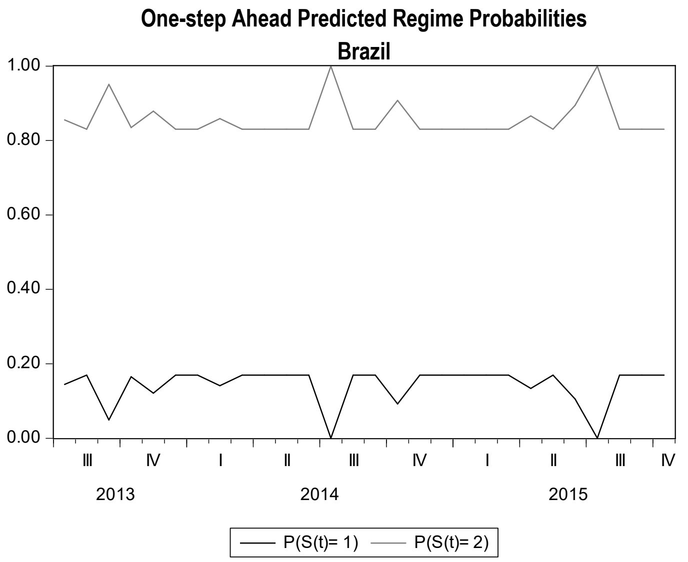


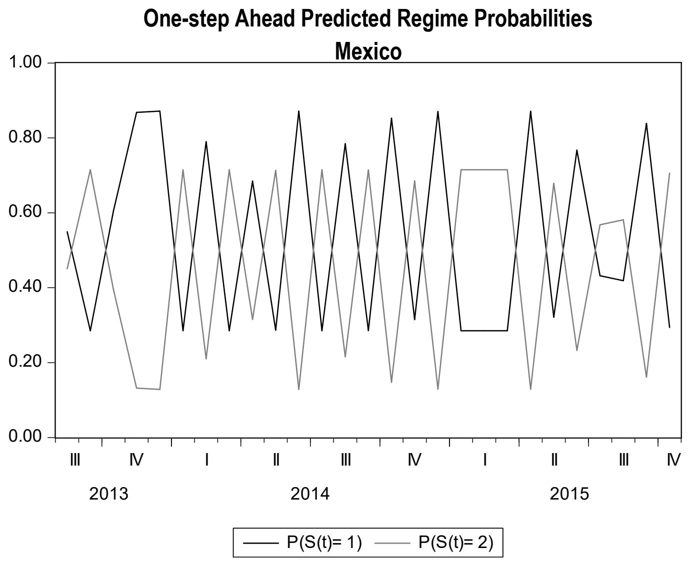
Table A3.2.
Domestic Government Bond Yield Spread Relative to U.S.

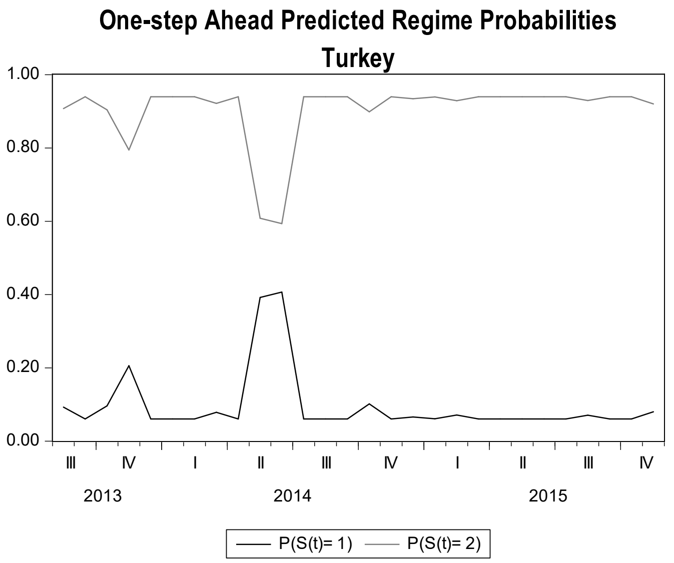
Time-Frame	EMEs				Advanced						
2013/06/28-2015/11/30	Brazil	Mexico	Turkey	S.A.	Australia	France	Japan	Netherlands	Singapore	U.K.	U.S.
Mean Spread	10.28006	3.586530	6.642413	5.668763	0.964963	-0.884637	-1.882670	-1.077337	-0.011463	-0.124137	0
Median	10.18650	3.588850	6.622000	5.731200	1.012100	-1.017850	-1.891150	-1.234350	-0.059500	-0.098150	0
Maximum	13.63850	3.938200	8.252700	6.307200	1.508800	-0.081400	-1.438400	-0.292400	0.609100	0.110700	0
Minimum	8.401300	3.168700	5.255000	4.928400	0.447400	-1.498600	-2.219100	-1.692600	-0.410400	-0.350600	0
Standard Deviation	1.276952	0.220628	0.730165	0.366534	0.346808	0.417467	0.189070	0.397657	0.279131	0.167133	0

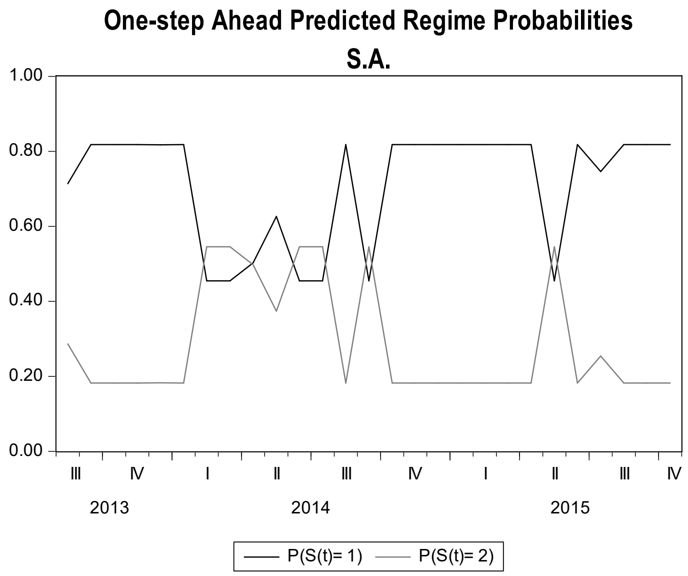
A4. EME vs. Advanced Regime Probabilities

Graph A4.1.
EME One-Step Ahead Predicted Regime Probabilities

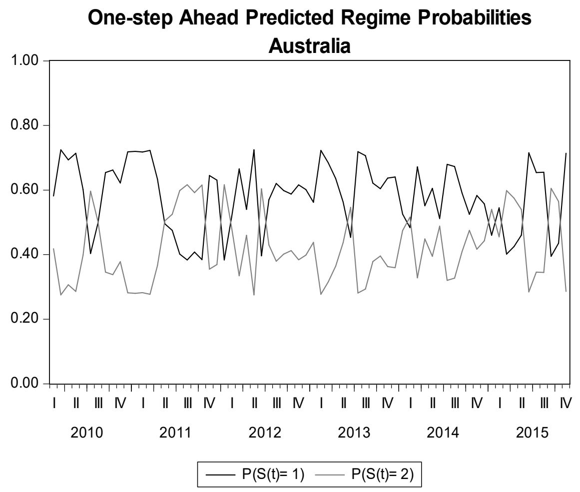


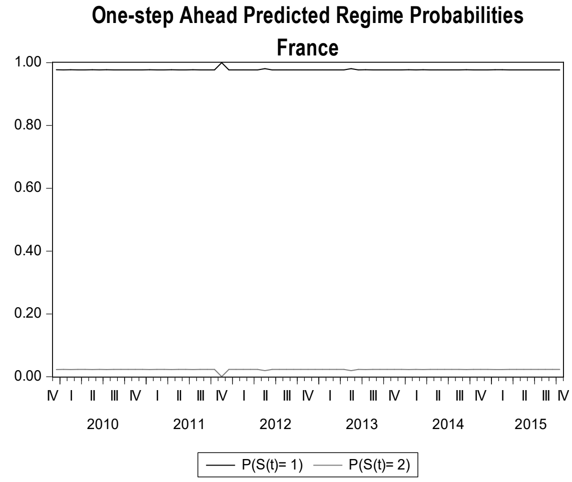


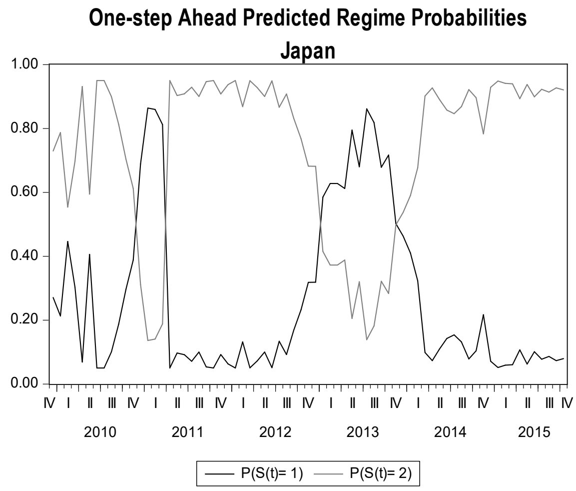


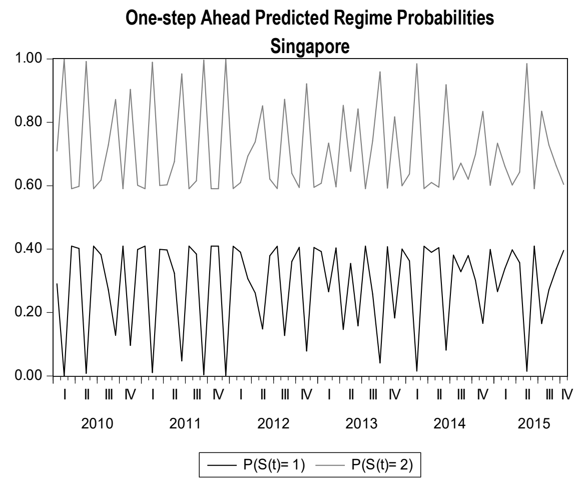


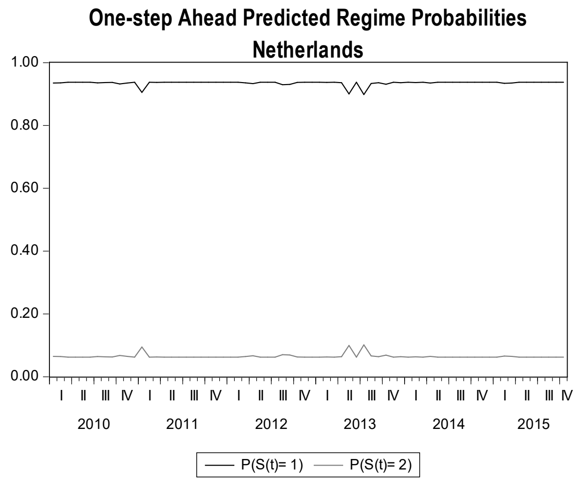
Graph A4.2.
Advanced Economy One-Step Ahead Predicted Regime Probabilities

