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Probability Density Distributions of Stock Returns, Market Regimes, and Financial Risk Measures

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Contents

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Abstract

The probability density distribution of stock returns is crucial in financial modelling and the estimation of financial risk measures. Numerous papers have been devoted to finding the best-fit distributional specifications of stock returns but no consensus has been reached in answering the question of whether there is a unique distributional family that fits all markets and market conditions. Similarly, numerous papers have been devoted to modelling tail risk but no consensus has been reached with regard to which methods provide the most accurate and reliable estimates. This research brings these two strands of the literature together by investigating how distributional specifications differ between the bull and bear markets, and between the developed and the emerging stock exchanges. It also contributes to our understanding of how the knowledge of distributional specifications informs the discussion on the best method of the VaR and ES estimation.

In its empirical part, this research investigates the probability density distributions of daily equity returns for 19 developed stock exchanges and 19 emerging stock exchanges. It considers the period of 01 January 2000 to 31 December 2016 and then separately for the bull and bear sub-periods. The results show that there are considerable differences in the probability density distributions for the developed and the emerging stock exchanges. Moreover, the probability density distributions of stock market returns change as the markets switch between the bull and the bear market regimes. These changes in the probability density distribution specifications impact on the values of VaR and ES. This research sheds light on the shortcomings of commonly used VaR and ES estimation methods such as Historical Simulation and Extreme Value Theory.

List of abbreviations

AIC	Akaike Information Criterion
DSE	Developed Stock Exchange
ES	Expected Shortfall
ESE	Emerging Stock Exchange
EVT	Extreme Value Theory
HST	Hansen's Skewed T Distribution
HS	Historical Simulation
LR	Log Likelihood
-LogL	Negative Log Likelihood
LT	Asger Lunde & Allan Timmermann's Bull/Bear Market Separation Method
N	Normal Distribution
ST	Student's T Distribution
SGT	Skewed Generalized T Distribution
SBC	Schwartz Bayesian Criterion
VaR	Value at Risk

1 Introduction

The start of this century witnesses the rapid development of the equity markets in both the developed countries and the developing countries. Besides the great investment opportunity, this development brings challenges to investors, scholars and regulators. To take this opportunity and to overcome the new challenges, it is fundamental and crucial to have an insightful understanding of the statistical properties of the stock returns of the equity market. For instance, without the knowledge of the probability density of the equity market returns, the financial modelling and forecasting based on the probability density of the equity market returns is impeded. As the stock market changes from time to time, the realized empirical distribution of stock market index returns may change significantly. These potential changes of the empirical distribution of stock market returns challenge the iid (independent and identically distributed) assumption in the financial modelling. Financial modelling based on the assumption of stable empirical distributions of stock market returns may not be reliable and may lead to inefficient decision making. There exists literature on the topic of the empirical distributions of stock market returns. However, the extant research of the empirical distribution of stock market returns does not break down the market conditions appropriately when investigating the empirical distribution of stock market returns and does not investigate how the empirical probability density of the stock market differs between different market conditions such as the bull market and the bear market. In addition, the extant literature is rather restricted to the developed countries, especially European countries and the US. In recent decades, many developing countries experienced unprecedented economic growth. The increased domestic investment and the inflow of the foreign capital lured by the higher expected returns and international diversification benefits led to the growth of the financial markets in developing countries. As a result, the emerging stock markets constitute an increasing share of the world equity market and hence become more and more important in global asset allocation. According to Morgan Stanley, "Investors poured more than $9 billion into emerging market (EM) equity funds in the six weeks ended Aug 10, 2016, the largest inflow over such a period in three years. The MSCI Emerging Market Index was returning 13.86%, year-to-date, compared with a return of around 5% for the MSCI World Index and 6.7% on the Dow Jones

Industrial Average."[1] Because of the differences in the regulations, of the investors' types and in the market structures, attention should be paid to the potential significant heterogeneity in the empirical probability density distributions in the developed and the emerging markets. For instance, in addition to being more volatile, the emerging markets are often expected to have a higher probability of extreme events. Hence, the distributions of returns in the emerging stock exchanges may have thicker tails than the distributions of the returns of developed stock exchanges. Consequently, the empirical research based on European countries and the US may not be suitable for the emerging markets. Therefore, a comprehensive empirical research on emerging markets is a necessity. Motivated by these puzzles and gaps in the extant literature, I investigate the research question of how empirical probability density of stock market returns differs between different market conditions such as the bull market and the bear market, and between the developed and the emerging stock exchanges.

The rapid development of international stock markets has also led to the increase in the popularity of new risk management tools. For instance, the so-called "tail risk" financial risk measures such as Value at risk (VaR) and Expected Shortfall (ES) are widely used in the financial industry. Accurate forecasting of the Value at risk and Expected Shortfall is crucial for efficient risk management. Compared with the estimation of the standard deviation, the estimation of the "tail risk" measures is more challenging in practice because these "tail risk" measures focus on the extreme negative returns (losses) which is related to the left-hand tail of the whole probability density distributions. The difficulties inspire tremendous discussion on estimating of tail risk measures. Numerous papers have been devoted to developing methods which provide the most accurate and reliable estimates of VaR and ES. Motivated by the fact that the VaR and ES are conceptually linked to the probability density of the stock returns, in this research I would like to investigate the research question of how distributional specifications of the stock market returns affect the estimation of VaR and ES. In addition, motivated by the results of the empirical probability density and the results showing how different distributional specifications affect the estimation of VaR and ES, I propose a novel tail risk forecasting strategy and hence contribute to the research topic of financial risk forecasting. The

[1] https://www.morganstanley.com/ideas/emerging-market-stocks published on 26th August 2016, accessed on 9th July 2017

innovative forecasting strategy is applied and assessed with different widely used conditional models (e.g. RiskMetrics, Normal-GARCH, Student's T-GACRH, Skewed T-GACRH and SGT-GARCH) on a broad sample of empirical data from the developed countries and the emerging countries.

Given the importance of the probability density distribution in empirical studies of stock returns, numerous specifications have been proposed in the past few decades. These specifications include the normal distribution (Bachelier (1900), Osborne (1959), Moore (1962), Akgiray and Booth(1987)), Paretian distribution (Fama (1963); Fama (1965); Mandelbrot (1966); Officer (1972); Clark (1973)), the power exponential distribution (Nelson (1991); Hsieh (1989); Theodossiou (1994); Koutmos and Theodossiou (1994); Akgiray and Booth (1988)), the student's t distribution (Praetz (1972); Blattberg and Gonedes (1974); Kon (1984); McDonald and Newey (1988); Gray and French (1990); Peiro (1994); Kim and Kon (1994); Aparicio and Estrada (2001)), skewed student's t distribution (Hansen (1994)), and skewed generalized t distribution (McDonald and Newey (1988), Theodossiou (1998); Butler, McDonald et al. (1990); Lye and Martin (1993); McDonald and Xu (1995); Harris and Küçüközmen (2001)). In addition, many studies claim that using a mixture of distributions rather than a single distribution offers a better fit with empirical data (see for example, Ball and Torous (1983), Kon (1984), Peiro (1994), Press (1967), Merton (1973), and Kim and Kon (1994)).

It is well recognised that stock markets' conditions are not time-invariant, indeed they change quite frequently. So-called bull and bear markets are examples of two market regimes that are associated with different supply and demand for securities, different investor sentiments, as well as changing economic and trading activities. The heterogeneity of the bull/bear market regimes' characteristics is often observed in the first two moments of stock market returns. In particular, the bull market regime is associated with a positive mean and lower standard deviation while the bear market regime is associated with a negative mean and higher standard deviation. These different characteristics of the first two moments during the bull market regime and the bear market regime are widely discussed in the literature. They were even used as the bull/bear market regime separation criteria in the early empirical research (Fabozzi and Francis (1977)) and more recently in Markov regime switching models (Maheu and McCurdy (2000), Maheu, McCurdy et al. (2012)).

As stock markets' conditions change frequently, the realised unconditional probability density of stock returns may be different in different market conditions. Thus, it is important to find the optimal probability density distribution specifications that corresponds to particular market conditions. Despite numerous studies on the probability density distributions of stock returns, there is scarce empirical evidence on how the probability density distributions of stock returns change as the stock market regimes change. Moreover, studies of the stock returns' distributional properties of the bull and bear market regimes are often limited to the changes in the first two moments, i.e., the mean and the standard deviation. However, narrowing the analysis down to the first two moments may be inappropriate since it is well-recognised that stock returns are not normally distributed. Given that the knowledge of the higher moments is critical in determining non-normal distributions, it may be particularly important to extend the analysis beyond the first two moments.

With regard to financial modelling, the efficient estimation of the parameters of econometric models requires a complete description or an explicit assumption about the probability density function. Moreover, the accuracy of predictive distributions critically depends upon knowledge of the correct description or assumption of the conditional probability density distribution for the normalized error term (Baillie and Bollerslev (1992)). Finally, a full specification of the probability density model is important when the higher moments of the probability density distribution are the crucial factor for financial decision making. For instance, in terms of financial risk management, the first two moments may not be sufficient for the decision making as investors may be concerned with the downside risk since it can be associated with extreme events. Hence, it is important to know how higher moments and even the probability density distribution change as stock market conditions change.

The scale of financial losses experienced by financial intermediaries during the 2008 financial crisis has contributed greatly to the rise of the importance of risk management of financial institutions. Following the financial crisis, considerable attention has also been put on the prudential risk management. Both the effective risk management and the regulatory processes critically rely on the accurate measurement of financial risk. For instance, the Basel regulations and determination of bank capital requirements depend heavily on the accurate assessment of market risk exposure of financial institutions.

In terms of financial risk measures, while the standard deviation is a fundamental concept of theoretical asset pricing and portfolio theory (Treynor (1961), Sharpe (1964), Lintner (1965)), financial regulators and practitioners have been working closely with VaR since the early 1920s, when it was used to specify capital requirements for firms listed on the New York Stock Exchange. The rapid development of international capital markets, growth of institutional investors, and regulatory changes following the 2007 financial crisis, contributed greatly to the popularisation of VaR and ES as the important tool in asset management and regulation. VaR and ES are often referred to as tail risk measures because they focus on the extreme negative returns (losses) which is related to the left-hand tail of the probability density distributions. In spite of the numerous papers and books written on the conceptualisation of the tail-risk measures, and how to calculate them in practice (Alexander (2009) and Daníelsson (2011)), it is still unclear what probability density best captures tail shapes, how the probability density changes with market conditions, and how accounting for these changes improves VaR and ES estimates. For these reasons, it is important to understand how the probability density changes affect the risk measure estimation and, hence, to what extent decision makers can rely on these risk measure estimation models.

Overall, this research contributes to the current knowledge in the following significant ways. First, this research contributes to the knowledge by documenting the heterogeneity of the probability density distribution model of stock returns between the different market regimes e.g. bull market and the bear market. In addition, the same conclusions are found to be robust to different market regime categorization approaches such as the market regimes based on the standard deviation and the skewness. The results imply that the empirical probability density distributions of stock returns change as the markets switch between different market regimes. Second, this research improves our understanding of the significant heterogeneity between different stock exchanges, i.e. the developed stock exchanges and emerging stock exchanges. Third, by using mathematical models and simulation results, this research provides compressive investigation on how the tail risk is affected by the changes of the parameters of different probability density models. Forth, based on the comparison of VaR and ES obtained for different methods of calibration, this research provides empirical assessment on the performance of different VaR and ES estimation methods and their vulnerabilities to the unstable return probability density distribution. The results indicate that different probability density models affect the risk measure estimates in practice, hence accounting for these time-variation probability density models improves estimations of VaR and ES. Fifth, based on the results on the empirical probability density distribution and the assessment of the tail risk and the probability density model, this research proposes a novel tail risk forecasting strategy (two different distributions in each market regime). This innovative tail risk forecasting strategy is applied with different conditional models (e.g. RiskMetrics, Normal-GARCH, Student's T-GACRH, Skewed T-GACRH and SGT-GARCH) on a broad sample of stock markets. The empirical performance of these models is assessed by backtesting.

2 Literature Review

2.1 Market Regimes and Stock Returns' Statistical Properties

Literature on the time variation in stock market return distribution properties is well established. There are two stands of the literature that provide the economic explanations for time variations in the distributional properties of financial time series. The first one is concerned with the behaviour of market participants (i.e., noise traders). It is argued that the speculative trading by the noise traders can cause fads, bubbles, or even market crashes (e.g., Flood and Hodrick (1990), Funke, Hall et al. (1994), Hamilton (1989), Van Norden and Schaller (1999), Van Norden and Vigfusson (1998), Dewachter (2001), Jeanne and Rose (2002), and Schmeling (2007)). Different market regimes are associated with different distributional properties. In particular, Lux (1997) discusses time variations of the second moment with a noise trader/infection model. Chen, Hong et al. (2001) argue that the past trading volume affects the conditional skewness of individual stocks. The other strand of the literature links stock market movements with macroeconomic activities such as economic growth (Cecchetti, Lam, and Mark (1990)) and economic recessions (Hamilton and Lin (1996)). In addition, a strongly countercyclical effect of real activity on stock return volatility is found in Campbell, Lettau et al. (2001) and Schwert (1989). There is still debate on the effect of real activity on the mean return (Campbell (1999)).

Besides the exploration of the causes of the time variation of stock returns, Markov regime switching models based on time variation in the first and the second moments of financial time series are widely applied in the literature (Hamilton (1989), Turner, Startz et al. (1989), Funke, Hall et al. (1994), Filardo (1994), Hamilton and Susmel (1994), Hamilton (1996), Van Norden and Schaller (1999), Schaller and Norden (1997), Dueker (1997), Van Norden and Vigfusson (1998), Chauvet and Potter (2000), Maheu and McCurdy (2000), Francq and Zakoıan (2001), Dewachter (2001), Jeanne and Rose (2002), Ang and Bekaert (2002), Ang and Chen (2002), Hess (2003), Guidolin and Timmermann (2005), Hondroyiannis and Papapetrou (2006), Moore and Wang (2007), and Wang and Theobald (2008)).

Although there exists literature on the time variation of financial time series' statistical properties, the discussion often concentrates on the properties of the first and the second moments. There is little research on the higher moments of stock returns or the whole probability density distribution of stock returns under different market regimes[2]. Intuition suggests that if there exists a mechanism causing the time variation in the first and the second moments of stock returns, the same mechanism is highly likely to cause the time variation in the higher moments and even the probability density of stock returns. In other words, it is likely that the probability density distribution of stock returns changes as the market regimes change.

The particular market regimes investigated in this research are the well-known bull market regime and the bear market regime. The bull market regime and the bear market regime are two distinguished market regimes which are widely observed (Keynes (1937), Lucas Jr (1978), JK (1979), Ball, Cecchetti et al. (1990), Shiller (1992), Allen and Gorton (1993), Allen, Morris et al. (1993), Basu and Vinod (1994), and Siegel and Coxe (2002)). The bull/bear market regime is chosen in this research for three reasons. First of all, the bull and the bear market regimes are natural representatives of structural breaks which may lead to different market conditions with different probability density distribution of stock returns. Second, the bull and bear market regimes are natural consequences of different types of trading activities based on the accumulation of different types of trading information within the financial market. Intuition suggests that under different market regimes, the accumulation of the different trading information leads to different trading activities. The probability density distribution of stock market returns can be regarded as the aggregation of all of the trading activities of the market participants. As the trading activities change, the probability density distribution of stock returns is likely to change. Third, the bull and bear market regimes can be interpreted as a proxy for the investors' sentiment. As the investors' sentiment changes, their trading behaviour changes, causing possible changes in the probability density distribution of stock returns.

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[2] Perez-Quiros and Timmermann (2001) investigate higher moments and the conditional density of stock returns and they argue that the economic output has significant influences on higher moments of stock returns. In addition, they propose a new mixture of Gaussian and student's t distributions regime switching framework and argue that the new model provides gains in predictive accuracy.

2.2 Probability Density Distribution Models

The normal distribution is the early proposition of asset return probability density model (Bachelier (1900), Osborne (1959), Moore (1962), Akgiray and Booth(1987)). Based on the Central Limit Theorem, Bachelier (1900) argues that the aggregate speculative activities in the financial markets lead to normal distribution of asset returns over a certain long term, no matter what distribution type is observed for a single speculator. By assuming that the variance of price changes over a unit time interval is a constant, Osborne's work implies that the distribution of share price changes should be normally distributed. However, the constant variance assumption is doubtful because financial markets often exhibit unstable volatility. The normal distribution model is one of the parsimonious models which successfully facilitate the theoretical analysis and is widely adopted in practice. US monthly equity returns are often argued to follow a normal distribution. However, higher frequency data are found not to be normally distributed. In particular, the normal distribution model is criticized for its incapability of capturing the nonzero skewness and leptokurtosis (also well known as a fat tail) of the empirical return distributions, which has been widely recognized:

“. . . as you well know, the biggest problems we now have with the whole evolution of risk is the fat-tail problem, which is really creating very large conceptual difficulties. Because as we all know, the assumption of normality enables us to drop off the huge amount of complexity in our equations . . . Because once you start putting in nonnormality assumptions, which is unfortunately what characterizes the real world, then these issues become extremely difficult.”

Alan Greenspan (1997)

The non-normality of stock returns has led to a sustained search for alternative distribution models with the intent to adequately capture empirical characteristics of financial data. These models include: Paretian distribution (Fama (1963); Fama (1965); Mandelbrot (1966); Officer (1972); Clark (1973)), the power exponential distribution (Nelson (1991); Hsieh (1989); Theodossiou (1994); Koutmos and Theodossiou (1994); Akgiray and Booth (1988)), the student's t distribution (Praetz (1972); Blattberg and Gonedes (1974); Kon (1984); McDonald and Newey (1988); Gray and French (1990); Peiro (1994); Kim and Kon (1994); Aparicio and Estrada (2001)), skewed *t* distribution (Hansen (1994)), and skewed generalized t distribution (McDonald and Newey (1988), Theodossiou (1998); Butler, McDonald et al. (1990); Lye and Martin (1993); McDonald and Xu (1995); Harris and Küçüközmen (2001)). In addition, many studies claim that using a mixture of distributions rather than a single distribution offers a better fit with empirical data (Ball and Torous (1983), Kon (1984), Peiro (1994), Press (1967), Merton (1973), and Kim and Kon (1994)) as distributional mixes are better at modelling distributions with non-zero skewness and excess kurtosis. This mixture model is consistent with the observed structural breaks and the market regime switching. In addition, the mixture models are supported by the empirical evidence that stock returns of different periods (e.g. high volatile and low volatile) exhibit different statistical properties.

The discussion of the empirical stock return distributions was an actively researched question in the 1980s and 1990s. This discussion winded down gradually from 2001. The extant discussion on the empirical distribution of stock reruns does not break down the market conditions and investigates the empirical distribution of stock reruns under different market conditions. In addition, the previous literature is rather restrictive to the developed markets and some emerging markets.

Some recent literature is potentially relevant to this research topic. There I discuss two stands of the recent literature which are most relevant to the research topic of this dissertation. The first stand discusses the forward-looking probability distribution derived from options. This literature origins from the seminal contributions of Ross (1976), Breeden and Litzenberger (1978), and Banz and Miller (1978). The more recent discussion on this topic includes Gallant (1994), Bondarenko (2003), Aıt-Sahalia and Duarte (2003), Monteiro, Tütüncü et al. (2008), Fengler and Hin (2015) and Taboga (2016). The forward-looking probability distribution is ex-ante and indicates people's perception about the probability density distribution of the future. The implied probability density distribution derived from options is the risk neutral probability density distribution. This stand of literatures is only partly relevant to the questions addressed in this dissertation because this stand of literature does not address (1) what the psychical probability density distribution is, (2) how the probability density distribution changes as the market regime changes, and (3) what the unstable probability density distribution implies for tail risk measure forecasting. The second stand of the literature which somewhat relevant to this research is concerned with the implications for the financial integration of emerging countries and empirical asset pricing (e.g., Carrieri, Errunza et al. (2007), Lee, Ng et al. (2009), Colacito and Croce (2013), Boubakri, Couharde et al. (2016), and Fama and French (2017)). The objective of this dissertation is to investigate the empirical probability density distribution of stock market returns of a broad range of international samples and discuss how the probability density distribution models of stock returns changes with the changing market conditions. Therefore, this dissertation may provide insightful empirical evidence on the research of the financial integration and empirical asset pricing and hence contribute this stand of literature.

2.3 Financial Risk Measures

Standard deviation is a statistical measure of the dispersion of data and has been widely used as a measure of uncertainty and volatility in the finance literature, especially in portfolio management and asset pricing (e.g. Markowitz (1952)[3], Treynor (1961), Sharpe (1964), and Lintner (1965), Campbell and Viceira (2002), DeMiguel, Garlappi et al. (2009), and Kirby and Ostdiek (2012)). In addition to the standard deviation, Value-at-Risk (VaR) has been widely used in the industry and by regulators and policy makers (Jorion (1997), and Saunders (2000))[4]. Compared with the standard deviation, which is symmetric to gains and losses around the target return, VaR concentrates on losses, and therefore, retains an asymmetric treatment of gains and losses. VaR is generally defined as the maximum loss over a target horizon such that there is a low, pre-specified probability that the actual loss will be larger (Jorion (2007)).

The notion of coherent risk measures was introduced by Artzner, Delbaen et al. (1999),

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[3] Instead of variance (square of standard deviation), Markowitz (1952) concluded that the most theoretical robust risk measure is semi-variance, i.e., the expected value of the squared negative deviations about a specified "target" rate of return. However, because of computational problems of semi-variance statistic, Markowitz used variance instead of semi-variance. Thanks to the symmetry of normal distribution, variance is equivalent to semi-variance in terms of portfolio optimization. The symmetry of normal distribution and variance are also consistent with the widely used mean-variance utility framework.

[4] Interestingly, this unprecedented popularity of VaR also inspired its emerging use in non-financial institutions (Bodnar et al. (1998)).

and Delbaen (2002). Conditional Value-at-Risk (ES) is an example of the coherent risk measure. The theoretical and empirical properties of ES are discussed in Acerbi, Nordio et al. (2001), Acerbi and Tasche (2002), and Acerbi (2002). ES can be seen as the expected loss conditional on VaR being violated. ES is also known as tail VaR, expected shortfall (ES), or expected tail loss. In theory, ES is a more appropriate risk measure than VaR but the estimation and back testing of ES is not straightforward in practice (Tasche (2002), and Yamai and Yoshiba (2005)). In addition to the conceptual discussion, the application of VaR/ES in portfolio management and financial risk management is discussed by Rockafellar and Uryasev (2000), Rockafellar and Uryasev (2002) , and Wipplinger (2007).

2.4 Estimation of VaR/ES

Numerous methods have been proposed to estimate VaR and ES. These estimation methods can be summarized into three categories:

a. Parametric (e.g., RiskMetrics and GARCH type models);

b. Non-parametric (e.g., Historical Simulation and Hybrid Model);

c. Semiparametric (e.g., Extreme Value Theory, CAViaR, and quasi-maximum likelihood).

With regard to the parametric models, researchers need to first estimate the standard deviation and then use it to estimate VaR/ES. The most widely used parametric models include ARCH/GARCH type models. Thanks to the iid assumption and the normality assumption, the 5% percentile VaR is just -1.645 times the estimated standard deviation obtained from the variance equation. The simple relationship between VaR and the standard deviation is based, however, on the assumption that the returns are normally distributed and that the mean is zero. Zero mean assumption is innocuous for high frequency data, such as daily data, because the mean value of the data is very close to zero. However, the normality assumption is not consistent with the empirical properties of the financial distributions at high frequency and in particular, with the frequently observed nonzero skewness and leptokurtosis. Moreover, it will be shown in the Section 3.3, under the normal distribution hypothesis, the conceptual difference between the standard deviation and VaR/ES is eliminated. In this case, VaR and ES deliver no extra information about the exposure to extreme losses than the standard deviation does.

RiskMetrics is another type of the parametric model family where the variance is computed by an exponentially weighted moving average which collapses to an Integrated GARCH model. The RiskMetrics model also assumes that standardised residuals are normally distributed. Therefore, RiskMetrics suffers from the same problems as the GARCH type models do. The performance assessment results indicate that both normal GARCH and RiskMetrics tend to underestimate VaR, because the normality assumption of the standardised residuals does not seem to be consistent with the properties of financial returns. This problem can get additionally complicated when a portfolio includes derivatives whose returns are not normally distributed. In the end, both GARCH and RiskMetrics are subject to the similar misspecification issues: (i) the specification of the variance equation may be incorrect (ii) the distribution chosen to build the log-likelihood may be incorrect. (iii) the standardised residuals may not be i.i.d.

Historical Simulation (HS) is an example of a nonparametric model. This approach does not rely on any particular distributional assumption of the financial returns. Therefore this approach is argued to be immune to the misspecification issue. Although this approach makes no explicit assumptions about the distributional form of the financial returns, a crucial implicit assumption is hidden within this procedure: the distribution of financial returns is stable, i.e., the return distribution does not change within a given time window. This implicit assumption makes HS vulnerable to several problems. First, this method is logically inconsistent. If the returns within any fixed time window are assumed to follow the same distribution, then the logical consequence must be that all the returns follow the same distribution, i.e., the financial return distribution does not change over time. However, if this were true, then the return distributions would be expected to be the same in different market regimes, which is implausible. Second, the empirical quantile estimator is consistent only if the sample size goes to infinity. However, in practice, there exists a dilemma about choosing the window length to increase the sample size and dropping outdated and potentially irrelevant data. To be more specific, the window length should be large enough in order to make statistical inference significant, and it must not be too large, to avoid the risk of taking observations outside of the current volatility cluster. Third, VaR estimates obtained by HS are likely to present predictable jumps because of the discreteness of extreme returns. So, even though HS is not affected by potential misspecification problem, HS is subject to other potential drawbacks.

In terms of semi-parameter models, Extreme Value Theory (EVT) was introduced to financial applications by Koedijk, Schafgans et al. (1990) and Jansen and De Vries

(1991). The EVT application in financial risk management is discussed in Diebold, Schuermann et al. (1998), and more recently in Roko and Gilli (2008).

The most attractive property of EVT is its ability to identify the asymmetry and the fat tail issue of the return distribution. The tail behaviour of financial series has been discussed in Koedijk, Schafgans et al. (1990), Dacorogna, Müller et al. (1995), Loretan and Phillips (1994), Longin (1996), and McNeil and Frey (2000). The main result of EVT is based on the form of the asymptotical distribution of a series of maxima (minima) under certain conditions (Fisher and Tippett (1928) and Gnedenko (1943)). With the asymptotical distribution of the maxima/minima, we can model the tail shape without concerning much about the type of the whole distribution. It is argued that EVT outperforms the other volatility based models, especially for high confidence interval tail-risk measure estimates, because of its ability to model fat tails (Gencay and Selcuk (2004) and Chan and Gray (2006)). However, there are some problems with EVT. First, once again, EVT relies on the assumption of i.i.d. which is inconsistent with the characteristics of financial returns. Although generalizations to dependent observations have been proposed (e.g., Leadbetter, Lindgren et al. (2012) or Embrechts, Klüppelberg et al. (2013)), they either estimate the marginal unconditional distribution or impose conditions that rule out the volatility clustering behaviour typical of financial data. Second, EVT works only for very low probability levels because we need to estimate the parameters based on extreme observations. However, the choice of the threshold to obtain extreme values is potentially an issue.

2.5 Summary

Overall, the current literature leaves some gaps to be filled in. First of all, as discussed in Section 2.2, there are numerous empirical studies on the unconditional probability density distribution models, however, there is no reason to assume that stock market returns follow a single probability density model consistently regardless of the market regime. The discussion on the time varying statistical properties of stock returns is usually restricted to the mean and the variance. However, if the first two moments of stock returns under the bull market regime and under the bear market regime have different characteristics, the probability density models of these stock returns are also likely to differ from each other. This research fills this gap by providing empirical evidence on the probability density distribution models of stock returns for during the bull market regimes and for the bear market regimes.

Second, there is a huge amount of literature on VaR/ES estimation methods. Most of these estimation methods rely on the iid assumption of the stock return distribution or of the normalized error term distribution. Considering that the probability density distribution of the asset returns is likely to change with market conditions, it is crucial to understand how the probability density changes affect the VaR/ES estimation and hence, to what extent decision makers can rely on established VaR/ES estimation models. Based on the comparison of VaR/ES measures calculated using different models, this research provides the empirical assessment on the performance of different VaR and ES estimation methods and their vulnerabilities to the return probability density distribution specification.

In addition to the two main contributions, this research adds new empirical evidence on the distribution of stock returns of a broad sample of both developed and emerging markets. It also provides evidence of the desynchronized cycles of the developed and the emerging stock markets.

3 Definitions, Models and Methods

In this section, the definitions, notations and relevant methods will be introduced and discussed. Section 3.1 provides the definitions of the bull market and the bear markets and the identification methods of the bull/bear market regimes. The identification method adopted in this research will also be introduced and discussed. To capture possible changes up to the forth moments of stock returns, four widely discussed probability density models will be discussed. Section 3.2 provides the discussion of these probability density models: the normal distribution (N), the student's t distribution (ST), Hansen's skewed student's t distribution (HST) and skewed generalised t distribution (SGT). Finally, the financial risk measures (standard deviation, VaR and ES) will be discussed in Section 3.3.

3.1 Bull and Bear Market Regimes

3.1.1 Definition of the Bull and the Bear Market Regime

There is no consolidated and sacrosanct definition of a bear/bull market, although this terminology is often used by practitioners and scholars to describe two distinguished regimes of stock markets. Before the bull/bear market concept attracts the attention of academia, there was anecdotal evidence on the characteristics of bull and bear stock markets in *The Wall Street Journal*. The Dow Theory, developed by Charles Dow, William Peter Hamilton and Robert Rhea is one of the early attempts to formally define bull and bear markets. The Dow Theory assumes that a stock market moves in persistent "Bull" and "Bear" trends. It distinguishes two kinds of stock market movements: the primary trends and the secondary reactions. Specifically, the broad upward and downward movements are known as bull and bear markets. Primary trends usually continue for years and are seldom shorter than a year with the average being longer than two years. In addition, these primary trends are usually interrupted by secondary reactions. For instance, there may be an important decline in a primary bull market or a rally in a primary bear market. These secondary reactions last from three weeks to many months. Consistently with the Dow Theory, Sperandeo (1994) defined a bull market as "a long-term… upward price movement characterized by a series of higher intermediate… highs interrupted by a series of higher intermediate lows" and a bear market as "a long-term downtrend characterized by lower intermediate lows interrupted by lower intermediate highs". More recently, Chauvet and Potter (2000) define bull and bear market as " In stock market terminology, bull (bear) market corresponds to periods of generally increasing (decreasing) market prices". Chauvet and Potter (2000)'s definition emphasized the primary trend without a detailed description of the fluctuations associated within the overall trends. Based on a variety of definitions, it can be found that the two fundamental characteristics of the bull and bear market definitions are (i) the overall trend/direction and (ii) the associated fluctuations of the stock market movement within the trend.

3.1.2 Identification of the Bull and Bear Market Regime

As discussed, it is commonly understood that a bull market is a market of rising prices, while a bear market is characterized by declining prices. Based on these characteristics, there are two categories of bull/bear markets' identification approaches: the fully parametric approach based on statistical models and the non-parametric approach based on rules. The parametric bull/bear separation approaches include the Markov regime switching model developed by Hamilton (1989). In the literature, the Markov-switching model has been used extensively to capture the cyclical patterns of asset prices (Schaller and Norden (1997), Hamilton and Lin (1996) and Gordon and St-Amour (2000), Maheu and McCurdy (2000) and (Maheu and McCurdy 2000b)). The Markov regime switching approach outweighs the rule-based approach because it can deliver the conditional forecast of the bull/bear market state. Hence Markov regime switching approach is powerful in terms of forecasting[5].

However, the Markov regime switching approach is more complex than the rule based approach. Another problem with the Markov regime switching approach, which is more reverent for this research, is that the Markov regime switching approach is built upon the modelling of financial time series with the assumption of the dynamics of the stock prices. In this way, the probability density model is directly decided assumed. Because this research concentrates on the probability density distribution of stock returns, it is important that the bull/bear market separation method does not depend on the assumption about the probably density distribution.

The rule-based methods outweigh the parametric models because they can get rid of the assumption of the dynamics of stock prices. The rule-based methods include the approach proposed by Fabozzi and Francis (1977)[6], the "business-cycle-analogous" Bry-Boschan program (Bry and Boschan (1971)) and more recently value-driven method used by Lunde and Timmermann (2004). Fabozzi and Francis (1977) developed the bull

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[5] There also exists another stand of the literature which attempts to capture the latent direction of a stock market with the help of non-market variables such as macroeconomics variable. For instance, Chen (2009) finds that term spreads and inflation rates are useful predictors of recessions (bear market) in the US stock market. In addition to Chen (2009), more recently Nyberg (2013) proposed a dynamic binary model to forecast the bull and bear market US stock market. However, there is model-misspecification risk with this kinds of methods. Hence the bull/bear market separation results may be wrong if the underlying assumption is not true.

[6] Fabozzi and Francis (1977)'s approach is adopted by Alexander and Stover (1980) and Klein and Rosenfeld (1987) and Hibbert and Lawrence (2010)

and the bear market designation method based on three definitions of bull and bear markets.

1. Bull and Bear (BB) markets. Bull and bear markets are delineated in accordance with the dates published in Cohen, Zinbarg et al. (1973). The method is not used in this research because the date-based method is not convincing, not appropriate for investment decision making and potentially inaccurate in multi-country sample.
2. Up and Down months. Specifically, months in which the return of the month are nonnegative are defined as Up months and months in which the return of the month are negative are designated as Down months.
3. Substantial Up and Down months. This method is a filter algorithm partitioning the sample into three subsets:
    a. Months in which the market moved up substantially
    b. Months in which the market moved down substantially
    c. Months in which the market moved either up or down substantially.

    In the original method, the substantial moves are defined as occurring when the absolute value of the month return is larger than half of one standard deviation of the market's return measured over the total sampled period.

The Up and Down months and Substantial Up and Down months are based on arbitrary criteria and ignore the primary direction of the definition of bull and bear market. Therefore, these two methods are not used in this research.

In this research, we adopt a market separation method based on finding the "turning points" of stock markets. The turning point filtering algorithms seeking for peaks and troughs include the NBER method[7] and Bry-Boschan program (Bry and Boschan (1971)). Bry-Boschan program is a pattern recognition program seeking to isolate the patterns using a sequence of rules. However, Bry-Boscham program smooths the data by removing the outliers. The process of eliminating "outliers" may drop some of the most important movements in the series. And the removal of the outlier is inconsistent with the observed extreme move of equity market during the bear market regime. The minimal length restriction in the method is also problematic. To illustrate, it let us consider the Black Monday in October 1987. Bry-Boscham program is unlikely to identify this phase as the bear market regime because of the short length of this bearish market regime (only

[7] http://www.nber.org/cycles/main.html

three month). However, the decline is big enough to cause huge losses to investors.

More recently, Pagan and Sossounov (2003) addressed this issue and corrected the Bry-Boscham program by adding an additional constraint. They impose that the minimal length of a phase (four months) can be disregarded if the stock price falls by 20% in a single month. This constraint borrows the idea of the value-driven method proposed by Lunde and Timmermann (2004).

Lunde and Timmermann (2004)'s method relies on finding the turning points of market states using the sample observations to decide the values of a series of binary variables indicating the market state. Following the bull and the bear market definition by the Dow Theory and by Sperandeo (1994), Lunde and Timmermann (2004) proposed a method to split the market into two distinct regimes: a bull market regime and a bear market regime.[8] Specifically, the idea of this method is that the stock market switches from a bull/bear state to a bear/bull state if stock prices have declined/increased by a certain percentage since their previous local peak/trough within the bull/bear state. This method does not rule out sequences of negative/positive price movements in stock prices within the bull/bear market as long as the cumulative value caused by the sequence of changes does not surpass a default threshold. Then a sequence of binary variables is constructed: it is set to be unity between toughs and peaks indicating the bull market regime and zero between peaks and troughs indicating the bear market regime. This method focuses on changes in asset values and ignores the durations of different phases. In addition, the observed durations of individual phases have no clear patterns. A rule-based approach involving duration restrictions has to deal with this practical issue of deciding the length of phases.

In summary, the parametric approach which incorporates the Markov regime switching mechanism into the modelling of financial time series is not adopted in this research because of the assumption of the dynamics of the stock price. As this research concentrates on the probability density distributions of the stock returns, it is important to adopt the rule-based separation method which does not depend on the assumption of

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[8] This method is discussed in Maheu et al. (2009), Kole and van Dijk (2010), and Maheu et al. (2012)

the probably density distribution itself. Considering the definitions of bull and bear markets and comparing different rule-based approaches, Lunde and Timmermann (2004)'s value driven approach will be adopted as it is consistent with the bull market and the bear market definitions of the Dow Theory and by Sperandeo (1994) and easy to use.

3.2 Probability Density Models

Assume that X is a continuous real-valued random variable with cumulative distribution function (CDF thereafter) $F: X \rightarrow R$ and probability density function (PDF thereafter) $f: X \rightarrow R$, and F and f satisfy that $P\{X \leq x\} = F(x) = \int_{-\infty}^{x} f(u)du = \alpha, \alpha \in [0,1]$. The first moment, i.e., the expected value of X is denoted by μ and the second central moment, i.e., the variance is denoted by σ^2. We define α-percentile of a random variable X as $q_\alpha(X) = inf\{x|P(X \leq x) \geq \alpha\}, \alpha \in [0,1]$ or satisfying that $F(x) = \int_{-\infty}^{q_\alpha(X)} f(u)du = \alpha$. C is defined as a constant.

3.2.1 Normal distribution

The normal distribution (N) is also known as Gaussian model and is widely used in financial analysis. The advantage of normal distribution is its simplicity with only two parameters. However, the normal distribution is rather restrictive in terms of the shape of the probability density distribution. The probability density function (PDF) of a normal distribution with mean μ and variance σ^2 is

$$\mathrm{f}(\mathrm{x}|\mu, \sigma) = \phi(\mathrm{x}|\mu, \sigma) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}} \tag{1}$$

The cumulative distribution function (CDF) is then the integral of the PDF up to random number X

$$\mathrm{F}(\mathrm{x}|\mu, \sigma) = \Phi(\mathrm{x}|\mu, \sigma) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{x} e^{-\frac{(t-\mu)^2}{2\sigma^2}} dt \tag{2}$$

3.2.2 The student's t distribution

The student's t distribution (ST) is well known for its heavy tail compared with the normal distribution. In addition, the student's t distribution is parsimonious with only one degree of freedom parameter. The PDF of the standard student's t distribution with standardized random variable z is given by:

$$f(z|\upsilon) = \frac{\Gamma\left(\frac{\nu+1}{2}\right)}{\Gamma\left(\frac{\nu}{2}\right)\sqrt{\pi\nu}}\left(1+\frac{z^2}{\upsilon}\right)^{-\frac{\nu+1}{2}} \tag{3}$$

where υ is the degree of freedom and Γ is the gamma function. This kind of student's t distribution is the standard student's t distribution and origins from the sampling of standard normal distribution.