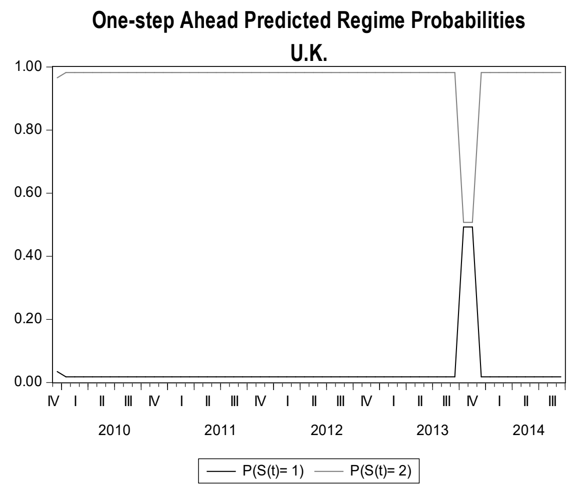


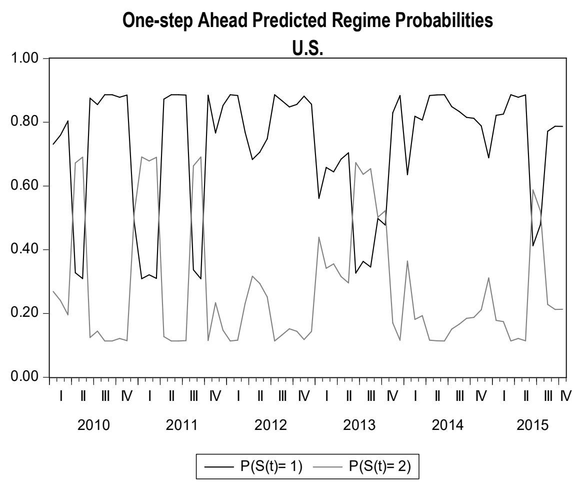




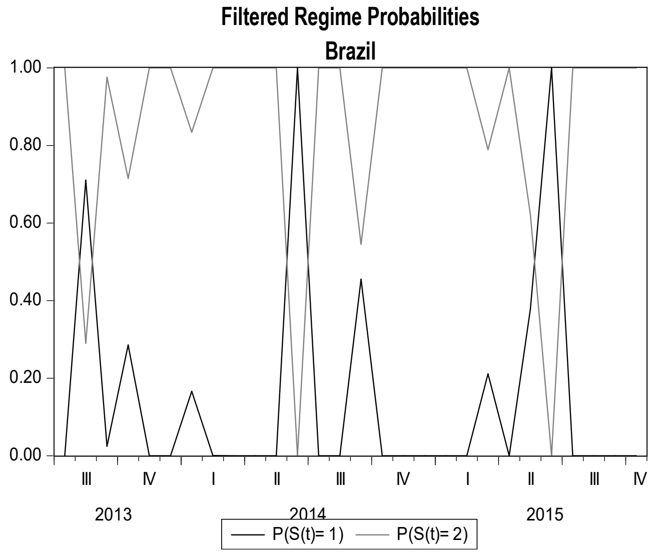


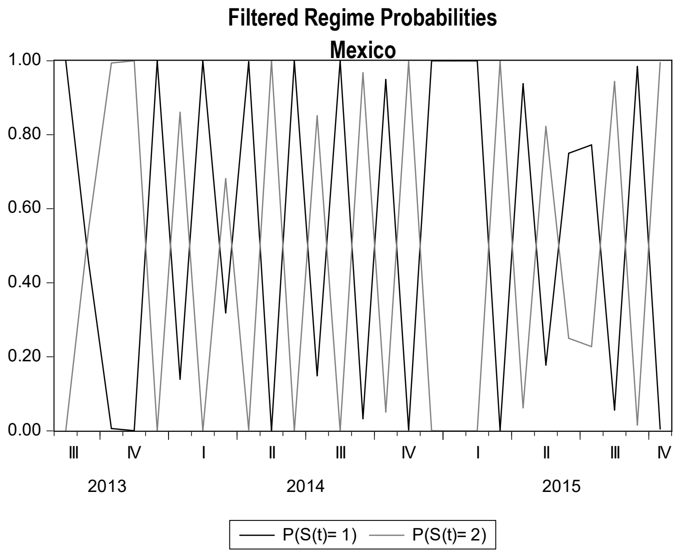


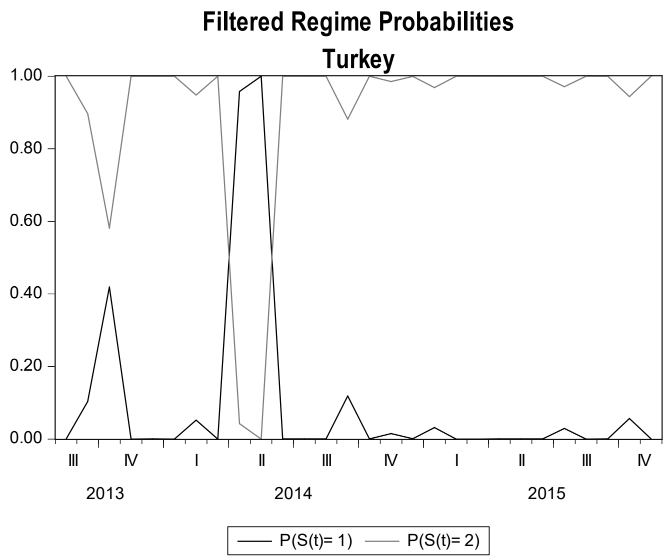


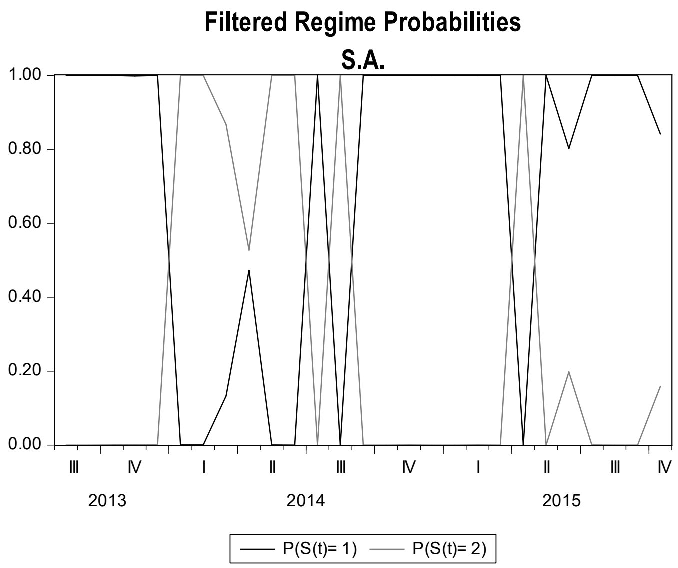


Graph A4.3.
EME Filtered Regime Probabilities





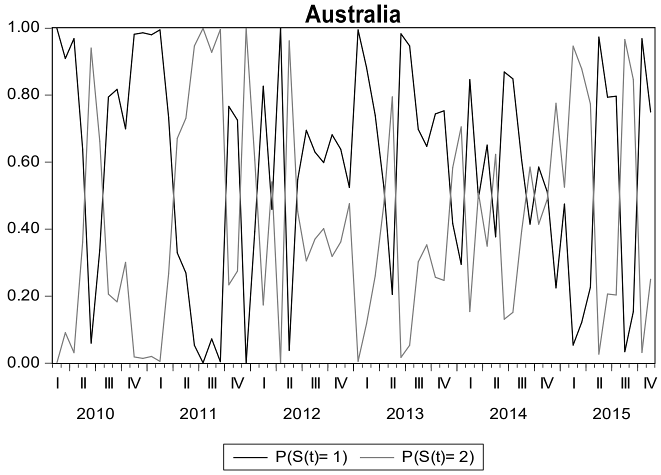




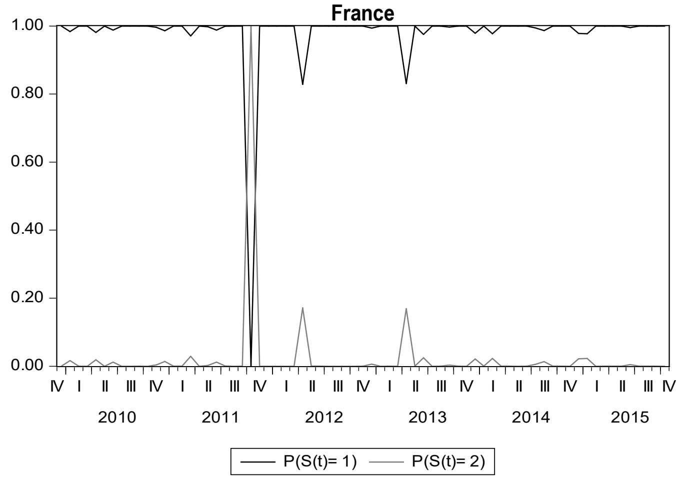
Graph A4.4.