3.2.3 The skewed student's t distribution

There exists two ways to define skewed student's t distribution. One way is to consider skewed student's t distribution as a special case of generalized hyperbolic distributions (e.g., Azzalini and Capitanio (2003), Branco and Dey (2001), Bauwens and Laurent (2005), Fernández and Steel (1998), Jones and Faddy (2003), Patton (2004), Sahu, Dey et al. (2003), and Venter and de Jongh (2002), Aas and Haff (2006)). The other widely used skewed t distribution is introduced and discussed by Hansen (1994) with the intent to deal with the issues of nonzero skewness and of excess kurtosis present in the error term distribution. The difference between these skewed student's t distributions is how the skewness is motivated. Hansen (1994)'s skewed student's t distribution (HST) is adopted in this research for two reasons. Frist it is widely used and discussed particularly in the finance literature. Second and more important, Hansen (1994)'s skewed student's t distribution is nested within the skewed generalised t distribution, which facilitates the empirical assessment of the these two probability density distribution models.

The PDF of Hansen (1994)'s skewed student's t distribution with standardized random variable z is given by:

$$f(z|\upsilon,\lambda) = \begin{cases} bc\left(1+\frac{1}{\upsilon-2}\left(\frac{bz+\alpha}{1-\lambda}\right)^2\right)^{-\frac{\upsilon+1}{2}} & ; z < -\frac{a}{b} \\ bc\left(1+\frac{1}{\upsilon-2}\left(\frac{bz+\alpha}{1+\lambda}\right)^2\right)^{-\frac{\upsilon+1}{2}} & ; z \geq -\frac{a}{b} \end{cases} \tag{4}$$

Where $2 < \nu < \infty$ and $-1 < \lambda < 1$. υ can be interpreted as the degree of freedom as in student's *t* distribution. λ is measure of skewness. The constants a, b, c are given by

$a = 4\lambda c\left(\frac{\nu-2}{\nu-1}\right)$; $\quad b^2 = 1 + 3\lambda^2 - \alpha^2$; $\quad c = \frac{\Gamma\left(\frac{\nu+1}{2}\right)}{\sqrt{\pi(\nu-2)}\Gamma\left(\frac{\nu}{2}\right)}$

Γ is the gamma function. Hansen (1994) proves that this is a proper density function with a mean of zero and a unit variance.

3.2.4 The skewed generalized t distribution

The skewed generalised t distribution (SGT) is proposed by Theodossiou (1998). There are two different parameterizations for the skewed generalized t distribution (Theodossiou (1998) and McDonald, Michelfelder et al. (2010)). The skewed generalized t distribution defined in McDonald, Michelfelder et al. (2010) is originally proposed for modelling conditional error terms and it has more parameters than the one defined in Theodossiou (1998) which is a flexible distribution for general research purposes. Therefore, in this research, the original parameterization defined in Theodossiou (1998) is used:

$$f(x|\nu, k, \lambda, \sigma) = \begin{cases} C(1 + (\frac{k}{\nu - 2})\theta^{-k}(1-\lambda)^{-k}\left|\frac{x}{\sigma}\right|^k)^{-\frac{(\nu+1)}{k}}, x < 0 \\ C(1 + (\frac{k}{\nu - 2})\theta^{-k}(1+\lambda)^{-k}\left|\frac{x}{\sigma}\right|^k)^{-\frac{(\nu+1)}{k}}, x \geq 0 \end{cases} \tag{5}$$

$\nu > 2$ and $k > 0$. k and ν parameters control the height and tails of the probability density. ν can be regarded as the degree of freedom measure when $\lambda = 0$ and $k = 2$. λ is a skewness parameter which controls the rate of descent of the density around $x = 0$ and $-1 < \lambda < 1$. σ is a scaling factor and σ^2 is the variance of x. $B(\cdot)$ is the Beta function. C and θ are the normalizing scalars ensuring that $f(\cdot)$ is a proper probability density function. For the above probability density function, C and θ are given by:

$$C = \frac{1}{2\sigma} kB\left(\frac{1}{k}, \frac{\nu}{k}\right)^{-\frac{3}{2}} B\left(\frac{3}{k}, \frac{\nu-2}{k}\right)^{\frac{1}{2}} S(\lambda)$$

$$\theta = \frac{1}{S(\lambda)}\left(\frac{k}{\nu-2}\right)^{\frac{1}{k}} B\left(\frac{1}{k}, \frac{\nu}{k}\right)^{\frac{1}{2}} B\left(\frac{3}{k}, \frac{\nu-2}{k}\right)^{-\frac{1}{2}}$$

with S given by:

$$S(\lambda) = \left[1 + 3\lambda^2 - 4\lambda^2 B\left(\frac{2}{k}, \frac{\nu-1}{k}\right)^2 B\left(\frac{1}{k}, \frac{\nu}{k}\right)^{-1} B\left(\frac{3}{k}, \frac{\nu-2}{k}\right)^{-1}\right]^{\frac{1}{2}}.$$

SGT provides great flexibility in terms of the shape of probability density distribution. In addition, many other popular distributions are nested within SGT model. The skewed generalized t distribution collapses to:

(i) McDonald's and Newey's generalized t distribution when $\lambda = 0$;

(ii) Hansen's skewed student's t distribution when $k = 2$;

(iii) the student's t distribution when $\lambda = 0$ and $k = 2$;

(iv) the Subbotin's power exponential distribution when $\lambda = 0, \nu = \infty$;

(v) the Laplace distribution when $\lambda = 0, k = 1, \nu = \infty$;

(vi) the Cauchy distribution when $\lambda = 0, k = 2, \nu = 1$;

(vii) the normal distribution when $k = 2,\ \lambda = 0, \nu = \infty$;

(viii) the uniform distribution when $\lambda = 0, k = \infty, \nu = \infty$.

3.3 Financial Risk Measures

The risk measure function $\varphi(\cdot)$ is defined as a real valued function. In risk management, there are basically two broad approaches to axiomize financial risk measures: the deviational risk measure and the coherent risk measure (Artzner, Delbaen et al. (1999))[9].

3.3.1 Standard Deviation

Standard deviation belongs to the deviational risk measures. To be more specific, standard deviation is a symmetric deviational risk measure, i.e., $\varphi(-X) = \varphi(X)$. In terms of mathematics, standard deviation is just the square root of the second central moment, i.e. variance. Variance of X is defined as

$$\sigma^2 = E[X - E(X)]^2 \qquad (6)$$

Or:

[9] Axioms of the deviational risk measure and the coherent risk measure are presented in Appendix.

$$\sigma^2 = \int_{-\infty}^{+\infty} [X - E(X)]^2 f(X) dX \qquad (7)$$

Thus the standard deviation is the square root of σ^2 i.e., σ.

Standard deviation have been widely used in both academia and the financial industry as the risk measure since the seminal portfolio analysis of Markowitz (1952). Unfortunatley, the theoractical assumptions necessary to suport variance as an aproperiate risk measrue are too restrictive in reality. First of all, variance is not consistent with investor's actucal risk percetion. By definition, standard deviation (σ) treats the fluctuations symmetrically and therefore cannot distinguish between gains and losses although it can simplify theoretical analysis in mean-variance framework (e.g. obtain closed form solution) and optimization algorithm in portfolio management. Obviously, a decrease in asset prices drags down investors' utility by a bigger amount compared to that of an equal increment in asset prices. In addition, standard deviation, as a deviational risk measure, gauges the degree of uncertainty in the investment value X. Therefore, adding cash to the current investment will no change the overall uncertainty/fluctuation of the current investment. However, in reality, adding constant C to the current investment is like adding cash (cash acts as insurance), so the risk of the new investment X+C should be less than the risk of X by the amount of cash, C (axiom C4). Standard deviation is a sufficient risk measure only when the financial returns are normally distributed because all statistical properties of the normal distribution are captured by the first and second moment: mean and standard deviation. However, normality assumption is violated for most if not all financial time series.

3.3.2 Value-at-Risk

Originally from the industry, VaR is generally defined as the maximum loss over a target horizon such that there is a low, pre-specified probability α that the actual loss will be larger ((Jorion 2007)). According to Danielsson (2011), value at risk is defined as the loss on a trading portfolio such that there is a probability α of losses equalling or exceeding VaR in a given trading period and the $(1-\alpha)$ probability of losses being lower than the VaR. If X is the return of the underlying asset or the portfolio, the mathematical definition of VaR is then the opposite of the solution to the following equation[10], i.e.$-X_\alpha$

[10] The opposite value is taken because of the loss is just the opposite of the returns.

$$P\{X \leq X_\alpha\} = \alpha \tag{8}$$

Or

$$\alpha = \int_{-\infty}^{X_\alpha} f(X)dX \tag{9}$$

VaR is widely used in the financial industry and even written in the Basel Accord by the regulators. The first advantage of VaR is its concentration on losses and therefore asymmetric treatment of gains and losses. In addition, there is a confidence level (the probability) associated with VaR. This confidence level can be interpreted as a risk tolerance of investors. However, there are some problems with VaR. First of all, VaR belongs to neither a deviational risk measure nor a coherent risk measure. Second, VaR is only a percentile of the whole distribution. It is the minimum potential loss that a portfolio can suffer in an adverse outcome. In other words, VaR gives the "best of the worst case scenarios". In practice, it is likely to see large losses in extreme events. Therefore under extreme market conditions, VaR is very likely to underestimate risk. Third, VaR is easy to be manipulated because it is only the specific percentile of the whole distribution. Therefore, in terms of regulatory reporting and financial disclosure, financial institutions have motivations to adopt thin tail distribution model to reduce the VaR magnitude and hide any potential losses beyond the VaR.

3.3.3 Conditional Value-at-Risk

Conditional value-at-risk (ES) is defined as the expected loss conditional on VaR being violated. In other words, it provides the expected loss once the loss is bigger than VaR. Conditional Value at risk is also known as tail VaR, expected shortfall (ES), or expected tail loss. By definition,

$$\mathrm{ES}_\alpha = -E[X | X \leq X_\alpha] \tag{10}$$

Or:

$$\mathrm{ES}_\alpha = -\int_{-\infty}^{X_\alpha} Xf(X)dX \tag{11}$$

where X is the return of the underlying asset or the portfolio and X_α is the solution to the equation of $P\{X \leq X_\alpha\} = \alpha$.

Compared with VaR, ES provides a better description about the tail shape of the whole distribution. Therefore, ES can be regarded as an improved VaR, i.e., ES retains all appropriate properties of VaR. In addition, ES is proved to be a coherent risk measure. However, the estimation and back-testing of ES is a demanding task in practice.

4 Data and Methodology

4.1 Samples and Descriptive Statistics

For the purpose of empirical testing, the daily stock price movement of the main stock market indexes from 19 developed stock exchanges (DSEs) and 19 emerging stock exchanges (ESEs) have been collected from DataSteam. The sample covers the period of 01 January 2000 – 31 December 2016. The quarterly price indexes for the same sample are collected from Q1 2000 to Q4 2016. The sample and period were selected to (i) maximise the sample size and coverage of the important changes that took place on the world stock exchanges, i.e., the burst of the dotcom bubble, the credit crunch and the collapse of the subprime mortgage market, (ii) ensure that bull and bear periods are long enough to provide reliable estimates of distribution parameters. The length of the individual time series differs because each stock exchange has a different number of traded days (e.g., nontraded days have been removed). For each time series daily returns for traded days are calculated.

In this research, I use the stock market index as the proxy of the stock market movement. One of the research objectives is to test difference between the probability density distributions of stock market index returns in different market conditions. Some factors may cause abnormal fluctuations of the index and hence affecting the results. To avoid this adverse affection, the data used in this research is the index which corrected the for the dividend payment and currency changes. All the data used in the dissertation is collected from DataStream and is checked before analysis.

The DSEs in the sample come from Canada, the United States of America (US), Japan, Singapore, Australia, New Zealand, Austria, Denmark, Finland, France, Germany, Greece, Italy, Ireland, the Netherlands, Portugal, Switzerland, Sweden, and the United Kingdom (UK). The ESEs are from South Africa, Morocco, China, India, Pakistan, Malaysia, Philippines, Saudi Arabia, Taiwan, Thailand, Hungary, Russia, Romania, Turkey, Argentina, Chile, Columbia, Mexico, and Peru. Therefore, the sample covers a wide range of stock markets at different levels of development, and operating on all continents.

The quarterly index level data for each country is used to separate the market into bull and bear periods. All the calculations and simulations are conducted on daily data. For each time series, daily log returns are calculated. The log returns are defined as $y = \ln P_t - \ln P_{t-1}$, where P_t denotes the price level of the daily index at time t.

The basic sample statistics of the daily log returns are presented in Table 1 for the DSEs and in Table 2 for the ESEs. In addition to the individual markets' statistics, the averages for each group of stock exchanges are provided. From Tables 1 and 2, it can be seen that the mean value of each stock return index is very close to zero. The average of all the sample means of the DSEs is 0.0002 and the average of the all the sample means of ESEs is 0.0004. This observation is intuitive as the daily movements of the stock market indexes are small. It is clear that based on the group averages, consistent with the common wisdom, the ESEs seem more volatile than the DSEs because the ESEs' average standard deviation is larger than that of the DSEs. The ESEs, on average, also have larger kurtosis suggesting that the distribution of daily returns of the ESE has thicker tails than the DSEs'.

However, a closer look at the statistics of the individual countries shows that both groups of stock exchanges are highly heterogeneous in the sense that some ESEs are less volatile and thinner tailed than some of the DSEs. For instance, the standard deviation of the Chilean SE is lower than the standard deviation of every DSE except for New Zealand. The Canadian SE's skewness is lower than any ESE's skewness, and the kurtosis of the Taiwanese SE is smaller than kurtosis of every single DSE. As shown in Tables 3 and 4, normality of the distributions of daily returns is rejected for every DSE and ESE.

Table 1. Descriptive Statistics of the Developed Stock Exchanges (Sample Period: 03/01/2000-30/12/2016)

_	Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
Sample Size	4270	4276	3678	4264	4312	4021	4212	3751	4268	4345
Maximum	0.0937	0.1096	0.1323	0.0731	0.0557	0.0581	0.1202	0.0820	0.1456	0.1032
Minimum	-0.0976	-0.0946	-0.1211	-0.0863	-0.0870	-0.0525	-0.1025	-0.1058	-0.1717	-0.0938
Mean	0.0002	0.0002	0.0002	0.0001	0.0003	0.0004	0.0003	0.0004	0.0000	0.0001
Median	0.0007	0.0006	0.0006	0.0005	0.0006	0.0008	0.0008	0.0009	0.0006	0.0005
Standard Deviation	0.0113	0.0124	0.0154	0.0113	0.0100	0.0070	0.0146	0.0117	0.0182	0.0143
Skewness	-0.6417	-0.1918	-0.4522	-0.3679	-0.4913	-0.5113	-0.3328	-0.3918	-0.2567	-0.0719
Kurtosis	12.1208	11.1490	9.7804	8.8000	8.6457	8.3391	9.8665	8.6159	9.4548	7.7493
	Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK	Average
Sample Size	4321	3895	4314	4298	4340	3891	4276	3766	4295	4147
Maximum	0.1080	0.1343	0.1088	0.0973	0.0983	0.1131	0.1079	0.0987	0.0881	0.1015
Minimum	-0.0887	-0.1747	-0.1333	-0.1396	-0.0945	-0.1038	-0.0907	-0.0880	-0.0871	-0.1060
Mean	0.0001	-0.0003	0.0000	0.0002	0.0001	0.0000	0.0001	0.0003	0.0002	0.0002
Median	0.0008	0.0003	0.0006	0.0007	0.0006	0.0005	0.0006	0.0007	0.0007	0.0006
Standard Deviation	0.0154	0.0192	0.0157	0.0141	0.0137	0.0121	0.0120	0.0146	0.0116	0.0134
Skewness	-0.0471	-0.3612	-0.1940	-0.6601	-0.2061	-0.2100	-0.1686	0.0320	-0.2093	-0.3018
Kurtosis	7.1825	9.4925	7.9430	10.9404	9.1011	10.0696	9.6826	7.2627	8.8779	9.2144

Note: Table 1 presents the basic sample statistics (Sample Size, Maximum, Minimum, Mean, Median, Standard Deviation, Skewness, and Kurtosis) of the daily log returns for the 19 DSEs. In addition to the individual markets' statistics, the averages for each group of stock exchanges are provided. The data source is DataStream and the Sample Period is 03/01/2000-30/12/2016.

Table 2. Descriptive Statistics of the Emerging Stock Exchanges Descriptive Statistics (Sample Period: 03/01/2000-30/12/2016)

_	South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
Sample Size	4247	3734	4112	4214	4195	4186	4170	4195	4200	4160
Maximum	0.0683	0.0446	0.0940	0.1503	0.0851	0.0450	0.1618	0.1640	0.0652	0.1058
Minimum	-0.0790	-0.0682	-0.0926	-0.1288	-0.0866	-0.0998	-0.1309	-0.1168	-0.0994	-0.1606
Mean	0.0004	0.0003	0.0002	0.0004	0.0008	0.0002	0.0003	0.0003	0.0000	0.0003
Median	0.0007	0.0004	0.0007	0.0014	0.0011	0.0004	0.0004	0.0010	0.0004	0.0005
Standard Deviation	0.0123	0.0077	0.0164	0.0152	0.0137	0.0083	0.0132	0.0154	0.0141	0.0137
Skewness	-0.1792	-0.4408	-0.3402	-0.5499	-0.3061	-0.8251	0.2685	-0.6052	-0.2437	-0.7176
Kurtosis	6.4408	9.7852	7.4910	10.4791	7.2410	13.2235	17.8295	15.0694	6.2146	12.4773
	Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru	Average
Sample Size	4248	4320	4254	4261	4174	4242	3781	4278	4249	4169
Maximum	0.1318	0.2523	0.1154	0.1777	0.1612	0.0906	0.1469	0.1044	0.1282	0.1207
Minimum	-0.1265	-0.2066	-0.1312	-0.1998	-0.1295	-0.0598	-0.1105	-0.0827	-0.1329	-0.1180
Mean	0.0003	0.0006	0.0006	0.0004	0.0008	0.0003	0.0006	0.0004	0.0005	0.0004
Median	0.0004	0.0005	0.0006	0.0008	0.0011	0.0005	0.0010	0.0008	0.0004	0.0007
Standard Deviation	0.0154	0.0211	0.0159	0.0218	0.0216	0.0075	0.0130	0.0132	0.0140	0.0144
Skewness	-0.0968	-0.2003	-0.4018	-0.0663	-0.1662	-0.1372	-0.1675	0.0238	-0.4242	-0.2935
Kurtosis	9.0147	17.7429	11.8929	10.3649	7.0954	13.1305	15.1452	8.0998	14.5258	11.2244

Note: Table 2 presents the basic sample statistics (Sample Size, Maximum, Minimum, Mean, Median, Standard Deviation, Skewness, and Kurtosis) of the daily log returns for the 19 ESEs. In addition to the individual markets' statistics, the averages for each group of stock exchanges are provided. The data source is DataStream and the Sample Period is 03/01/2000-30/12/2016.

Table 3. Normality Test Results of the Developed Stock Exchanges (Sample Period: 03/01/2000-30/12/2016)

		Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
Jaque Bera Test	Test Statistic	15093.8	11857.7	7170.8	6072.9	5900.2	4951.1	8352.3	5025.2	7456.2	4087.3
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality Test	Test Statistic	0.4813	0.4788	0.4768	0.4804	0.4817	0.4880	0.4771	0.4811	0.4714	0.4781
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK	
Jaque Bera Test	Test Statistic	3151.1	6925.8	4419.0	11603.3	6761.9	8131.6	7976.6	2851.9	6214.3	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Kolmogorov–Smirnov Normality Test	Test Statistic	0.4750	0.4716	0.4769	0.4776	0.4772	0.4819	0.4791	0.4768	0.4807	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	

Note: Tables 3 demonstrates the normality of the distributions of daily returns. The test statistics values and the associated p values are presented for both Jaque Bera Test and Kolmogorov–Smirnov Normality Test. The results of Table 3 indicate that the normality of the distributions of daily returns is rejected for every DSE. The data source is DataStream and the Sample Period is 03/01/2000-30/12/2016.

Table 4. Normality Test Results of the Emerging Stock Exchanges (Sample Period: 03/01/2000-30/12/2016)

		South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
Jaque Bera Test	Test Statistic	2117.8	7283.7	3534.9	10034.1	3209.4	18704.9	38259.9	25718.2	1850.0	15925.6
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality Test	Test Statistic	0.4799	0.4855	0.4756	0.4763	0.4783	0.4853	0.4800	0.4752	0.4769	0.4783
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
Jaque Bera Test	Test Statistic	6409.9	39152.3	14131.9	9633.2	2936.1	18152.7	23255.9	4636.4	23646.3
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality Test	Test Statistic	0.4759	0.4696	0.4736	0.4678	0.4687	0.4870	0.4782	0.4767	0.4768
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: Tables 4 demonstrates the normality of the distributions of daily returns. The test statistics values and the associated p values are presented for both Jaque Bera Test and Kolmogorov–Smirnov Normality Test. The results of Table 3 indicate that the normality of the distributions of daily returns is rejected for every ESE. The data source is DataStream and the Sample Period is 03/01/2000-30/12/2016.

4.2 Methodology

4.2.1 Probability Models and the Assessment Framework

The extant research on the probability density distribution of stock returns implicitly assumes the homogenous probability density distribution during different market conditions. As discussed in Introduction, the stock markets' conditions are not time-invariant, indeed they change quite frequently. The changing market conditions are associated with different supply and demand for securities, different investor sentiment, as well as changing economic and trading activities, which may intuitively lead to different probability density distribution of stock returns of different market conditions. The first hypothesis for this research is that the probability density distribution of stock returns changes as the stock market conditions change. The second hypothesis is that empirical probability density distributions of stock returns are heterogeneous in different groups of stock exchanges such as developed stock exchanges and the emerging stock exchanges. The third hypothesis is that the probability density distributions of stock returns has significant influence on the magnitude of the tail risk measures. The forth hypothesis is that considering different probability density distributions in different market regimes provides high quality forecasting of VaR and ES.

The first hypothesis for this research is that the probability density distribution of stock returns changes as the stock market condition changes. Therefore, to capture possible changes in the first four moments and the potential change in the probability density model, the empirical research is based on four widely discussed distributional specifications: the normal distribution (N), the student's t distribution (ST), Hansen's skewed t distribution (HST) and skewed generalised t distribution (SGT).

As discussed in Section 3.2.4, following Theodossiou (1998), SGT is defined by the density function:

$$f(x|\nu,k,\lambda,\sigma) = \begin{cases} C\left(1+\left(\frac{k}{\nu-2}\right)\theta^{-k}(1-\lambda)^{-k}\left|\frac{x}{\sigma}\right|^{k}\right)^{-\frac{(\nu+1)}{k}}, x<0 \\ C\left(1+\left(\frac{k}{\nu-2}\right)\theta^{-k}(1+\lambda)^{-k}\left|\frac{x}{\sigma}\right|^{k}\right)^{-\frac{(\nu+1)}{k}}, x\geq 0 \end{cases} \quad (12)$$

where $\nu > 2$ and $k > 0$. k and ν parameters control the height and tails of the probability density. ν can be regarded as the degree of freedom measure when $\lambda = 0$ and $k = 2$. λ is a skewness parameter which controls the rate of descent of the density around $x = 0$ and $-1 < \lambda < 1$. σ is a scaling factor and σ^2 is the variance of x. B(·) is the Beta function. C and θ are the normalizing scalars ensuring that f(·) is a proper probability density function. For the above probability density function, C and θ are given by:

$$C = \frac{1}{2\sigma} kB\left(\frac{1}{k}, \frac{\nu}{k}\right)^{-\frac{3}{2}} B\left(\frac{3}{k}, \frac{\nu-2}{k}\right)^{\frac{1}{2}} S(\lambda)$$

$$\theta = \frac{1}{S(\lambda)} \left(\frac{k}{\nu-2}\right)^{\frac{1}{k}} B\left(\frac{1}{k}, \frac{\nu}{k}\right)^{\frac{1}{2}} B\left(\frac{3}{k}, \frac{\nu-2}{k}\right)^{-\frac{1}{2}}$$

with S given by:

$$S(\lambda) = \left[1 + 3\lambda^2 - 4\lambda^2 B\left(\frac{2}{k}, \frac{\nu-1}{k}\right)^2 B\left(\frac{1}{k}, \frac{\nu}{k}\right)^{-1} B\left(\frac{3}{k}, \frac{\nu-2}{k}\right)^{-1}\right]^{\frac{1}{2}}.$$

The other three probability density models are obtained as follows:

(i) the PDF of the normal distribution (N) is obtained by $k = 2,\ \lambda = 0, \nu = \infty$;

(ii) the PDF of the student's t distribution (ST) is obtained by $\lambda = 0$ and $k = 2$;

(iii) the PDF of the Hansen's skewed t distribution (HST) is obtained by $k = 2$.

It can be noticed that, there is no location parameter within the PDF of SGT and the PDF is separated into two forms around 0. In order to fit SGT to the empirical data, the logreturn series of y is centralized: $u = y - \mu_{\bar{y}}$, where $\mu_{\bar{y}}$ is the sample mean of y.

According to sample mean theorem, the expected value of the sample mean is the population mean, i.e., $E[\mu_{\bar{y}}] = \mu_y$. Hence $E[u] = E[y - \mu_{\bar{y}}] = E[y] - E[\mu_{\bar{y}}] = \mu_y - \mu_y = 0$. u is then centralized around 0. The centralization of the random variable is also used in Theodossiou (1998) when Theodossiou fitts SGT to US data. In addition, the sample mean is nearly zero for daily data as mentioned in Section 4.1(the average of the all the DSEs means is 0.0002 and the average of the all the ESEs means is 0.0004). Therefore, this manipulation is innocuous and it facilitates the modelling and analysis. Therefore all of the probability density models are estimated based on the centralized time series u. The parameters of the probability models are estimated by maximizing the log-likelihood of the relevant probability density function. The optimization algorithm of Nelder and Mead (1965) is adopted and the starting values are obtained from US data fitted parameters in Theodossiou (1998).

To assess the quality of the goodness of fit of the probability density model, the –Log Likelihood (-LogL), the Akaike Information Criterion (AIC) and the Schwartz Bayesian Criterion (SBC) are calculated. –Log Likelihood (-LogL) is the minus maximized value of the log likelihood function:

– Log Likelihood $(-\text{LogL}) = -\hat{L}$, where $\hat{L}$ is maximum likelihood.

Both of AIC and SBC are based on the maximum log-likelihood function value but are adjusted for the loss of degrees of freedom that results from the estimation of additional parameters:

Akaike Information Criterion (AIC) is $AIC = 2k - 2\ln\hat{L}$

Schwartz Bayesian Criterion (SBC) is $SBC = \ln\hat{L} - \frac{1}{2}k\ln T$

–LogL statistics are provided for the completeness of the analysis as it is expected that the criterion will be biased towards the distribution with the highest number of parameters and may lead to 'overfitting'. Given that both AIC and SBC 'penalise' for the number of the parameters, they are of the main interest to us. Moreover, AIC has several advantages over SBC (e.g., AIC is derived from the principles of information and has the prior that is a declining function of the number of parameters), therefore more weight will be put on the AIC than on the SBC outcomes.

As mentioned the normal distribution (N), student's t distribution (T) and Hansen's skewed t distribution (ST) are nested within the skewed generalized t distribution (SGT), likelihood ratio test can be conducted to test the validity of the parameter restrictions that are implied by each of the nested distributions. The validity of the parameters indicates whether the simplified model is optimal compared with SGT. By conducting this test with regard to each of these nested models, we can identify the most optimal probability density model for each stock exchange and for each market condition.

Formally, the validity of the parameters will be tested using the likelihood ratio test (LR test), $LR = -2(\ln L_0 - L_1)$, where L_0 is the maximum log likelihood of the restricted distribution while L_1 is the maximum log likelihood of the unrestricted distribution. Under the null hypothesis that the parameter restrictions are valid, the likelihood ratio test statistic follows an asymptotic χ^2 distribution with k degrees of freedom, where k is the number of the restrictions imposed.

Normal Distribution against skewed Generalized T distribution:

Null hypothesis is that the Normal distribution outperforms the skewed Generalized T distribution as the optimal model for the empirical daily stock index returns. The alternative hypothesis is that the Normal distribution tails to outperform the skewed Generalized T distribution as the optimal model for the empirical daily stock index returns. Mathematically:

$$H_0: \nu = \infty, \mathrm{k} = 2, \lambda = 0$$

$$H_1: \nu \neq \infty, \mathrm{k} \neq 2, \lambda \neq 0$$

Student's T Distribution against skewed Generalized T distribution:

Null hypothesis is that the Student's T Distribution outperforms the skewed Generalized T distribution as the optimal model for the empirical daily stock index returns. The alternative hypothesis is that the Student's T Distribution tails to outperform the skewed Generalized T distribution as the optimal model for the empirical daily stock index returns. Mathematically:

$$H_0: \mathrm{k} = 2, \lambda = 0$$

$$H_1: \mathrm{k} \neq 2, \lambda \neq 0$$

Hansen's Skewed T Distribution against skewed Generalized T distribution:

Null hypothesis is that the Hansen's Skewed T Distribution outperforms the skewed Generalized T distribution as the optimal model for the empirical daily stock index returns. The alternative hypothesis is that the Hansen's Skewed T Distribution tails to outperform the skewed Generalized T distribution as the optimal model for the empirical daily stock index returns. Mathematically:

$$H_0: \mathrm{k} = 2$$

$$H_1: \mathrm{k} \neq 2$$

4.2.2 The Bull and Bear Market Regime Separation

The separation of the bull market regime and the bear market regimes is determined by the turning points identification approach developed by Lunde and Timmermann (2004) (further after referred to as LT). The LT method identifies local peaks and troughs and, hence, allows us to focus on the systematic up-and-down movements in stock prices. This method relies on finding turning points of market states by using the sample observations to decide the values of a series of binary variables indicating the particular market state.

According to the literature (Bry and Boschan (1971), Lunde and Timmermann (2004), and Pagan and Sossounov (2003)), the bull/bear phrase usually lasts for at least several months. It is also observed that short term reversal periods within the bull/bear periods can occur. Because daily data may be too noisy, quarterly data are used to separate the whole sample period into the bull market and the bear market regimes in order to capture the primary trends.

Let's define I_t as a bull market indicator variable taking value of unity if the stock market is in a bull state at time t and 0 if the stock market is in a bear market state. The stock price at the end of period t is P_t. Let η_1 be a scalar defining the threshold of the movement in stock prices that trigger a switch from a bear to a bull market, and let η_2 be the threshold for shifts from a bull to a bear market. Suppose that at time t_0, the stock market is at the local maximum ($I_{t_0} = 1$) and we set $P_{t_0}^{max} = P_{t_0}$, where P_{t_0} is the value at time t_0 of the stochastic process of stock price. As proceeding forward, two actions are expected to be taken depending on the data: update of the local maximum value or a trough is detected, and therefore, the market condition switches into bear state. Let τ_{max} and τ_{min} be the stopping-time variables defined by the conditions:

$$\tau_{max}\left(P_{t_0}^{max}, t_0 | I_{t_0} = 1\right) = inf\left\{t_0 + \tau : P_{t_0+\tau} \geq P_{t_0}^{max}\right\}$$
$$\tau_{min}\left(P_{t_0}^{max}, t_0, \lambda_2 | I_{t_0} = 1\right) = inf\left\{t_0 + \tau : P_{t_0+\tau} < (1 - \lambda_2) P_{t_0}^{max}\right\}$$

where $\tau \geq 1$. Then the $\min(\tau_{max}, \tau_{min})$ is the first time that the price process crosses one of the two barriers$\left\{P_{t_0}^{max}, (1 - \theta_2) P_{t_0}^{max}\right\}$. If $\tau_{max} < \tau_{min}$, then we update the local maximum in the current bull market state, i.e.,

$$P^{max}_{t_0+\tau_{max}} = P_{t_0+\tau_{max}},$$

which continued from $t_0 + 1$ to $t_0 + \tau_{max}$: $I_{t_{0+1}} = \cdots = I_{t_0+\tau_{max}} = 1$. Conversely, if $\tau_{min} < \tau_{max}$, so that the stock price at $t_0 + \tau_{min}$ has declined by a fraction η_2 since its nearest local peak,

$$P_{t_{0+\tau_{min}}} < (1 - \eta_2)\, P^{max}_{t_0}$$

then the bull market has switched to a bear market that prevailed from $t_0 + 1$ to $t_0 + \tau_{min}$: $I_{t_0+1} = \cdots = I_{t_0+\tau_{min}} = 0$. In this case, we set $P^{min}_{t_0+\tau_{min}} = P_{t_0+\tau_{min}}$. If the starting point at t_0 is a bear market state, then the stopping time series are defined as:

$$\tau_{min}\left(P^{min}_{t_0}, t_0 | I_{t_0} = 0\right) = inf\left\{t_0 + \tau : P_{t_0+\tau} \leq P^{min}_{t_0}\right\}$$
$$\tau_{max}\left(P^{min}_{t_0}, t_0, \lambda_1 | I_{t_0} = 0\right) = inf\left\{t_0 + \tau : P_{t_0+\tau} < (1 + \lambda_1) P^{min}_{t_0}\right\}$$

We assume that the starting time point is a bull market and conduct the stock market partitioning exercise. With regard to the value of$(\eta_1\,, \eta_2)$, the smaller the values at which these parameters are set, the more bull and bear market separations are likely to be generated by this algorithm. The financial industry and financial press in developed markets, commonly assume that a 20% fall in the index value, i.e., $\eta_2 = 20\%$ is a signal of bearish market. Hence $(\eta_1 = 20\%\,, \eta_2 = 20\%)$ is adopted for the bull/bear market separations. This set of parameter is also used in Lunde and Timmermann (2004).
This approached has its shortcomings. First, this approach is able to identify the primary trends but it may not be able to precisely locate the turning points (peaks/troughs) and separate the bull and the bear markets according to the exact turning points (peaks/troughs). In other words, this approach may recognise the bear market regime when the market has been in the bear market phase and vice versa. This problem cannot be solved by changing the threshold values. In addition, as quarterly data is used to separate the markets, it is more likely that this algorithm missed the exact turning points (peaks/troughs). To deal with this problems, the index level and the market regime for each country are plotted and the market identification is manually adjusted so that the bull/bear start/finish points are located to the exact turning points.

Another potential problem with this algorithm is that there may be a very short period of market crash. The crash is too short to be identified by the algorithm as bear market period. However, the market crash period is highly likely to demonstrate distinguished distribution properties as discussed. If the short term market crashes are not removed from the bull market regime, the distributional properties of the bull market will be distorted by the bearish distributional properties of the market crash. Hence, the short periods of market crash will be manually picked up and defined as a bear market regime (For instance, there was a nearly 30% drop in the stock market in Romania during the period from 02/03/2005 to 30/05/2005, the period from 07/02/2006 to 27/06/2006, and the period from 16/04/2010 to 25/05/2010). The manually-adjusted bull/bear market separation results will be presented in the main text and used in this research. The original LT bull/bear market separation results will be provided in the appendix.

4.2.3 VaR and ES Calculation

VaR and ES are straightforward to calculate when the underlying probability density model is the normal distribution because there exists a closed form formula which links VaR/ES and the parameter values. There exists no such closed form expression for SGT. To deal with it, the bisection method is adopted. To be more specific, the bisection method is adopted to find the value of random variable, X_α, which makes cumulative distribution function (numerical integration of probability density function from $-\infty$ to X_α) equal to the associated confidence level α. VaR is then obtained as $-(X_\alpha + \mu_{\bar{y}})$. To calculate ES, 10,000 random numbers are generated from the probability density function. Then, all the values X smaller than X_α are picked and decentralized by adding $\mu_{\bar{y}}$, i.e., $X + \mu_{\bar{y}}$. Then ES is the opposite number of the numerical average of all of these decentralized values, i.e. ES= $-\frac{1}{m}\sum_1^m(X_i + \mu_{\bar{y}})$ where m is the number of X which are smaller than X_α.

In addition to using probability density distribution models to calculate VaR/ES, HS and HS specified in Daníelsson (2011) and EVT are adopted. In terms of HS, To be more specific, all the returns are sorted in an ascending order. Let's assume that the sample size is N, then the $(N * \alpha)$th smallest data from the sorted return data is picked. If (N*α) is not an integer, the number is rounded to the smallest integer which is not less than (N*α). Then VaR is calculated as the opposite number of this picked data point. Based on VaR, ES is the value of the opposite number of the numerical average of all data points smaller than the $(N * \alpha)$th data point of the sorted returns.

With regard to the VaR/ES calculation based on EVT, the 'evir' Package in R language is used to fit the extreme value distributions to the data and to calculate VaR/ES. The return data is switched to loss data by putting minus sign in front of each of the returns, i.e., the loss data is obtained by finding the opposite number of each return. VaR/ES is calculated on the loss data.

In terms of modelling, the Generalized Pareto Distribution is adopt to model the extreme values. To be more specific, loss data is first sorted in a decreasing order. In order to apply the Generalized Pareto Distribution to model the extreme values and to calculate VaR/ES. The extreme values need to be picked from the sample. Let γ denote the threshold which will decide the extreme values from the sample. The sample size is denoted by N, then the $(N * \gamma)$th largest data point of sorted loss data is picked. If $(N * \gamma)$ is not an integer, the number is rounded to the smallest integer number which is not less than the $(N * \gamma)$. There is no theory or empirical evidence on how to best choose the threshold γ. Different kinds of data may require different values of the threshold. Mover, there is trade-off of between increasing the sample size and bearing the risk of including non-extreme data or decreasing the sample size and reducing the risk of including non-extreme data. In this research, γ is set as 5% to strike a reasonable balance between the two objectives: (i) to have a sufficient number of data for parameter estimation of the Generalized Pareto Distribution and (ii) to avoid the inclusion of too much data which is not "relatively extreme". Other values of γ will be used and investigated in the robustness discussion. The "gpd" function is applied to fit the Generalized Pareto model to the data points bigger than the threshold. Based on the fitted the Generalized Pareto model, "riskmeasures" function of 'evir' Package in R language is adopted to calculate the VaR and ES at the α confidence level.

I consider two categories of conditional models: the RiskMetrics model and the GARCH-class of models. In addition, these models are augmented by switching the parameters according to market conditions (i.e., the bull market and the bear market). As a parsimonious model compared with GARCH model with more lags, GARCH (1,1) model is considered to capture the conditional dynamics of the volatility.

Let's assume we have t observed returns $r_1, r_2, r_3, r_4, \ldots, r_{t-1}, r_t$. As discussed in the Methodology, the logreturns of the stock r , are demeaned, i.e., the sample mean of the returns are subtracted so that the returns have zero mean. Let's assume we have t observed demeaned logreturns $x_1, x_2, x_3, \ldots, x_{t-1}, x_t$. The variance of x is denoted by σ^2.