Advanced Economy Filtered Regime Probabilities

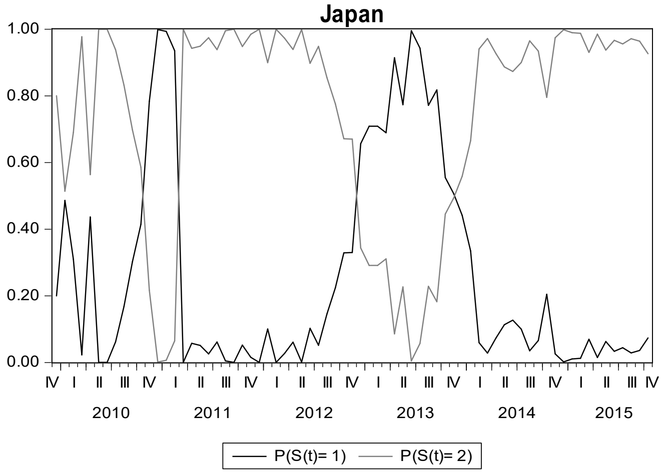
Filtered Regime Probabilities
Australia



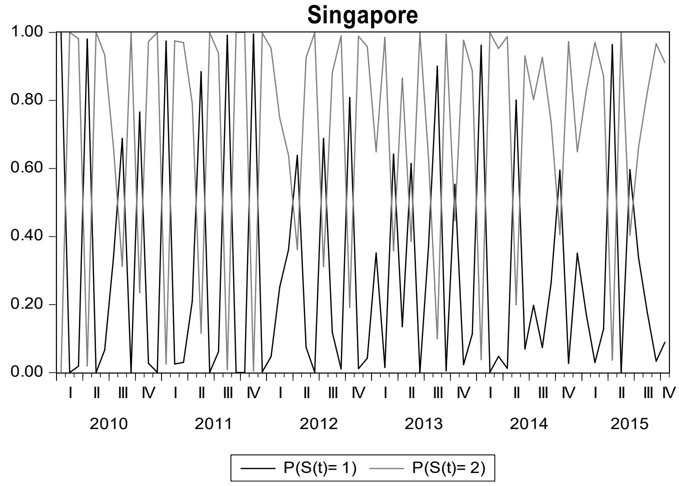
Filtered Regime Probabilities
France



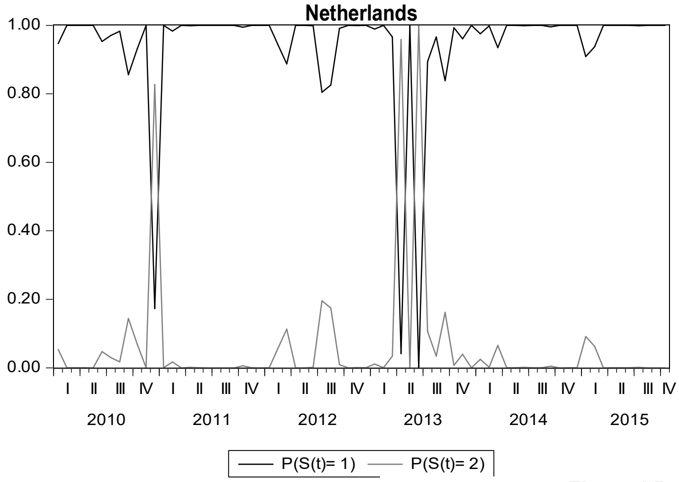
Filtered Regime Probabilities
Japan



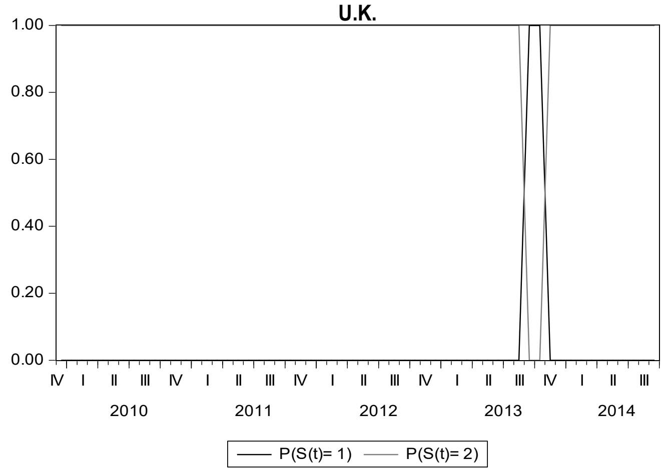
Filtered Regime Probabilities
Singapore



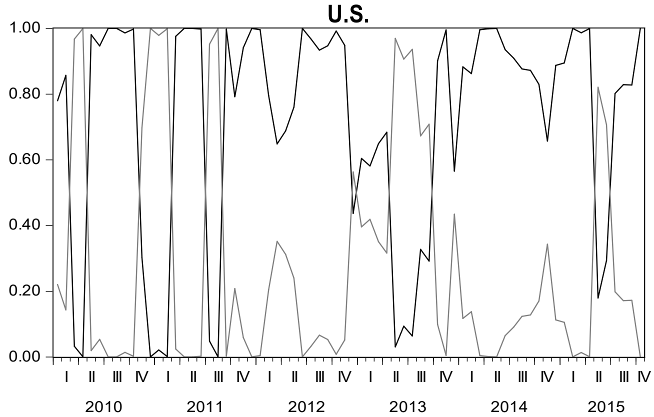
Filtered Regime Probabilities
Netherlands



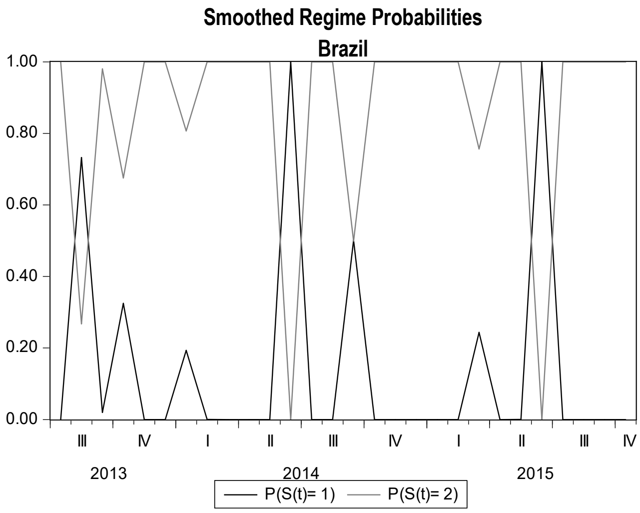
Filtered Regime Probabilities
U.K.

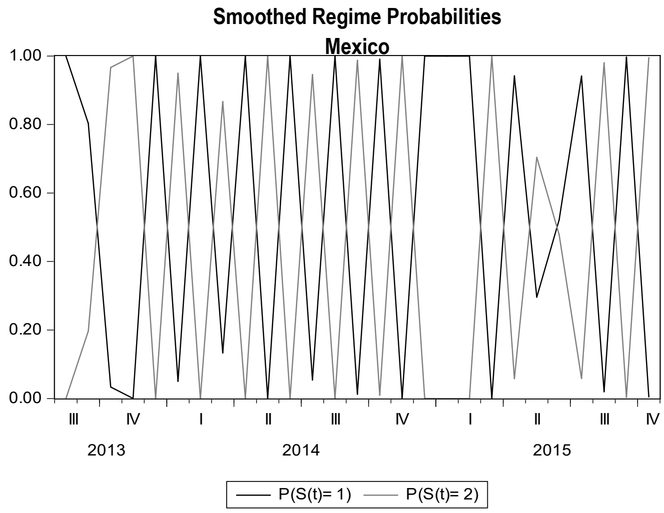


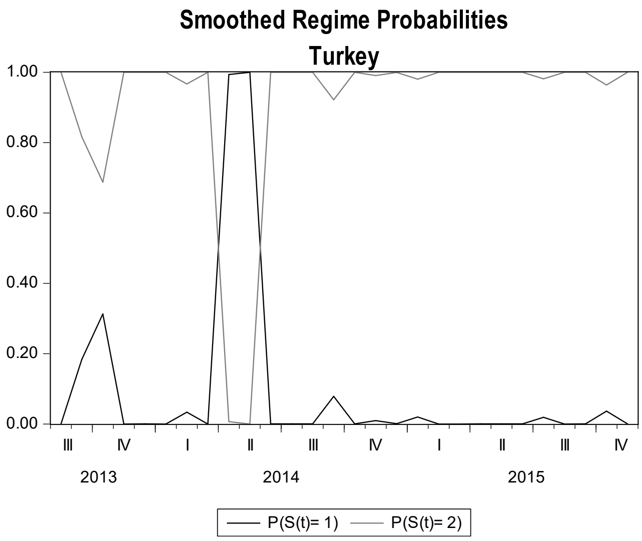
Filtered Regime Probabilities
U.S.