The GARCH (1,1) model can be defined as:

$$\sigma_t^2 = \omega + \beta_1 x_{t-1}^2 + \beta_2 \sigma_{t-1}^2 \tag{13}$$

I assume that the demened logreturn x follow different probability density distributions considered in this dissertation. Different probability density distribution assumptions of the returns will be considered and will be done by restricting the values of the parameters of the skewed generalised t distribution (SGT). As mentioned, the probability density function specified by the skewed generalised t distribution (Theodossiou (1998)) can be defined as:

$$f(x|\nu,k,\lambda,\sigma) = \begin{cases} C(1+(\frac{k}{\nu-2})\theta^{-k}(1-\lambda)^{-k}\left|\frac{x}{\sigma}\right|^{k})^{-\frac{(\nu+1)}{k}}, x<0 \\ C(1+(\frac{k}{\nu-2})\theta^{-k}(1+\lambda)^{-k}\left|\frac{x}{\sigma}\right|^{k})^{-\frac{(\nu+1)}{k}}, x\geq 0 \end{cases}$$

$\nu > 2$ and $k > 0$. k and ν parameters control the height and tails of the probability density. ν can be regarded as the degree of freedom measure when $\lambda = 0$ and $k = 2$. λ is a skewness parameter which controls the rate of descent of the density around $x = 0$ and $-1 < \lambda < 1$. σ is a scaling factor and σ^2 is the variance of x. $B(\cdot)$ is the Beta function. C and θ are the normalizing scalars ensuring that $f(\cdot)$ is a proper probability density function. For the above probability density function, C and θ are given by:

$$C = \frac{1}{2\sigma} kB\left(\frac{1}{k},\frac{\nu}{k}\right)^{-\frac{3}{2}} B\left(\frac{3}{k},\frac{\nu-2}{k}\right)^{\frac{1}{2}} S(\lambda)$$

$$\theta = \frac{1}{S(\lambda)}\left(\frac{k}{\nu-2}\right)^{\frac{1}{k}} B\left(\frac{1}{k},\frac{\nu}{k}\right)^{\frac{1}{2}} B\left(\frac{3}{k},\frac{\nu-2}{k}\right)^{-\frac{1}{2}}$$

with S given by:

$$S(\lambda) = \left[1+3\lambda^2-4\lambda^2 B\left(\frac{2}{k},\frac{\nu-1}{k}\right)^2 B\left(\frac{1}{k},\frac{\nu}{k}\right)^{-1} B\left(\frac{3}{k},\frac{\nu-2}{k}\right)^{-1}\right]^{\frac{1}{2}}.$$

By restricting the values of the parameters, other probability density models are achieved:

(i) Hansen's skewed student's t distribution when $k = 2$;

(ii) the student's t distribution when $\lambda = 0$ and $k = 2$;

(iii) the normal distribution when $k = 2$, $\lambda = 0, \nu = \infty$;

The parameters of the models are estimated by using the Maximum Likelihood Estimation (MLE). For instance, the log likelihood function at x_t is

$$\log\mathcal{L}(\alpha,\beta_1,\beta_2|x_t) = \begin{cases} \log C - \frac{(\nu+1)}{k}\log(1+(\frac{k}{\nu-2})\theta^{-k}(1-\lambda)^{-k}\left|\frac{x_t}{\sqrt{\omega+\alpha x_{t-1}^2+\beta\sigma_{t-1}^2}}\right|^{k}), x<0 \\ \log C - \frac{(\nu+1)}{k}\log(1+(\frac{k}{\nu-2})\theta^{-k}(1+\lambda)^{-k}\left|\frac{x_t}{\sqrt{\omega+\alpha x_{t-1}^2+\beta\sigma_{t-1}^2}}\right|^{k}), x\geq 0 \end{cases}$$

By recursive substituting, the log likelihood function is

$$\log\mathcal{L}(\alpha,\beta_1,\beta_2,\mathrm{v},\mathrm{k},\lambda,|x_t) = \begin{cases} (\mathrm{T}-1)\log\mathrm{C} - \frac{(\mathrm{v}+1)}{\mathrm{k}}\sum_{2}^{T}\log(1+(\frac{\mathrm{k}}{\mathrm{v}-2})\theta^{-\mathrm{k}}(1-\lambda)^{-\mathrm{k}}\left|\frac{x_t}{\sqrt{\omega+\alpha x_{t-1}^2+\beta\sigma_{t-1}^2}}\right|^{\mathrm{k}}), \mathrm{x}<0 \\ (\mathrm{T}-1)\log\mathrm{C} - \frac{(\mathrm{v}+1)}{\mathrm{k}}\sum_{2}^{T}\log(1+(\frac{\mathrm{k}}{\mathrm{v}-2})\theta^{-\mathrm{k}}(1+\lambda)^{-\mathrm{k}}\left|\frac{x_t}{\sqrt{\omega+\alpha x_{t-1}^2+\beta\sigma_{t-1}^2}}\right|^{\mathrm{k}}), \mathrm{x}\geq 0 \end{cases}$$

Hence the parameter values are estimated by maximizing this objective function. The tail risk measures are then calculated based on the parameters' values.

The other conditional model is RiskMetrics (exponentially weighted moving average (EWMA)) which can be expressed as follows:

$$\hat{\sigma}_t^2 = (1-\lambda)r_{t-1}^2 + \lambda\hat{\sigma}_{t-1}^2 \tag{14}$$

where $0 < \lambda < 1$ is the decay factor, $\hat{\sigma}_t^2$ is the conditional volatility forecast on day t. In this dissertation, λ is set as 0. 94 which is often chosen for daily data according to Daníelsson (2011). The tail risk measures calculated based on RiskMetrics is built upon the normality assumption. The tail risk measures are then calculated based on the formula of (1) and (2) on page 25 once σ_t is calculated.

Backtesting of VaR:

A good tail risk forecasting model is one that has the desired number of violations (ie 1% or 5%) with independent violations. The unconditional coverage is conducted by Bernoulli coverage test. The null hypothesis and the alternative hypothesis are:

H_0: the number of violations follows a Bernoulli distribution of probability p ;

H_1: the number of violations does not follow a Bernoulli distribution of probability p.

The null hypothesis can be mathematically expressed:

$$H_0: \eta \sim B(p)$$

where B stands for Bernoulli distribution given as

$$(1-p)^{1-\eta_t}(p)^{\eta_t}$$

The probability p can be estimated as

$$\hat{p}=\frac{v_1}{W_T}$$

The likelihood function is given as

$$\mathcal{L}_U(\hat{p})=\prod_{t=W_E}^{T}(1-\hat{p})^{1-\eta_t}(\hat{p})^{\eta_t}=(1-\hat{p})^{v_0}(\hat{p})^{v_1}$$

Under H_0: $p=\hat{p}$, the restricted likelihood function is

$$\mathcal{L}_R(\hat{p})=\prod_{t=W_E}^{T}(1-p)^{1-\eta_t}(p)^{\eta_t}=(1-p)^{v_0}(p)^{v_1}$$

Then, the likelihood ratio test is conducted to statistically test whether $\mathcal{L}_R=\mathcal{L}_U$

$$LR=2\left(\log\mathcal{L}_U(\hat{p})-\log\mathcal{L}_R(\hat{p})\right)=2\log\frac{(1-\hat{p})^{v_0}(\hat{p})^{v_1}}{(1-p)^{v_0}(p)^{v_1}}\sim\chi^2_{(1)}$$

To test the independence of violations, I calculate the probabilities of two consecutive violations and the probability of a violation if there was no violation on the previous day, i.e.,

$$p_{ij}=\Pr(\eta_t=i|\eta_{t-1}=j)$$

Where i and j are either 0 or 1. The first-order transition probability matrix is defined as:

$$\Pi_1=\begin{pmatrix}1-p_{01} & p_{01}\\ 1-p_{11} & p_{11}\end{pmatrix}$$

The restricted likelihood function -where the transition matrix from the null hypothesis is used since the sequence is Bernoulli distributed as:

$$\mathcal{L}_R(\Pi_1)=(1-p_{01})^{v_{00}}{p_{01}}^{v_{01}}(1-p_{11})^{v_{10}}{p_{11}}^{v_{11}}$$

Where v_{ij} is the number of observations where j follows i. Maximum likelihood estimates are obtained by maximizing $\mathcal{L}_R(\Pi_1)$

$$\widehat{\Pi}_1 = \begin{pmatrix} \frac{v_{00}}{v_{00}+v_{01}} & \frac{v_{01}}{v_{00}+v_{01}} \\ \frac{v_{10}}{v_{10}+v_{11}} & \frac{v_{11}}{v_{10}+v_{11}} \end{pmatrix}$$

Under the null hypothesis of no clustering, the probability of a violation tomorrow does not depend on today seeing a violation; then $p_{01} = p_{11} = p$ and the estimated transition matrix is simply:

$$\Pi_0 = \begin{pmatrix} 1-\hat{p} & \hat{p} \\ 1-\hat{p} & \hat{p} \end{pmatrix}$$

where $\hat{p} = \frac{v_{01}+v_{11}}{v_{00}+v_{10}+v_{01}+v_{11}}$

The unrestricted likelihood function according to the null hypothesis uses the estimated transition matrix and is

$$\mathcal{L}_U(\Pi_1) = (1-p_{01})^{v_{00}} p_{01}{}^{v_{01}} (1-p_{11})^{v_{10}} p_{11}{}^{v_{11}}$$

The likelihood ratio test is implemented with likelihood

$$LR(\Pi_1) = 2\big(\log \mathcal{L}_U(\hat{p}) - \log \mathcal{L}_R(\hat{p})\big) \sim \chi^2_{(1)}$$

This test does not depend on true p and only tests for independence.

Backtesting of ES: I adopt the method in Daníelsson (2011). Let's define Normalized Shortfall (NS) as:

$$NS_t = \frac{r_t}{ES_t}$$

where ES_t is the observed ES on day t.

According to the definition of ES, the expected r_t given VaR is violated is

$$\frac{E[r_t | r_t < -VaR_t]}{ES_t} = 1$$

Therefore, the NS would be equal to 1 on average, i.e. $\overline{NS} = 1$. Hence the null hypothesis is set up as follows:

$$H_0: \overline{NS} = 1$$

$$H_1: \overline{NS} \neq 1$$

5 Empirical Analysis

5.1 Probability Density Distributions of Stock Returns

5.1.1 The Whole Sample Period Analysis

This section discusses the estimated parameters of different probability density distribution models for each of the stock exchanges. In addition, the goodness of fit of these probability density distribution models is discussed.

Tables 5 and 6 show the estimated parameters for different probability density models for the DSEs and the ESEs respectively. From Tables 5 and 6, it can be seen that there are considerable differences in the parameter values of the probability density models. Another interesting result is that the skewness parameter, λ, is positive for both HST and SGT for all the countries. In terms of ν, ν of SGT is larger than ν of ST and of HST.

Tables 7 and 8 present the -LogL, AIC, SBC and the LR test results for each of the distribution specifications for the DSEs and the ESEs respectively. In the tables, the optimal values for Loglikelihood, AIC and SBC are in bold. Based on the –LogL results presented in Table 7, SGT offers the best fit for every DSE except for New Zealand for which ST is the most optimal specification. This is not surprising as the –LogL does not penalise for the increase in the number of parameters used to specify the probability density model. The AIC and the SBC, which correct for the increase in the number of parameters defining the probability density model, challenge the results given by –LogL. According to AIC, for 12 out of 19 DSEs, SGT is the best specifications. However, in the case of Canada, Japan, New Zealand, Denmark, and Switzerland, ST offers the optimal fit. In addition, HST is best for Austria and Ireland. A stronger departure from the SGT specification is reported for SBC, for which 13 out of 19 DSEs are better described by less parameter-intensive distributions i.e., ST or HST. Only the US, Finland, Germany, Greece, Italy, and Portugal are consistently better described by SGT according to SBC. The normal distribution is not supported for any exchange in the sample. The LR test results are generally consistent with AIC. For instance, when AIC indicates the superiority of SGT, the LR test rejects the null hypothesis that the parameter restrictions are valid. Conversely, if AIC does not indicate superiority of SGT, the LR test cannot statistically reject the null hypothesis that the parameter restrictions are valid.

The results obtained for the ESEs, as shown in Table 8, are more diverse. The lowest AIC in support of SGT is obtained for 11 exchanges. And for the remaining exchanges, 6 exchanges are best fitted with ST and the other 2 with HST. The SBC, as the criterion that sets higher penalties than the AIG for using additional parameters, confirms that SGT is the optimal specification for China, Pakistan, Saudi Arabia, Taiwan, Romania, and Argentina while the others are better specified by probability density models with less parameters. The normal distribution is not supported for any exchange in the sample.

In summary, if we were to put more weight on the AIC, then we would conclude that using SGT may be appropriate to describe the data for the majority of the DSEs and the ESEs. However, some of the DSEs and the ESEs may require ST and HST. The normal distribution is inappropriate for all the exchanges in the sample. Considering the higher level of volatility and uncertainty of the emerging markets, complex models with more parameters are expected to outperform the simpler ones. Interestingly, in the case of some ESEs, simpler probability density models seem sufficient.

Table 5. Probability Density Models and Parameters of the Developed Stock Exchanges (Sample Period: 03/01/2000-30/12/2016)

_	_	Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
N	σ	0.0113	0.0124	0.0154	0.0113	0.0100	0.0071	0.0145	0.0117	0.0182	0.0143
ST	ν	3.0928	2.7661	4.0824	3.1858	3.6436	4.4730	3.1655	3.4987	2.8587	3.5486
	σ	0.0119	0.0142	0.0154	0.0120	0.0103	0.0070	0.0154	0.0122	0.0206	0.0149
HST	ν	3.0639	2.7662	4.0373	3.1627	3.6177	4.4206	3.1335	3.4683	2.8370	3.5525
	λ	0.0152	0.0010	0.0150	0.0150	0.0152	0.0152	0.0149	0.0147	0.0134	-0.0016
	σ	0.0120	0.0142	0.0155	0.0121	0.0103	0.0071	0.0155	0.0122	0.0207	0.0149
SGT	ν	3.4319	5.1957	5.2731	4.2832	4.8042	4.2519	3.3263	4.4471	4.9633	5.0526
	λ	0.0150	0.0152	0.0170	0.0171	0.0141	0.0150	0.0129	0.0147	0.0008	0.0151
	k	1.7936	1.2840	1.6555	1.5893	1.6309	2.0626	1.8912	1.6724	1.3774	1.5767
	σ	0.0117	0.0125	0.0153	0.0115	0.0101	0.0071	0.0152	0.0118	0.0184	0.0144

		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK
N	σ	0.0153	0.0192	0.0156	0.0141	0.0137	0.0121	0.0120	0.0146	0.0116
ST	ν	3.4601	3.1867	3.4697	3.0921	2.8391	3.4430	3.2328	3.3560	3.2152
	σ	0.0162	0.0205	0.0164	0.0150	0.0154	0.0127	0.0126	0.0155	0.0123
HST	ν	3.4785	3.1626	3.4385	3.0678	2.8177	3.4378	3.2086	3.3304	3.1889
	λ	-0.0028	0.0130	0.0149	0.0153	0.0145	0.0026	0.0146	0.0148	0.0150
	σ	0.0161	0.0206	0.0165	0.0151	0.0156	0.0127	0.0127	0.0155	0.0124
SGT	ν	7.3091	5.2383	6.4159	3.2696	3.8386	6.3787	3.7648	4.7952	4.1988
	λ	-0.0015	0.0008	-0.0002	0.0140	0.0127	0.0162	0.0175	0.0116	0.0171
	k	1.3390	1.4439	1.4096	1.8838	1.5516	1.3844	1.7410	1.5676	1.6265
	σ	0.0154	0.0193	0.0157	0.0148	0.0142	0.0121	0.0123	0.0148	0.0118

Note: Tables 5 demonstrates the estimated values of parameters for different probability density models for 19 DSEs. The estimated values of parameters of the same probability density models are heterogenous for different stock exchanges. The data source is DataStream and the Sample Period is 03/01/2000-30/12/2016.

Table 6. Probability Density Models and Parameters of the Emerging Stock Exchanges (Sample Period: 03/01/2000-30/12/2016)

_	_	South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
N	σ	0.0123	0.0077	0.0164	0.0152	0.0137	0.0083	0.0132	0.0154	0.0141	0.0137
ST	ν	4.4779	2.6903	2.9103	3.2509	2.5277	3.0873	3.9364	2.0178	2.9987	3.7954
	σ	0.0124	0.0090	0.0184	0.0161	0.0176	0.0089	0.0130	0.0719	0.0159	0.0138
HST	ν	4.4375	2.6804	2.8933	3.2260	2.5162	3.0804	3.9185	2.0763	2.9771	3.7697
	λ	0.0152	0.0146	0.0129	0.0054	0.0134	0.0150	0.0156	0.0005	0.0136	0.0149
	σ	0.0124	0.0090	0.0185	0.0161	0.0178	0.0089	0.0131	0.0356	0.0159	0.0139
SGT	ν	4.3114	4.0831	7.4056	4.1477	10.3225	4.1026	3.4671	3.3268	16.5682	4.7351
	λ	0.0149	0.0150	0.0146	0.0047	0.0152	0.0157	0.0147	0.0144	0.0010	0.0151
	k	2.0410	1.4288	1.1886	1.6507	1.0374	1.5954	2.2407	1.1105	1.0829	1.6954
	σ	0.0125	0.0079	0.0165	0.0154	0.0138	0.0084	0.0133	0.0166	0.0141	0.0136

		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
N	σ	0.0154	0.0212	0.0159	0.0218	0.0216	0.0075	0.0130	0.0132	0.0140
ST	ν	4.1776	2.8937	2.4700	3.4814	3.3019	3.6457	3.0714	3.2824	2.5596
	σ	0.0155	0.0226	0.0201	0.0224	0.0231	0.0076	0.0136	0.0140	0.0165
HST	ν	4.1640	2.8812	2.4618	3.4792	3.3001	3.6264	3.0565	3.2840	2.5556
	λ	0.0145	0.0124	0.0148	-0.0019	0.0017	0.0150	0.0135	-0.0026	0.0127
	σ	0.0155	0.0227	0.0203	0.0224	0.0231	0.0076	0.0137	0.0140	0.0166
SGT	ν	4.4395	4.1043	3.5889	4.0457	6.2329	3.5175	3.6180	4.1257	3.0313
	λ	0.0159	0.0085	0.0163	0.0162	0.0013	0.0150	0.0154	0.0139	0.0147
	k	1.9080	1.4734	1.4279	1.7664	1.3844	2.0572	1.7077	1.6652	1.6737
	σ	0.0154	0.0209	0.0165	0.0220	0.0218	0.0077	0.0131	0.0135	0.0149

Note: Tables 6 demonstrates the estimated values of parameters for different probability density models for 19 ESEs. The estimated values of parameters of the same probability density models are heterogenous for different stock exchanges. The data source is DataStream and the Sample Period is 03/01/2000-30/12/2016.

Table 7. Goodness of Fit of Probability Density Models of the Developed Stock Exchanges (The optimal value for Loglikelihood, AIC and SBC are in bold)

		Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
-Log Likelihood	N	-13076.15	-12696.53	-10135.11	-13080.35	-13731.84	-14224.70	-11846.31	-11375.88	-11051.61	-12303.68
	ST	-13601.02	-13226.51	-10415.31	-13485.81	-14074.53	-14471.26	-12297.95	-11677.12	-11498.08	-12630.72
	HST	-13601.02	-13226.51	-10415.30	-13485.81	-14074.53	-14471.26	-12297.93	-11677.11	-11498.08	-12630.73
	SGT	**-13601.89**	**-13243.61**	**-10418.10**	**-13490.46**	**-14078.13**	**-14471.32**	**-12298.26**	**-11679.65**	**-11509.73**	**-12635.51**
Akaike Information Criterion	N	-26148.30	-25389.06	-20266.23	-26156.70	-27459.69	-28445.40	-23688.62	-22747.75	-22099.21	-24603.37
	ST	-27196.03	-26447.02	-20824.62	-26965.62	-28143.05	**-28936.52**	**-24589.90**	-23348.24	-22990.15	-25255.44
	HST	**-27196.03**	-26447.02	-20824.60	-26965.61	-28143.06	-28936.52	-24589.86	-23348.23	-22990.16	-25255.46
	SGT	-27193.78	**-26477.23**	**-20826.20**	**-26970.91**	**-28146.26**	-28932.65	-24586.53	**-23349.31**	**-23009.46**	**-25261.01**
Schwartz Bayesian Criterion	N	13067.79	12688.17	10126.90	13071.99	13723.47	14216.40	11837.96	11367.65	11043.25	12295.31
	ST	13588.48	13213.97	**10403.00**	**13473.27**	14061.97	**14458.81**	**12285.43**	**11664.78**	11485.54	12618.15
	HST	**13588.48**	13213.97	10402.99	13473.27	**14061.97**	14458.81	12285.41	11664.77	11485.54	**12618.16**
	SGT	13580.99	**13222.71**	10397.58	13469.56	14057.21	14450.57	12277.40	11659.08	**11488.83**	12614.56
N vs SGT	LR Statistic	1051.48	1094.17	565.97	820.21	692.58	493.25	903.91	607.55	916.25	663.64
	P value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST vs SGT	LR Statistic	1.75	34.20	5.58	9.29	7.21	0.12	0.63	5.06	23.31	9.57
	P value	0.42	0.00	0.06	0.01	0.03	0.94	0.73	0.08	0.00	0.01
HST vs SGT	LR Statistic	1.75	34.21	5.60	9.30	7.21	0.12	0.66	5.08	23.30	9.56
	P value	0.19	0.00	0.02	0.00	0.01	0.73	0.42	0.02	0.00	0.00

Note: Tables 7 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p values) for each of the probability density model for each DSE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream and the Sample Period is 03/01/2000-30/12/2016.

Table 7 (Cont.). Goodness of Fit of Probability Density Models of the Developed Stock Exchanges (The optimal value for Loglikelihood, AIC and SBC are in bold)

		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK
-Log Likelihood	N	-11919.87	-9872.58	-11817.15	-12221.55	-12455.90	-11647.37	-12844.38	-10584.03	-13063.89
	ST	-12233.48	-10232.98	-12137.19	-12705.30	-12956.26	-11970.76	-13284.61	-10876.73	-13463.46
	HST	-12233.48	-10232.96	-12137.19	-12705.31	-12956.24	-11970.76	-13284.60	-10876.74	-13463.44
	SGT	**-12248.40**	**-10241.56**	**-12148.78**	**-12705.50**	**-12961.66**	**-11982.76**	**-13286.27**	**-10880.91**	**-13467.13**
Akaike Information Criterion	N	-23835.74	-19741.15	-23630.30	-24439.10	-24907.80	-23290.74	-25684.76	-21164.06	-26123.79
	ST	-24460.96	-20459.96	-24268.37	-25404.60	-25906.52	-23935.53	**-26563.22**	-21747.46	-26920.92
	HST	-24460.96	-20459.93	-24268.37	**-25404.62**	-25906.48	-23935.52	-26563.20	-21747.47	-26920.88
	SGT	**-24486.81**	**-20473.11**	**-24287.55**	-25400.99	**-25913.32**	**-23955.52**	-26562.54	**-21751.82**	**-26924.26**
Schwartz Bayesian Criterion	N	11911.50	9864.31	11808.78	12213.18	12447.53	11639.10	12836.02	10575.80	13055.53
	ST	12220.92	10220.58	12124.63	12692.75	**12943.70**	11958.36	**13272.07**	10864.38	**13450.91**
	HST	12220.92	10220.56	12124.63	**12692.76**	12943.68	11958.36	13272.06	**10864.38**	13450.89
	SGT	**12227.48**	**10220.89**	**12127.85**	12684.58	12940.72	**11962.09**	13265.37	10860.32	13446.22
N vs SGT	LR Statistic	657.06	737.96	663.25	967.90	1011.52	670.77	883.78	593.76	806.48
	P value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST vs SGT	LR Statistic	29.85	17.15	23.18	0.40	10.80	23.99	3.32	8.36	7.34
	P value	0.00	0.00	0.00	0.82	0.00	0.00	0.19	0.02	0.03
HST vs SGT	LR Statistic	29.84	17.18	23.18	0.38	10.84	24.00	3.34	8.35	7.38
	P value	0.00	0.00	0.00	0.54	0.00	0.00	0.07	0.00	0.01

Note: Tables 7 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p values) for each of the probability density model for each DSE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream and the Sample Period is 03/01/2000-30/12/2016.

Table 8. Goodness of Fit of Probability Density Models of the Emerging Stock Exchanges (The optimal value for Loglikelihood, AIC and SBC are in bold)

		South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
-Log Likelihood	N	-12664.27	-12877.04	-11081.27	-11658.49	-12040.45	-14113.72	-12140.30	-11580.94	-11951.00	-11958.13
	ST	-12882.68	-13345.64	-11472.66	-12066.49	-12491.14	-14578.98	-12547.29	-12658.80	-12264.04	-12308.06
	HST	-12882.68	-13345.62	-11472.92	-12066.48	-12490.70	-14578.98	-12547.30	-12663.80	-12264.00	-12308.05
	SGT	**-12882.74**	**-13353.83**	**-11496.23**	**-12069.66**	**-12521.08**	**-14583.30**	**-12548.17**	**-12690.83**	**-12293.08**	**-12310.45**
Akaike Information Criterion	N	-25324.53	-25750.08	-22158.53	-23312.98	-24076.90	-28223.45	-24276.59	-23157.88	-23898.00	-23912.25
	ST	**-25759.36**	-26685.28	-22939.32	-24126.97	-24976.28	-29151.96	-25088.58	-25311.60	-24522.07	-24610.13
	HST	-25759.36	-26685.25	-22939.84	-24126.95	-24975.40	-29151.95	**-25088.60**	-25321.60	-24522.00	-24610.10
	SGT	-25755.48	**-26697.67**	**-22982.47**	**-24129.32**	**-25032.17**	**-29156.59**	-25086.34	**-25371.66**	**-24576.15**	**-24610.91**
Schwartz Bayesian Criterion	N	12655.91	12868.81	11072.95	11650.14	12032.11	14105.38	12131.96	11572.60	11942.66	11949.79
	ST	**12870.15**	**13333.30**	11460.18	**12053.97**	12478.63	**14566.47**	12534.79	12646.29	12251.52	**12295.56**
	HST	12870.15	13333.29	11460.44	12053.96	12478.19	14566.47	**12534.80**	12651.29	12251.48	12295.55
	SGT	12861.86	13333.27	**11475.43**	12048.79	**12500.23**	14562.45	12527.33	**12669.98**	**12272.22**	12289.62
N vs SGT	LR Statistic	436.95	953.59	829.93	822.34	961.27	939.15	815.75	2219.78	684.15	704.65
	P value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST vs SGT	LR Statistic	0.13	16.39	47.14	6.35	59.89	8.63	1.76	64.05	58.08	4.78
	P value	0.94	0.00	0.00	0.04	0.00	0.01	0.41	0.00	0.00	0.09
HST vs SGT	LR Statistic	0.13	16.42	46.63	6.37	60.77	8.64	1.74	54.06	58.16	4.81
	P value	0.72	0.00	0.00	0.01	0.00	0.00	0.19	0.00	0.00	0.03

Note: Tables 8 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the distribution specifications for each ESE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream and the Sample Period is 03/01/2000-30/12/2016

Table 8 (Cont.). Goodness of Fit of Probability Density Models of the Emerging Stock Exchanges (The optimal value for Loglikelihood, AIC and SBC are in bold)

		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
-Log Likelihood	N	-11702.70	-10545.03	-11588.31	-10265.57	-10080.60	-14722.90	-11055.31	-12435.65	-12130.63
	ST	-11996.84	-11188.77	-12261.38	-10663.14	-10400.21	-15139.14	-11560.00	-12816.05	-12850.97
	HST	-11996.83	-11189.29	-12261.36	-10663.15	-10400.20	-15139.13	-11559.91	-12816.06	-12850.78
	SGT	**-11997.00**	**-11196.55**	**-12270.82**	**-10664.36**	**-10411.24**	**-15139.19**	**-11562.11**	**-12818.65**	**-12853.76**
Akaike Information Criterion	N	-23401.40	-21086.05	-23172.62	-20527.15	-20157.20	-29441.80	-22106.63	-24867.30	-24257.25
	ST	**-23987.67**	-22371.54	-24516.76	-21320.27	-20794.42	**-30272.27**	-23114.00	-25626.09	-25695.93
	HST	-23987.66	-22372.57	-24516.72	**-21320.30**	-20794.40	-30272.26	-23113.82	-25626.12	-25695.56
	SGT	-23984.00	**-22383.10**	**-24531.65**	-21318.72	**-20812.47**	-30268.38	**-23114.22**	**-25627.31**	**-25697.51**
Schwartz Bayesian Criterion	N	11694.35	10536.65	11579.95	10257.22	10072.26	14714.55	11047.08	12427.29	12122.27
	ST	**11984.31**	11176.21	12248.85	10650.60	10387.71	**15126.61**	**11547.64**	12803.50	**12838.44**
	HST	11984.30	**11176.73**	12248.82	**10650.61**	10387.70	15126.60	11547.55	**12803.52**	12838.25
	SGT	11976.12	11175.62	**12249.93**	10643.46	**10390.40**	15118.31	11541.52	12797.75	12832.87
N vs SGT	LR Statistic	588.60	1303.05	1365.03	797.57	661.27	832.58	1013.59	766.00	1446.26
	P value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST vs SGT	LR Statistic	0.33	15.56	18.89	2.45	22.05	0.11	4.23	5.21	5.58
	P value	0.85	0.00	0.00	0.29	0.00	0.95	0.12	0.07	0.06
HST vs SGT	LR Statistic	0.34	14.52	18.93	2.42	22.07	0.12	4.41	5.19	5.96
	P value	0.56	0.00	0.00	0.12	0.00	0.73	0.04	0.02	0.01

Note: Tables 8 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the distribution specifications for each ESE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream and the Sample Period is 03/01/2000-30/12/2016

5.1.2 Analysis of the Bull and Bear Markets

5.1.2.1 The bull and bear market regime separation results

Before discussing the statistical properties of the stock market returns during the bull market and the bear market regimes, the bull/bear market regime separation of the whole sample period is presented and discussed.

Figures 1 to 19 demonstrate the market bull/bear market regime separation results for the DSEs. Figures 20 to 38 demonstrate the market bull/bear market regime separation results for the ESEs. The blue lines are the daily movement of the stock market indexes for the whole sample period 1 January 2000 and 31 January 2016. The left-hand vertical axis indicates the value of the stock market index and the right-hand side vertical axis indicates the market regimes with 1 denoting the bull market regime and 0 denoting the bear market regime. Based on the comparison of these figures, the first point to note is that the frequency of the bull/bear market switches is quite different across the countries. For instance, there are more market regime switches in the US than in Australia. Similarly, it can be seen that there are more market regime switches in China than in Russia. In addition, all of these exchanges experienced the market declines following 2008 financial crisis. A dramatic decline in share prices following the dot com bubble burst is also found in many stock exchanges. However, Australia, New Zealand, Austria, Denmark, Saudi Arabia, Russia, Romania, Argentina, Chile, Columbia, Mexico and Peru were not affected. In these countries, Internet and high-tech companies constitute a relatively small fraction of their stock markets, hence it is not surprising that the dot com bubble burst had hardly any impact on them.

In addition to these two worldwide crashes, the stock exchanges experienced specific stock market shocks at different times. These were caused by regional issues (e.g., European debt crisis around 2014) or by the specific factor for the particular country. Unlike the global disasters, such as the dot com bubble burst and the subprime mortgage crisis which have a similar starting date and duration, the starting date and the duration of the specific stock market crashes are different across countries. In addition to the plots, Tables 9 and 10 list the peak and trough date for each country demonstrating the detailed information about the synchronized and desynchronized cycles among the stock markets.

Given that individual bull and bear markets are often too short to provide sufficient amount of information for distributional fitting, for each stock exchange, the observations from its bull (bear) periods are pooled together to create a bull (bear) sample which will be referred to as bull (bear) market. These bull (bear) markets will be used to determine the statistical and distributional properties of the bull and the bear periods for each stock exchange.

Figure 39 shows that nearly all stock exchanges have more bull market returns than bear market returns indicating that the bull market regimes have overall duration. The only exception to this observation is China which exhibits more bear market returns than bull market returns. Affected by a sequence of financial market turmoil, Greece has almost the equal amount of bull market regime returns and bear market regime returns. South Africa, Pakistan, and Mexico have the highest percentages of the bull market returns (over 90%).

Figures 1 to 19 present the market bull/bear market regime separation results for the DSEs. Figures 20 to 38 demonstrate the market bull/bear market regime separation results for the ESEs. In these Figures, the blue lines are the daily movement of the stock market indexes for the whole sample period 1 January 2000 and 31 January 2016 with the left-hand vertical axis indicating the value of the stock market index. The right-hand side vertical axis indicates the market regimes with 1 denoting the bull market regime and 0 denoting the bear market regime.

Figure 1. Canada: stock market index and market regimes

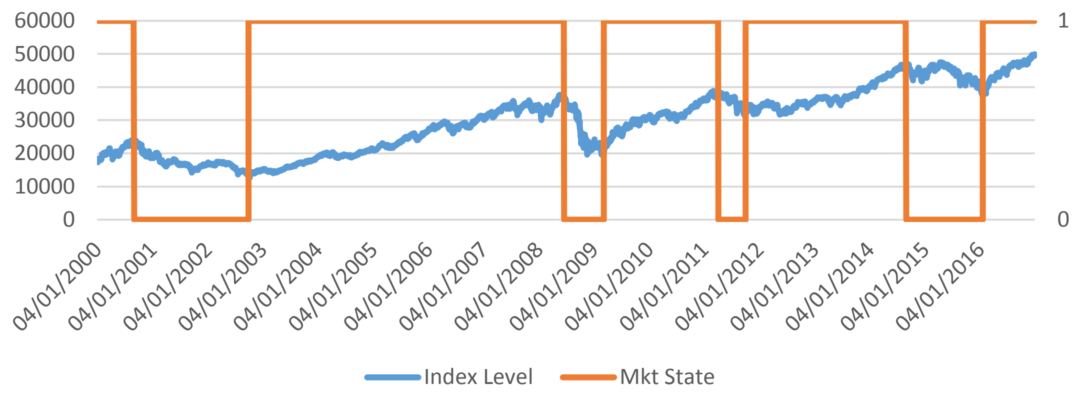


Figure 2. US: stock market index and market regimes

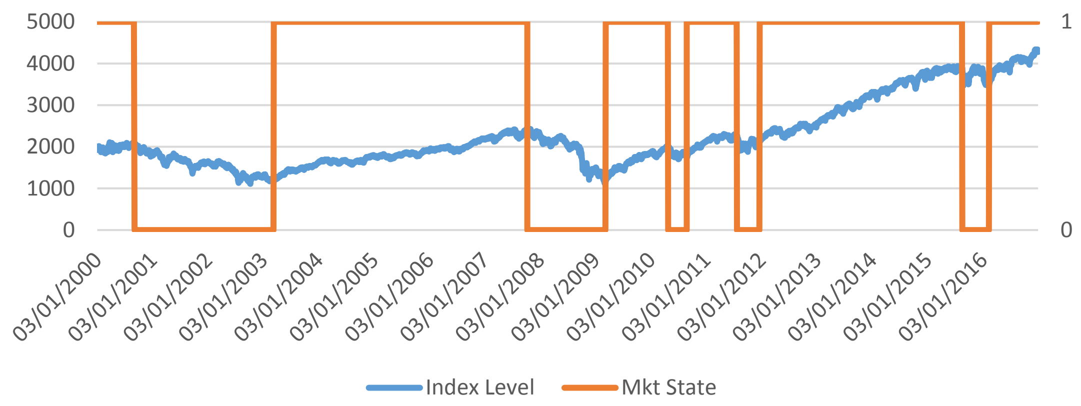


Figure 3. Japan: stock market index and market regimes

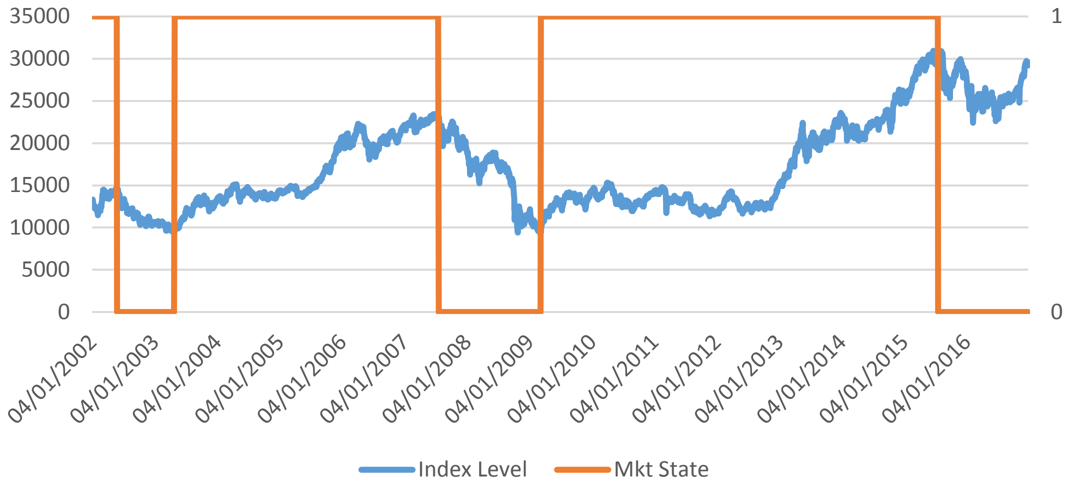


Figure 4. Singapore: stock market index and market regimes

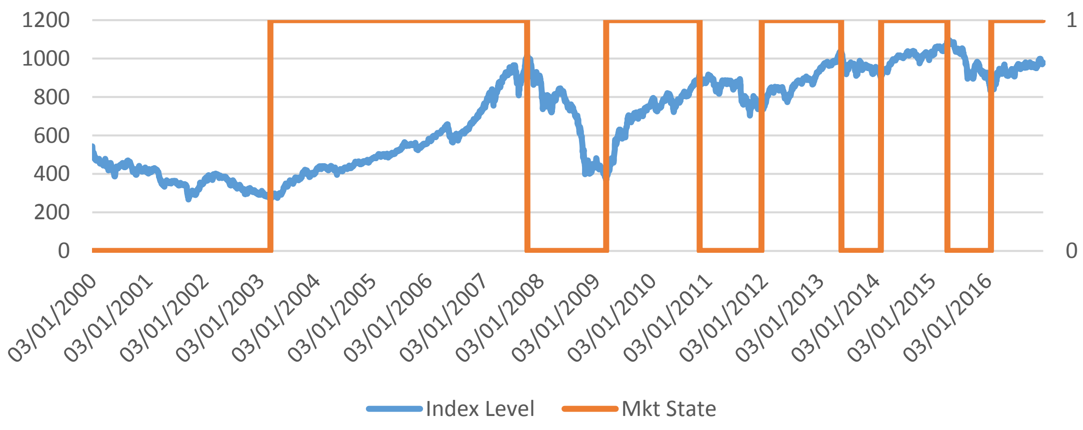
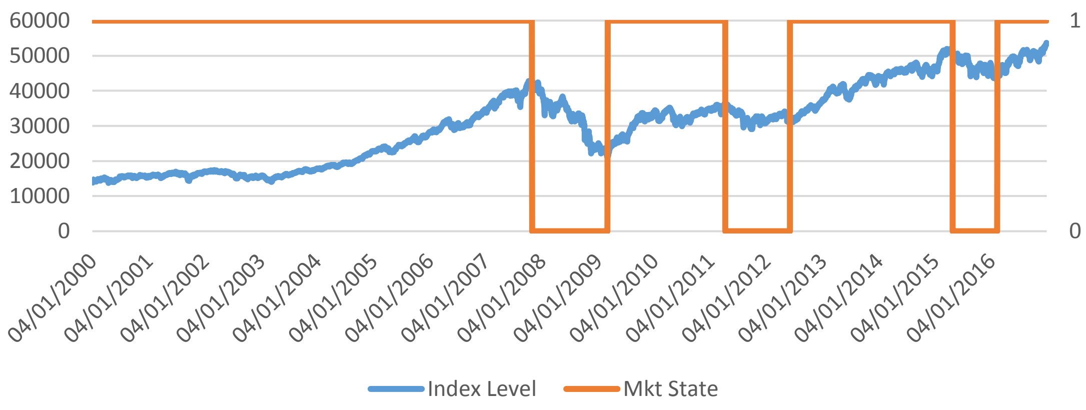
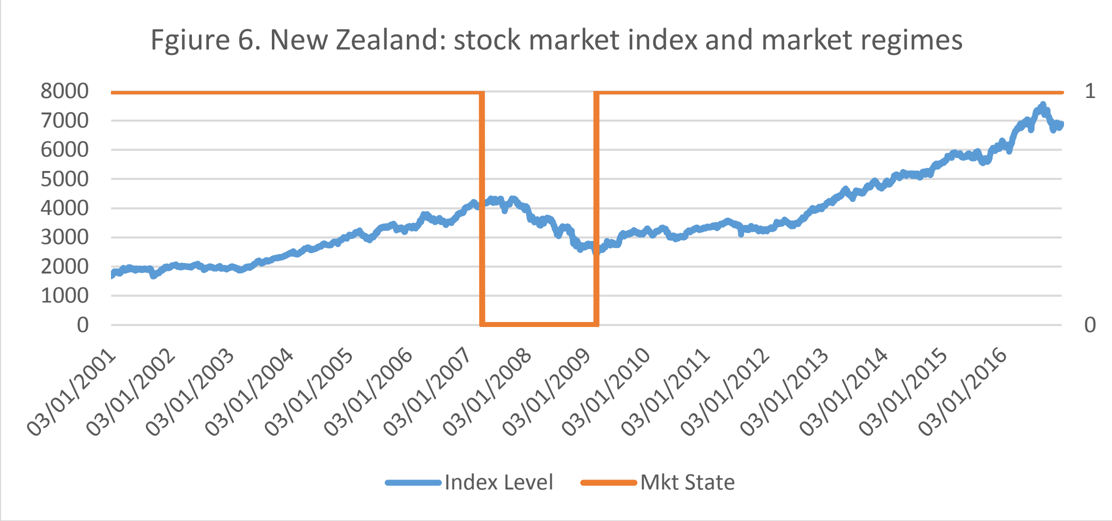