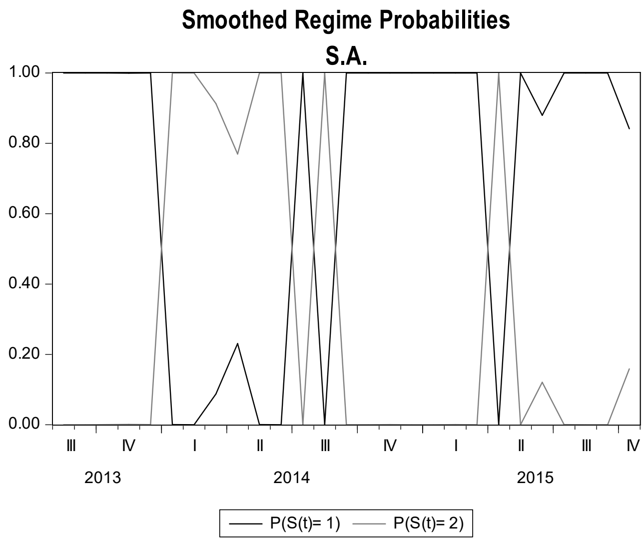


Graph A4.5.
EME Smoothed Regime Probabilities



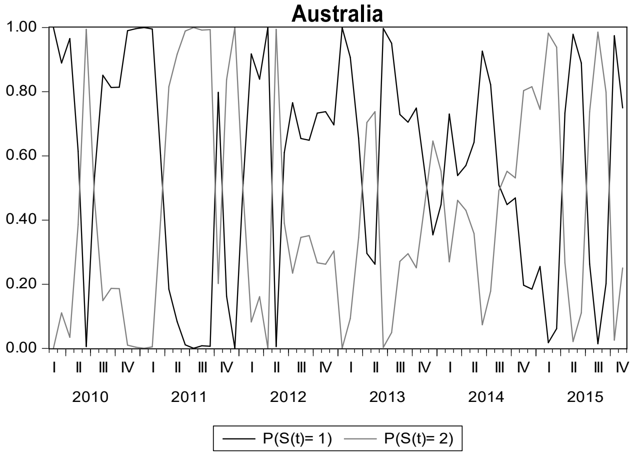




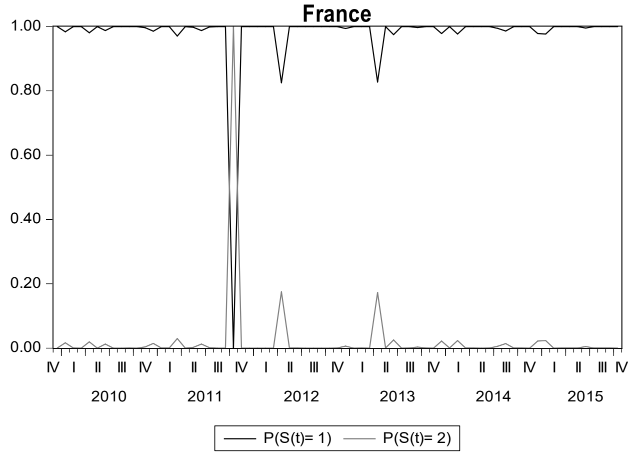


Graph A4.6.
Advanced Economy Smoothed Regime Probabilities

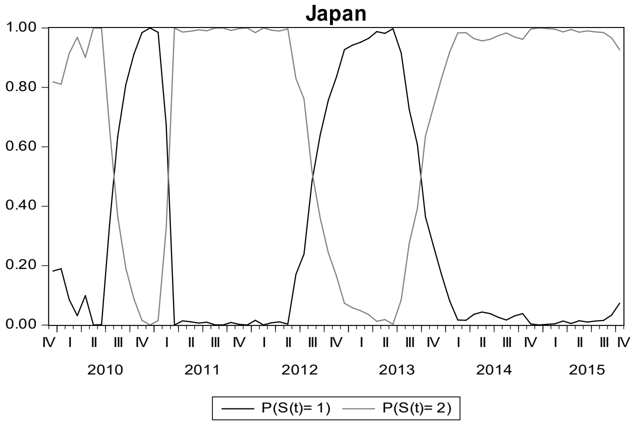
Smoothed Regime Probabilities
Australia



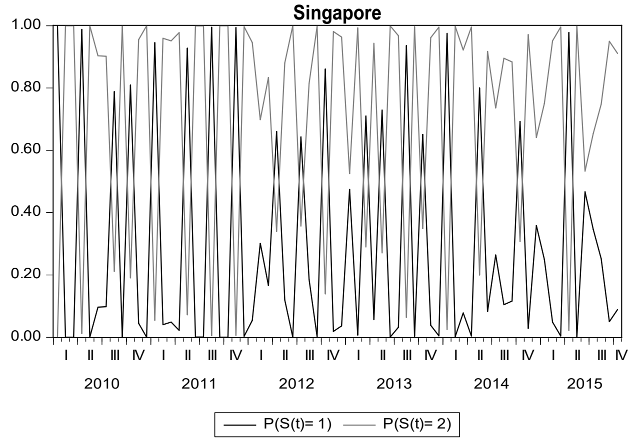
Smoothed Regime Probabilities
France



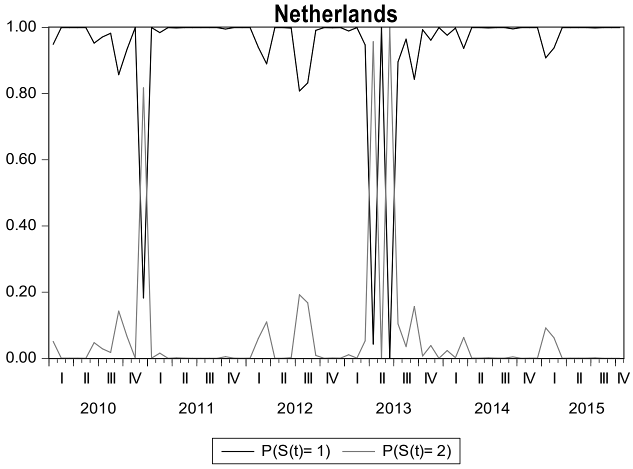
Smoothed Regime Probabilities
Japan



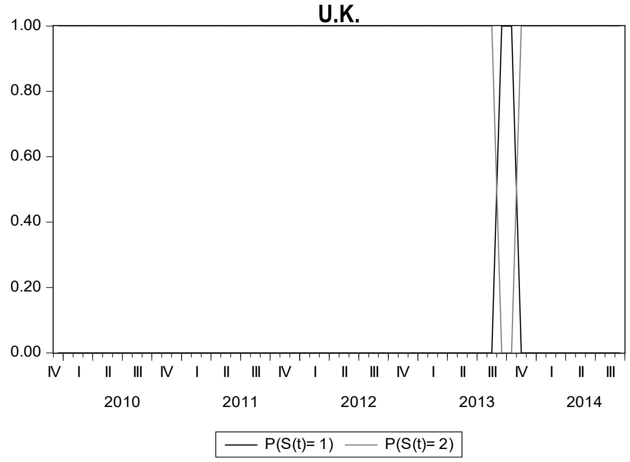
Smoothed Regime Probabilities
Singapore



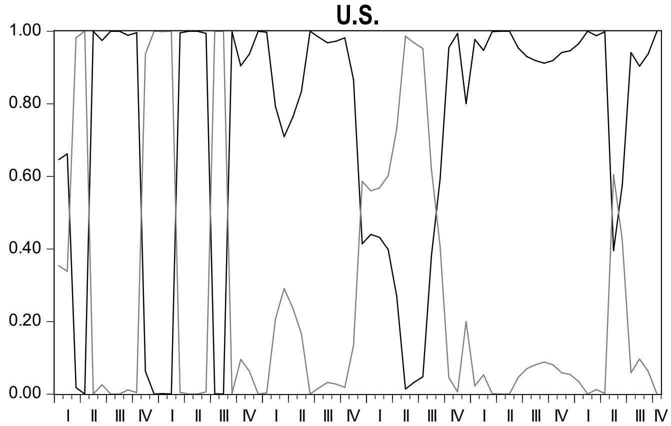
Smoothed Regime Probabilities
Netherlands



Smoothed Regime Probabilities
U.K.

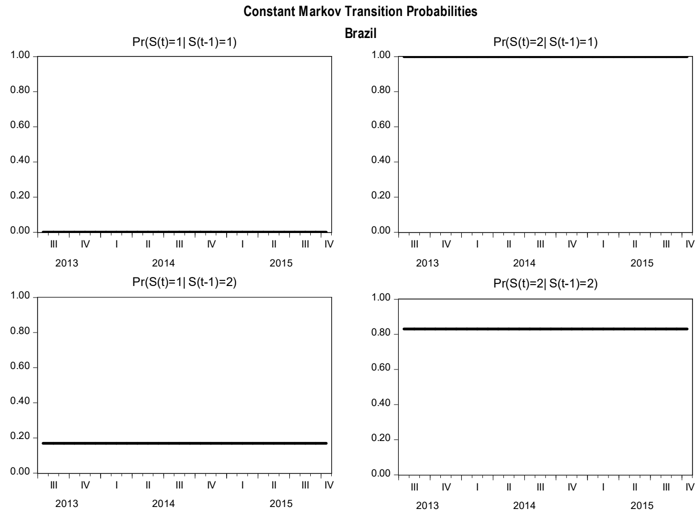


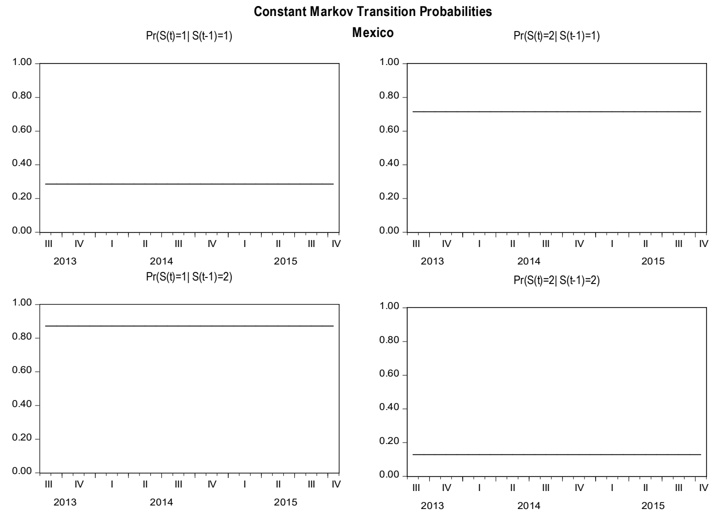
Smoothed Regime Probabilities
U.S.

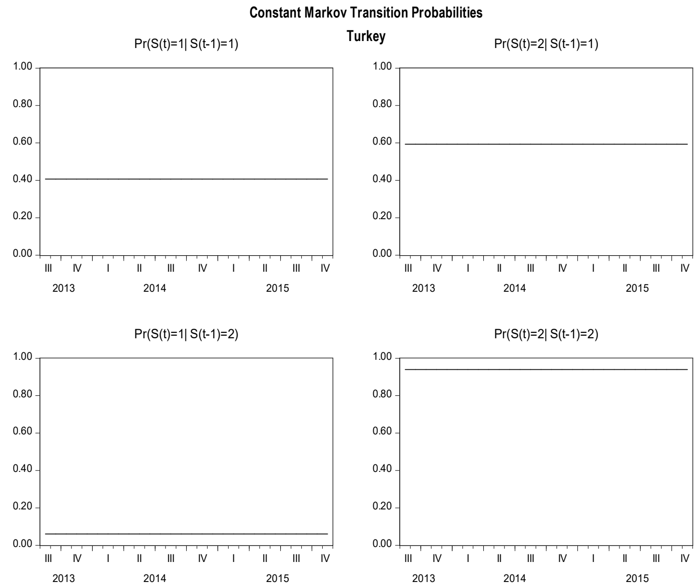


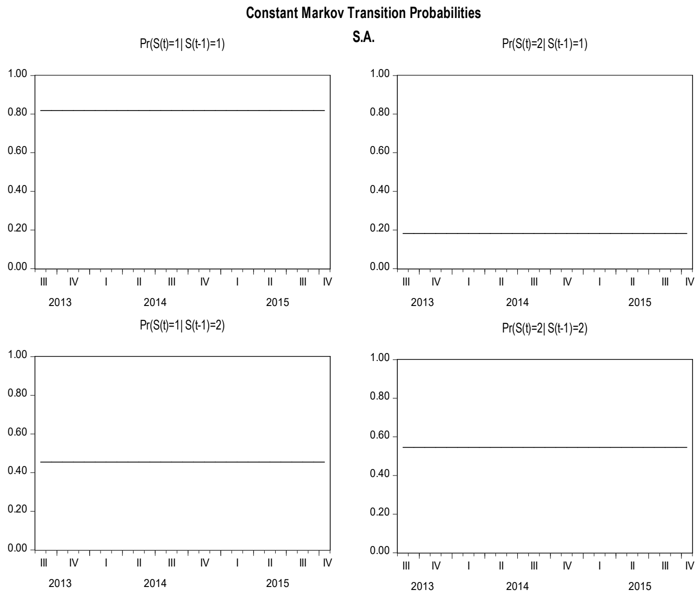
A5. EME vs. Advanced Constant Markov Transition Probabilities and Expected Durations

Graph A5.1.
EME Constant Markov Transition Probabilities







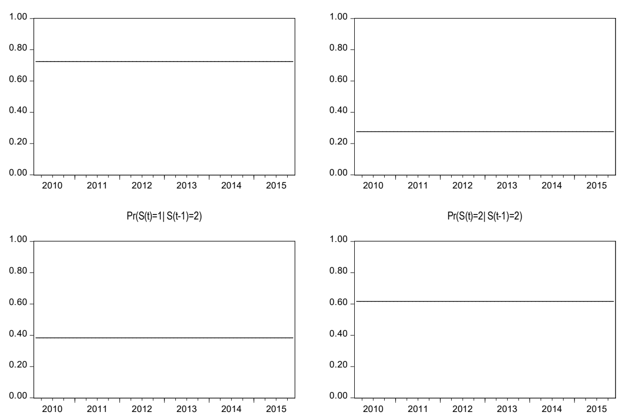


Graph A5.2.

Advanced Economy Constant Markov Transition Probabilities

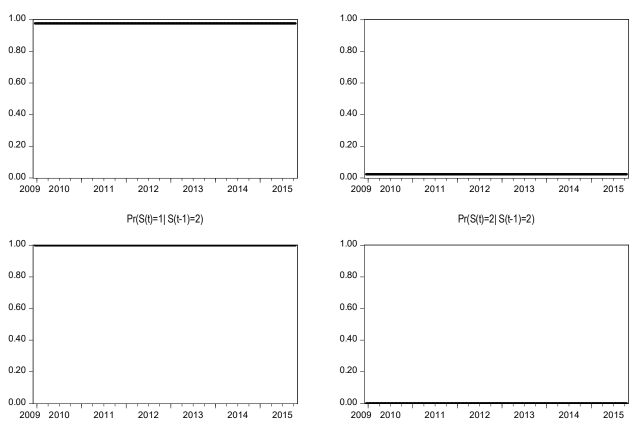
Constant Markov Transition Probabilities

Australia



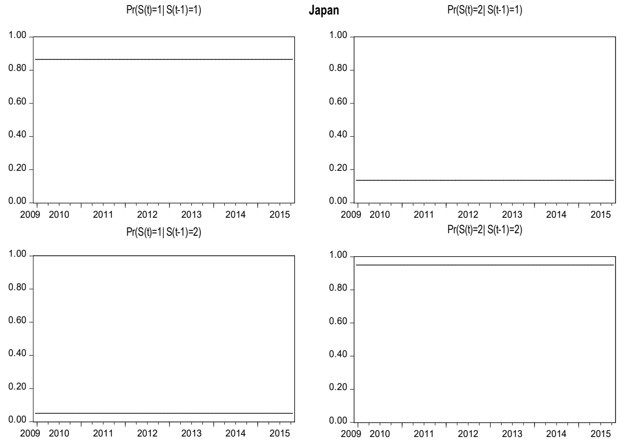
Constant Markov Transition Probabilities

France



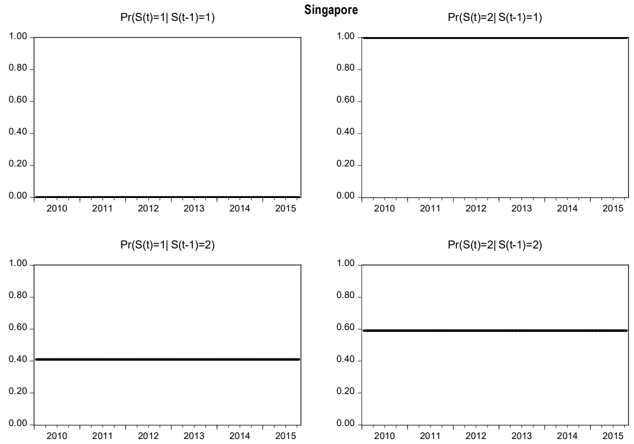
Constant Markov Transition Probabilities

Japan



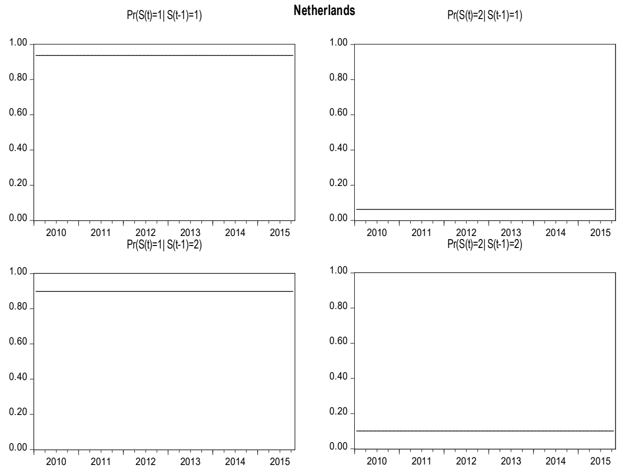
Constant Markov Transition Probabilities

Singapore



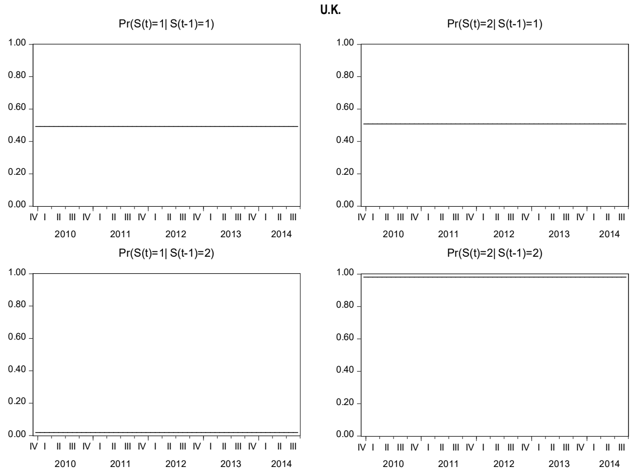
Constant Markov Transition Probabilities

Netherlands



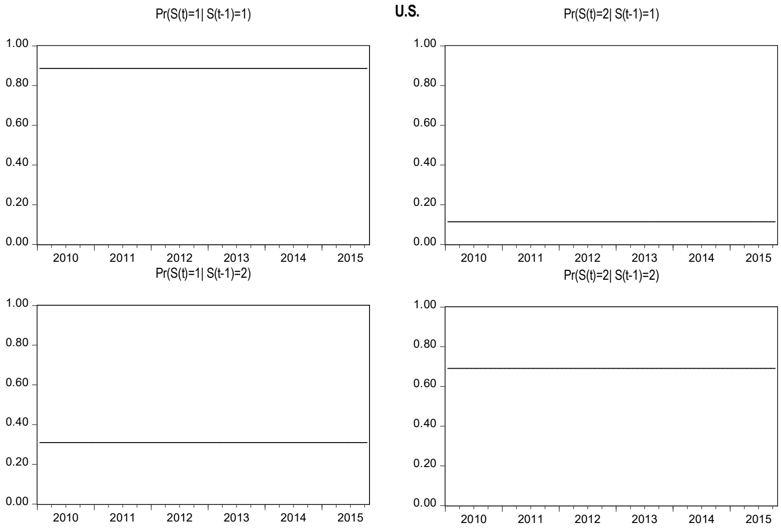
Constant Markov Transition Probabilities

U.K.

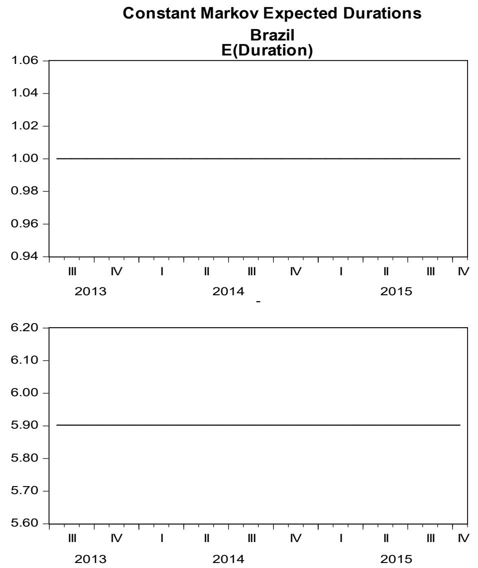


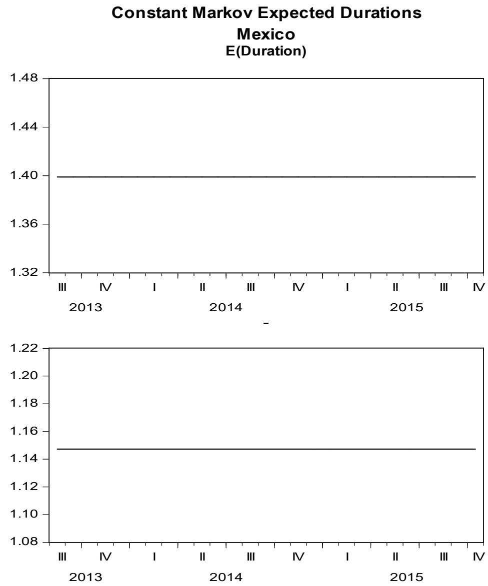
Constant Markov Transition Probabilities

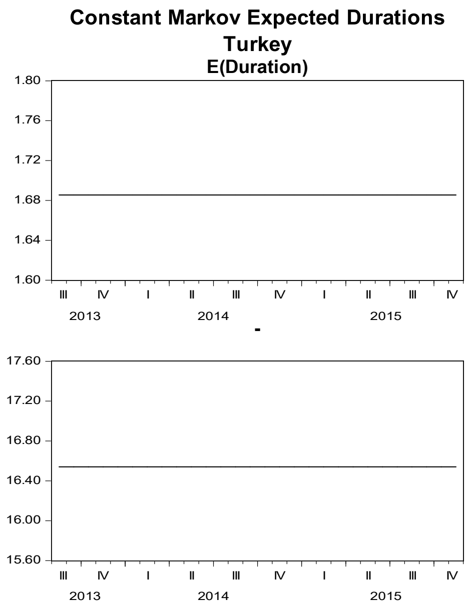
U.S.