Figure 5. Australia: stock market index and market regimes




Fgiure 6. New Zealand: stock market index and market regimes
8000
7000
6000
5000
4000
3000
2000
1000
0
1
0
03/01/2001
03/01/2002
03/01/2003
03/01/2004
03/01/2005
03/01/2006
03/01/2007
03/01/2008
03/01/2009
03/01/2010
03/01/2011
03/01/2012
03/01/2013
03/01/2014
03/01/2015
03/01/2016
Index Level
Mkt State

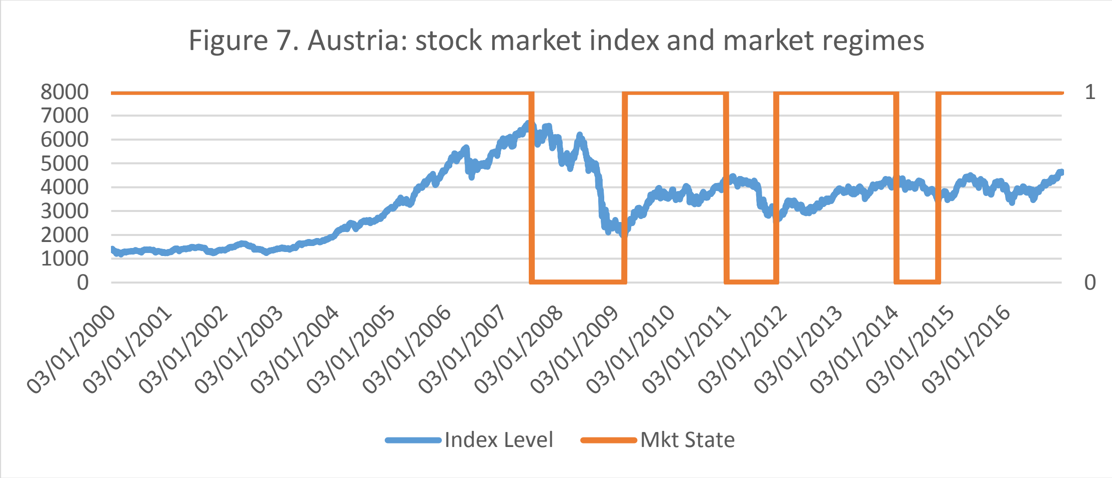


Figure 7. Austria: stock market index and market regimes
8000
7000
6000
5000
4000
3000
2000
1000
0
1
0
03/01/2000
03/01/2001
03/01/2002
03/01/2003
03/01/2004
03/01/2005
03/01/2006
03/01/2007
03/01/2008
03/01/2009
03/01/2010
03/01/2011
03/01/2012
03/01/2013
03/01/2014
03/01/2015
03/01/2016
Index Level
Mkt State

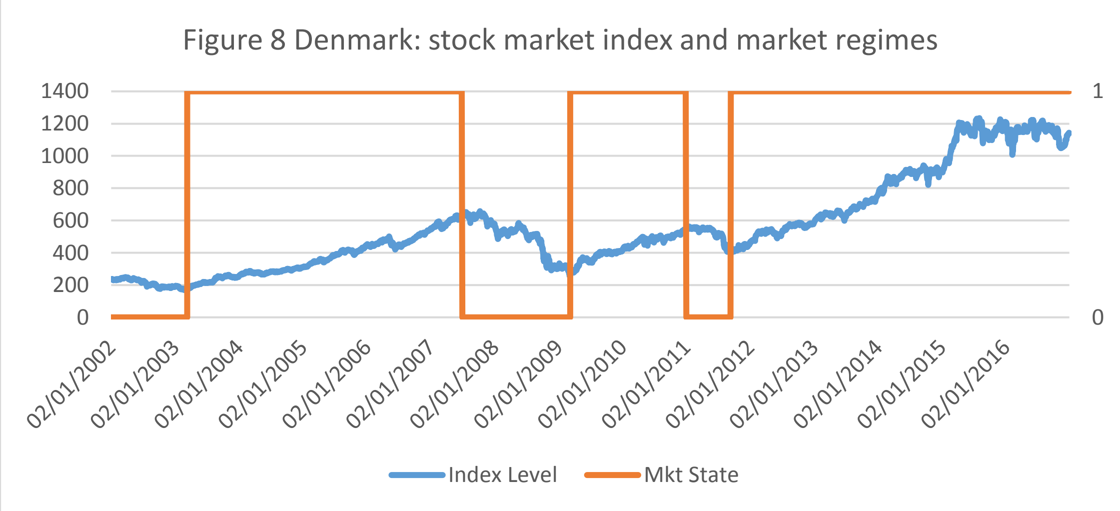


Figure 8 Denmark: stock market index and market regimes
1400
1200
1000
800
600
400
200
0
1
0
02/01/2002
02/01/2003
02/01/2004
02/01/2005
02/01/2006
02/01/2007
02/01/2008
02/01/2009
02/01/2010
02/01/2011
02/01/2012
02/01/2013
02/01/2014
02/01/2015
02/01/2016
Index Level
Mkt State

Figure 9. Finland: stock market index and market regimes

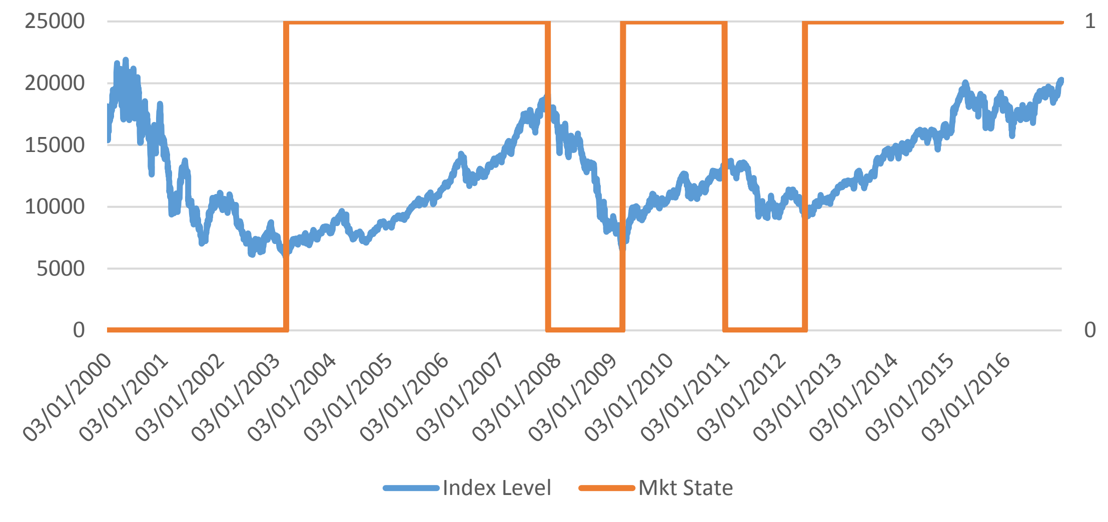


Figure 10. France: stock market index and market regimes

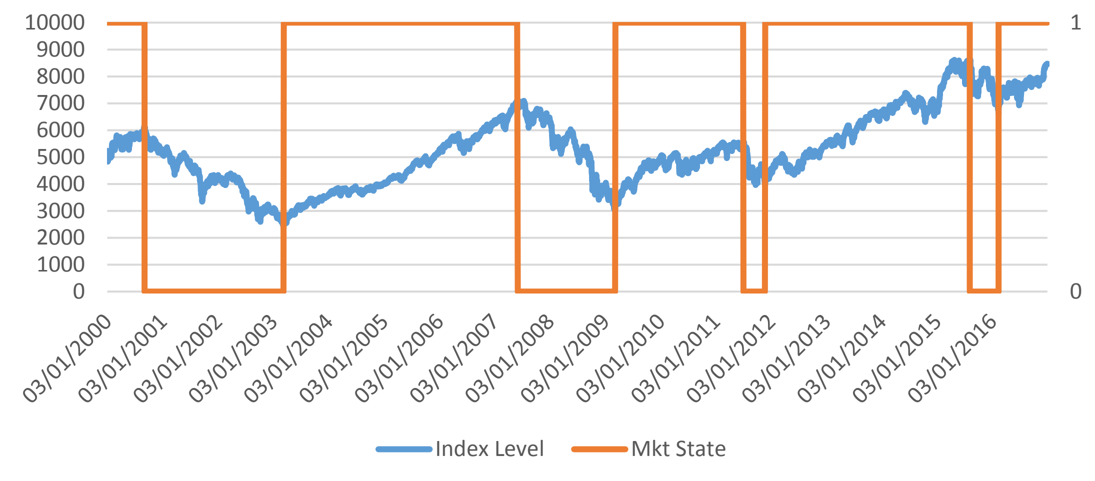


Figure 11. Germany: stock market index and market regimes

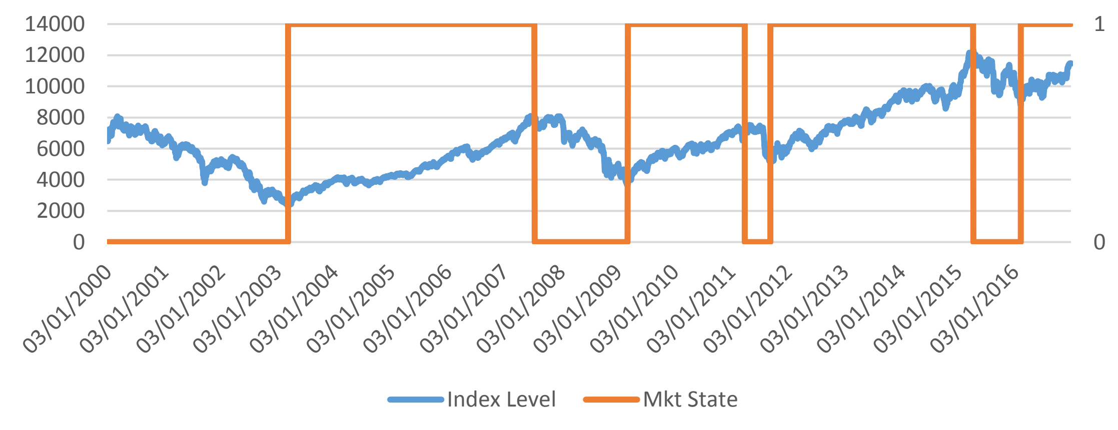


Figure 12. Greece: stock market index and market regimes

Figure 13. Italy: stock market index and market regimes

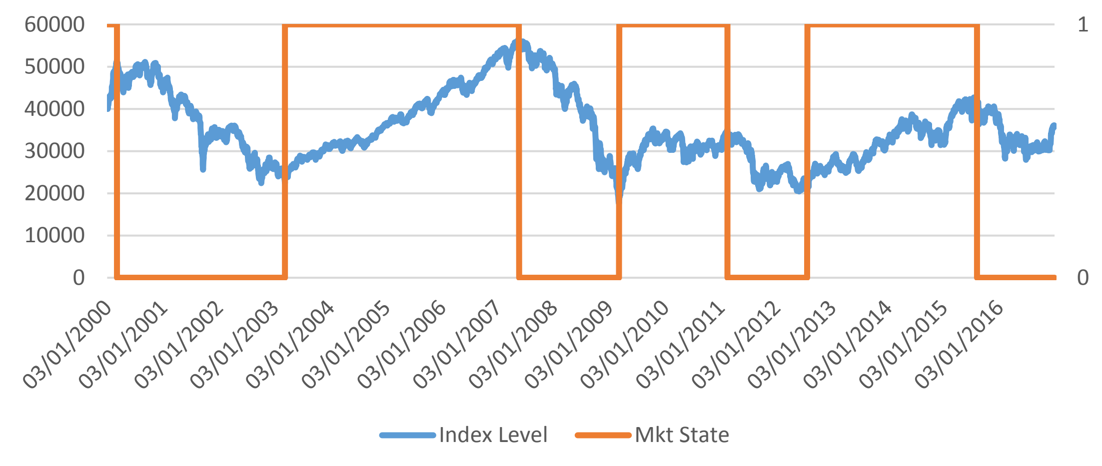


Figure 14. Ireland: stock market index and market regimes

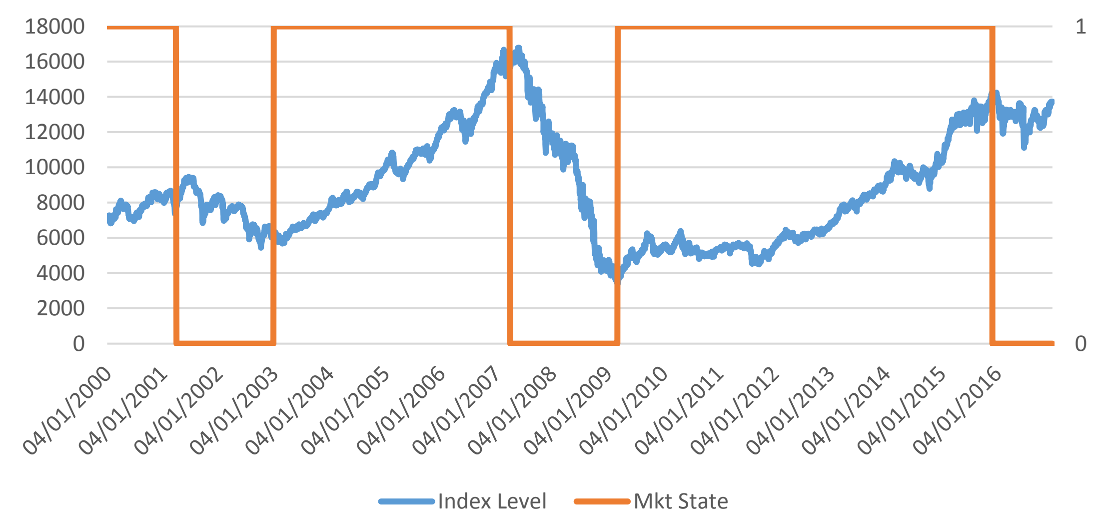


Figure 15. Netherlands: stock market index and market regimes

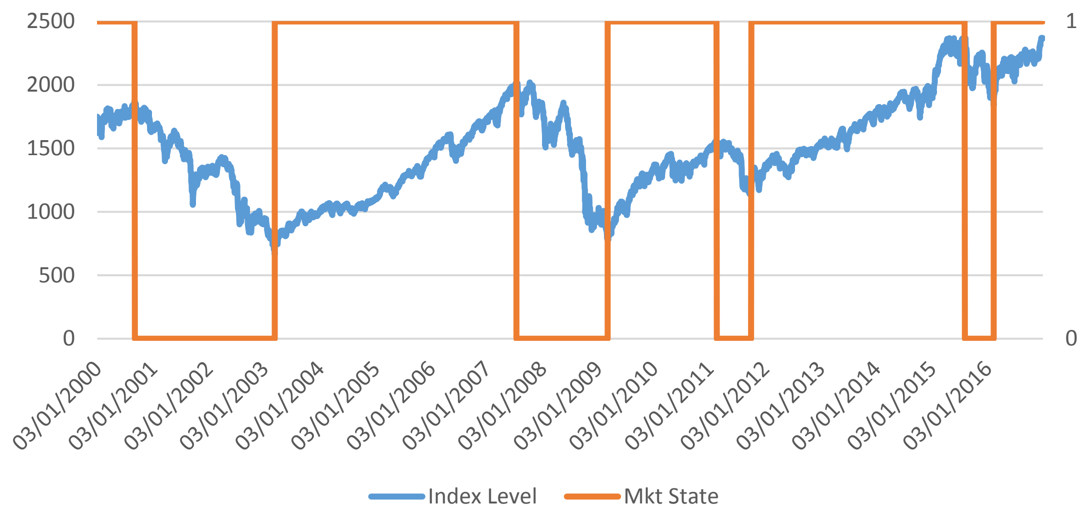


Figure 16. Portugal: stock market index and market regimes

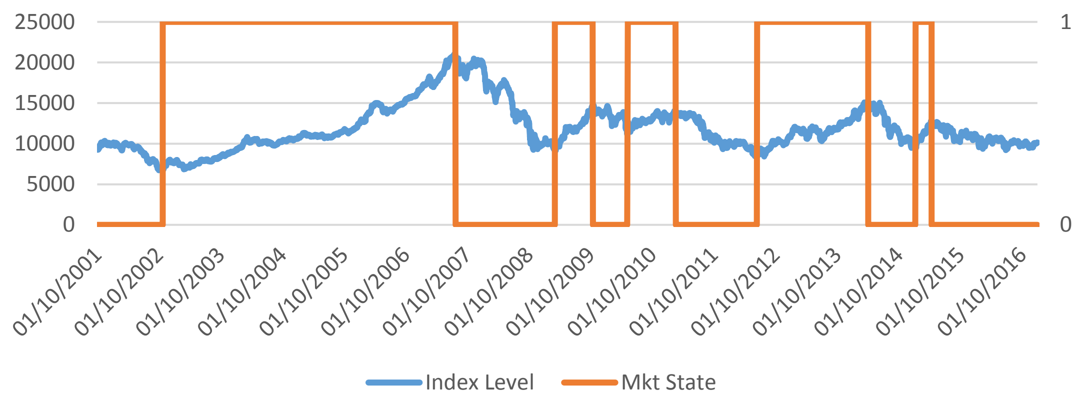


Figure 17. Switzerland: stock market index and market regimes

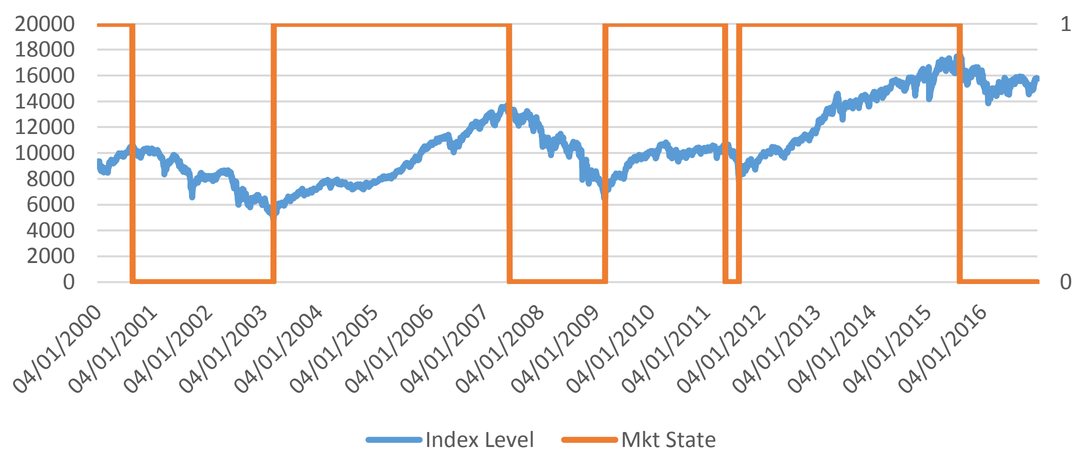


Figure 18. Sweden: stock market index and market regimes

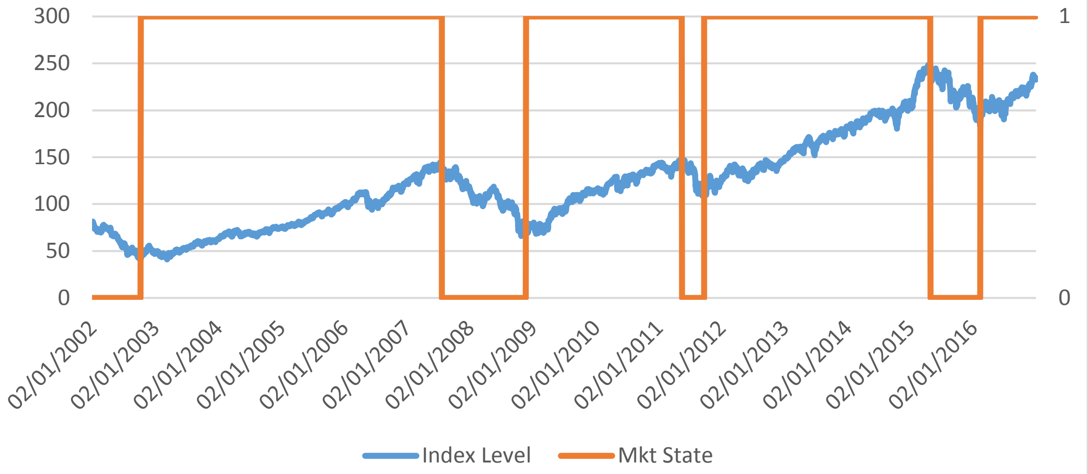


Figure 19. United Kingdom: stock market index and market regimes

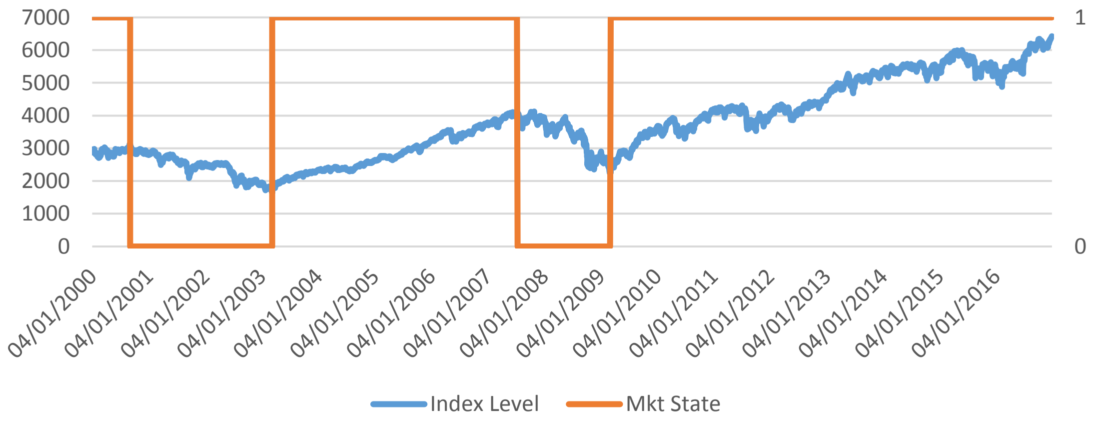


Figure 20. South Africa: stock market index and market regimes

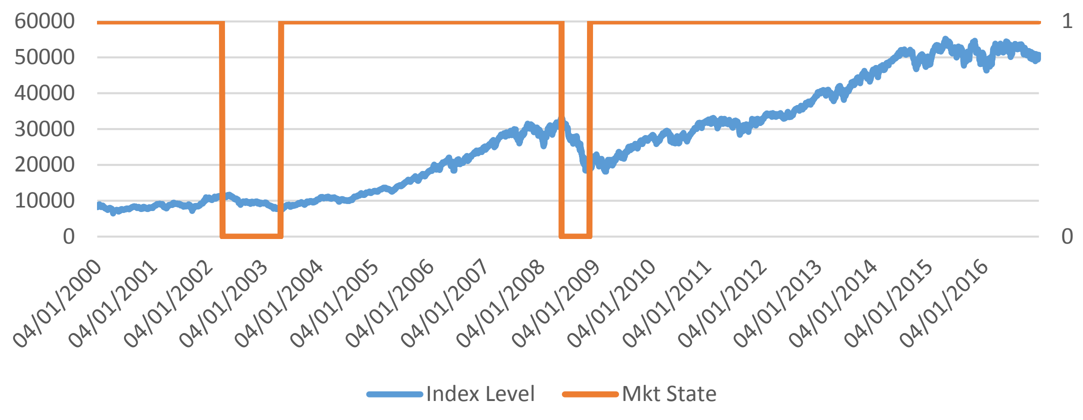


Figure 21. Morocco: stock market index and market regimes

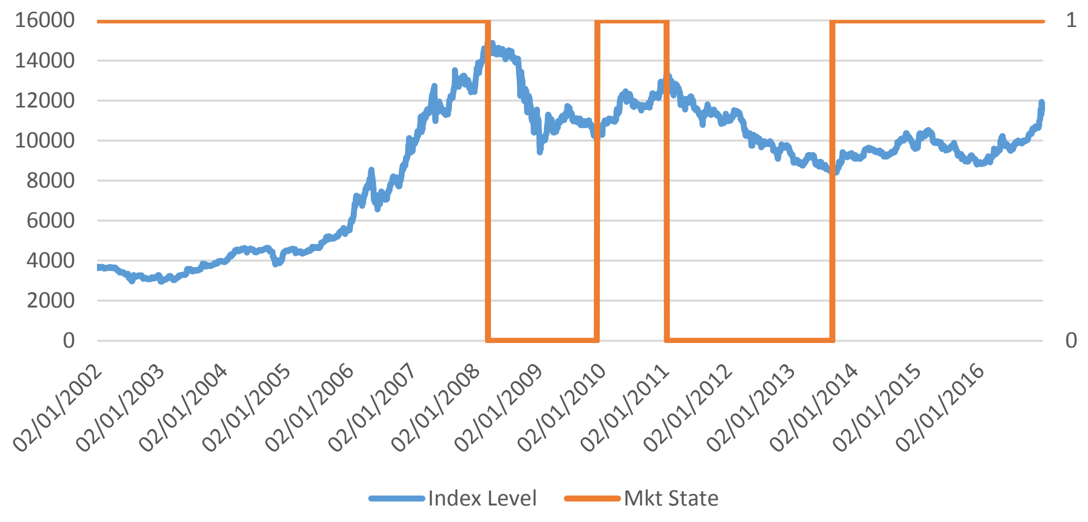
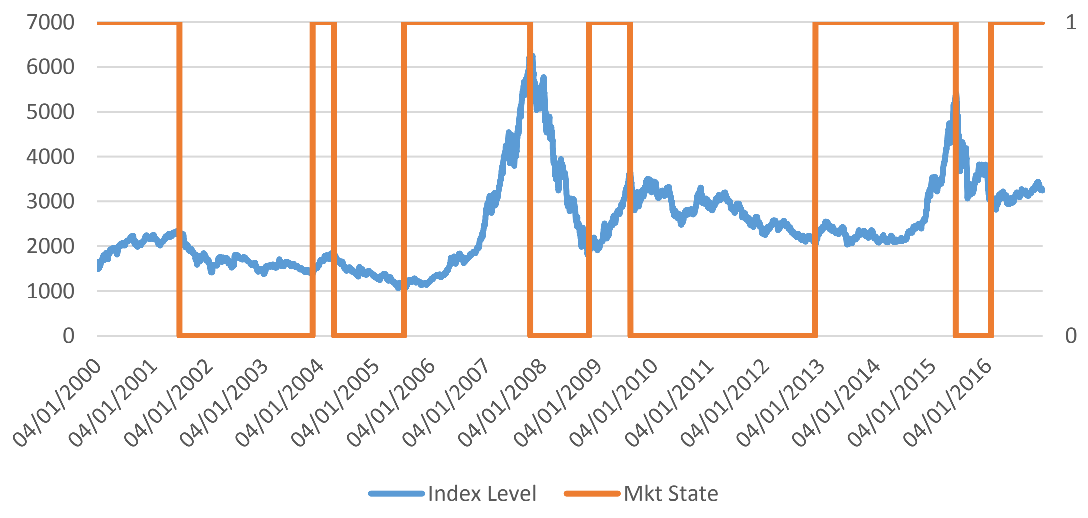


Figure 22. China: stock market index and market regimes



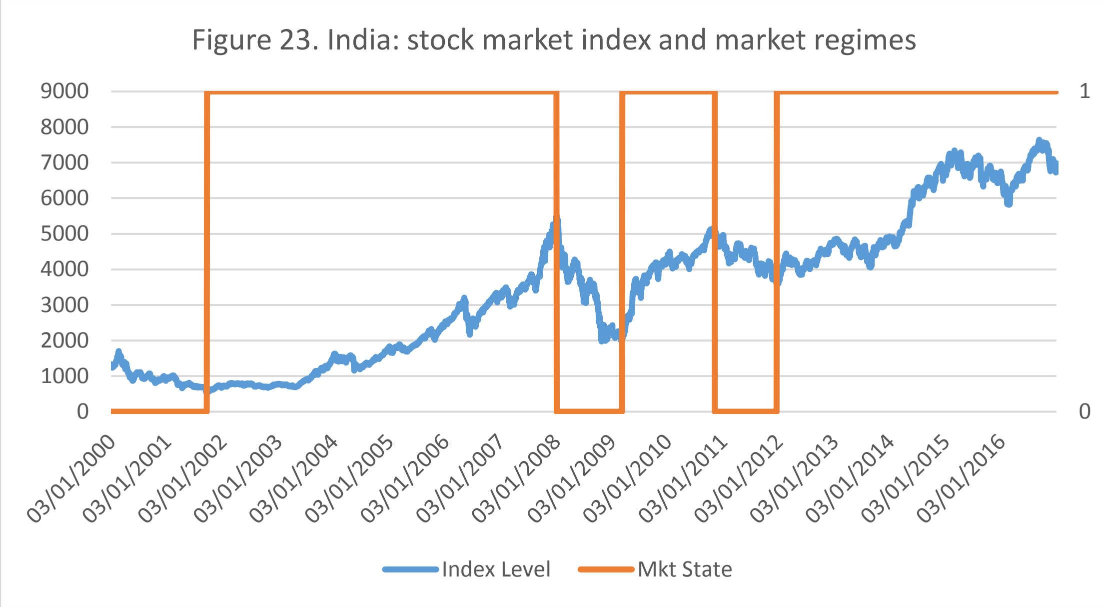


Figure 23. India: stock market index and market regimes
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
1
0
03/01/2000
03/01/2001
03/01/2002
03/01/2003
03/01/2004
03/01/2005
03/01/2006
03/01/2007
03/01/2008
03/01/2009
03/01/2010
03/01/2011
03/01/2012
03/01/2013
03/01/2014
03/01/2015
03/01/2016
Index Level
Mkt State

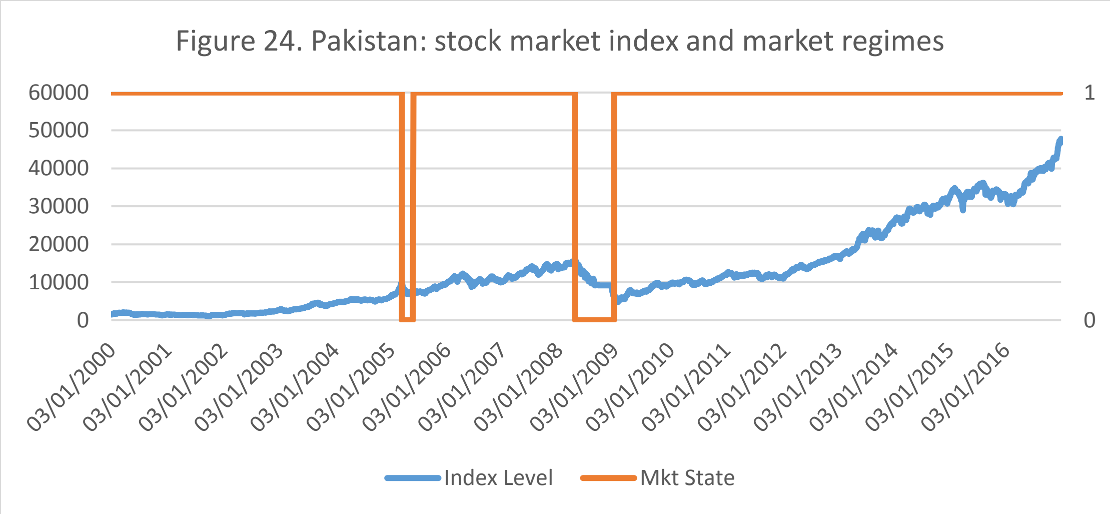


Figure 24. Pakistan: stock market index and market regimes
60000
50000
40000
30000
20000
10000
0
1
0
03/01/2000
03/01/2001
03/01/2002
03/01/2003
03/01/2004
03/01/2005
03/01/2006
03/01/2007
03/01/2008
03/01/2009
03/01/2010
03/01/2011
03/01/2012
03/01/2013
03/01/2014
03/01/2015
03/01/2016
Index Level
Mkt State

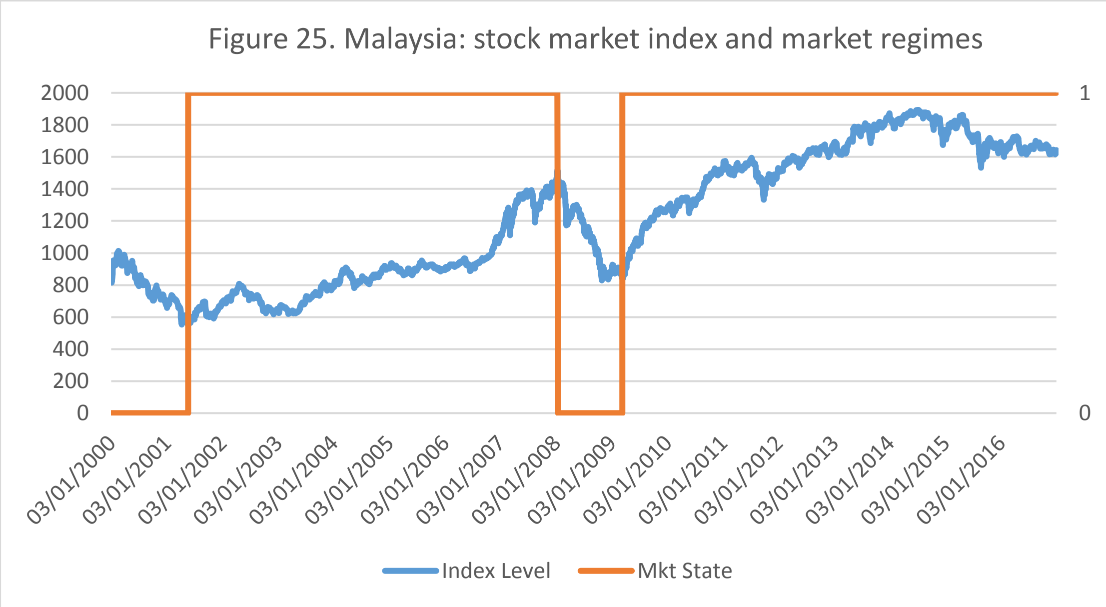


Figure 25. Malaysia: stock market index and market regimes
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1
0
03/01/2000
03/01/2001
03/01/2002
03/01/2003
03/01/2004
03/01/2005
03/01/2006
03/01/2007
03/01/2008
03/01/2009
03/01/2010
03/01/2011
03/01/2012
03/01/2013
03/01/2014
03/01/2015
03/01/2016
Index Level
Mkt State

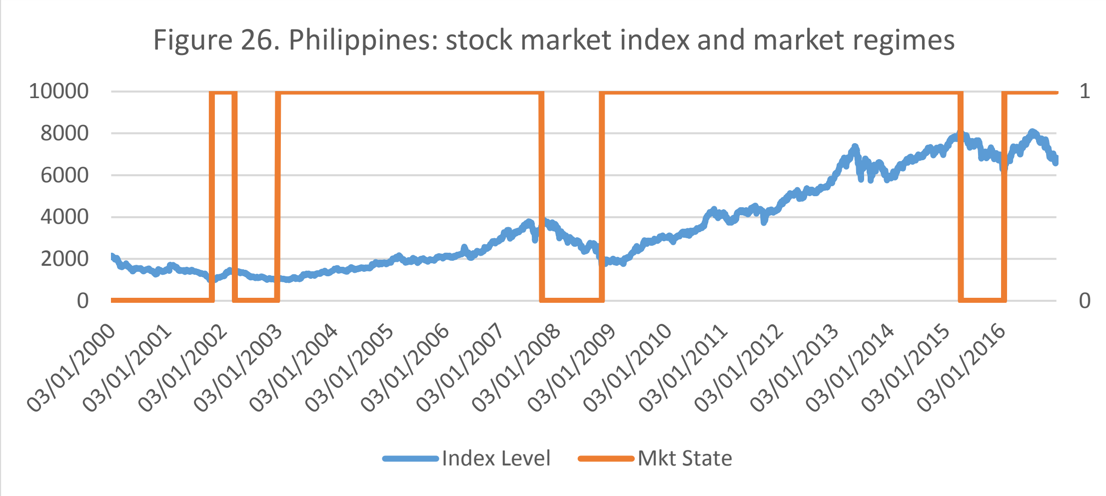


Figure 26. Philippines: stock market index and market regimes
10000
8000
6000
4000
2000
0
1
0
03/01/2000
03/01/2001
03/01/2002
03/01/2003
03/01/2004
03/01/2005
03/01/2006
03/01/2007
03/01/2008
03/01/2009
03/01/2010
03/01/2011
03/01/2012
03/01/2013
03/01/2014
03/01/2015
03/01/2016
Index Level
Mkt State

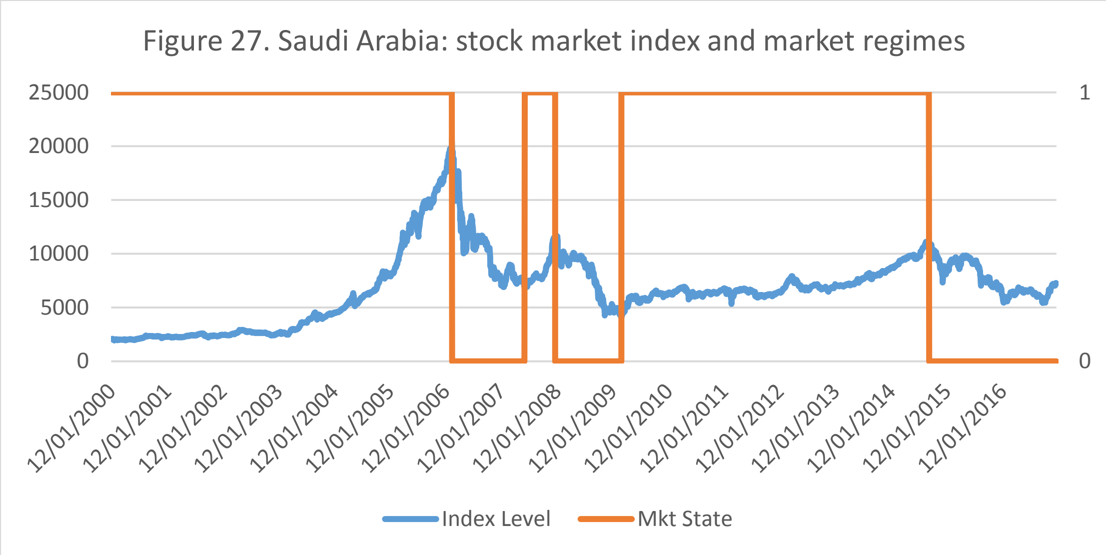


Figure 27. Saudi Arabia: stock market index and market regimes
25000
20000
15000
10000
5000
0
1
0
12/01/2000
12/01/2001
12/01/2002
12/01/2003
12/01/2004
12/01/2005
12/01/2006
12/01/2007
12/01/2008
12/01/2009
12/01/2010
12/01/2011
12/01/2012
12/01/2013
12/01/2014
12/01/2015
12/01/2016
Index Level
Mkt State

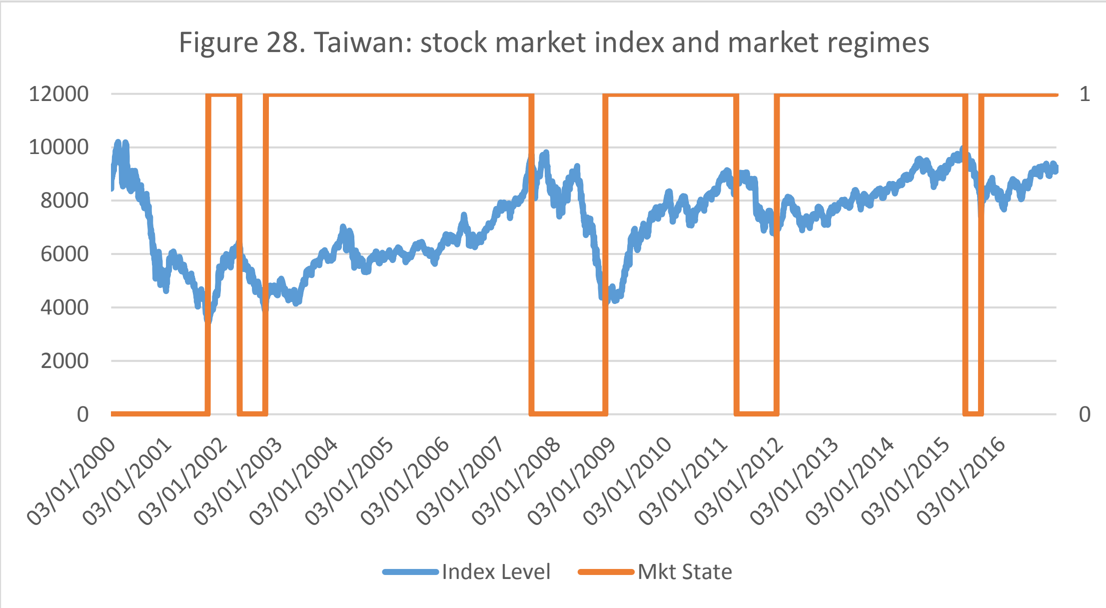


Figure 28. Taiwan: stock market index and market regimes
12000
10000
8000
6000
4000
2000
0
1
0
03/01/2000
03/01/2001
03/01/2002
03/01/2003
03/01/2004
03/01/2005
03/01/2006
03/01/2007
03/01/2008
03/01/2009
03/01/2010
03/01/2011
03/01/2012
03/01/2013
03/01/2014
03/01/2015
03/01/2016
Index Level
Mkt State

Figure 29. Thailand: stock market index and market regimes

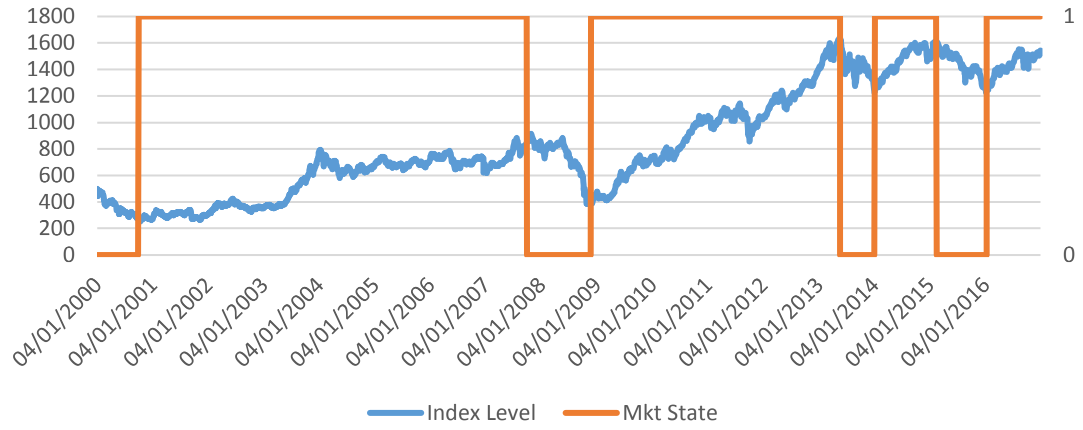


Figure 30. Hungary: stock market index and market regimes

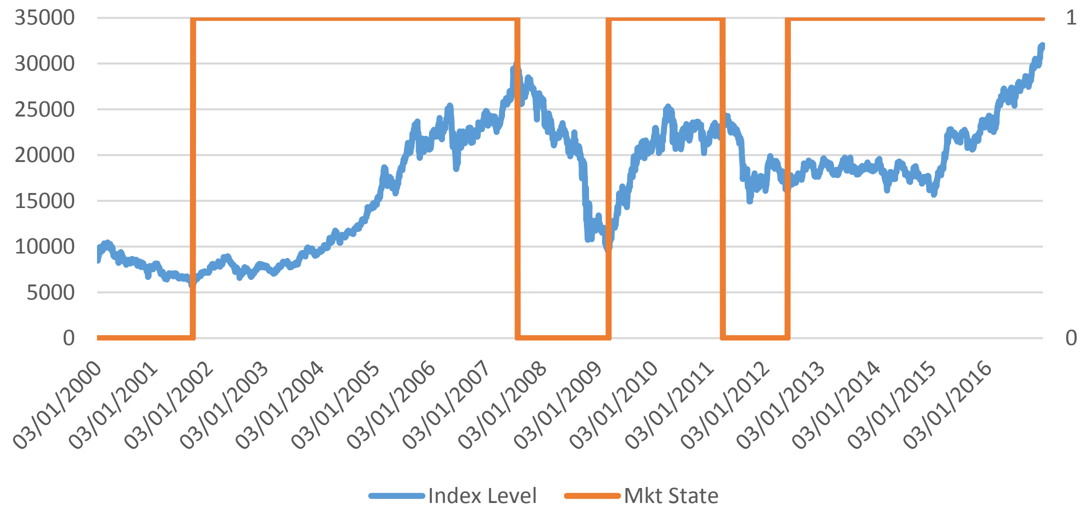


Figure 31. Russia: stock market index and market regimes

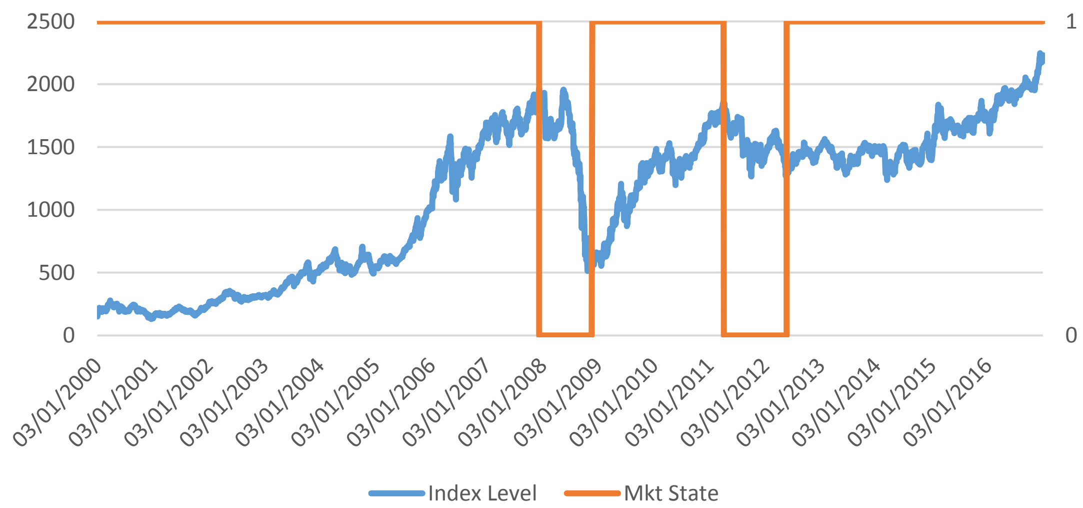


Figure 32. Romania: stock market index and market regimes

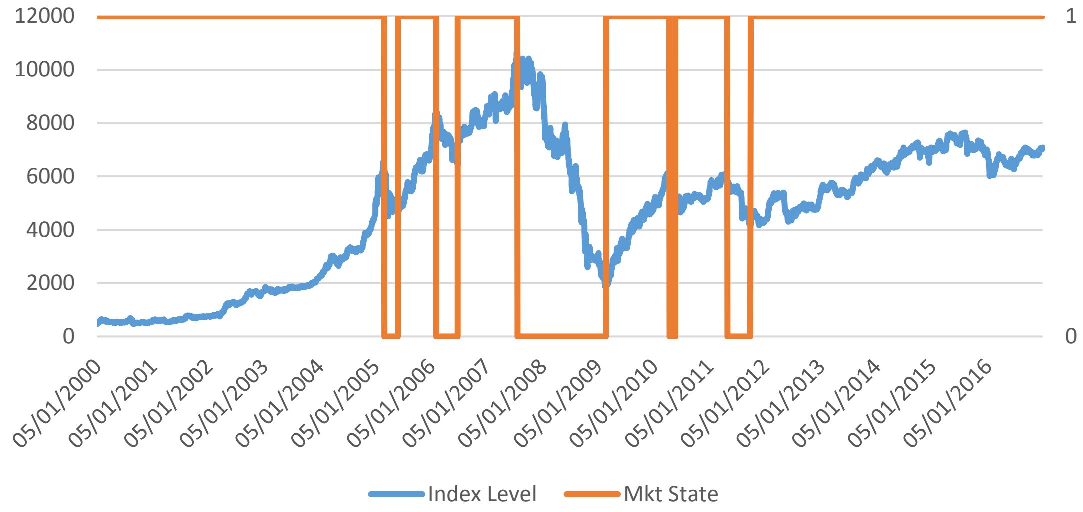


Figure 33. Turkey: stock market index and market regimes

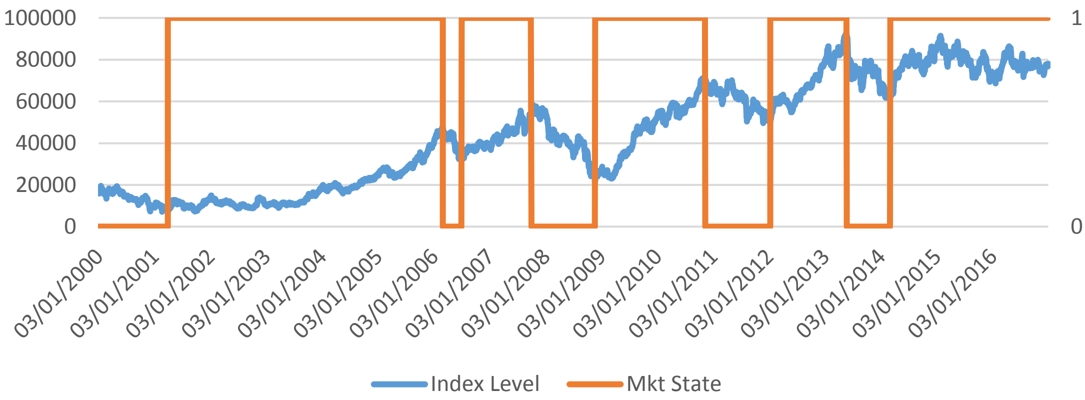
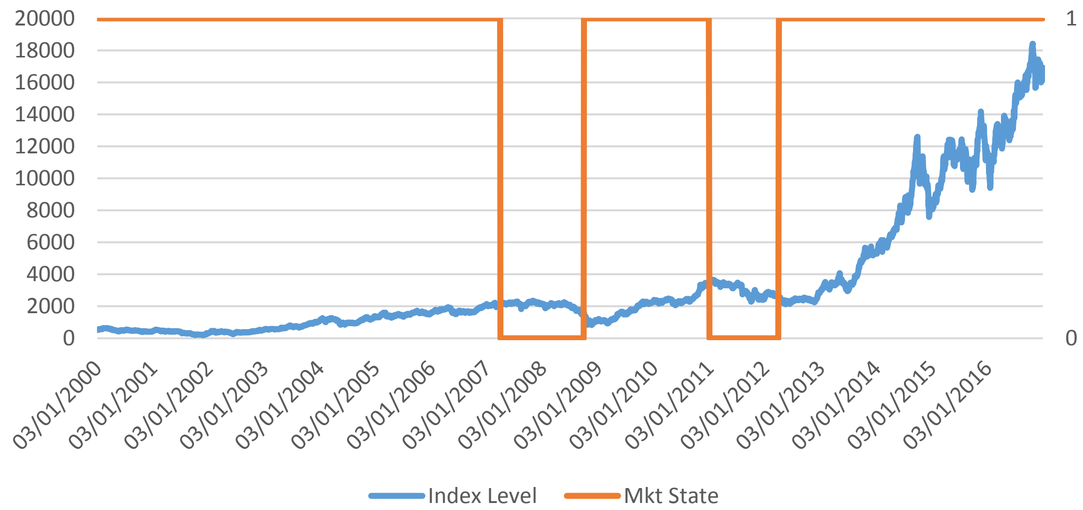


Figure 34. Argentina: stock market index and market regimes



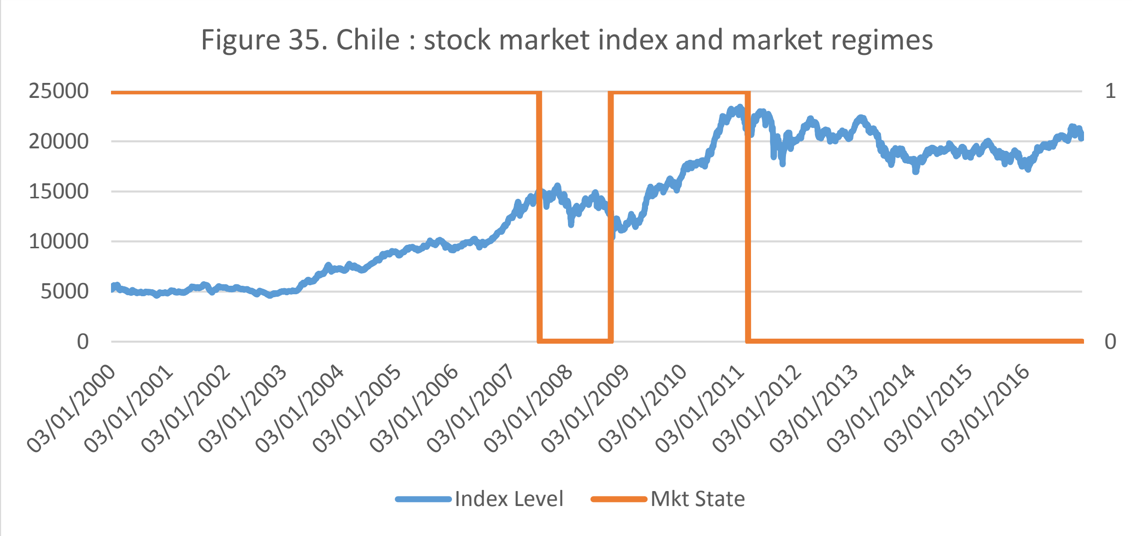


Figure 35. Chile : stock market index and market regimes
25000
20000
15000
10000
5000
0
1
0
03/01/2000
03/01/2001
03/01/2002
03/01/2003
03/01/2004
03/01/2005
03/01/2006
03/01/2007
03/01/2008
03/01/2009
03/01/2010
03/01/2011
03/01/2012
03/01/2013
03/01/2014
03/01/2015
03/01/2016
Index Level
Mkt State

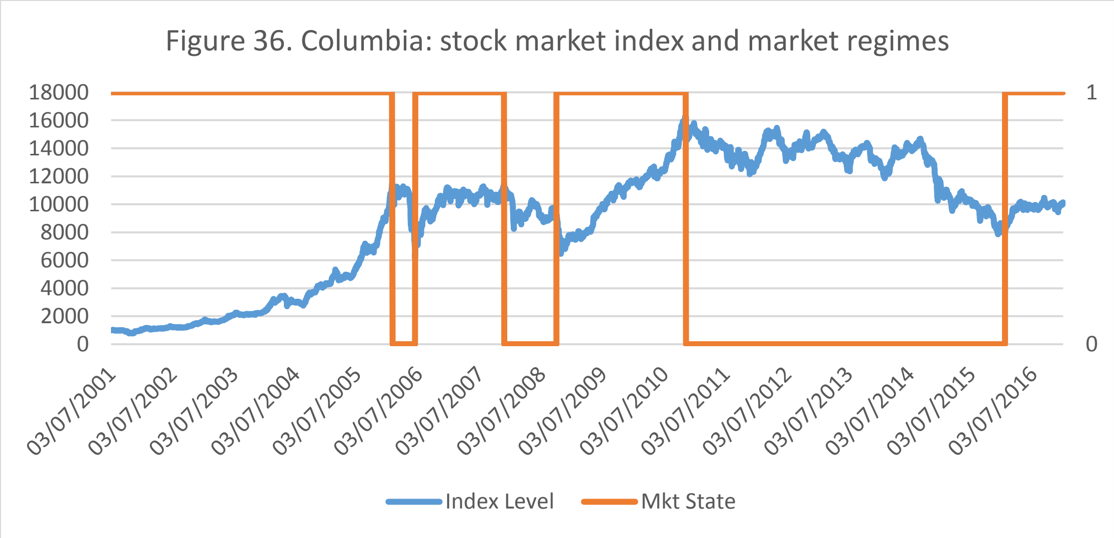


Figure 36. Columbia: stock market index and market regimes
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
1
0
03/07/2001
03/07/2002
03/07/2003
03/07/2004
03/07/2005
03/07/2006
03/07/2007
03/07/2008
03/07/2009
03/07/2010
03/07/2011
03/07/2012
03/07/2013
03/07/2014
03/07/2015
03/07/2016
Index Level
Mkt State


Figure 37. Mexico : stock market index and market regimes
60000
50000
40000
30000
20000
10000
0
1
0
03/01/2000
03/01/2001
03/01/2002
03/01/2003
03/01/2004
03/01/2005
03/01/2006
03/01/2007
03/01/2008
03/01/2009
03/01/2010
03/01/2011
03/01/2012
03/01/2013
03/01/2014
03/01/2015
03/01/2016
Index Level
Mkt State

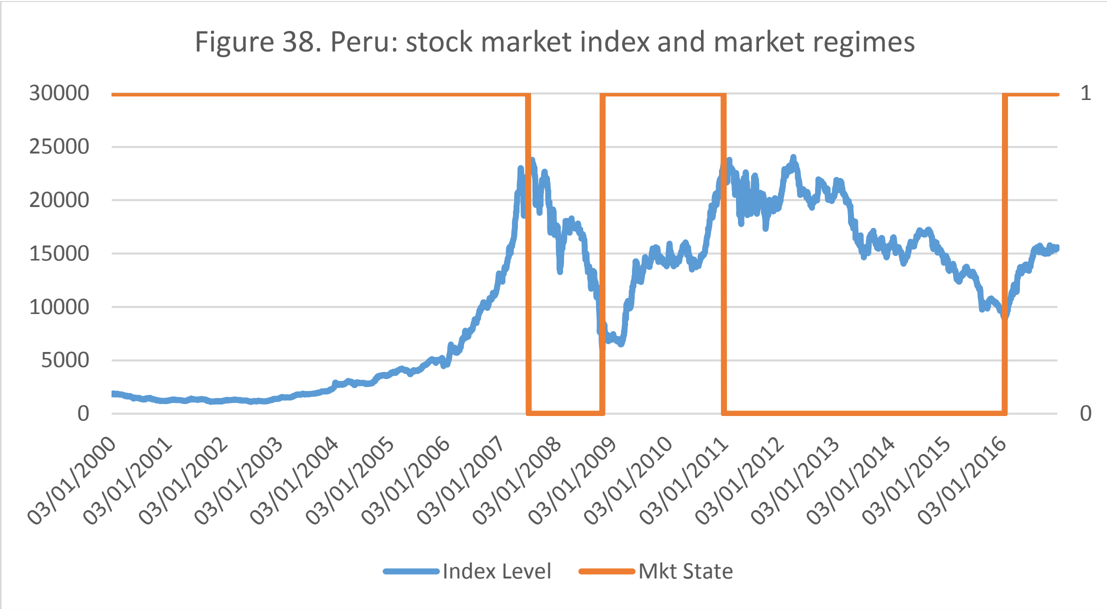


Figure 38. Peru: stock market index and market regimes
30000
25000
20000
15000
10000
5000
0
1
0
03/01/2000
03/01/2001
03/01/2002
03/01/2003
03/01/2004
03/01/2005
03/01/2006
03/01/2007
03/01/2008
03/01/2009
03/01/2010
03/01/2011
03/01/2012
03/01/2013
03/01/2014
03/01/2015
03/01/2016
Index Level
Mkt State

Table 9. Peaks and Troughs of the Developed Stock Exchange (The first date is the starting date and the last is the end date)

	Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
1	04/01/2000	03/01/2000	04/01/2002	03/01/2000	04/01/2000	03/01/2001	03/01/2000	02/01/2002	03/01/2000	03/01/2000
2	05/09/2000	01/09/2000	27/05/2002	10/03/2003	01/11/2007	30/03/2007	09/07/2007	12/03/2003	10/03/2003	04/09/2000
3	30/09/2002	11/03/2003	28/04/2003	11/10/2007	06/03/2009	03/03/2009	06/03/2009	29/06/2007	07/11/2007	12/03/2003
4	18/06/2008	09/10/2007	20/07/2007	09/03/2009	11/04/2011	30/12/2016	30/12/2010	09/03/2009	06/03/2009	01/06/2007
5	09/03/2009	09/03/2009	10/03/2009	09/11/2010	04/06/2012		23/11/2011	30/12/2010	30/12/2010	09/03/2009
6	05/04/2011	26/08/2010	21/07/2015	19/12/2011	28/04/2015		15/01/2014	12/09/2011	04/06/2012	01/07/2011
7	04/10/2011	22/07/2011	30/12/2016	22/05/2013	12/02/2016		16/10/2014		30/12/2016	23/11/2011
8	29/08/2014	19/12/2011		05/02/2014	30/12/2016		30/12/2016			05/08/2015
9	20/01/2016	17/08/2015		15/04/2015						11/02/2016
10		11/02/2016		26/01/2016						
11		30/12/2016								
12										

	Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK
1	03/01/2000	02/04/2001	03/01/2000	04/01/2000	03/01/2000	01/10/2001	04/01/2000	02/01/2002	04/01/2000
2	12/03/2003	31/03/2003	06/03/2000	30/03/2001	04/09/2000	23/10/2002	23/08/2000	09/10/2002	04/09/2000
3	16/07/2007	06/11/2007	12/03/2003	31/12/2002	12/03/2003	23/07/2007	12/03/2003	23/07/2007	12/03/2003
4	06/03/2009	09/03/2009	23/05/2007	30/03/2007	16/07/2007	03/03/2009	15/06/2007	21/11/2008	13/07/2007
5	12/09/2011	14/10/2009	09/03/2009	02/12/2015	05/03/2009	14/10/2009	09/03/2009	16/05/2011	06/03/2009
6	10/04/2015	05/06/2012	17/02/2011	30/12/2016	18/02/2011	07/05/2010	11/05/2011	22/09/2011	30/12/2016
7	11/02/2016	02/04/2014	24/07/2012		04/10/2011	17/02/2011	10/08/2011	27/04/2015	
8	30/12/2016	11/02/2016	10/08/2015		05/08/2015	13/06/2012	05/08/2015	11/02/2016	
9		30/12/2016	30/12/2016		11/02/2016	03/04/2014	30/12/2016	30/12/2016	
10					07/01/2015				
11					13/04/2015				
12					30/12/2016				

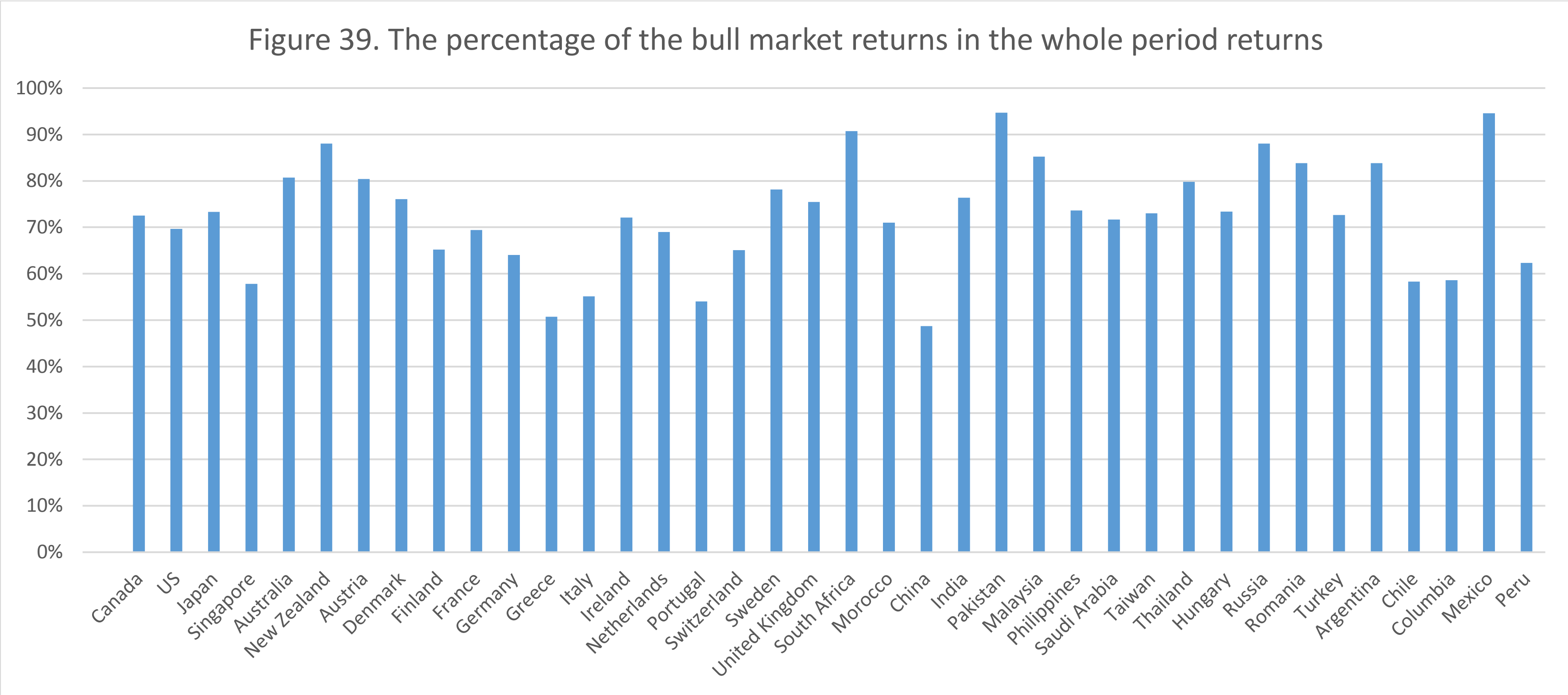
Note: Tables 9 lists the turning points of the stock market index (peak and trough dates) for each DSE. More listed dates indicate more frequent switches of bull/bear market.

Table. 10 Peaks and Troughs of the Emerging Stock Exchange (The first date is the starting date and the last is the end date)

	South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
1	04/01/2000	02/01/2002	04/01/2000	03/01/2000	03/01/2000	03/01/2000	03/01/2000	12/01/2000	03/01/2000	04/01/2000
2	05/04/2002	13/03/2008	27/06/2001	21/09/2001	15/03/2005	21/05/2001	24/10/2001	23/02/2006	28/09/2001	29/09/2000
3	25/04/2003	04/12/2009	18/11/2003	04/01/2008	27/05/2005	11/01/2008	22/03/2002	14/06/2007	24/04/2002	28/09/2007
4	20/05/2008	12/01/2011	07/04/2004	09/03/2009	18/04/2008	12/03/2009	27/12/2002	31/12/2007	11/10/2002	24/11/2008
5	21/11/2008	29/08/2013	11/07/2005	09/11/2010	31/12/2008	30/12/2016	28/09/2007	09/03/2009	24/07/2007	21/05/2013
6	30/12/2016	30/12/2016	16/10/2007	20/12/2011	30/12/2016		28/10/2008	17/09/2014	20/11/2008	03/01/2014
7			06/11/2008	30/12/2016			10/04/2015	30/12/2016	31/03/2011	13/02/2015
8			04/08/2009				21/01/2016		20/12/2011	11/01/2016
9			29/11/2012				29/12/2016		12/05/2015	30/12/2016
10			08/06/2015						30/12/2016	
11			28/01/2016							
12			30/12/2016							

	Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
1	03/01/2000	03/01/2000	05/01/2000	03/01/2000	03/01/2000	03/01/2000	03/07/2001	03/01/2000	03/01/2000
2	21/09/2001	12/12/2007	02/03/2005	29/03/2001	30/03/2007	29/06/2007	27/01/2006	31/03/2008	28/06/2007
3	23/07/2007	21/11/2008	30/05/2005	01/03/2006	30/09/2008	30/09/2008	13/06/2006	02/03/2009	27/10/2008
4	12/03/2009	06/04/2011	07/02/2006	30/06/2006	30/12/2010	05/01/2011	23/11/2007	30/12/2016	31/12/2010
5	31/03/2011	23/05/2012	27/06/2006	28/09/2007	30/03/2012	30/12/2016	30/09/2008		20/01/2016
6	30/05/2012	30/12/2016	24/07/2007	20/11/2008	30/12/2016		08/11/2010		30/12/2016
7	30/12/2016		25/02/2009	09/11/2010			18/01/2016		
8			16/04/2010	09/01/2012			30/12/2016		
9			25/05/2010	22/05/2013					
10			02/05/2011	03/03/2014					
11			30/09/2011	30/12/2016					
12			30/12/2016						

Tables 10 lists the turning points of the stock market index (peak and trough dates) for each ESE. More listed dates indicate more frequent switches of bull/bear market.



Note: Figure 39 shows the percentage of the bull market returns in the whole sample return for each stock exchange. This percentages indicates the weight of the bull market periods in the whole sample periods.

5.1.2.2 Probability density distribution of the bull/bear market regime

Table 11, Panels A and B present the basic statistics for the DSE's bull and bear market returns respectively. Similarly, Table 12 Panels A and B show the basic statistics for the ESE's bull and bear market returns respectively.

In addition to individual stock exchanges' statistics, the averages of the statistics for each group are provided for both the bull market regime and the bear market regime respectively. Panel A and Panel B of Table 11 show that, consistent with expectations and previous research, each DSE has a lower mean and higher standard deviation during the bear markets than during the bull markets. No such pattern can be observed for the skewness and kurtosis. The skewness and kurtosis are more diverse. To be more specific, Canada, Singapore, Australia, Denmark, Italy, and Ireland exhibit the lower skewness during the bear market than during the bull market. The opposite is true for the rest of the DSEs. In terms of the kurtosis, Australia, New Zealand, Finland, France, Greece, Italy, Switzerland and Sweden have lower kurtosis during the bear markets than during the bull markets while the rest of the DSEs demonstrate higher kurtosis during the bear markets than during the bull markets.

Similarly, comparing Panel A and Panel B of Table 12, it can be seen that each ESE has lower mean and higher standard deviation during the bear markets than during the bull markets. More diversity is found for the skewness and kurtosis. Unlike the DSEs, 14 out of 19 ESEs have lower skewness during the bear markets than during the bull markets, leaving the remaining five ESEs having higher skewness during the bear markets than during the bull markets. In terms of the kurtosis, 9 ESEs have higher kurtosis during the bear markets than during bull markets while the other 10 demonstrate lower kurtosis during the bear markets than during the bull markets. According to the normality test results presented in Tables 13 and14, the normal distribution is rejected for any exchange during both the bull and the bear markets.

In summary, the mean and the standard deviation exhibit clear pattern related to the bull and the bear markets for both the DSEs and the ESEs. To be more specific, the mean of the bull market stock returns is larger than that of the bear market returns while the standard deviation of the bull market stock returns is lower than that of the bear market returns. However, there is less regularity for the skewness and the kurtosis. Considering the rejection of the normal distribution, this finding indicates that there may exist implicit risk when only the mean and the standard deviation are considered in modelling while the skewness and the kurtosis are ignored. To account for the diversity of the third and the forth moment, it may be necessary to adopt more flexible probability density models which are capable of modelling the skewness and the kurtosis in addition to the mean and the standard deviation.

Table 11. Descriptive Statistics of the Developed Stock Exchanges

Panel A. Bull Markets										
	Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
Sample Size	3097	2978	2697	2465	3481	3539	3386	2854	2783	3016
Maximum	0.0518	0.0686	0.0574	0.0577	0.0481	0.0322	0.0871	0.0600	0.0716	0.0882
Minimum	-0.0564	-0.0600	-0.1115	-0.0451	-0.0569	-0.0525	-0.0777	-0.0515	-0.0922	-0.0792
Mean	0.0008	0.0008	0.0008	0.0012	0.0007	0.0005	0.0009	0.0011	0.0010	0.0009
Median	0.0011	0.0008	0.0008	0.0012	0.0008	0.0009	0.0012	0.0015	0.0012	0.0011
Standard Deviation	0.0091	0.0088	0.0130	0.0092	0.0081	0.0063	0.0121	0.0099	0.0122	0.0113
Skewness	-0.2520	-0.0510	-0.4798	0.0650	-0.2764	-0.5320	-0.3033	-0.1945	-0.3904	-0.1167
Kurtosis	5.9255	6.8983	6.6234	7.4239	5.7871	7.0421	6.5833	5.7107	8.0033	6.6121
	Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK	Average
Sample Size	2767	1975	2378	3098	2993	2102	2783	2943	3240	2872
Maximum	0.0590	0.0964	0.1068	0.0757	0.0691	0.0426	0.0569	0.0911	0.0503	0.0669
Minimum	-0.0707	-0.1441	-0.0680	-0.0675	-0.0535	-0.0546	-0.0907	-0.0880	-0.0463	-0.0719
Mean	0.0011	0.0018	0.0010	0.0008	0.0009	0.0012	0.0008	0.0010	0.0006	0.0009
Median	0.0014	0.0020	0.0012	0.0010	0.0011	0.0011	0.0009	0.0010	0.0008	0.0011
Standard Deviation	0.0120	0.0150	0.0125	0.0115	0.0103	0.0090	0.0093	0.0125	0.0093	0.0106
Skewness	-0.0982	-0.5419	0.0159	-0.3021	-0.0483	-0.1561	-0.5144	0.0849	-0.1602	-0.2238
Kurtosis	5.5875	10.3140	7.3990	6.1818	6.3684	5.5885	9.2954	7.1713	5.4022	6.8378

Note: Table 11 presents the basic subsample statistics (Sample Size, Maximum, Minimum, Mean, Median, Standard Deviation, Skewness, and Kurtosis) of the daily log returns for the DSEs with Bull market in Panel A and Bear market in Panel B. In addition to the individual markets' statistics, the averages for each group of stock exchanges are provided. The data source is DataStream.

Table 11 (Cont.). Descriptive Statistics of the Developed Stock Exchanges

Panel B. Bear Markets										
_ _	Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
Sample Size	1173	1298	981	1799	831	482	826	897	1485	1329
Maximum	0.0937	0.1096	0.1323	0.0731	0.0557	0.0581	0.1202	0.0820	0.1456	0.1032
Minimum	-0.0976	-0.0946	-0.1211	-0.0863	-0.0870	-0.0494	-0.1025	-0.1058	-0.1717	-0.0938
Mean	-0.0014	-0.0013	-0.0013	-0.0013	-0.0012	-0.0011	-0.0024	-0.0017	-0.0017	-0.0017
Median	-0.0005	-0.0008	-0.0004	-0.0010	-0.0008	-0.0005	-0.0017	-0.0012	-0.0020	-0.0017
Standard Deviation	0.0158	0.0182	0.0205	0.0135	0.0156	0.0108	0.0218	0.0158	0.0259	0.0193
Skewness	-0.5387	-0.0072	-0.2441	-0.3620	-0.3062	-0.1316	-0.0353	-0.2624	-0.0233	0.1451
Kurtosis	9.8472	7.1238	8.6363	7.6894	5.7449	6.2885	7.4439	7.6217	5.9047	5.8650
	Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK	Average
Sample Size	1554	1920	1936	1200	1347	1789	1493	823	1055	1275
Maximum	0.1080	0.1343	0.1088	0.0973	0.0983	0.1131	0.1079	0.0987	0.0881	0.1015
Minimum	-0.0887	-0.1747	-0.1333	-0.1396	-0.0945	-0.1038	-0.0811	-0.0751	-0.0871	-0.1046
Mean	-0.0016	-0.0024	-0.0013	-0.0015	-0.0018	-0.0014	-0.0012	-0.0022	-0.0011	-0.0016
Median	-0.0010	-0.0021	-0.0007	-0.0007	-0.0014	-0.0008	-0.0007	-0.0019	-0.0011	-0.0011
Standard Deviation	0.0198	0.0225	0.0188	0.0192	0.0192	0.0149	0.0159	0.0201	0.0167	0.0181
Skewness	0.1430	-0.1318	-0.1424	-0.6036	-0.0196	-0.0297	0.1483	0.2154	-0.0380	-0.1171
Kurtosis	5.8350	8.0163	6.7267	9.1460	6.4609	8.7694	7.1872	5.3529	6.7601	7.1800

Note: Table 11 presents the basic subsample statistics (Sample Size, Maximum, Minimum, Mean, Median, Standard Deviation, Skewness, and Kurtosis) of the daily log returns for the DSEs with Bull market in Panel A and Bear market in Panel B. In addition to the individual markets' statistics, the averages for each group of stock exchanges are provided. The data source is DataStream.