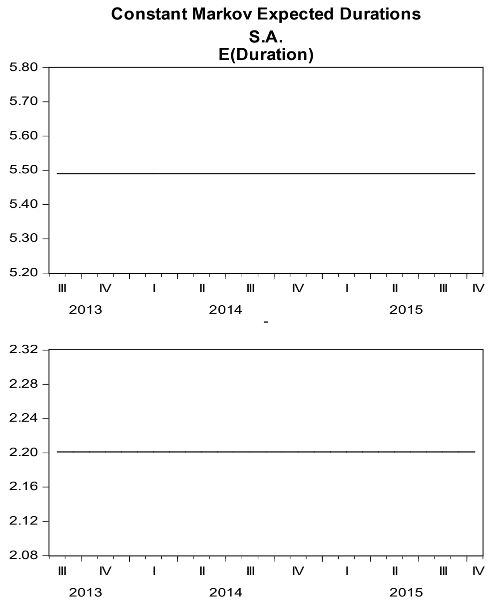


Graph A5.3.
EME Constant Markov Expected Durations





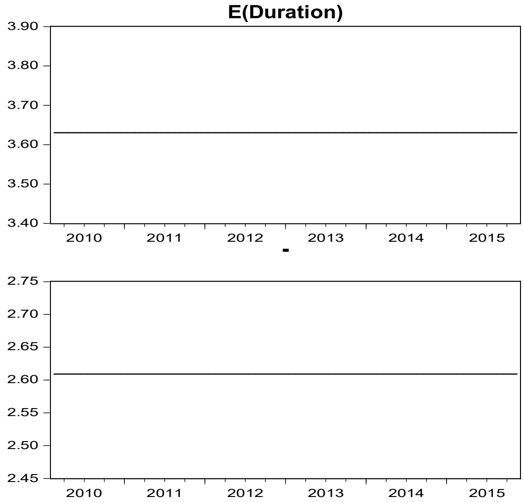




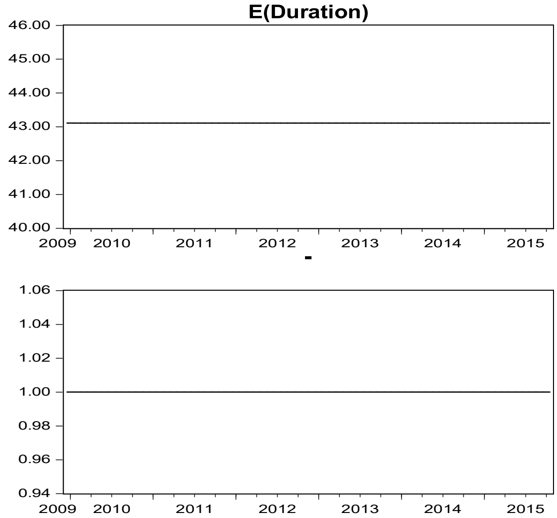
Graph A5.4.

Advanced Economy Constant Markov Expected Durations

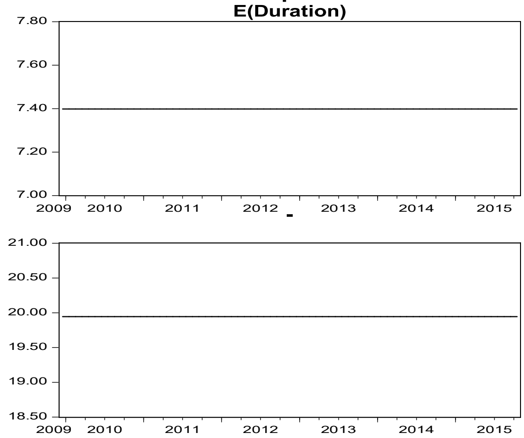
Constant Markov Expected Durations
Australia
E(Duration)



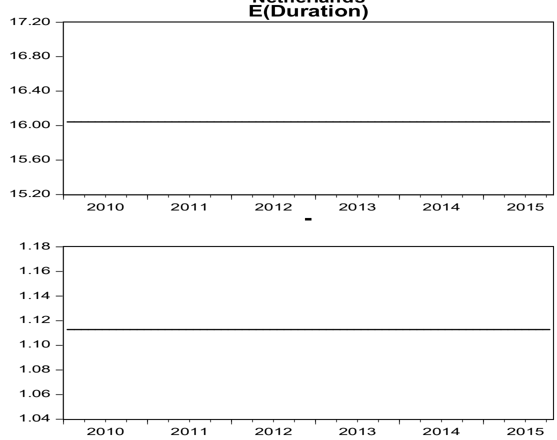
Constant Markov Expected Durations
France
E(Duration)



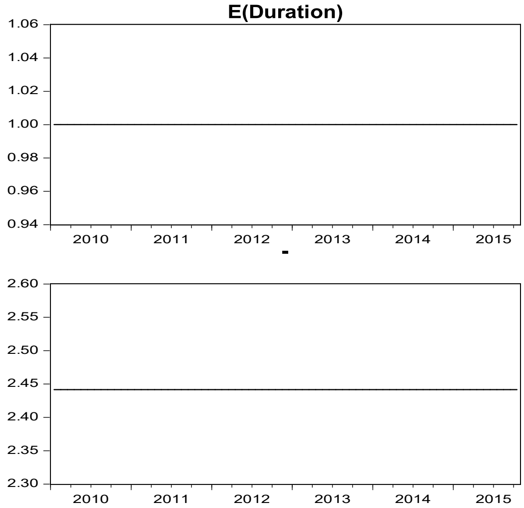
Constant Markov Expected Durations
Japan
E(Duration)



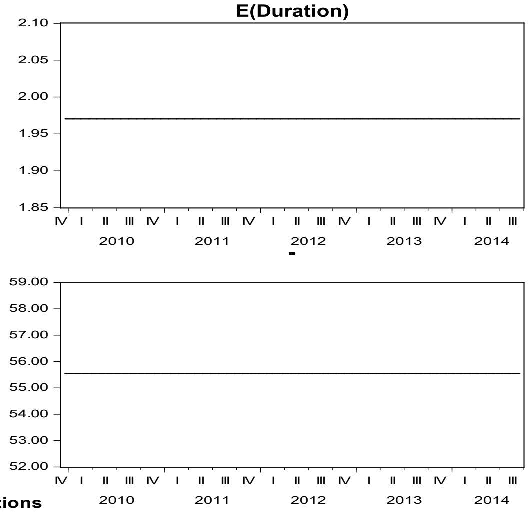
Constant Markov Expected Durations
Netherlands
E(Duration)



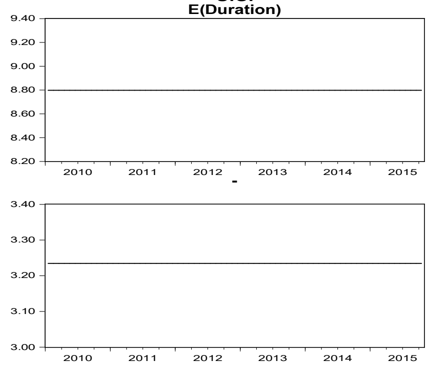
Constant Markov Expected Durations
Singapore
E(Duration)



Constant Markov Expected Durations
U.K.
E(Duration)



Constant Markov Expected Durations
U.S.
E(Duration)



A6. Data Appendix Tables

List of Variables Used In Regression Analyses and Model Outputs: (All Bloomberg Data Are Gross Point Average (GPA))

Ticker (or symbol)	Australia Variable	Source
S&P/ASX200 (AS51 Index)	Stock Market and REIT Sector	Bloomberg data terminal
ELAU Index	Trailing dividend yield (TDY)	Bloomberg data terminal
	Trailing earnings yield (TEY)	
	Forward dividend yield (FWD DY)	
	Forward earnings yield (converted: ((1/BEST_PE_RATIO)*100)	
	Payout ratios	Calculated: DY/EY
AUCPIYOY Index	Inflation	Bloomberg data terminal
	E[Inflation] (%)	Calculated: Nominal government bond yield - ILGBY
	Central bank interest (policy) rate	Bloomberg data terminal
AU0001M Index	Interbank rate (%)	
GACGB10 Index	Generic 10-Y nominal government bond yield	
AUSTLA CDS USD SR 5Y D14 Corp	5-Y Credit default swap (CDS) in US$	
N/A	10-Y Real government bond yield	Calculated: nominal GBY-inflation
GTAUDII10Y Govt	Generic 10-Y inflation-linked government bond yield	Bloomberg data terminal
EHBBAUY Index	(Public fiscal balance) government budget balance	
B1_GE: Gross domestic product - expenditure approach: Australian Dollar	Nominal gross domestic product (GDP): expenditure approach	OECD Statistics, online database [http://stats.oecd.org/#]
GDDBAUSL Index	Debt-to-GDP (%)	Bloomberg data terminal
	Debt-to-GDP^2 (%)	Calculated
EHCAAU Index	BOPs: Current account balance (% GDP)	Bloomberg data terminal
AUD Curncy	Exchange Rate (Spot) US$/AUD	
N/A	E[exch rate depreciation]	Calculated: Domestic nominal GBY – U.S. GBY
N/A	Unemployment rate	OECD Statistics, online database [http://stats.oecd.org/#]
VIX: IND	Chicago Board Options Exchange (CBOE) Volatility Index (VIX)	Bloomberg data terminal
N/A	Sovereign risk spread	Calculated

Note.
All Bloomberg data are Grade Point average (GPA). The FTSE EPRA Australia Index is a market capitalisation-weighted index composed of the most prominent traded real estate stocks in Australia (EPRA, 2015).