Table 12. Descriptive Statistics of the Emerging Stock Exchanges

Panel A. Bull Markets

	South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
Sample Size	3852	2651	2004	3219	3973	3567	3071	3007	3067	3319
Maximum	0.0683	0.0355	0.0869	0.1503	0.0851	0.0426	0.0937	0.0904	0.0652	0.1058
Minimum	-0.0790	-0.0682	-0.0926	-0.1288	-0.0866	-0.0567	-0.0825	-0.0702	-0.0691	-0.1606
Mean	0.0007	0.0008	0.0021	0.0012	0.0012	0.0005	0.0011	0.0012	0.0009	0.0009
Median	0.0010	0.0006	0.0020	0.0018	0.0014	0.0005	0.0010	0.0012	0.0008	0.0010
Standard Deviation	0.0116	0.0074	0.0147	0.0128	0.0130	0.0070	0.0121	0.0110	0.0115	0.0126
Skewness	-0.0864	-0.5028	-0.5529	-0.3023	-0.2661	-0.2807	-0.1527	-0.1138	-0.0462	-0.6202
Kurtosis	5.9601	10.8613	7.6306	15.0409	7.6561	7.8267	7.1431	12.7718	6.4504	14.4106
	Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru	Average
Sample Size	3117	3804	3565	3095	3498	2474	2215	4045	2649	3168
Maximum	0.1067	0.1303	0.1154	0.1269	0.1612	0.0906	0.1469	0.0702	0.1004	0.0985
Minimum	-0.0665	-0.1142	-0.0940	-0.1334	-0.1295	-0.0502	-0.0908	-0.0827	-0.0789	-0.0913
Mean	0.0010	0.0011	0.0015	0.0013	0.0012	0.0006	0.0017	0.0006	0.0017	0.0011
Median	0.0008	0.0008	0.0010	0.0016	0.0013	0.0007	0.0017	0.0009	0.0011	0.0011
Standard Deviation	0.0135	0.0189	0.0135	0.0190	0.0223	0.0071	0.0128	0.0124	0.0124	0.0129
Skewness	0.1014	-0.2434	0.2285	0.0502	-0.1385	0.1853	0.5284	-0.0708	0.4915	-0.0943
Kurtosis	5.8836	7.4744	10.0519	7.7042	6.8231	18.1269	16.3547	6.5433	10.1566	9.7300

Note: Table 12 presents the basic subsample statistics (Sample Size, Maximum, Minimum, Mean, Median, Standard Deviation, Skewness, and Kurtosis) of the daily log returns for the ESEs with Bull market in Panel A and Bear market in Panel B. In addition to the individual markets' statistics, the averages for each group of stock exchanges are provided. The data source is DataStream.

Table 12 (Cont.). Descriptive Statistics of the Emerging Stock Exchanges

Panel B. Bear Markets

	South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
Sample Size	395	1083	2108	995	222	619	1099	1188	1133	841
Maximum	0.0650	0.0446	0.0940	0.0680	0.0825	0.0450	0.1618	0.1640	0.0617	0.0755
Minimum	-0.0758	-0.0467	-0.0887	-0.1159	-0.0470	-0.0998	-0.1309	-0.1168	-0.0994	-0.1109
Mean	-0.0025	-0.0008	-0.0016	-0.0022	-0.0063	-0.0016	-0.0019	-0.0020	-0.0024	-0.0023
Median	-0.0023	-0.0005	-0.0009	-0.0011	-0.0003	-0.0023	-0.0014	0.0002	-0.0016	-0.0020
Standard Deviation	0.0174	0.0083	0.0176	0.0211	0.0217	0.0136	0.0158	0.0227	0.0192	0.0170
Skewness	-0.1510	-0.2595	-0.1319	-0.4262	0.2334	-0.7864	0.9657	-0.3896	-0.0879	-0.6434
Kurtosis	5.5214	8.1512	7.3244	5.2207	3.8482	9.0696	27.0048	9.0687	4.2588	8.2132

	Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru	Average
Sample Size	1131	516	689	1166	676	1768	1566	233	1600	1001
Maximum	0.1318	0.2523	0.1056	0.1777	0.0975	0.0447	0.0774	0.1044	0.1282	0.1043
Minimum	-0.1265	-0.2066	-0.1312	-0.1998	-0.1135	-0.0598	-0.1105	-0.0727	-0.1329	-0.1098
Mean	-0.0017	-0.0029	-0.0040	-0.0023	-0.0009	-0.0001	-0.0009	-0.0027	-0.0014	-0.0021
Median	-0.0017	-0.0007	-0.0033	-0.0019	0.0001	0.0001	-0.0002	-0.0020	-0.0005	-0.0012
Standard Deviation	0.0196	0.0330	0.0243	0.0277	0.0176	0.0082	0.0132	0.0231	0.0161	0.0188
Skewness	-0.1065	0.1164	-0.5065	-0.0091	-0.6219	-0.3880	-1.0497	0.5635	-0.9613	-0.2442
Kurtosis	9.1497	19.2099	7.9020	9.8853	8.5772	8.7151	13.4308	6.8166	15.3815	9.8289

Note: Table 12 presents the basic subsample statistics (Sample Size, Maximum, Minimum, Mean, Median, Standard Deviation, Skewness, and Kurtosis) of the daily log returns for the ESEs with Bull market in Panel A and Bear market in Panel B. In addition to the individual markets' statistics, the averages for each group of stock exchanges are provided. The data source is DataStream.

Table 13. Normality Test Results of the Developed Stock Exchanges

Panel A. Bull Markets

		Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
Jaque Bera Test	Test Statistic	1137.23	1886.97	1578.85	2011.83	1171.01	2576.13	1863.48	891.80	2973.46	1646.49
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4849	0.4850	0.4811	0.4837	0.4866	0.4893	0.4812	0.4832	0.4807	0.4827
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		Germany	Greece	Italy	Ireland	NL	Portugal	Switzerland	Sweden	UK	
Jaque Bera Test	Test Statistic	776.33	4498.82	1917.50	1353.94	1416.12	595.38	4718.41	2137.21	792.91	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Kolmogorov–Smirnov Normality test	Test Statistic	0.4820	0.4765	0.4811	0.4824	0.4830	0.4854	0.4847	0.4801	0.4849	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	

Panel B. Bear Markets

		Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
Jaque Bera Test	Test Statistic	2348.21	919.75	1308.27	1687.64	273.86	218.58	679.85	808.64	522.18	459.20
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4769	0.4736	0.4695	0.4785	0.4779	0.4855	0.4681	0.4769	0.4650	0.4721
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK	
Jaque Bera Test	Test Statistic	525.71	2018.65	1126.87	1961.55	672.35	2481.42	1096.15	196.21	621.74	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Kolmogorov–Smirnov Normality test	Test Statistic	0.4713	0.4674	0.4742	0.4718	0.4703	0.4794	0.4749	0.4735	0.4755	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	

Note: Tables 13 demonstrates the normality of the distributions of daily returns of the bull and bear subsamples (Panel A for bull market and Panel B for bear market). The test statistics values and the associated p values are presented of Jaque Bera Test and Kolmogorov–Smirnov Normality Test are presented. The results of Table 13 indicate that the normality of the distributions of daily returns is rejected for every DSE for both bull market and bear market. The data source is DataStream.

Table 14. Normality Test Results of the Emerging Stock Exchanges

Panel A. Bull Markets

		South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
Jaque Bera Test	Test Statistic	1411.14	6938.07	1892.53	19494.80	3635.76	3509.41	2208.42	11970.35	1522.47	18218.43
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4818	0.4860	0.4790	0.4803	0.4781	0.4879	0.4803	0.4787	0.4811	0.4802
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
Jaque Bera Test	Test Statistic	1085.25	3210.71	7417.97	2855.11	2141.49	23601.97	16563.06	2119.42	5759.73
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4790	0.4703	0.4779	0.4718	0.4681	0.4881	0.4786	0.4792	0.4810
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Panel B. Bear Markets

		South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
Jaque Bera Test	Test Statistic	106.13	1209.56	1648.64	234.58	8.67	1013.97	26557.46	1853.11	76.26	1010.36
	P Value	0.0000	0.0000	0.0000	0.0000	0.0131	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4764	0.4858	0.4731	0.4731	0.4812	0.4820	0.4795	0.4685	0.4757	0.4767
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
Jaque Bera Test	Test Statistic	1784.35	5650.50	719.32	2303.25	919.72	2450.53	7386.87	153.75	10466.50
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4718	0.4657	0.4686	0.4638	0.4768	0.4856	0.4787	0.4710	0.4752
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: Tables 14 demonstrates the normality of the distributions of daily returns of the bull and bear subsamples (Panel A for bull market and Panel B for bear market). The test statistics values and the associated p values are presented of Jaque Bera Test and Kolmogorov–Smirnov Normality Test are presented. The results of Table 14 indicate that the normality of the distributions of daily returns is rejected for every ESE for both bull market and bear market. The data source is DataStream.

Table 15 Panel A presents the estimated parameter values for different probability density models fitted to the bull market returns for the DSEs. Table 15, Panel B presents the estimated parameter values for different probability density models fitted to the bear market returns for the DSEs. Table 16 is analogous to Table 15 but it presents the results for the ESEs.

Tables 15 and 16 show that, for every stock exchange, there exist considerable differences in the parameters of each probability density model during the bull markets and the bear markets. For instance, during the bull markets, the skewness parameter λ is positive for both HST and SGT for all the DSEs except Finland. During the bear markets, the skewness parameter λ of HST and SGT is negative for some DSEs, i.e. US, France, Germany, Greece, Netherland, Portugal, and Switzerland. In terms of ν, SGT has larger values of ν compared with ST and HST. In addition, for all ST, HST, and SGT, ν tends to be smaller during the bear markets than during the bull markets indicating fatter tails of the distribution of the bear market returns.

Table 15. Probability Density Models and Parameters of the Developed Stock Exchanges

Panel A. Bull Markets

Model	Parameter	Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
N	σ	0.0091	0.0088	0.0130	0.0092	0.0081	0.0063	0.0121	0.0099	0.0122	0.0113
ST	ν	4.0340	3.8871	5.7807	3.3650	4.9409	5.7444	3.9707	4.2188	4.3033	4.2952
	σ	0.0093	0.0090	0.0130	0.0097	0.0082	0.0063	0.0124	0.0102	0.0123	0.0116
HST	ν	4.0459	3.8879	5.7759	3.3620	4.9403	5.7548	3.9580	4.2209	4.3059	4.2986
	λ	-0.0025	-0.0009	0.0010	0.0009	-0.0004	-0.0045	0.0024	-0.0008	-0.0010	0.0003
	σ	0.0093	0.0090	0.0130	0.0097	0.0082	0.0063	0.0124	0.0102	0.0123	0.0116
SGT	ν	7.7936	9.8676	12.0896	4.3417	7.7169	5.2585	4.6836	6.6142	4.9009	7.8340
	λ	-0.0025	-0.0009	-0.0013	0.0003	-0.0009	-0.0044	0.0016	-0.0015	-0.0011	-0.0011
	k	1.4575	1.3278	1.5101	1.6581	1.6230	2.1169	1.7911	1.5873	1.8326	1.5076
	σ	0.0091	0.0087	0.0129	0.0093	0.0081	0.0063	0.0122	0.0100	0.0122	0.0113

Model	Parameter	Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK
N	σ	0.0120	0.0150	0.0125	0.0115	0.0103	0.0090	0.0093	0.0125	0.0093
ST	ν	4.0359	3.2511	3.7014	4.0705	3.7372	3.7075	4.3691	3.7144	3.9543
	σ	0.0125	0.0160	0.0130	0.0118	0.0107	0.0095	0.0093	0.0130	0.0097
HST	ν	4.0391	3.2537	3.6954	4.0663	3.7363	3.7068	4.3639	3.7149	3.9509
	λ	-0.0012	0.0051	0.0012	0.0031	0.0001	0.0028	0.0031	-0.0028	-0.0005
	σ	0.0125	0.0160	0.0130	0.0118	0.0107	0.0095	0.0093	0.0130	0.0097
SGT	ν	25.2407	4.2205	6.3825	4.7754	6.0802	10.8731	5.5224	4.4614	7.0977
	λ	-0.0012	0.0041	0.0000	0.0023	-0.0006	0.0012	0.0022	-0.0024	-0.0015
	k	1.1924	1.6554	1.4876	1.7995	1.5221	1.3098	1.7285	1.7587	1.5052
	σ	0.0120	0.0153	0.0125	0.0116	0.0103	0.0091	0.0092	0.0127	0.0094

Note: Tables 15 demonstrates the estimated values of the parameters for different probability density models for each DSE. The estimated values of parameters of the same probability density models are heterogenous for different stock exchanges and for different market regimes. The data source is DataStream.

Table 15 (Cont.). Probability Density Models and Parameters of the Developed Stock Exchanges

Panel B. Bear Markets

		Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
N	σ	0.0158	0.0182	0.0205	0.0135	0.0156	0.0108	0.0217	0.0158	0.0258	0.0193
ST	ν	2.6962	3.9034	3.5173	3.5826	4.8065	4.1987	3.0680	3.4060	5.3011	4.4828
	σ	0.0181	0.0186	0.0211	0.0140	0.0157	0.0111	0.0237	0.0167	0.0260	0.0195
HST	ν	2.6822	3.9014	3.5216	3.5832	4.8075	4.2022	3.0642	3.4017	5.3037	4.4850
	λ	0.0108	-0.0035	-0.0003	0.0018	-0.0013	-0.0038	0.0005	0.0014	0.0024	-0.0018
	σ	0.0182	0.0186	0.0211	0.0140	0.0157	0.0111	0.0237	0.0167	0.0260	0.0195
SGT	ν	2.7307	4.8690	3.5860	4.4362	3.6496	7.2516	4.0519	4.8223	8.0172	4.4434
	λ	0.0107	-0.0026	-0.0003	0.0019	-0.0020	-0.0034	0.0002	0.0012	0.0022	-0.0016
	k	1.9614	1.7175	1.9659	1.7049	2.5181	1.5153	1.6052	1.5765	1.6513	2.0115
	σ	0.0180	0.0183	0.0210	0.0137	0.0161	0.0108	0.0223	0.0160	0.0258	0.0195

		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK
N	σ	0.0198	0.0225	0.0188	0.0192	0.0192	0.0149	0.0159	0.0201	0.0167
ST	ν	4.3504	3.6604	4.2124	2.7797	3.2835	4.4081	3.3975	4.6837	3.6954
	σ	0.0202	0.0233	0.0191	0.0219	0.0206	0.0149	0.0167	0.0204	0.0172
HST	ν	4.3516	3.6610	4.2092	2.7732	3.2865	4.4172	3.3978	4.6801	3.6911
	λ	-0.0055	-0.0014	-0.0020	0.0066	-0.0016	-0.0041	-0.0031	-0.0043	0.0013
	σ	0.0202	0.0233	0.0191	0.0220	0.0206	0.0149	0.0167	0.0204	0.0172
SGT	ν	5.3616	5.5191	6.4633	3.7213	5.0098	5.0485	3.6942	6.3646	3.9727
	λ	-0.0052	-0.0006	-0.0019	0.0071	-0.0012	-0.0041	-0.0030	-0.0039	0.0006
	k	1.7656	1.5399	1.5758	1.5645	1.5203	1.8241	1.8689	1.7124	1.8923
	σ	0.0200	0.0226	0.0188	0.0199	0.0195	0.0148	0.0164	0.0201	0.0171

Note: Tables 15 demonstrates the estimated values of the parameters for different probability density models for each DSE. The estimated values of parameters of the same probability density models are heterogenous for different stock exchanges and for different market regimes. The data source is DataStream.

Table 16 Emerging Stock Exchanges Probability Density Models and Parameters

Panel A. Bull Market Regime

		South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
N	σ	0.0116	0.0074	0.0147	0.0128	0.0130	0.0070	0.0121	0.0110	0.0115	0.0126
ST	ν	4.9536	2.4911	2.9561	3.8296	2.7710	3.6001	4.4838	2.1229	3.3752	4.2322
	σ	0.0117	0.0094	0.0164	0.0128	0.0152	0.0073	0.0122	0.0225	0.0122	0.0126
HST	ν	4.9545	2.4906	2.9515	3.8228	2.7614	3.6014	4.4802	2.1233	3.3724	4.2305
	λ	-0.0044	0.0027	0.0167	0.0015	0.0106	0.0019	0.0033	0.0103	0.0025	0.0013
	σ	0.0117	0.0094	0.0165	0.0128	0.0152	0.0073	0.0122	0.0225	0.0122	0.0126
SGT	ν	4.7590	3.8809	7.1425	4.1442	5.6913	5.9761	4.0239	3.4528	6.0206	5.7388
	λ	-0.0039	0.0019	0.0074	0.0011	-0.0034	0.0015	0.0037	0.0067	0.0007	0.0010
	k	2.0521	1.3877	1.2381	1.8762	1.2788	1.4822	2.1700	1.2663	1.4276	1.6551
	σ	0.0117	0.0077	0.0147	0.0127	0.0132	0.0070	0.0123	0.0117	0.0116	0.0124

		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
N	σ	0.0135	0.0189	0.0135	0.0190	0.0223	0.0070	0.0128	0.0124	0.0124
ST	ν	5.2123	3.2278	2.7796	3.8326	3.3914	3.9848	3.1953	3.6651	2.9752
	σ	0.0136	0.0203	0.0154	0.0194	0.0237	0.0069	0.0132	0.0129	0.0135
HST	ν	5.2200	3.2191	2.7750	3.8269	3.3919	3.9787	3.1976	3.6649	2.9731
	λ	0.0014	0.0081	-0.0017	-0.0019	0.0021	0.0041	0.0033	-0.0035	-0.0038
	σ	0.0136	0.0203	0.0154	0.0194	0.0237	0.0069	0.0132	0.0129	0.0135
SGT	ν	6.7766	5.8839	3.9590	4.7708	6.6707	3.3520	3.7646	5.5072	3.2664
	λ	0.0014	0.0046	-0.0024	-0.0019	0.0012	0.0049	0.0025	-0.0022	-0.0037
	k	1.7578	1.3703	1.4992	1.7180	1.3797	2.3885	1.7244	1.5580	1.8336
	σ	0.0135	0.0190	0.0139	0.0191	0.0224	0.0071	0.0128	0.0125	0.0130

Note: Tables 16 demonstrates the values of the estimated parameters for different probability density models for each ESE. The values of the estimated parameters of the same probability density models are heterogenous for different stock exchanges and for different market regimes. The data source is DataStream.

Table 16 Emerging Stock Exchanges Probability Density Models and Parameters Cont.

Panel B. Bear Market Regime

		South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
N	σ	0.0174	0.0083	0.0176	0.0211	0.0217	0.0135	0.0158	0.0227	0.0192	0.0170
ST	ν	3.7952	3.4686	2.8789	4.6257	9.7813	3.7656	3.2100	2.3908	5.9041	3.2354
	σ	0.0181	0.0086	0.0200	0.0215	0.0217	0.0138	0.0154	0.0311	0.0194	0.0181
HST	ν	3.7950	3.4702	2.8782	4.6467	8.7142	3.7770	3.2051	2.3584	5.8995	3.2291
	λ	0.0006	-0.0014	0.0017	-0.0042	-0.0396	0.0160	0.0024	0.0173	-0.0039	0.0089
	σ	0.0181	0.0086	0.0200	0.0215	0.0217	0.0138	0.0154	0.0320	0.0194	0.0181
SGT	ν	6.8638	3.4063	4.6904	17.2114	42.5336	3.3483	2.8472	3.4810	753.8803	4.9876
	λ	0.0003	-0.0015	0.0015	-0.0052	-0.0241	0.0170	0.0032	0.0168	-0.0023	0.0068
	k	1.4669	2.0397	1.4188	1.3307	1.4657	2.2228	2.2935	1.4233	1.2874	1.4760
	σ	0.0175	0.0086	0.0180	0.0210	0.0217	0.0141	0.0161	0.0243	0.0192	0.0171

		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
N	σ	0.0196	0.0329	0.0242	0.0277	0.0176	0.0082	0.0132	0.0231	0.0161
ST	ν	3.5667	2.1713	2.8586	3.5273	3.5021	3.4172	2.8982	2.2257	2.2908
	σ	0.0200	0.0525	0.0272	0.0283	0.0182	0.0085	0.0142	0.0395	0.0227
HST	ν	3.5691	2.1486	2.8500	3.5292	3.5018	3.4176	2.8837	2.2340	2.2685
	λ	0.0007	0.0199	0.0117	-0.0012	-0.0001	0.0029	0.0111	-0.0128	0.0247
	σ	0.0200	0.0558	0.0272	0.0283	0.0182	0.0085	0.0142	0.0390	0.0234
SGT	ν	3.1438	2.3238	3.4772	3.4713	4.3938	4.1230	3.2618	4.4854	2.7631
	λ	0.0004	0.0127	0.0104	-0.0011	0.0010	0.0028	0.0107	-0.0078	0.0239
	k	2.2710	1.8384	1.6711	2.0288	1.6733	1.7215	1.7715	1.2571	1.5889
	σ	0.0206	0.0415	0.0255	0.0284	0.0177	0.0083	0.0136	0.0242	0.0179

Note: Tables 16 demonstrates the values of the estimated parameters for different probability density models for each ESE. The values of the estimated parameters of the same probability density models are heterogenous for different stock exchanges and for different market regimes. The data source is DataStream.

In addition to the comparison of the probability density model parameter values, it is important to discuss the goodness of fit of these probability models. Table 17, Panels A and B present the -LogL, AIC, SBC the LR test results for each of the DSE distributional specifications for the bull markets and the bear markets respectively. Table 18 is analogous to Table 17 but presents the results for the ESEs. Based on the comparison of the –LogL results of Panels A and B of Table 17, it can be seen that during bull markets, SGT offers the best fit for every DSE except for New Zealand and Finland. SGT is less successful in the bear markets in the sense that more DSEs are better described by simpler probability density models (Canada, Japan, Portugal, Switzerland and the UK).

The AIC and the SBC, support the findings based on –LogL, i.e., that the probability density distribution become simpler during the bear markets than during the bull markets. According to AIC, during the bull markets, for 11 out of 19 DSEs, SGT is the best specification. In the rest of the sample, ST is the optimal fit for Singapore, New Zealand, Austria, Greece, Ireland, Switzerland and Sweden while HST is the best for Finland. However, during the bear markets, AIC indicates that SGT is the best specification for Greece only. SBC demonstrates more extreme results. During the bull markets, only the US, Germany and Portugal out of 19 DSEs are better described by SGT and none of the DSEs is optimally specified by SGT during the bear markets. The LR test results are, in general, consistent with AIC. For instance, when AIC indicates the superiority of SGT, LR test rejects the null hypothesis that the parameter restrictions are valid. Conversely, if AIC does not indicate superiority of SGT, the LR test cannot statistically reject the null hypothesis that the parameter restrictions are valid.

From Table 18, based on the comparison of the –LogL results, it can be seen that during the bull markets, SGT offers the best fit for every ESE except for South Arica, India, Philippines, and Peru. During the bear markets, SGT offers the best fit for every ESE except for Morocco, Russia and Turkey. The AIC and the SBC indicates that the probability density distribution become simpler during the bear markets than during the bull markets. According to AIC, during the bull markets, for 10 out of 19 ESEs, SGT is the best specifications. However, during the bear markets, this number recues to only four (China, India, Saudi Arabia and Taiwan). SBC demonstrate more extreme results. During the bull markets, only 5 out of 19 ESEs (China, Pakistan, Saudi Arabia, Russia and Argentina) are better described by SGT and none of the ESEs is optimally specified by SGT during the bear markets.

Table 17. Goodness of Fit of Probability Density Models of the Developed Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

		Panel A. Bull Markets									
_	_	Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
-Log Likelihood	N	-10177.05	-9886.14	-7882.26	-8070.44	-11815.21	-12892.25	-10147.32	-9113.46	-8314.73	-9237.06
	ST	-10338.00	-10057.07	-7972.40	-8274.85	-11948.34	-13033.47	-10346.41	-9248.95	-8485.75	-9383.26
	HST	-10338.02	-10057.07	-7972.41	-8274.85	-11948.34	-13033.55	-10346.43	-9248.96	-8485.75	-9383.26
	SGT	**-10343.38**	**-10067.94**	**-7977.39**	**-8276.50**	**-11951.47**	**-13033.80**	**-10347.15**	**-9251.91**	**-8486.18**	**-9388.18**
Akaike Information Criterion	N	-20350.10	-19768.27	-15760.52	-16136.88	-23626.41	-25780.51	-20290.63	-18222.92	-16625.47	-18470.11
	ST	-20669.99	-20108.14	-15938.81	-16543.70	-23890.68	-26060.94	-20686.82	-18491.91	-16965.50	-18760.52
	HST	-20670.03	-20108.14	-15938.81	**-16543.70**	-23890.68	**-26061.09**	**-20686.86**	-18491.91	**-16965.51**	-18760.52
	SGT	**-20676.76**	**-20125.89**	**-15944.78**	-16542.99	**-23892.93**	-26057.59	-20684.31	**-18493.83**	-16962.35	**-18766.37**
Schwartz Bayesian Criterion	N	10169.01	9878.14	7874.36	8062.63	11807.05	12884.08	10139.19	9105.51	8306.80	9229.05
	ST	10325.94	10045.07	7960.55	8263.13	11936.11	13021.21	10334.22	9237.02	8473.85	9371.24
	HST	**10325.96**	10045.07	**7960.56**	**8263.14**	**11936.11**	**13021.29**	**10334.24**	**9237.02**	**8473.86**	**9371.24**
	SGT	10323.28	**10047.95**	7957.64	8256.97	11931.08	13013.37	10326.84	9232.02	8466.35	9368.15
Normal Distribution	LR Statistic	332.7	363.6	190.3	412.1	272.5	283.1	399.7	276.9	342.9	302.3
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	10.8	21.8	10.0	3.3	6.3	0.7	1.5	5.9	0.9	9.8
	P value	0.0046	0.0000	0.0068	0.1923	0.0438	0.7203	0.4754	0.0518	0.6533	0.0073
Skewed T Distribution	LR Statistic	10.7	21.7	10.0	3.3	6.3	0.5	1.4	5.9	0.8	9.8
	P value	0.0011	0.0000	0.0016	0.0696	0.0124	0.4805	0.2289	0.0150	0.3578	0.0017

Note: Table 17 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each DSE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 17(Cont.). Goodness of Fit of Probability Density Models of the Developed Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel A. Bull Market Regime

		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK
-Log Likelihood	N	-8304.894	-5488.287	-7050.886	-9440.819	-9454.935	-6910.329	-9081.640	-8712.249	-10560.283
	ST	-8432.529	-5667.144	-7202.103	-9612.661	-9637.466	-7017.419	-9253.583	-8913.967	-10717.449
	HST	-8432.532	-5667.192	-7202.107	-9612.692	-9637.466	-7017.436	-9253.612	-8913.990	-10717.450
	SGT	**-8448.376**	**-5668.509**	**-7206.239**	**-9613.278**	**-9641.796**	**-7025.410**	**-9254.805**	**-8914.876**	**-10721.821**
Akaike Information Criterion	N	-16605.788	-10972.574	-14097.773	-18877.638	-18905.871	-13816.658	-18159.281	-17420.499	-21116.566
	ST	-16859.058	-11328.287	-14398.206	-19219.321	-19268.932	-14028.839	-18501.166	-17821.935	-21428.899
	HST	-16859.064	**-11328.383**	-14398.214	**-19219.384**	-19268.932	-14028.871	**-18501.225**	**-17821.980**	-21428.900
	SGT	**-16886.753**	-11327.018	**-14402.478**	-19216.556	**-19273.592**	**-14040.821**	-18499.610	-17819.752	**-21433.642**
Schwartz Bayesian Criterion	N	8296.968	5480.699	7043.112	9432.781	9446.931	6902.679	9073.709	8704.262	10552.199
	ST	8420.641	5655.761	7190.442	9600.603	9625.460	7005.943	9241.686	8901.987	10705.324
	HST	8420.644	**5655.809**	**7190.446**	**9600.634**	**9625.460**	7005.960	**9241.715**	**8902.009**	**10705.325**
	SGT	**8428.563**	5649.538	7186.804	9593.182	9621.786	**7006.284**	9234.977	8894.908	10701.613
Normal Distribution	LR Statistic	286.96	360.44	310.70	344.92	373.72	230.16	346.33	405.25	323.08
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	31.70	2.73	8.27	1.23	8.66	15.98	2.44	1.82	8.74
	P value	0.0000	0.2552	0.0160	0.5393	0.0132	0.0003	0.2947	0.4031	0.0126
Skewed T Distribution	LR Statistic	31.69	2.63	8.26	1.17	8.66	15.95	2.38	1.77	8.74
	P value	0.0000	0.1045	0.0040	0.2790	0.0033	0.0001	0.1225	0.1832	0.0031

Note: Table 17 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each DSE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 17 (Cont.). Goodness of Fit of Probability Density Models of the Developed Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel B. Bear Markets											
_	_	Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
-Log Likelihood	N	-3203.023	-3357.230	-2420.692	-5188.986	-2278.874	-1497.183	-1990.449	-2446.251	-3321.711	-3364.076
	ST	-3368.168	-3444.076	-2512.115	-5331.554	-2315.438	-1522.319	-2070.102	-2518.202	-3375.281	-3427.247
	HST	-3368.300	-3444.093	-2512.115	-5331.560	-2315.440	-1522.327	-2070.102	-2518.204	-3375.290	-3427.250
	SGT	**-3368.308**	**-3444.648**	**-2512.120**	**-5332.414**	**-2315.818**	**-1523.191**	**-2070.787**	**-2519.264**	**-3376.459**	**-3427.251**
Akaike Information Criterion	N	-6402.047	-6710.460	-4837.384	-10373.973	-4553.748	-2990.366	-3976.899	-4888.502	-6639.422	-6724.152
	ST	-6730.336	-6882.152	-5018.230	-10657.108	-4624.877	-3038.638	-4134.204	-5030.405	-6744.561	-6848.493
	HST	**-6730.600**	**-6882.187**	**-5018.230**	**-10657.120**	**-4624.879**	**-3038.654**	**-4134.205**	**-5030.408**	**-6744.581**	**-6848.501**
	SGT	-6726.617	-6879.297	-5014.240	-10654.828	-4621.636	-3036.382	-4131.575	-5028.527	-6742.919	-6844.503
Schwartz Bayesian Criterion	N	3195.956	3350.061	2413.803	5181.491	2272.151	1491.005	1983.733	2439.452	3314.408	3356.884
	ST	3357.567	3433.323	2501.782	5320.311	2305.354	1513.052	2060.027	2508.004	3364.326	3416.458
	HST	**3357.699**	**3433.340**	**2501.782**	**5320.317**	**2305.356**	**1513.060**	**2060.027**	**2508.005**	**3364.336**	**3416.462**
	SGT	3350.640	3426.727	2494.899	5313.676	2299.011	1507.746	2053.996	2502.266	3358.201	3409.271
Normal Distribution	LR Statistic	330.57	174.84	182.86	286.86	73.89	52.02	160.68	146.03	109.50	126.35
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	0.28	1.14	0.01	1.72	0.76	1.74	1.37	2.12	2.36	0.01
	P value	0.8688	0.5642	0.9946	0.4232	0.6840	0.4183	0.5040	0.3460	0.3077	0.9952
Skewed T Distribution	LR Statistic	0.02	1.11	0.01	1.71	0.76	1.73	1.37	2.12	2.34	0.00
	P value	0.8969	0.2921	0.9187	0.1912	0.3844	0.1887	0.2418	0.1455	0.1263	0.9642

Note: Table 17 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each DSE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 17 (Cont.). Goodness of fit of Probability Density Models of the Developed Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel B. Bear Markets										
		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK
-Log Likelihood	N	-3887.867	-4557.573	-4950.523	-3040.257	-3413.147	-4989.289	-4069.203	-2049.474	-2822.871
	ST	-3962.890	-4701.358	-5057.499	-3183.685	-3516.193	-5106.599	-4188.993	-2081.506	-2897.207
	HST	-3962.943	-4701.362	-5057.507	-3183.741	-3516.197	-5106.631	-4189.008	-2081.523	-2897.208
	SGT	**-3963.391**	**-4703.958**	**-5059.692**	**-3185.016**	**-3517.997**	**-5106.957**	**-4189.145**	**-2081.962**	**-2897.267**
Akaike Information Criterion	N	-7771.734	-9111.147	-9897.045	-6076.514	-6822.295	-9974.579	-8134.405	-4094.949	-5641.741
	ST	-7919.781	-9396.717	-10108.997	-6361.370	-7026.387	-10207.197	-8371.986	-4157.011	-5788.414
	HST	**-7919.886**	-9396.724	-10109.014	**-6361.481**	**-7026.394**	**-10207.262**	**-8372.016**	**-4157.046**	**-5788.417**
	SGT	-7916.781	**-9397.915**	**-10109.384**	-6360.032	-7025.993	-10203.914	-8368.291	-4153.923	-5784.534
Schwartz Bayesian Criterion	N	3880.518	4550.013	4942.954	3033.167	3405.942	4981.800	4061.894	2042.761	2815.909
	ST	3951.867	4690.018	5046.146	3173.050	3505.385	5095.365	4178.030	2071.436	2886.765
	HST	**3951.920**	**4690.022**	**5046.155**	**3173.106**	**3505.389**	**5095.397**	**4178.045**	**2071.454**	**2886.766**
	SGT	3945.019	4685.057	5040.771	3167.291	3499.983	5088.233	4170.874	2065.179	2879.864
Normal Distribution	LR Statistic	151.05	292.77	218.34	289.52	209.70	235.33	239.89	64.97	148.79
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	1.00	5.20	4.39	2.66	3.61	0.72	0.30	0.91	0.12
	P value	0.6062	0.0743	0.1115	0.2642	0.1648	0.6990	0.8588	0.6338	0.9417
Skewed T Distribution	LR Statistic	0.90	5.19	4.37	2.55	3.60	0.65	0.27	0.88	0.12
	P value	0.3440	0.0227	0.0366	0.1102	0.0578	0.4195	0.6006	0.3490	0.7325

Note: Table 17 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each DSE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 18. Goodness of Fit of Probability Density Models of the Emerging Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel A. Bull Markets											
_	_	South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
-Log Likelihood	N	-11704.41	-9245.77	-5619.09	-9457.73	-11606.68	-12640.94	-9204.85	-9283.95	-9346.07	-9801.87
	ST	-11865.51	-9625.94	-5799.40	-9760.80	-12013.87	-12899.65	-9375.54	-9896.82	-9567.70	-10046.07
	HST	-11865.59	-9625.95	-5799.94	-9760.81	-12014.31	-12899.67	-9375.58	-9897.11	-9567.72	-10046.07
	SGT	**-11865.62**	**-9632.38**	**-5810.11**	**-9761.09**	**-12027.60**	**-12906.12**	**-9375.94**	**-9909.13**	**-9574.06**	**-10048.80**
Akaike Information Criterion	N	-13816.66	-18159.28	-17420.50	-21116.57	-23404.83	-18487.54	-11234.18	-18911.47	-23209.36	-25277.89
	ST	-14028.84	-18501.17	-17821.93	-21428.90	-23725.01	-19245.88	-11592.80	-19515.60	-24021.75	-25793.31
	HST	-14028.87	**-18501.22**	**-17821.98**	-21428.90	**-23725.18**	-19245.91	-11593.89	**-19515.62**	-24022.61	-25793.34
	SGT	**-14040.82**	-18499.61	-17819.75	**-21433.64**	-23721.24	**-19254.76**	**-11610.23**	-19512.18	**-24045.20**	**-25802.23**
Schwartz Bayesian Criterion	N	6902.68	9073.71	8704.26	10552.20	11696.16	9237.89	5611.49	9449.66	11598.39	12632.76
	ST	7005.94	9241.69	8901.99	10705.32	11853.12	9614.11	5787.99	9748.69	12001.44	12887.39
	HST	7005.96	**9241.72**	**8902.01**	**10705.32**	**11853.21**	**9614.13**	5788.54	**9748.69**	12001.87	**12887.40**
	SGT	**7006.28**	9234.98	8894.91	10701.61	11844.98	9612.67	**5791.11**	9740.90	**12006.88**	12885.67
Normal Distribution	LR Statistic	322.41	773.22	382.04	606.71	841.84	530.35	342.18	1250.36	455.98	493.86
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	0.23	12.89	21.43	0.58	27.45	12.92	0.79	24.61	12.72	5.46
	P value	0.8925	0.0016	0.0000	0.7492	0.0000	0.0016	0.6732	0.0000	0.0017	0.0653
Skewed T Distribution	LR Statistic	0.06	12.86	20.34	0.56	26.59	12.90	0.71	24.04	12.68	5.44
	P value	0.8144	0.0003	0.0000	0.4528	0.0000	0.0003	0.3989	0.0000	0.0004	0.0196

Note: Table 18 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the distribution specifications for each ESE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 18 (Cont.). Goodness of Fit of Probability Density Models of the Emerging Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel A. Bull Markets										
		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
-Log Likelihood	N	-8995.29	-9691.25	-10276.59	-7876.49	-8336.13	-8747.10	-6509.39	-12012.61	-7875.65
	ST	-9107.63	-10025.46	-10717.96	-8095.82	-8588.47	-9004.85	-6799.01	-12280.34	-8184.27
	HST	-9107.64	-10025.71	-10717.97	-8095.83	-8588.49	-9004.90	-6799.03	-12280.38	-8184.30
	SGT	**-9108.70**	**-10035.16**	**-10723.71**	**-8097.20**	**-8598.05**	**-9006.29**	**-6799.98**	**-12285.18**	**-8184.67**
Akaike Information Criterion	N	-17986.58	-19378.50	-20549.18	-15748.99	-16668.25	-17490.20	-13014.78	-24021.22	-15747.31
	ST	-18209.27	-20044.92	-21429.92	-16185.64	-17170.94	-18003.70	-13592.02	-24554.68	-16362.53
	HST	**-18209.28**	-20045.42	-21429.95	**-16185.66**	-17170.98	**-18003.80**	**-13592.07**	-24554.76	**-16362.61**
	SGT	-18207.40	**-20060.31**	**-21437.43**	-16184.40	**-17186.11**	-18002.58	-13589.96	**-24560.35**	-16359.35
Schwartz Bayesian Criterion	N	8987.25	9683.01	10268.41	7868.46	8327.97	8739.29	6501.69	12004.30	7867.77
	ST	9095.57	10013.09	10705.69	8083.76	8576.23	8993.13	6787.46	12267.88	8172.44
	HST	**9095.57**	10013.35	**10705.70**	**8083.77**	8576.25	**8993.18**	**6787.48**	**12267.92**	**8172.48**
	SGT	9088.59	**10014.55**	10703.27	8077.10	**8577.65**	8986.76	6780.72	12264.41	8164.97
Normal Distribution	LR Statistic	226.8161	687.8106	894.2439	441.4069	523.8525	518.3859	581.1824	545.1357	618.0362
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	2.1353	19.3955	11.5034	2.7570	19.1646	2.8809	1.9426	9.6756	0.8116
	P value	0.3438	0.0001	0.0032	0.2520	0.0001	0.2368	0.3786	0.0079	0.6664
Skewed T Distribution	LR Statistic	2.1216	18.8888	11.4815	2.7327	19.1306	2.7892	1.8948	9.5900	0.7368
	P value	0.1452	0.0000	0.0007	0.0983	0.0000	0.0949	0.1687	0.0020	0.3907

Note: Table 18 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the distribution specifications for each ESE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 18 (Cont.) Goodness of Fit of Probability Density Models of the Emerging Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel B. Bear Markets											
_	_	South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
-Log Likelihood	N	-1040.853	-3651.118	-5519.768	-2429.248	-535.795	-1784.256	-3002.422	-2810.524	-2870.667	-2231.995
	ST	-1062.845	-3753.204	-5730.807	-2466.130	-537.565	-1833.545	-3203.251	-2980.721	-2892.339	-2310.164
	HST	-1062.845	-3753.206	-5730.812	-2466.149	-537.979	-1833.714	-3203.257	-2981.038	-2892.359	-2310.232
	SGT	**-1063.437**	**-3753.213**	**-5735.943**	**-2469.098**	**-538.994**	**-1833.830**	**-3203.677**	**-2983.525**	**-2898.355**	**-2311.564**
Akaike Information Criterion	N	-2077.705	-7298.235	-11035.536	-4854.496	-1067.589	-3564.512	-6000.845	-5617.047	-5737.334	-4459.991
	ST	-2119.689	-7500.408	-11455.614	-4926.261	-1069.129	-3661.089	-6400.501	-5955.441	-5778.678	-4614.328
	HST	**-2119.690**	**-7500.413**	-11455.623	-4926.298	**-1069.957**	**-3661.428**	**-6400.514**	-5956.076	-5778.718	**-4614.464**
	SGT	-2116.874	-7496.426	**-11461.886**	**-4928.196**	-1067.989	-3657.661	-6397.355	**-5957.050**	**-5786.709**	-4613.129
Schwartz Bayesian Criterion	N	1034.874	3644.130	5512.115	2422.345	**530.392**	1777.828	2995.420	2803.444	2863.634	2225.261
	ST	1053.876	3742.723	5719.327	2455.776	529.461	1823.902	3192.748	2970.101	2881.790	2300.062
	HST	**1053.877**	**3742.725**	**5719.332**	**2455.795**	529.875	**1824.072**	**3192.754**	**2970.418**	**2881.810**	**2300.130**
	SGT	1048.49	3735.74	5716.81	2451.84	525.49	1817.76	3186.17	2965.82	2880.77	2294.73
Normal Distribution	LR Statistic	45.1688	204.1908	432.3500	79.6995	6.3996	99.1486	402.5096	346.0028	55.3754	159.1379
	P value	0.0000	0.0000	0.0000	0.0000	0.0937	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	1.1845	0.0184	10.2727	5.9350	2.8595	0.5713	0.8531	5.6086	12.0314	2.8006
	P value	0.5531	0.9908	0.0059	0.0514	0.2394	0.7515	0.6528	0.0605	0.0024	0.2465
Skewed T Distribution	LR Statistic	1.1841	0.0132	10.2628	5.8971	2.0315	0.2331	0.8406	4.9737	11.9916	2.6648
	P value	0.2765	0.9086	0.0014	0.0152	0.1541	0.6293	0.3592	0.0257	0.0005	0.1026

Note: Table 18 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the distribution specifications for each ESE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 18 (Cont.). Goodness of fit of Probability Density Models of the Emerging Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel B. Bear Markets

		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
-Log Likelihood	N	-2841.72	-1029.05	-1585.33	-2526.38	-1771.41	-5992.46	-4554.32	-547.81	-4338.36
	ST	-2950.02	-1187.09	-1663.81	-2639.65	-1831.95	-6153.92	-4784.52	-575.85	-4684.20
	HST	-2950.03	**-1187.27**	-1663.90	-2639.65	-1831.95	-6153.93	-4784.71	-575.88	-4685.10
	SGT	**-2950.39**	-1187.20	**-1664.34**	**-2639.66**	**-1832.27**	**-6154.70**	**-4785.20**	**-576.53**	**-4686.77**
Akaike Information Criterion	N	-5679.45	-2054.09	-3166.66	-5048.75	-3538.82	-11980.92	-9104.65	-1091.61	-8672.71
	ST	-5894.05	-2368.18	-3321.62	-5273.30	-3657.89	-12301.83	-9563.04	-1145.69	-9362.41
	HST	**-5894.05**	**-2368.55**	**-3321.80**	**-5273.31**	**-3657.89**	**-12301.86**	**-9563.42**	**-1145.76**	**-9364.20**
	SGT	-5890.77	-2364.40	-3318.67	-5269.31	-3654.54	-12299.40	-9560.39	-1143.07	-9363.55
Schwartz Bayesian Criterion	N	2834.69	1022.80	1578.79	2519.32	1764.89	5984.98	4546.97	542.36	4330.98
	ST	2939.48	1177.72	1654.01	2629.06	1822.17	6142.70	4773.49	567.67	4673.14
	HST	**2939.48**	**1177.91**	**1654.10**	**2629.06**	**1822.17**	**6142.72**	**4773.67**	**567.71**	**4674.03**
	SGT	2932.81	1171.58	1648.00	2622.00	1815.98	6136.01	4766.81	562.91	4668.33
Normal Distribution	LR Statistic	217.3226	316.3014	158.0156	226.5599	121.7255	324.4802	461.7492	57.4535	696.8385
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	0.7227	0.2124	1.0571	0.0114	0.6521	1.5664	1.3495	1.3737	5.1398
	P value	0.6967	0.8992	0.5894	0.9943	0.7218	0.4569	0.5093	0.5032	0.0765
Skewed T Distribution	LR Statistic	0.7217	-0.1539	0.8758	0.0082	0.6521	1.5348	0.9780	1.3041	3.3488
	P value	0.3956	1.0000	0.3494	0.9277	0.4194	0.2154	0.3227	0.2535	0.0673

Note: Table 18 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the distribution specifications for each ESE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

5.1.3 Concluding Remarks

Table 19 provides the summary of the best fit probability density models for the whole sample period, the bull markets and the bear markets. The three columns of the left-hand half section of Table 19 demonstrate the optimal probability density models for the whole sample, for the bull markets and the bear markets for the DSEs. Similarly the three columns of the right-hand half section demonstrate the optimal probability density models for the whole sample, the bull markets and the bear markets for the ESEs. The optimal probability density models are selected mainly based on AIC. SBC and the LR test results are also considered and these two criteria usually indicate the same results as given by AIC.

Columns, 2 and 6 of Table 19, show that for the whole sample period, SGT which offers the optimal fit for the majority of the DSEs and the ESEs. The optimal probability density models for the DSEs and the ESEs are more diverse for the bull/bear markets. Comparing columns 3 and 4, for the DSEs, the optimal probability density model changes as the market regime switches. The same conclusion can be drawn for the ESEs based on the comparison of columns 7 and 8. To be more specific, the optimal probability density models changes as the stock market switches between the bull markets and the bear markets for 15 out of 19 DSEs. 8 out 19 ESEs change the optimal probability density models as the market regime switches. This finding implies that the empirical probability density distribution of the stock market returns tends to be more persistent for the ESEs than for the DSEs. In addition, it is interesting to note that the optimal probability density model becomes simpler when the market switches from the bull markets to the bear markets.

Table 19 Optimal Probability Density Distribution Models (Consistency of the probability density distribution models are in bold)

Developed Stock Exchanges				Emerging Stock Exchanges			
1	2	3	4	5	6	7	8
Country	Whole	Bull	Bear	Country	Whole	Bull	Bear
Canada	ST	SGT	HST	South Africa	ST	**ST**	**ST**
US	SGT	SGT	ST	Morocco	SGT	SGT	ST
Japan	ST	SGT	ST	China	SGT	**SGT**	**SGT**
Singapore	SGT	**ST**	**ST**	India	SGT	ST	SGT
Australia	SGT	SGT	ST	Pakistan	SGT	SGT	HST
New Zealand	ST	**ST**	**ST**	Malaysia	SGT	SGT	HST
Austria	HST	ST	HST	Philippines	ST	**ST**	**ST**
Denmark	ST	SGT	HST	Saudi Arabia	SGT	**SGT**	**SGT**
Finland	SGT	HST	ST	Taiwan	SGT	**SGT**	**SGT**
France	SGT	SGT	ST	Thailand	ST	**HST**	**HST**
Germany	SGT	SGT	ST	Hungary	ST	ST	HST
Greece	SGT	ST	SGT	Russia	SGT	SGT	HST
Italy	SGT	SGT	ST	Romania	SGT	SGT	HST
Ireland	HST	**ST**	**ST**	Turkey	HST	**HST**	**HST**
Netherlands	SGT	SGT	HST	Argentina	SGT	SGT	HST
Portugal	SGT	SGT	HST	Chile	ST	**ST**	**ST**
Switzerland	ST	ST	HST	Columbia	ST	ST	HST
Sweden	SGT	**ST**	**ST**	Mexico	HST	SGT	ST
UK	SGT	SGT	HST	Peru	SGT	ST	HST

Note: Table 19 presents the optimal probability density model (highlighted in bold) for the whole sample period, for the bull market period and the bear market period for the DSEs and the ESEs respectively. The data source is DataStream.

5.2 VaR and ES

From Section 3.3, by definition, VaR and ES are semiparametric modelling of the whole probability density distribution. Therefore, values of VaR/ES will be affected by the change of the parameter values of the probability density distribution or the change of the probability density distribution type itself. As Section 5.1 shows, there are considerable differences in parameter values of the probability density models for the bull and the bear markets and across the exchanges. Hence it is important to understand how VaR/ES changes with respect to the change of the parameter values of the probability density distribution. Section 5.2.1 discusses how the probability density distribution parameters affect VaR/ES by describing the relationship between VaR/ES and the probability density distribution parameters.

The analysis of Sections 5.2.2 and 5.2.3 is conducted based on the comparison of VaRs/ESs given by different estimation methods, for different market regimes and across different stock exchanges. The non-normal probability density distribution models are supported by AIC, SBC and LR test results. Hence VaR/ES values given by the non-normal probability density models are used as benchmarks to assess the other estimation methods (non-normal probability density distribution models are called benchmark models thereafter in this section). As discussed, HS and the EVT are argued to be able to get rid of the specification of the underling probability density distribution and hence reducing their vulnerability to the misspecification risk of the underlying probability density distributions. In order to assess the reliability of these two methods, VaR/ES based on HS and the EVT will be calculated and discussed alongside the probability density models.

5.2.1 VaR/ES and Probability Density Distributions

This section describes the relationship between VaR/ES and the probability density distributions. The hypothetical probability density models considered in this section are the same as discussed in the previous sections: the normal distribution (N), the student's t distribution (ST), Hansen (1994)'s skewed t distribution (HST) and skewed generalized t distribution (SGT).

5.2.1.1 Normal distribution (N)

Thanks to the fact that the normal distribution probability density function is fully described by the first two moments, i.e. the mean and standard deviation, a closed form solution can be derived to establish the relationship between the VaR/ES and the normal distribution parameters (Bertsimas, Lauprete et al. (2004)).

The PDF of a normal distribution with mean μ and variance σ^2 is

$$f(x|\mu,\sigma) = \phi(x|\mu,\sigma) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}} \tag{15}$$

The CDF is then the integral of the PDF up to a random number X

$$F(x|\mu,\sigma) = \Phi(x|\mu,\sigma) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{x} e^{-\frac{(t-\mu)^2}{2\sigma^2}} dt \tag{16}$$

Then it is straightforward to obtain:

$$\mathrm{VaR} = -F^{-1}(\alpha) \tag{17}$$

It is easy to notice that VaR will increase as α decreases or σ increases.

Now consider ES,

$$CVaR_{\alpha} = -\int_{-\infty}^{-VaR} x f(x) dx = -\frac{1}{\alpha}\int_{-\infty}^{-VaR} x \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}} dx \tag{18}$$

In order to derive the closed form solution, let us set up an auxiliary function A as:

$$\mathrm{A} = \mu + CVaR_{\alpha}$$

Then,

$$A = \mu + CVaR_{\alpha} = \mu - \frac{1}{\alpha}\int_{-\infty}^{-VaR} x\frac{1}{\sigma\sqrt{2\pi}}e^{-\frac{(x-\mu)^2}{2\sigma^2}}dx$$

$$A = -\frac{1}{\alpha\sigma\sqrt{2\pi}}\int_{-\infty}^{-VaR}(x-\mu)e^{-\frac{(x-\mu)^2}{2\sigma^2}}dx$$

$$A = -\frac{\sigma}{\alpha\sqrt{2\pi}}\int_{-\infty}^{z_{\alpha}} ye^{-\frac{y^2}{2}}dy\ (y = \frac{x-\mu}{\sigma})$$

$$A = -\frac{\sigma}{\alpha\sqrt{2\pi}}\int_{-\infty}^{z_{\alpha}} d(-e^{-\frac{y^2}{2}})$$

$$A = \frac{\sigma}{\alpha\sqrt{2\pi}}e^{-\frac{y^2}{2}}$$

$$A = \frac{\sigma}{\alpha}\frac{1}{\sqrt{2\pi}}e^{-\frac{(z_{\alpha})^2}{2}}$$

$$A = \frac{\phi(z_{\alpha})}{\alpha}\sigma$$

Because $CVaR_{\alpha} = \mathrm{A} - \mu$, it is straightforward to obtain:

$$CVaR_{\alpha} = \frac{\phi(z_{\alpha})}{\alpha}\sigma - \mu \qquad (19)$$

where ϕ is the PDF of the standard normal distribution and z_{α} is the α percentile of a standard normal distribution.

As can be seen from the formula, $\frac{\phi(z_{\alpha})}{\alpha}$ is determined once α is fixed. Hence, ES can be regarded as the scaled σ and $\frac{\phi(z_{\alpha})}{\alpha}$ is merely the multiplier. Therefore, ES increases with the increase in σ holding α constant. ES increases as the confidence level α decreases holding σ constant. In summary, both VaR and ES will increase when σ increases or when α decreases.

In addition to the analytical solution of the relationship between VaR/ES and the normal distribution parameters, simulation methods are used to approximate the relationship between VaR/ES and the normal distribution parameters. The results are presented graphically in figures.

Based on the results for both the bull and the bear markets presented in Section 5.1.2.2, Table 20 shows the ranges and the averages of the parameters of different probability density models.

Table 20. Parameter Value Range and Average

		Min	Max	Mean
Sample Mean		-0.0063	0.0021	-0.0002
N	σ	0.006	0.033	0.015
ST	ν	2.018	9.790	3.625
	σ	0.006	0.072	0.016
HST	ν	2.076	8.709	3.600
	λ	-0.040	0.020	0.010
	σ	0.006	0.060	0.016
SGT	ν	2.339	182.254	8.173
	λ	-0.017	0.021	0.011
	k	1.037	2.507	1.648
	σ	0.006	0.041	0.015

A sequence of VaRs/ESs are calculated to approximate the relationship between VaR/ES and the normal distribution parameter σ[11]. The range of σ for N is [0.006, 0.33]. VaR/ES is calculated for 10 different values of σ from the lower bound of 0.006 with an equal amount of incrementation all the way up to the upper bound 0.33.

As in Section 4.2.3, the bisection method is used to find the value of the random variable, X_α, which makes cumulative distribution function (numerical integration of probability density function from $-\infty$ to X_α) equal to the associated confidence level α. VaR is then obtained as $-(X_\alpha + \mu_{\bar{y}})$. To calculate ES, 10,000 random numbers are generated from the normal distribution specified by a particular value of σ. Then, all the random numbers whose values are smaller than X_α are selected and decentralized by adding $\mu_{\bar{y}}$, i.e., $X + \mu_{\bar{y}}$. Then ES is the opposite number to the numerical average of all of these

[11] With respect to the normal distribution, the mean parameter μ is not included because the model parameters are estimated based on decentralized data u whose mean is zero.

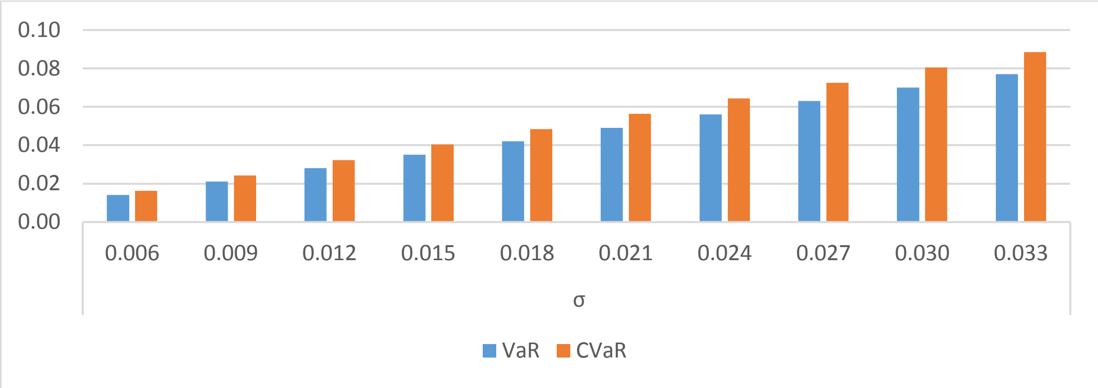
decentralized values, i.e. ES= $-\frac{1}{m}\sum_{1}^{m}(X_i + \mu_{\bar{y}})$ where m is the number of the random numbers which are smaller than X_α. $\mu_{\bar{y}}$ is -0.0002 which is the mean of all sample means.

The relationship between VaR/ES and σ is presented in Figure 40. Form the Figure 40, it can be seen that consistent with the closed form solution, as σ increases, both VaR and ES increase. In addition, as α increases from 1% to 5%, both VaR and ES decrease.

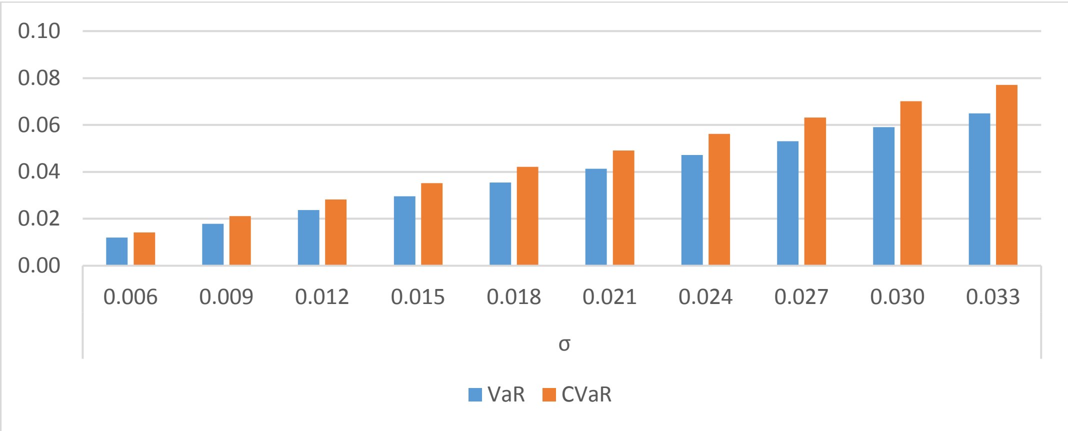
For instance, from Panel A of Figure 40, it can be found when σ is 0.6% and the estimated VaR is 1%. This result indicates a trading desk within a position of £100,000 is likely to loss £ 1,000 on a daily horizon for the chance of 1 %. Alternatively, this result implies that the investment portfolio expects to lose £ 1,000 or more, once every 100 trading days. When σ increases to 3.3%, the estimated VaR is 5.4%. This result means a trading desk within the same position of £100,000 is likely to loss £ 5,400 on a daily horizon for the chance of 1%. As σ of the underlying investment portfolio triples, the daily potential loss of the investment portfolio quintuples, which is a very significant change.

Figure 40. Normal Distribution VaR/ES with respect to σ

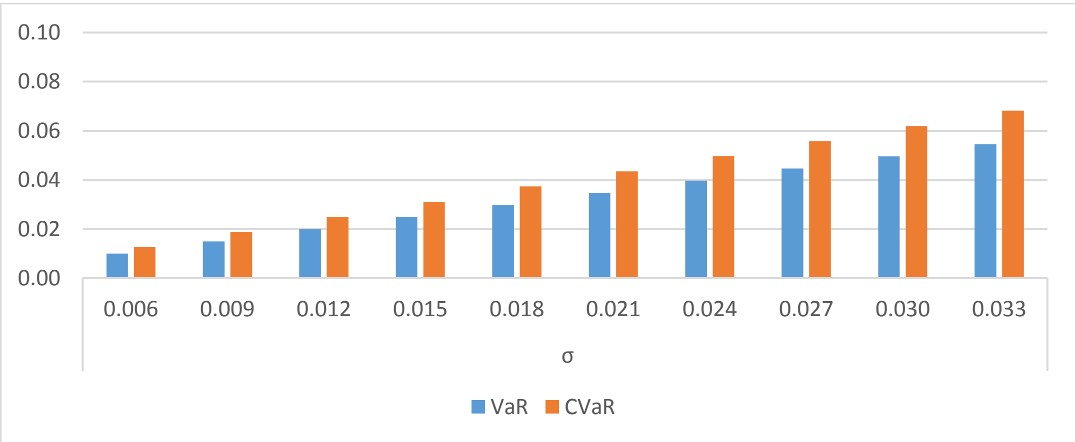
Panel. A $\alpha = 1\%$



Panel. B $\alpha = 2.5\%$



Panel. C $\alpha = 5\%$



If the probability density distribution has several parameters, the analytical expression of the relationship between VaR/ES and the probability density distribution parameters may not be obtainable. The analytical expression between VaR/ES and ST parameters is obtainable. However, the analytical expression is not as compact as the one for N. The parameters of ST are also correlated with each other. Therefore it is not clear how the parameters affect VaR/ES. Therefore, the simulation methods are used to approximate the relationship between VaR/ES and the probability density distribution parameters.

To illustrate the simulation method, let's consider ST. The range of ν for ST is [2.018, 9.790]. A sequence of VaR/ES is calculated for 10 different values of ν from the lower bound of 2.018 with the equal incrementation all the way up to the upper bound 9.790 while the other parameter σ is held constant at the mean value 0.016. The same simulation is conducted with respect to different values of σ while ν is held constant at the mean value of 3.625.

With regard to the calculations of VaR/ES, as explained in Section 4.2.3, the bisection method is used to find the value of the random variable, X_α, which makes the cumulative distribution function (numerical integration of the probability density function from $-\infty$ to X_α) equal to the associated confidence level α. VaR is then obtained as $-(X_\alpha + \mu_{\bar{y}})$. To calculate ES, 10,000 random numbers are generated from the ST probability density function specified by a set of parameters. Then, all the values X smaller than X_α are selected and decentralized by adding $\mu_{\bar{y}}$, i.e., $X + \mu_{\bar{y}}$. Then ES is the opposite number of the numerical average of all of these decentralized values, i.e. ES= $-\frac{1}{m}\sum_1^m (X_i + \mu_{\bar{y}})$ where m is the number of random numbers whose values are smaller than X_α. For all the calculations, $\mu_{\bar{y}}$ is -0.0002 which is the mean of all the sample means.

This simulation method was applied to all the non-normal probability density models, i.e., ST, HST, and SGT. In the following calculations, the confidence level is set at 1%.

5.2.1.2 the student's t distribution (ST)

Figure 41 shows how VaR and ES change with respect to the change in σ and ν with Panel A showing the results for VaR and Panel B for ES. Table 21 provides the numbers behind Figure 41.

From Figure 41 it can be seen that both σ and ν effect the values of VaR and of ES. Both VaR and ES increase monotonously as σ increases. This finding is consistent with the intuition. The scaling parameter σ can be interpreted as volatility. Higher volatility indicates flatter probability density distribution and hence fatter tails which gives higher VaR and ES.

The relationship between VaR/ES and ν is not as simple as that between VaR/ES and σ. From Table 21, it can be seen that both VaR and ES increase significantly as ν increases from 2.018 to 3.745. After 3.745, both VaR and ES decreases gradually as ν increases. This relationship between VaR/ES and ν makes the VaR surface and the ES surface concave.

Figure 41. The Student's T Distribution VaR/ES Surface: ν is the degree of freedom and σ is a measure of volatility.
Panel A. VaR Surface

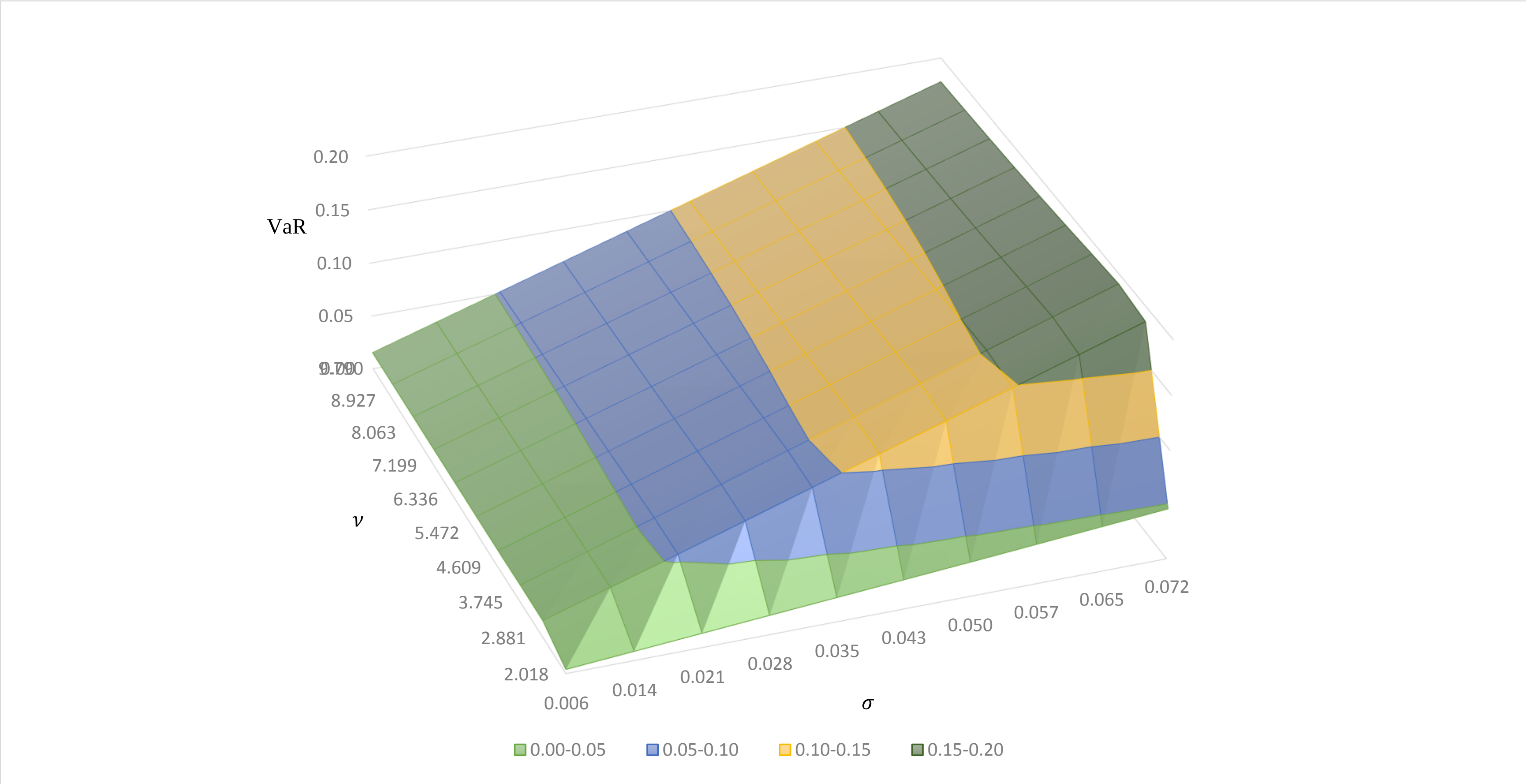


Figure 41. The Student's T Distribution VaR/ES Surface: ν is the degree of freedom and σ is a measure of volatility.
Panel B. ES Surface

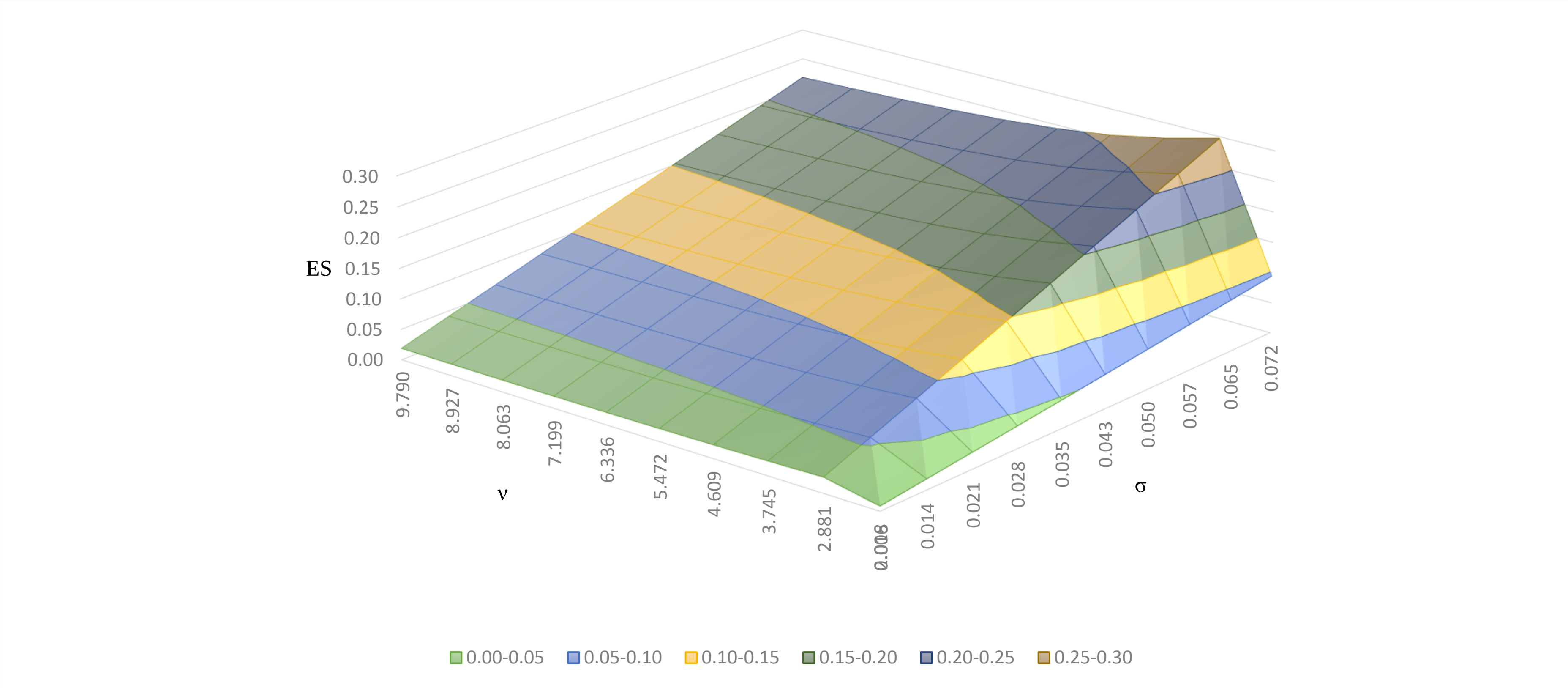


Table 21 The Student's T Distribution VaR/ES Surface Data

Panel A. VaR with respect to ν and σ

		ν									
		2.018	2.881	3.745	4.609	5.472	6.336	7.199	8.063	8.927	9.790
σ	0.006	0.004	0.016	0.016	0.016	0.016	0.016	0.016	0.015	0.015	0.015
	0.014	0.008	0.035	0.036	0.035	0.035	0.034	0.034	0.034	0.034	0.033
	0.021	0.013	0.054	0.055	0.054	0.054	0.053	0.052	0.052	0.052	0.051
	0.028	0.018	0.073	0.075	0.074	0.073	0.072	0.071	0.070	0.070	0.069
	0.035	0.023	0.092	0.094	0.093	0.091	0.090	0.089	0.089	0.088	0.087
	0.043	0.027	0.111	0.113	0.112	0.110	0.109	0.108	0.107	0.106	0.105
	0.050	0.032	0.130	0.133	0.131	0.129	0.127	0.126	0.125	0.124	0.124
	0.057	0.037	0.148	0.152	0.150	0.148	0.146	0.145	0.143	0.142	0.142
	0.065	0.041	0.167	0.171	0.169	0.167	0.165	0.163	0.162	0.161	0.160
	0.072	0.046	0.186	0.191	0.188	0.186	0.183	0.181	0.180	0.179	0.178

Panel B. ES with respect to ν and σ

		ν									
		2.018	2.881	3.745	4.609	5.472	6.336	7.199	8.063	8.927	9.790
σ	0.006	0.008	0.026	0.024	0.022	0.021	0.020	0.020	0.019	0.019	0.019
	0.014	0.018	0.056	0.052	0.048	0.046	0.044	0.043	0.042	0.042	0.041
	0.021	0.027	0.086	0.079	0.074	0.071	0.068	0.066	0.065	0.064	0.063
	0.028	0.037	0.116	0.107	0.100	0.095	0.092	0.090	0.088	0.086	0.085
	0.035	0.046	0.146	0.135	0.126	0.120	0.116	0.113	0.111	0.109	0.107
	0.043	0.056	0.177	0.163	0.152	0.145	0.140	0.136	0.133	0.131	0.129
	0.050	0.065	0.207	0.191	0.178	0.170	0.164	0.159	0.156	0.154	0.152
	0.057	0.075	0.237	0.219	0.204	0.194	0.188	0.183	0.179	0.176	0.174
	0.065	0.085	0.267	0.246	0.230	0.219	0.212	0.206	0.202	0.198	0.196
	0.072	0.094	0.297	0.274	0.256	0.244	0.235	0.229	0.225	0.221	0.218

5.2.1.3 Hansen's skewed t distribution (HST)

HST has three parameters: σ, ν, and λ. Figure 42 shows how VaR and ES change when these parameters change. Panel A and Panel B show the results for σ and ν, Panel C and Panel D for ν and λ, Panel E and Panel F for σ and λ. Table 22 provides the numbers behind Figure 42.

From Figure 42, it can be seen that all of these parameters effect VaR and ES. Both VaR and ES increase monotonically as σ increases. This finding is consistent with the intuition. The scaling parameter σ can be interpreted as volatility. As expected, higher volatility is associated with fatter tails and, therefore, larger VaR/ES.

The relationship between VaR/ES and ν is not as simple as that between VaR/ES and σ. From Table 22 Panel A and Panel C, it can be seen that VaR increases as ν increases from 2.018 to 3.550. After 3.550, VaR decreases gradually as ν increases. From Table 22 Panel B and Panel D, it can be seen that ES increases as ν increases from 2.018 to 2.813. After 2.813, ES decreases gradually as ν increases. This relationship between VaR/ES and ν makes the VaR surface and the ES surface concave in.

From Table 22 Panel C, Panel D, Panel E and Panel F, it can be seen that both VaR and ES decrease monotonically as λ increases. This finding is intuitive as lower λ indicates longer left-hand tail and, therefore, higher VaR/ES.