Ticker (or symbol)	France Variable	Source
CAC Index	Stock Market and REIT Sector	
EPFR Index	Trailing dividend yield (TDY)	Bloomberg data terminal
	Trailing earnings yield (TEY)	
	Forward dividend yield (FWD DY)	
	Forward earnings yield (converted: ((1/BEST_PE_RATIO)*100)	
	Payout ratios	Calculated: DY/EY
FRCPIYOY Index	Inflation	Bloomberg data terminal
N/A	E[Inflation] (%)	Calculated: Nominal government bond yield - ILGBY
EURR002W Index	Central bank interest (policy) rate	Bloomberg data terminal
PIBOFF1M Index	Interbank rate (%)	
GFRN10 Index	Generic 10-Y nominal government bond yield	
FRANCE CDS USD SR 5Y D14 Corp	5-Y Credit default swap (CDS) in US$	
N/A	10-Y Real government bond yield	Calculated: nominal GBY-inflation
GTFRFII10Y Govt	Generic 10-Y inflation-linked government bond yield	Bloomberg data terminal
EHBBFRY Index	(Public fiscal balance) government budget balance	
B1_GE: Gross domestic product - expenditure approach: Euro	Nominal gross domestic product (GDP): expenditure approach	OECD Statistics, online database [http://stats.oecd.org/#]
GDDBFRAN Index	Debt-to-GDP (%)	Bloomberg data terminal
	Debt-to-GDP^2 (%)	Calculated
EHCAFR Index	BOPs: Current account balance (% GDP)	Bloomberg data terminal
EUR Curncy	Exchange Rate (Spot) US$/EUR	
N/A	E[exch rate depreciation]	Calculated: Domestic nominal GBY – U.S. GBY
N/A	Unemployment rate	OECD Statistics, online database [http://stats.oecd.org/#]
VIX: IND	Chicago Board Options Exchange (CBOE) Volatility Index (VIX)	Bloomberg data terminal
N/A	Sovereign risk spread	Calculated

Note.
All Bloomberg data are Grade Point average (GPA). FTSE EPRA/NAREIT France Index is intended to gauge the stock performance of companies engaged in specific real estate activities of French real estate markets (EPRA, 2015).

Ticker (or symbol)	Japan Variable	Source
NKY Index	Stock Market and REIT Sector	
ELJP Index	Trailing dividend yield (TDY) Trailing earnings yield (TEY) Forward dividend yield (FWD DY) Forward earnings yield (converted: ((1/BEST_PE_RATIO)*100)	Bloomberg data terminal
	Payout ratios	Calculated: DY/EY
JNCPIYOY Index	Inflation	Bloomberg data terminal
N/A	E[Inflation] (%)	Calculated: Nominal government bond yield - ILGBY
MUTKCALM Index	Central bank interest (policy) rate	Bloomberg data terminal
JY0001M Index	Interbank rate (%)	
GJGB10 Index	Generic 10-Y nominal government bond yield	
JGB CDS USD SR 5Y D14 Corp	5-Y Credit default swap (CDS) in US$	
N/A	10-Y Real government bond yield	Calculated: nominal GBY-inflation
GTJPYII10Y Govt	Generic 10-Y inflation-linked government bond yield	Bloomberg data terminal
JNFONETG Index	(Public fiscal balance) government budget balance	
B1_GE: Gross domestic product - expenditure approach: Yen	Nominal gross domestic product (GDP): expenditure approach	OECD Statistics, online database [http://stats.oecd.org/#]
GDDBJAPN Index	Debt-to-GDP (%)	Bloomberg data terminal
	Debt-to-GDP^2 (%)	Calculated
EHCAJP Index	BOPs: Current account balance (% GDP)	Bloomberg data terminal
JPY Curncy	Exchange Rate (Spot) US$/JPY	
N/A	E[exch rate depreciation]	Calculated: Domestic nominal GBY – U.S. GBY
N/A	Unemployment rate	OECD Statistics, online database [http://stats.oecd.org/#]
VIX: IND	Chicago Board Options Exchange (CBOE) Volatility Index (VIX)	Bloomberg data terminal
N/A	Sovereign risk spread	Calculated

Note.
All Bloomberg data are Grade Point average (GPA). FTSE EPRA/NAREIT France Index is intended to gauge the stock performance of companies engaged in specific real estate activities of French real estate markets (EPRA, 2015).

Ticker (or symbol)	Netherlands Variable	Source
AEX Index	Stock Market and REIT Sector	
EPNL Index	Trailing dividend yield (TDY) Trailing earnings yield (TEY) Forward dividend yield (FWD DY) Forward earnings yield (converted: ((1/BEST_PE_RATIO)*100)	Bloomberg data terminal
	Payout ratios	Calculated: DY/EY
NECPIYOY Index	Inflation	Bloomberg data terminal
N/A	E[Inflation] (%)	Calculated: Nominal government bond yield - ILGBY
EURR002W Index	Central bank interest (policy) rate	Bloomberg data terminal
NEC0PR01 Index	Interbank rate (%)	
GNTH10YR Index	Generic 10-Y nominal government bond yield	
NETHER CDS USD SR 5Y D14 Corp	5-Y Credit default swap (CDS) in US$	
N/A	10-Y Real government bond yield	Calculated: nominal GBY-inflation
NEDWBK 0 05/15/2018 Corp	Generic inflation-linked government bond yield	Bloomberg data terminal
EUBDNETH Index	(Public fiscal balance) government budget balance	
B1_GE: Gross domestic product - expenditure approach: Euro	Nominal gross domestic product (GDP): expenditure approach	OECD Statistics, online database [http://stats.oecd.org/#]
GDDBNETH Index	Debt-to-GDP (%)	Bloomberg data terminal
	Debt-to-GDP^2 (%)	Calculated
EHCANL Index	BOPs: Current account balance (% GDP)	Bloomberg data terminal
EUR Curncy	Exchange Rate (Spot) US$/EUR	
N/A	E[exch rate depreciation]	Calculated: Domestic nominal GBY – U.S. GBY
N/A	Unemployment rate	OECD Statistics, online database [http://stats.oecd.org/#]
VIX: IND	Chicago Board Options Exchange (CBOE) Volatility Index (VIX)	Bloomberg data terminal
N/A	Sovereign risk spread	Calculated

Note.
All Bloomberg data are Grade Point average (GPA). FTSE EPRA/NAREIT Netherlands Index is intended to gauge the stock performance of companies engaged in specific real estate activities of Dutch real estate markets.

Ticker (or symbol)	Singapore Variable	Source
STI Index	Stock Market and REIT Sector	
ELSI Index	Trailing dividend yield (TDY) Trailing earnings yield (TEY) Forward dividend yield (FWD DY) Forward earnings yield (converted: ((1/BEST_PE_RATIO)*100)	Bloomberg data terminal
	Payout ratios	Calculated: DY/EY
SICPIYOY Index	Inflation	Bloomberg data terminal
N/A	E[Inflation] (%)	Calculated: Nominal government bond yield - ILGBY
MASB10Y Index	Generic 10-Y nominal government bond yield	Bloomberg data terminal
N/A	10-Y Real government bond yield	Calculated: nominal GBY-inflation
EHBBSG Index	(Public fiscal balance) government budget balance	Bloomberg data terminal
N/A	Nominal gross domestic product (GDP): expenditure approach	Department of statistics Singapore
N/A	Unemployment	http://stats.mom.gov.sg/Pages/UnemploymentTimeSeries.aspx
GDDBSING Index	Debt-to-GDP (%)	Bloomberg data terminal
	Debt-to-GDP^2 (%)	Calculated
EHCASG Index	BOPs: Current account balance (% GDP)	Bloomberg data terminal
SGD Curncy	Exchange Rate (Spot) US$/SGD	
N/A	E[exch rate depreciation]	Calculated: Domestic nominal GBY – U.S. GBY
Department of Statistics Singapore	Unemployment rate	OECD Statistics, online database [http://stats.oecd.org/#]
VIX: IND	Chicago Board Options Exchange (CBOE) Volatility Index (VIX)	Bloomberg data terminal

Note.
All Bloomberg data are Grade Point average (GPA). The FTSE EPRA Singapore Index is a market capitalisation-weighted index comprising of the most prominent traded real estate stocks in Singapore (EPRA, 2015).

Ticker (or symbol)	U.K. Variable	Source
UKX Index	Stock Market and REIT Sector	
ELUK Index	Trailing dividend yield (TDY)	Bloomberg data terminal
	Trailing earnings yield (TEY)	
	Forward dividend yield (FWD DY)	
	Forward earnings yield (converted: ((1/BEST_PE_RATIO)*100)	
	Payout ratios	Calculated: DY/EY
UKRPCJYR Index	Inflation	Bloomberg data terminal
N/A	E[Inflation] (%)	Calculated: Nominal government bond yield - ILGBY
UKBRBASE Index	Central bank interest (policy) rate	Bloomberg data terminal
BP0001M Index	Interbank rate (%)	
GUKG10 Index	Generic 10-Y nominal government bond yield	
UK CDS USD SR 5Y D14 Corp	5-Y Credit default swap (CDS) in US$	
N/A	10-Y Real government bond yield	Calculated: nominal GBY-inflation
GTGBPII10Y Govt	Generic 10-Y inflation-linked government bond yield	Bloomberg data terminal
EHBBGB Index	(Public fiscal balance) government budget balance	
B1_GE: Gross domestic product - expenditure approach: Pound Sterling	Nominal gross domestic product (GDP): expenditure approach	OECD Statistics, online database [http://stats.oecd.org/#]
GDDBUNKI Index	Debt-to-GDP (%)	Bloomberg data terminal
	Debt-to-GDP^2 (%)	Calculated
UKCA Index	BOPs: Current account balance (% GDP)	Bloomberg data terminal
GBP Curncy	Exchange Rate (Spot) US$/GBP	
N/A	E[exch rate depreciation]	Calculated: Domestic nominal GBY – U.S. GBY
N/A	Unemployment rate	OECD Statistics, online database [http://stats.oecd.org/#]
VIX: IND	Chicago Board Options Exchange (CBOE) Volatility Index (VIX)	Bloomberg data terminal
N/A	Sovereign risk spread	Calculated

Note.
All Bloomberg data are Grade Point average (GPA). The FTSE EPRA U.K. Index is a market capitalisation-weighted index consisting of the most prominent traded real estate stocks in the U.K (EPRA, 2015).

Ticker (or symbol)	U.S. Variable	Source
SPX Index	Stock Market and REIT Sector	
UNUS Index	Trailing dividend yield (TDY)	Bloomberg data terminal
	Trailing earnings yield (TEY)	
	Forward dividend yield (FWD DY)	
	Forward earnings yield (converted: ((1/BEST_PE_RATIO)*100)	
	Payout ratios	Calculated: DY/EY
CPI YOY Index	Inflation	Bloomberg data terminal
N/A	E[Inflation] (%)	Calculated: Nominal government bond yield - ILGBY
FDTR Index	Central bank interest (policy) rate	Bloomberg data terminal
US0001M Index	Interbank rate (%)	
USGG10YR Index	Generic 10-Y nominal government bond yield	
US CDS EUR SR 5Y D14 Corp	5-Y Credit default swap (CDS) in US$	
N/A	10-Y Real government bond yield	Calculated: nominal GBY-inflation
GTII10 Govt	Generic 10-Y inflation-linked government bond yield	Bloomberg data terminal
EHBBUS Index	(Public fiscal balance) government budget balance	
B1_GE: Gross domestic product - expenditure approach: US Dollar	Nominal gross domestic product (GDP): expenditure approach	OECD Statistics, online database [http://stats.oecd.org/#]
GDDBUNST Index	Debt-to-GDP (%)	Bloomberg data terminal
	Debt-to-GDP^2 (%)	Calculated: Domestic nominal GBY – U.K. GBY
EHCAUS Index	BOPs: Current account balance (% GDP)	Bloomberg data terminal
USD Curncy	Exchange Rate (Spot) US$/US$	
N/A	E[exch rate depreciation]	Calculated
N/A	Unemployment rate	OECD Statistics, online database [http://stats.oecd.org/#]
VIX: IND	Chicago Board Options Exchange (CBOE) Volatility Index (VIX)	Bloomberg data terminal
N/A	Sovereign risk spread	Calculated

Note.
All Bloomberg data are Grade Point average (GPA). The FTSE EPRA/NAREIT U.S. Index is a subsection of the EPRA/NAREIT Global Index and the EPRA/NAREIT North America Index. It comprises of public real estate companies that conform with EPRA's standards (EPRA, 2015).

Ticker (or symbol)	Brazil Variable	Source
IBOV Index	Stock Market and REIT Sector	
ENEIBRU Index	Trailing dividend yield (TDY)	Bloomberg data terminal
	Trailing earnings yield (TEY)	
	Forward dividend yield (FWD DY)	
	Forward earnings yield (converted: ((1/BEST_PE_RATIO)*100)	
	Payout ratios	Calculated: DY/EY
BZPIIPCY Index	Inflation	Bloomberg data terminal
N/A	E[Inflation] (%)	Calculated: Nominal government bond yield - ILGBY
BZSTSETA Index	Central bank interest (policy) rate	Bloomberg data terminal
BZFXPINT Index	Interbank rate (%)	
GEBR10Y Index	Generic 10-Y nominal government bond yield	
BRAZIL CDS USD SR 5Y D14 Corp	5-Y Credit default swap (CDS) in US$	
N/A	10-Y Real government bond yield	Calculated: nominal GBY-inflation
ILB GTBRLII8Y Govt	Generic 8-Y inflation-linked government bond yield	Bloomberg data terminal
EHBBBR Index	(Public fiscal balance) government budget balance	
B1_GE: GDP - expenditure approach: Brazilian Real	Nominal gross domestic product (GDP): expenditure approach	OECD Statistics, online database [http://stats.oecd.org/#]
GDDBBRAZ Index	Debt-to-GDP (%)	Bloomberg data terminal
	Debt-to-GDP^2 (%)	Calculated
EHCABR Index	BOPs: Current account balance (% GDP)	Bloomberg data terminal
BRL Curncy	Exchange Rate (Spot) US$/BRL	
N/A	E[exch rate depreciation]	Calculated
N/A	Unemployment rate	OECD Statistics, online database [http://stats.oecd.org/#]
VIX: IND	Chicago Board Options Exchange (CBOE) Volatility Index (VIX)	Bloomberg data terminal
N/A	Sovereign risk spread	Calculated

Note.
All Bloomberg data are Grade Point average (GPA). FTSE EPRA/NAREIT Emerging BRAZIL Index USD is intended to gauge the stock performance of companies engaged in specific real estate activities of Brazil's real estate markets (EPRA, 2015).

Ticker (or symbol)	Mexico Variable	Source
MEXBOL Index	Stock Market and REIT Sector	
ENEIMXU Index	Trailing dividend yield (TDY) Trailing earnings yield (TEY) Forward dividend yield (FWD DY) Forward earnings yield (converted: ((1/BEST_PE_RATIO)*100)	Bloomberg data terminal
	Payout ratios	Calculated: DY/EY
MXCPYOY Index	Inflation	Bloomberg data terminal
N/A	E[Inflation] (%)	Calculated: Nominal government bond yield - ILGBY
MXONBR Index	Central bank interest (policy) rate	Bloomberg data terminal
GMXN10YR Index	Interbank rate (%)	
MEX CDS USD SR 5Y D14 Corp	Generic 10-Y nominal government bond yield	
N/A	5-Y Credit default swap (CDS) in US$	
ILB GTMXNII10Y Govt	10-Y Real government bond yield	Calculated: nominal GBY-inflation
EHBBMX Index	(Public fiscal balance) government budget balance	
B1_GE: Gross domestic product - expenditure approach: Mexican Peso	Nominal gross domestic product (GDP): expenditure approach	OECD Statistics, online database [http://stats.oecd.org/#]
GDDBMXCO Index	Debt-to-GDP (%)	Bloomberg data terminal
	Debt-to-GDP^2 (%)	Calculated
EHCAMX Index	BOPs: Current account balance (% GDP)	Bloomberg data terminal
MXN Curncy	Exchange Rate (Spot) US$/MXN	
N/A	E[exch rate depreciation]	Calculated
N/A	Unemployment rate	OECD Statistics, online database [http://stats.oecd.org/#]
VIX: IND	Chicago Board Options Exchange (CBOE) Volatility Index (VIX)	Bloomberg data terminal
N/A	Sovereign risk spread	Calculated

Note.
All Bloomberg data are Grade Point average (GPA). FTSE EPRA/NAREIT Emerging MEXICO Index USD is intended to gauge the stock performance of companies engaged in specific real estate activities of Mexico's real estate markets (EPRA, 2015).

Ticker (or symbol)	Turkey Variable	Source
XU100 Index	Stock Market and REIT Sector	
ENEITRU Index	Trailing dividend yield (TDY)	Bloomberg data terminal
	Trailing earnings yield (TEY)	
	Forward dividend yield (FWD DY)	
	Forward earnings yield (converted: ((1/BEST_PE_RATIO)*100)	
	Payout ratios	Calculated: DY/EY
TUCPIY Index	Inflation	Bloomberg data terminal
N/A	E[Inflation] (%) = [NomGBYs - ILGBYs]	Calculated
TUBR1WRA Index	Central bank interest (policy) rate	Bloomberg data terminal
TRLIB1M Index	Interbank Agreed (Offer) Rates(%)	
IESM10Y Index	Generic 10-Y Nominal Government bond yield	
TURKEY CDS USD SR 5Y D14 Corp	5-Y Credit Default Swap (CDS) in US$	
N/A	10-Y Real Government Bond Yields = [Nominal GBYs-Inflation]	Calculated
BEMT7P Index	Generic 8-Y inflation-linked government bond yield	Bloomberg data terminal
EHBBTR Index	(Public fiscal balance) government budget balance	
B1_GE: Gross domestic product - expenditure approach: Turkish Lira	Nominal gross domestic product (GDP): expenditure approach	OECD Statistics, online database [http://stats.oecd.org/#]
GDDBTURK Index	Debt-to-GDP (%)	Bloomberg data terminal
	Debt-to-GDP^2 (%)	Calculated
EHCATR Index	BOPs: Current account balance (% GDP)	Bloomberg data terminal
TRY Curncy	Exchange Rate (Spot) US$/TRY	
N/A	E[exch rate depreciation]	Calculated
N/A	Unemployment rate	OECD Statistics, online database [http://stats.oecd.org/#]
VIX: IND	Chicago Board Options Exchange (CBOE) Volatility Index (VIX)	Bloomberg data terminal
N/A	Sovereign risk spread	Calculated

Note.
All Bloomberg data are Grade Point average (GPA). FTSE EPRA/NAREIT Emerging SOUTH AFRICA Index USD is intended to gauge the stock performance of companies engaged in specific real estate activities of S.A.'s real estate markets (EPRA, 2015).

Ticker (or symbol)	S.A. Variable	Source
JALSH Index	Stock Market and REIT Sector	
ENEIZAU Index	Trailing dividend yield (TDY)	Bloomberg data terminal
	Trailing earnings yield (TEY)	
	Forward dividend yield (FWD DY)	
	Forward earnings yield (converted: ((1/BEST_PE_RATIO)*100)	
	Payout ratios	Calculated: DY/EY
SACPIYOY Index	Inflation	Bloomberg data terminal
N/A	E[Inflation] (%)	Calculated: Nominal government bond yield - ILGBY
SARPRT Index	Central bank interest (policy) rate	Bloomberg data terminal
JIBA1M Index	Interbank rate (%)	
GSAB10YR Index	Generic 10-Y nominal government bond yield	
SOAF CDS USD SR 5Y D14 Corp	5-Y Credit default swap (CDS) in US$	
N/A	10-Y Real government bond yield	Calculated: nominal GBY-inflation
ILB GTZARII8Y Govt	Generic 8-Y inflation-linked government bond yield	Bloomberg data terminal
EHBBZA Index	(Public fiscal balance) government budget balance	
B1_GE: Gross domestic product - expenditure approach: Rand	Nominal gross domestic product (GDP): expenditure approach	OECD Statistics, online database [http://stats.oecd.org/#]
GDDBSOAF Index	Debt-to-GDP (%)	Bloomberg data terminal
	Debt-to-GDP^2 (%)	Calculated
EHCAZA Index	BOPs: Current account balance (% GDP)	Bloomberg data terminal
ZAR Curncy	Exchange rate (spot): US$/ZAR	
N/A	E[exch rate depreciation]	Calculated: domestic GBY-foreign GBY
VIX: IND	Chicago Board Options Exchange (CBOE) Volatility Index (VIX)	Bloomberg data terminal
N/A	Sovereign risk spread	Calculated: domestic CDS - U.S. CDS

Note.

All Bloomberg data are Grade Point average (GPA). FTSE EPRA/NAREIT Emerging SOUTH AFRICA Index USD is intended to gauge the stock performance of companies engaged in specific real estate activities of S.A.'s real estate markets (EPRA, 2015).