Figure 42. Skewed T Distribution VaR/ES Surface: ν is the degree of freedom and σ is a measure of volatility.
Panel A. VaR Surface with respect to ν and σ

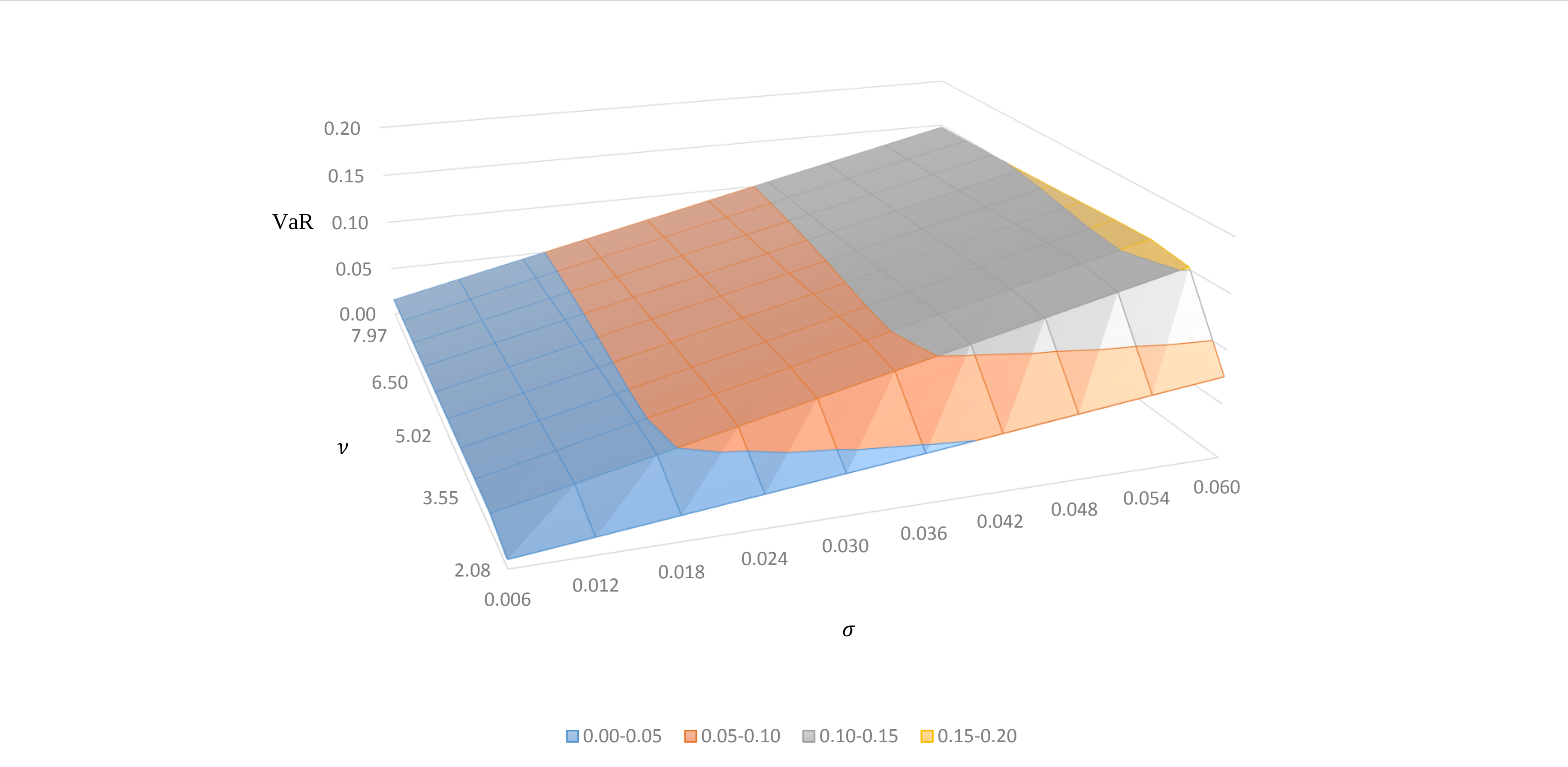


Figure 42. Skewed T Distribution VaR/ES Surface: ν is the degree of freedom and σ is a measure of volatility.
Panel B. ES Surface with respect to ν and σ

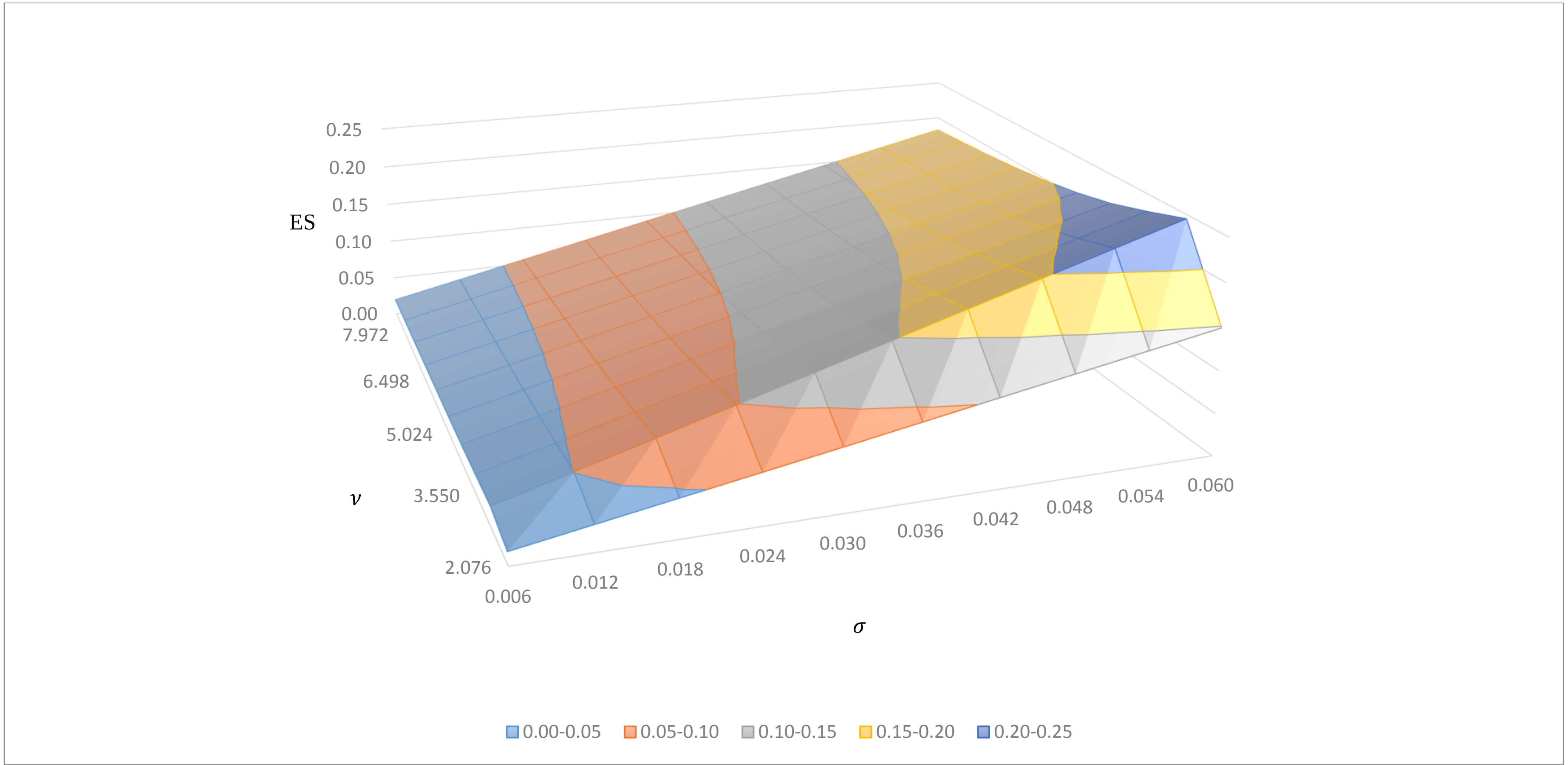


Figure 42. Skewed T Distribution VaR/ES Surface: ν is the degree of freedom and λ is a measure of skewness.
Panel C. VaR Surface with respect to ν and λ

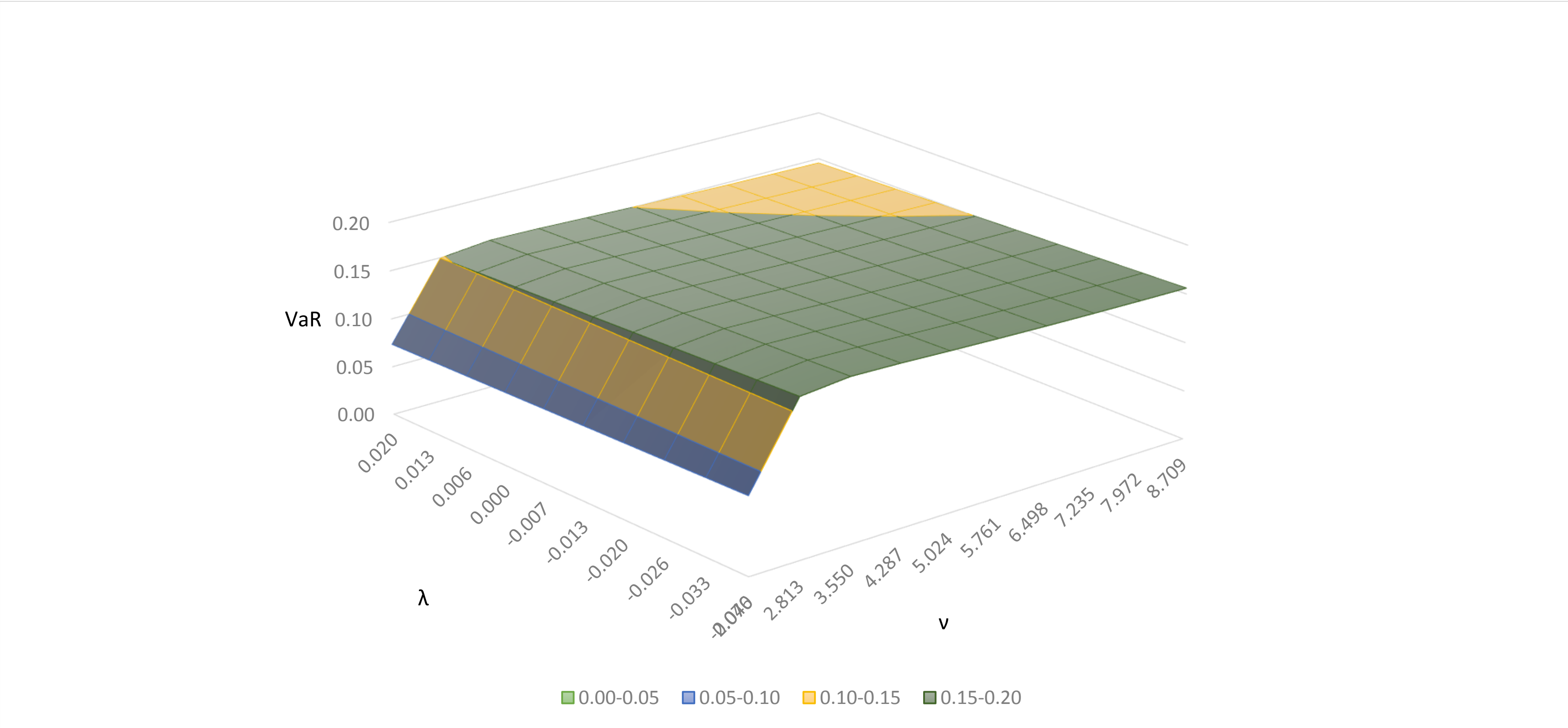


Figure 42. Skewed T Distribution VaR/ES Surface: ν is the degree of freedom and λ is a measure of skewness.
Panel D. ES Surface with respect to ν and λ

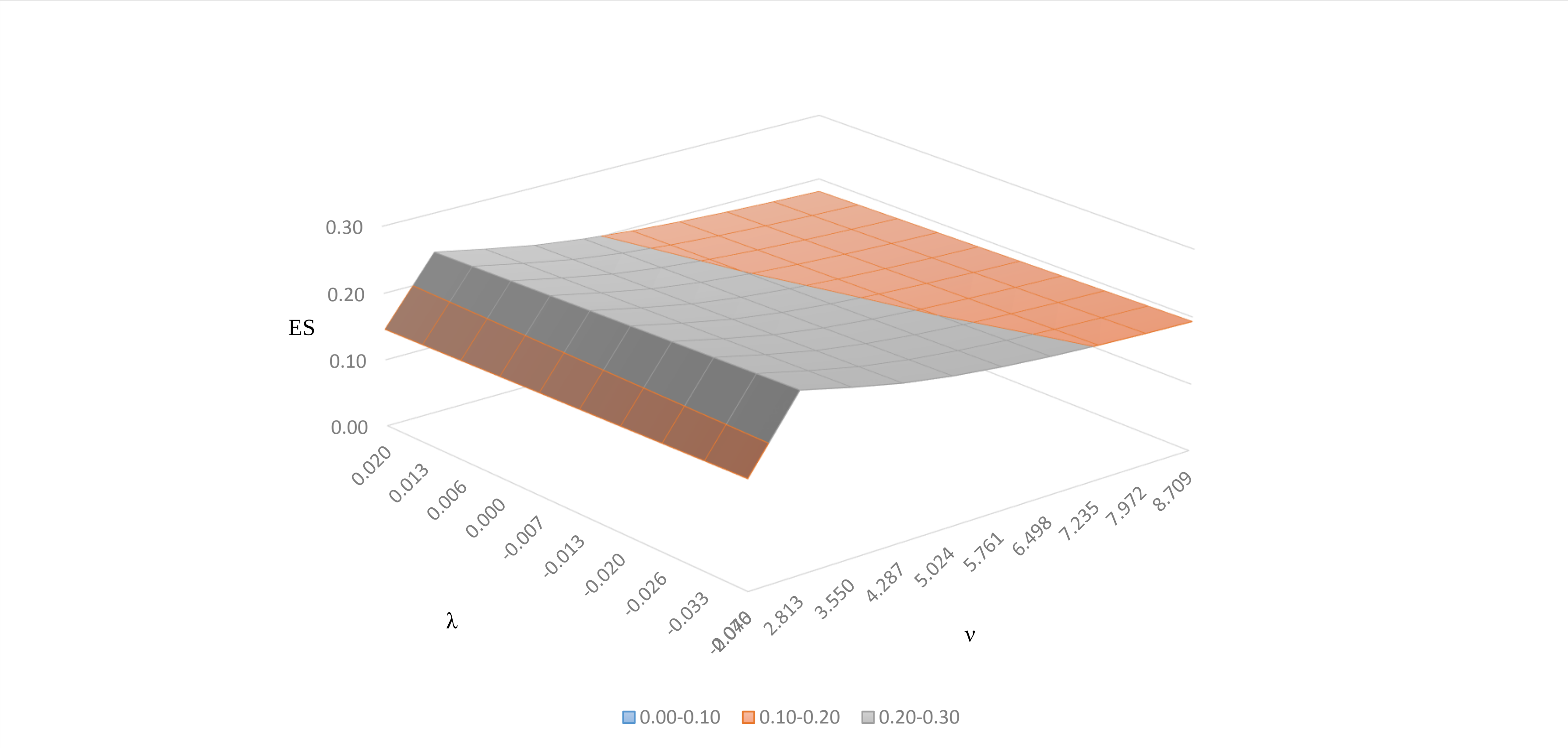


Figure 42. Skewed T Distribution VaR/ES Surface: σ is a measure of volatility and λ is a measure of skewness.
Panel E. VaR Surface with respect to σ and λ

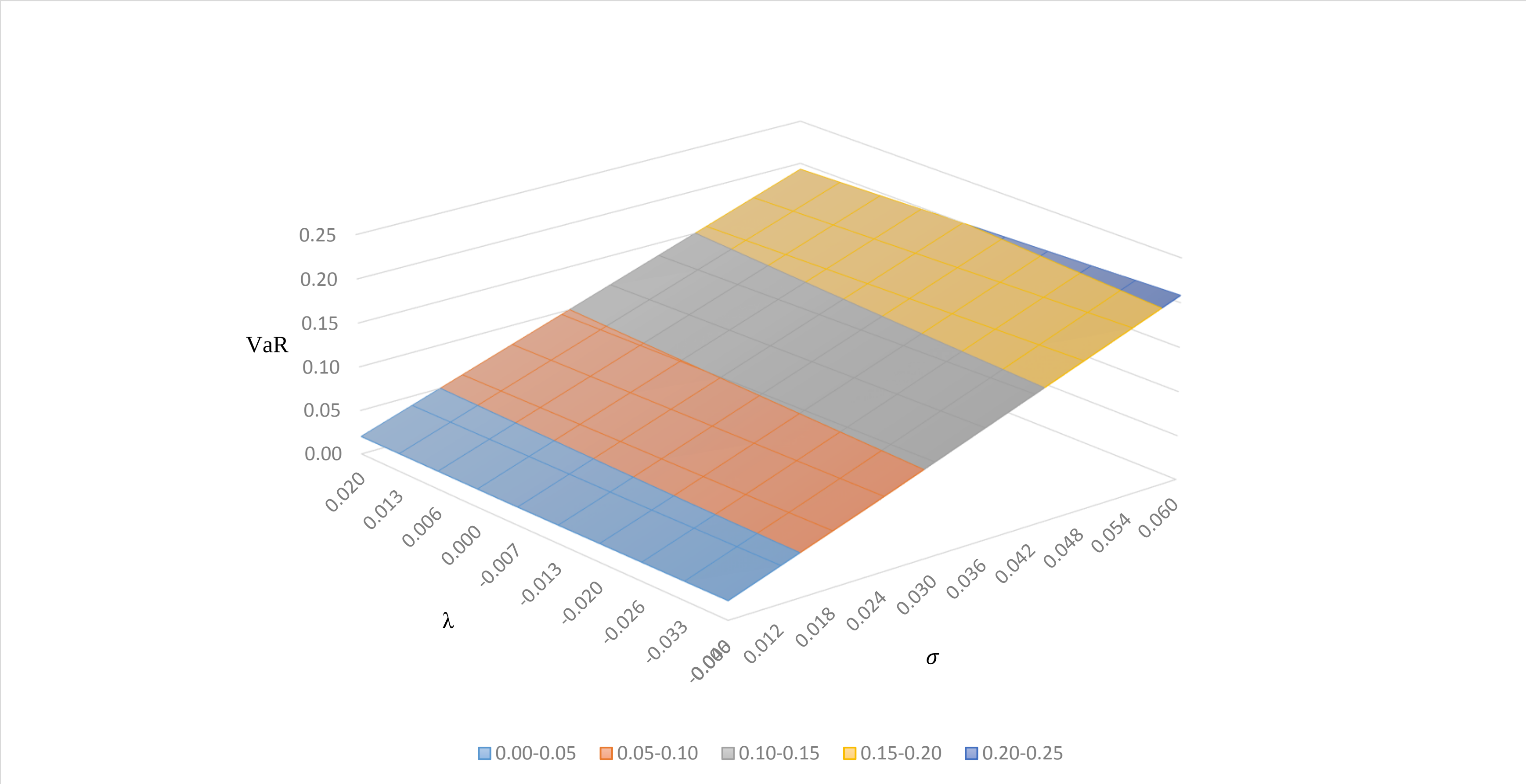


Figure 42. Skewed T Distribution VaR/ES Surface: σ is a measure of volatility and λ is a measure of skewness.
Panel F. ES Surface with respect to σ and λ

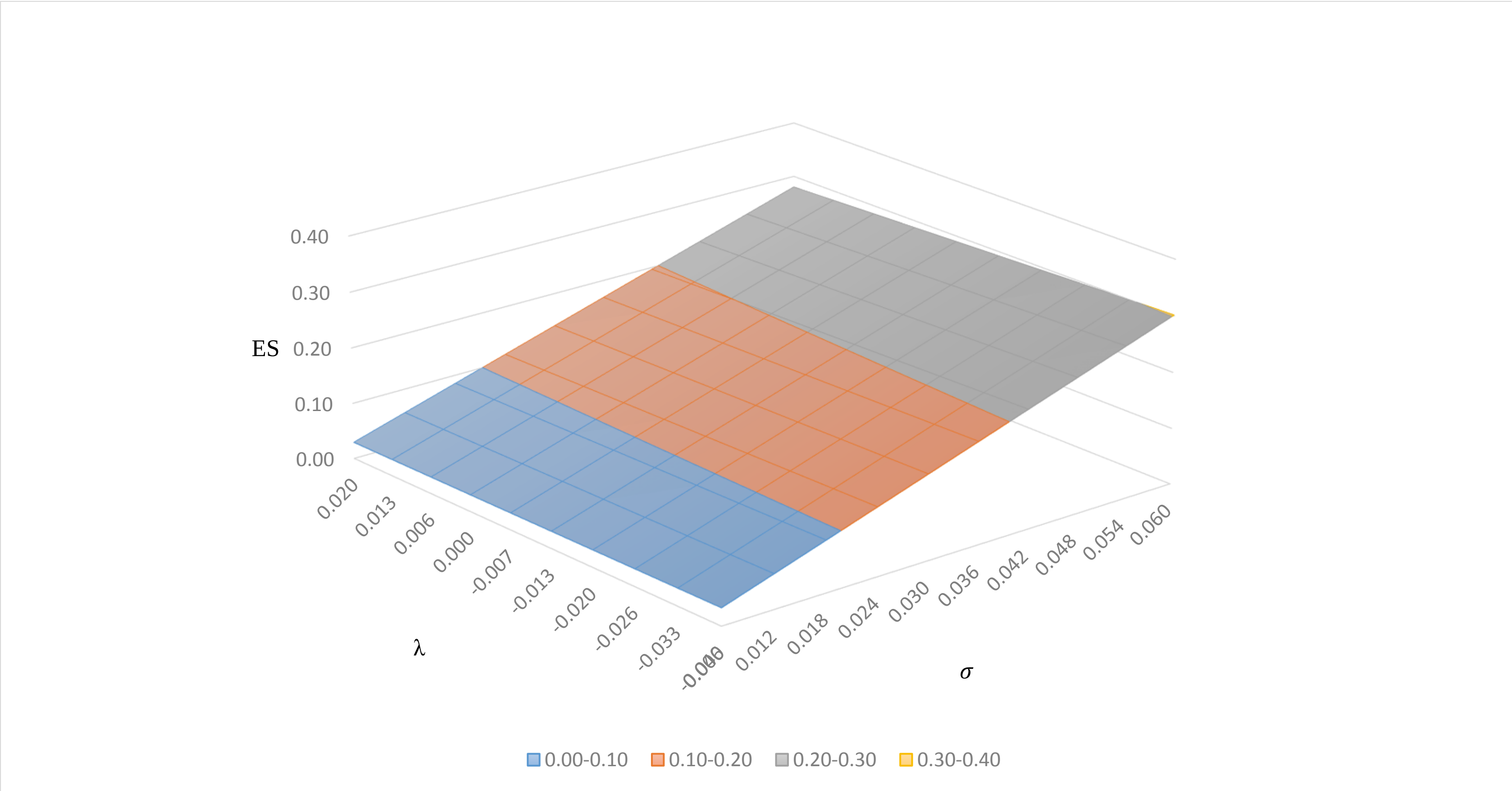


Table 22. Skewed Student's T Distribution VaR/ES Surface Data

Panel A. VaR with respect to ν and σ

		ν									
		2.08	2.81	3.55	4.29	5.02	5.76	6.50	7.24	7.97	8.71
σ	0.006	0.008	0.016	0.017	0.017	0.016	0.016	0.016	0.016	0.016	0.016
	0.012	0.016	0.031	0.032	0.032	0.032	0.031	0.031	0.031	0.031	0.030
	0.018	0.023	0.046	0.048	0.048	0.047	0.046	0.046	0.046	0.045	0.045
	0.024	0.030	0.061	0.063	0.063	0.062	0.062	0.061	0.060	0.060	0.060
	0.030	0.038	0.077	0.079	0.078	0.078	0.077	0.076	0.075	0.075	0.074
	0.036	0.045	0.092	0.095	0.094	0.093	0.092	0.091	0.090	0.089	0.089
	0.042	0.053	0.107	0.110	0.109	0.108	0.107	0.106	0.105	0.104	0.104
	0.048	0.060	0.122	0.126	0.125	0.123	0.122	0.121	0.120	0.119	0.118
	0.054	0.068	0.137	0.141	0.140	0.139	0.137	0.136	0.135	0.134	0.133
	0.060	0.075	0.152	0.157	0.156	0.154	0.152	0.151	0.149	0.148	0.147

Panel B. ES with respect to ν and σ

		ν									
		2.076	2.813	3.550	4.287	5.024	5.761	6.498	7.235	7.972	8.709
σ	0.006	0.016	0.026	0.024	0.023	0.022	0.021	0.020	0.020	0.020	0.019
	0.012	0.031	0.050	0.047	0.044	0.042	0.041	0.040	0.039	0.038	0.038
	0.018	0.045	0.075	0.070	0.066	0.063	0.060	0.059	0.057	0.056	0.056
	0.024	0.060	0.099	0.093	0.087	0.083	0.080	0.078	0.076	0.075	0.074
	0.030	0.075	0.123	0.116	0.108	0.103	0.100	0.097	0.095	0.093	0.092
	0.036	0.090	0.148	0.138	0.130	0.124	0.119	0.116	0.114	0.112	0.110
	0.042	0.104	0.172	0.161	0.151	0.144	0.139	0.135	0.132	0.130	0.128
	0.048	0.119	0.197	0.184	0.173	0.165	0.159	0.154	0.151	0.148	0.146
	0.054	0.134	0.221	0.207	0.194	0.185	0.178	0.174	0.170	0.167	0.164
	0.060	0.148	0.245	0.230	0.216	0.205	0.198	0.193	0.189	0.185	0.183

Table 22. Skewed Student's T Distribution VaR/ES Surface Data

Panel C. VaR with respect to ν and λ

		ν									
		2.076	2.813	3.550	4.287	5.024	5.761	6.498	7.235	7.972	8.709
λ	-0.040	0.080	0.162	0.167	0.165	0.163	0.161	0.160	0.158	0.157	0.156
	-0.033	0.079	0.161	0.166	0.164	0.162	0.160	0.158	0.157	0.156	0.155
	-0.026	0.079	0.159	0.164	0.163	0.161	0.159	0.157	0.156	0.155	0.154
	-0.020	0.078	0.158	0.163	0.162	0.159	0.158	0.156	0.155	0.153	0.152
	-0.013	0.077	0.157	0.162	0.160	0.158	0.156	0.155	0.153	0.152	0.151
	-0.007	0.076	0.155	0.160	0.159	0.157	0.155	0.153	0.152	0.151	0.150
	0.000	0.076	0.154	0.159	0.158	0.156	0.154	0.152	0.151	0.150	0.149
	0.006	0.075	0.152	0.157	0.156	0.154	0.152	0.151	0.150	0.149	0.148
	0.013	0.074	0.151	0.156	0.155	0.153	0.151	0.150	0.148	0.147	0.146
	0.020	0.073	0.150	0.155	0.153	0.152	0.150	0.148	0.147	0.146	0.145

Panel D. ES with respect to ν and λ

		ν									
		2.076	2.813	3.550	4.287	5.024	5.761	6.498	7.235	7.972	8.709
λ	-0.040	0.159	0.262	0.244	0.229	0.218	0.210	0.204	0.199	0.196	0.193
	-0.033	0.158	0.259	0.242	0.227	0.216	0.208	0.202	0.198	0.194	0.192
	-0.026	0.156	0.257	0.240	0.225	0.214	0.207	0.201	0.197	0.193	0.190
	-0.020	0.155	0.255	0.238	0.223	0.213	0.205	0.199	0.195	0.192	0.189
	-0.013	0.153	0.253	0.236	0.222	0.211	0.204	0.198	0.194	0.190	0.187
	-0.007	0.152	0.251	0.234	0.220	0.209	0.202	0.196	0.192	0.189	0.186
	0.000	0.150	0.248	0.232	0.218	0.208	0.200	0.195	0.191	0.187	0.184
	0.006	0.149	0.246	0.230	0.216	0.206	0.199	0.193	0.189	0.186	0.183
	0.013	0.147	0.244	0.228	0.214	0.204	0.197	0.192	0.188	0.184	0.182
	0.020	0.146	0.242	0.226	0.213	0.203	0.195	0.190	0.186	0.183	0.180

Table 22. Skewed Student's T Distribution VaR/ES Surface Data

Panel E. VaR with respect to σ and λ

		σ									
		0.006	0.012	0.018	0.024	0.030	0.036	0.042	0.048	0.054	0.060
λ	-0.040	0.0217	0.0424	0.0631	0.0838	0.1046	0.1253	0.1460	0.1667	0.1874	0.2081
	-0.033	0.0215	0.0421	0.0626	0.0832	0.1037	0.1243	0.1448	0.1654	0.1859	0.2065
	-0.026	0.0213	0.0417	0.0621	0.0825	0.1029	0.1233	0.1436	0.1640	0.1844	0.2048
	-0.020	0.0211	0.0414	0.0616	0.0818	0.1020	0.1222	0.1425	0.1627	0.1829	0.2031
	-0.013	0.0210	0.0410	0.0611	0.0811	0.1012	0.1212	0.1413	0.1613	0.1814	0.2014
	-0.007	0.0208	0.0407	0.0606	0.0804	0.1003	0.1202	0.1401	0.1600	0.1798	0.1997
	0.000	0.0206	0.0403	0.0600	0.0798	0.0995	0.1192	0.1389	0.1586	0.1783	0.1980
	0.006	0.0204	0.0400	0.0595	0.0791	0.0986	0.1181	0.1377	0.1572	0.1768	0.1963
	0.013	0.0203	0.0396	0.0590	0.0784	0.0977	0.1171	0.1365	0.1559	0.1752	0.1946
	0.020	0.0201	0.0393	0.0585	0.0777	0.0969	0.1161	0.1353	0.1545	0.1737	0.1929

Panel F. ES with respect to σ and λ

		σ									
		0.006	0.012	0.018	0.024	0.030	0.036	0.042	0.048	0.054	0.060
λ	-0.040	0.0315	0.0616	0.0916	0.1216	0.1516	0.1816	0.2117	0.2417	0.2717	0.3017
	-0.033	0.0313	0.0611	0.0909	0.1206	0.1504	0.1802	0.2100	0.2398	0.2696	0.2994
	-0.026	0.0310	0.0606	0.0901	0.1197	0.1492	0.1788	0.2083	0.2379	0.2674	0.2970
	-0.020	0.0308	0.0601	0.0894	0.1187	0.1480	0.1773	0.2066	0.2359	0.2652	0.2945
	-0.013	0.0305	0.0596	0.0887	0.1177	0.1468	0.1759	0.2049	0.2340	0.2631	0.2921
	-0.007	0.0303	0.0591	0.0879	0.1167	0.1456	0.1744	0.2032	0.2320	0.2609	0.2897
	0.000	0.0300	0.0586	0.0872	0.1158	0.1443	0.1729	0.2015	0.2301	0.2587	0.2873
	0.006	0.0298	0.0581	0.0864	0.1148	0.1431	0.1714	0.1998	0.2281	0.2565	0.2848
	0.013	0.0295	0.0576	0.0857	0.1138	0.1419	0.1700	0.1981	0.2262	0.2543	0.2823
	0.020	0.0292	0.0571	0.0849	0.1128	0.1406	0.1685	0.1963	0.2242	0.2520	0.2799

5.2.1.4 Skewed generalized t distribution (SGT)

SGT has four parameters: σ, ν, λ and k. Figure 43 shows how VaR and ES change when the values of these parameters change. Panel A and Panel B show the results for ν and σ, Panel C and Panel D for ν and λ, Panel E and Panel F for ν and k, Panel G and Panel H for σ and λ, Panel I and Panel J for σ and k, and finally Panel K and Panel L for k and λ. Table 23 provides the numbers behind Figure 43.

From Figure 43, it can be seen that all of these parameters have considerable effects on the values of VaR and ES. Both VaR and ES increase monotonically as σ increases. This finding is consistent with the intuition. Again as the scaling parameter σ can be interpreted as volatility, the higher volatility is, the fatter probability density distribution, and hence, the fatter tails and higher VaR/ES.

The relationship between VaR/ES and ν is not as simple as that between VaR/ES and σ. With regarding to VaR, Table 23 Panel A, Panel C and Panel E show that VaR increases as ν increases from 2.34 to 22.33. Beyond 22.33, VaR decreases gradually as ν increases. With regarding to ES, Table 22 Panel B, Panel D and Panel F show that ES decreases significantly as ν increases from 2.34 to 22.33. After 22.33, ES keeps decreasing as ν increases but at a slower rate. This relationship between VaR/ES and ν makes the VaR surface concave and makes the ES surface convex.

Table 23 Panel C, Panel D, Panel G and Panel H show that, both VaR and ES decrease monotonically as λ increases. This finding is intuitive as lower λ indicates longer left-hand tail and, therefore,higher VaR/ES.

Table 23 Panel E, Panel F, Panel I and Panel J show that both VaR and ES decrease monotonically as k increases. The only exception to this trend is the case when ν and k are both at their lower bounds, i.e., $\nu = 2.34, \mathrm{k} = 1.037$ (Table 23 Panel E and Panel F). In this case, VaR/ES is found to be smaller than the other VaR/ES next to it.

Figure 43. Skewed Generalized T Distirbution VaR/ES Surface: ν is degree of freedom and σ is a measure of volatility.
Panel A. VaR Surface with respect to ν and σ

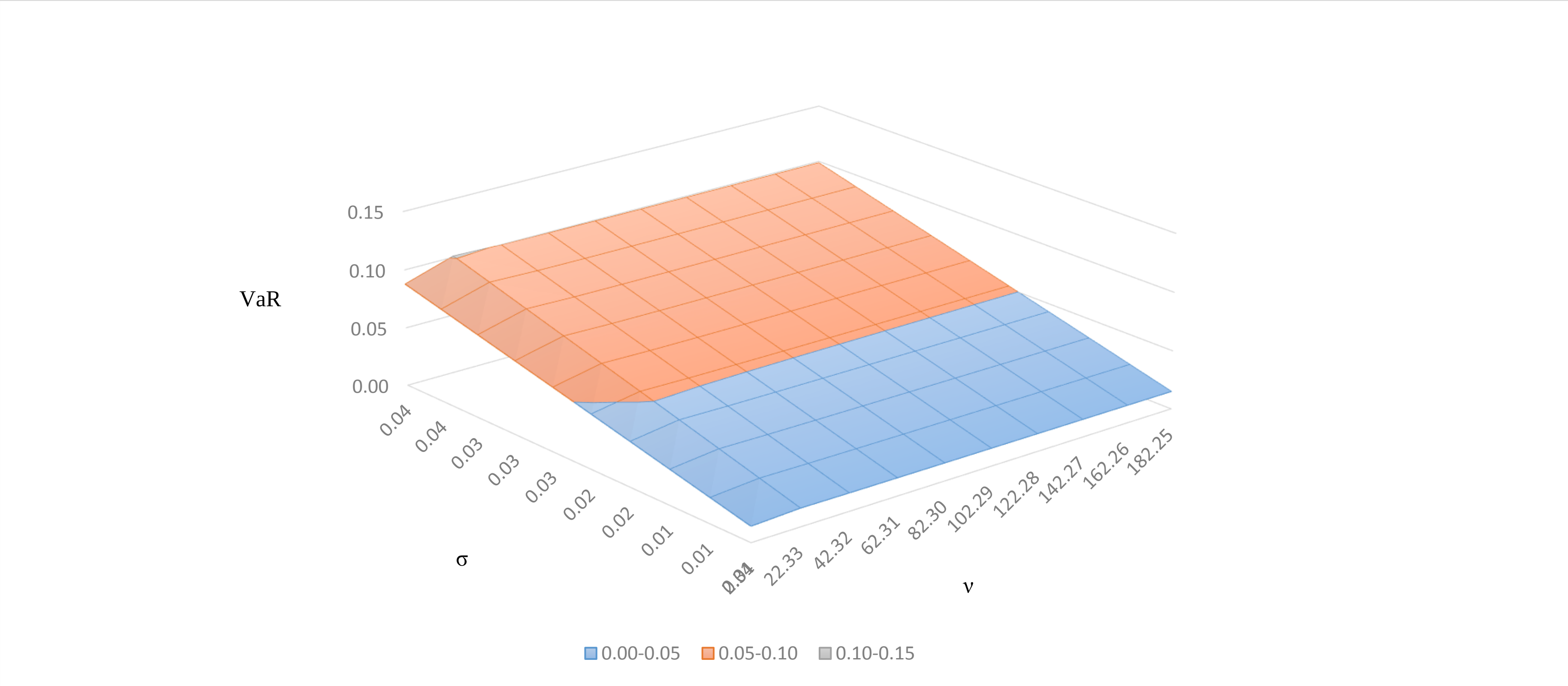


Figure 43. Skewed Generalized T Distirbution VaR/ES Surface: ν is degree of freedom and σ is a measure of volatility.
Panel B. ES Surface with respect to ν and σ

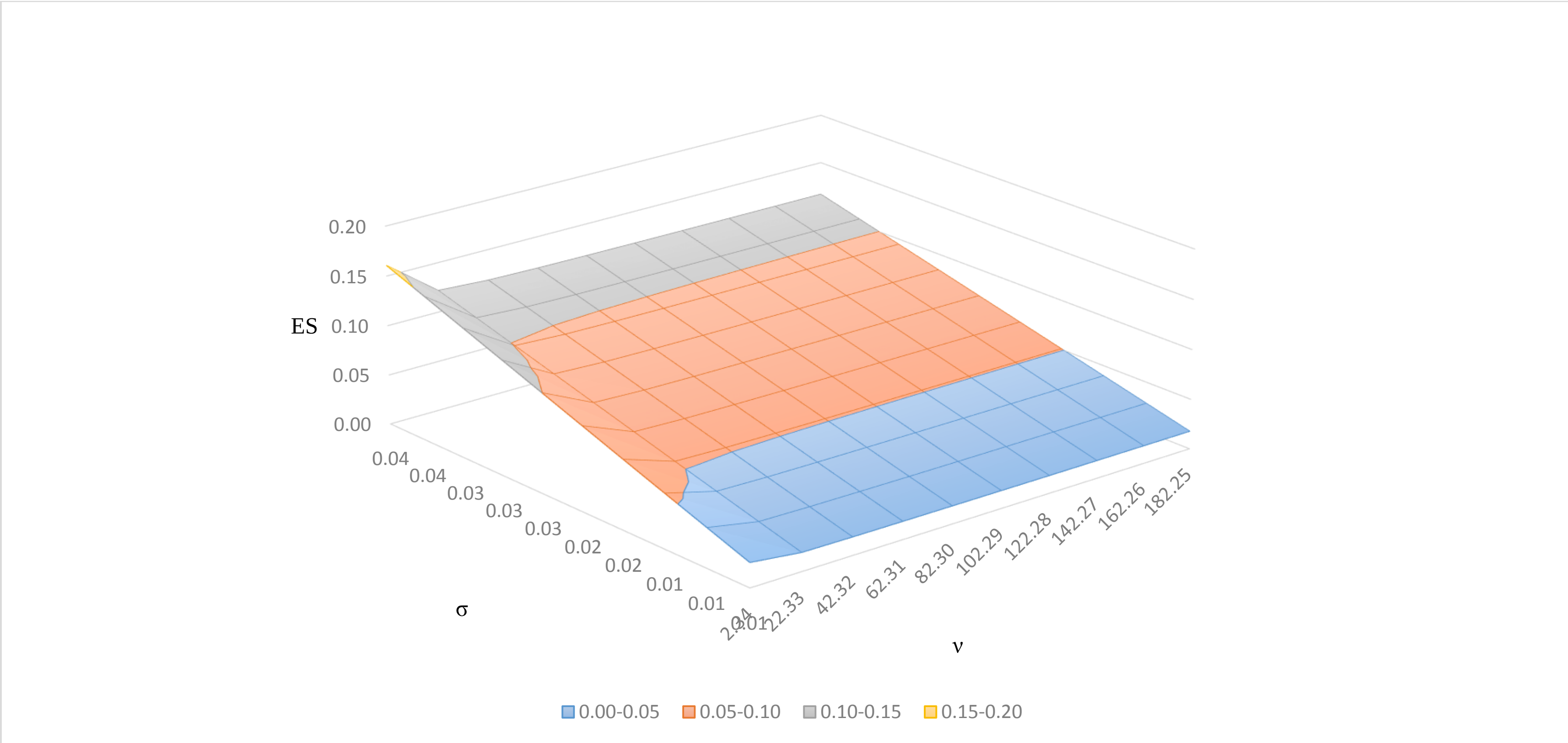


Figure 44. Skewed Generalized T Distirbution VaR/ES Surface: ν is degree of freedom and λ is a measure of skewness.
Panel C. VaR Surface with respect to λ and ν

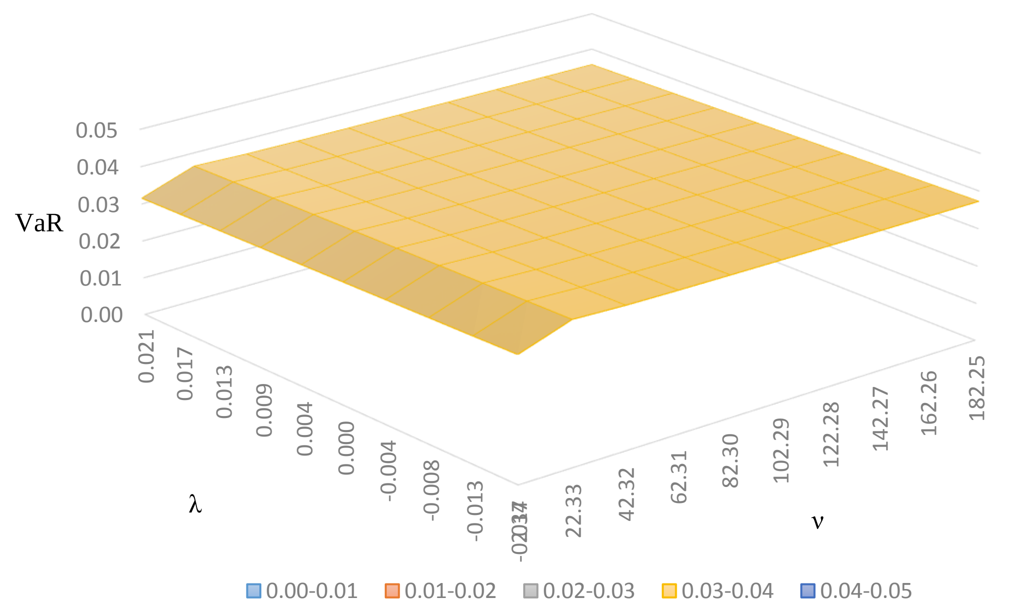


Figure 44. Skewed Generalized T Distirbution VaR/ES Surface: ν is degree of freedom and λ is a measure of skewness.
Panel D. ES Surface with respect to λ and ν

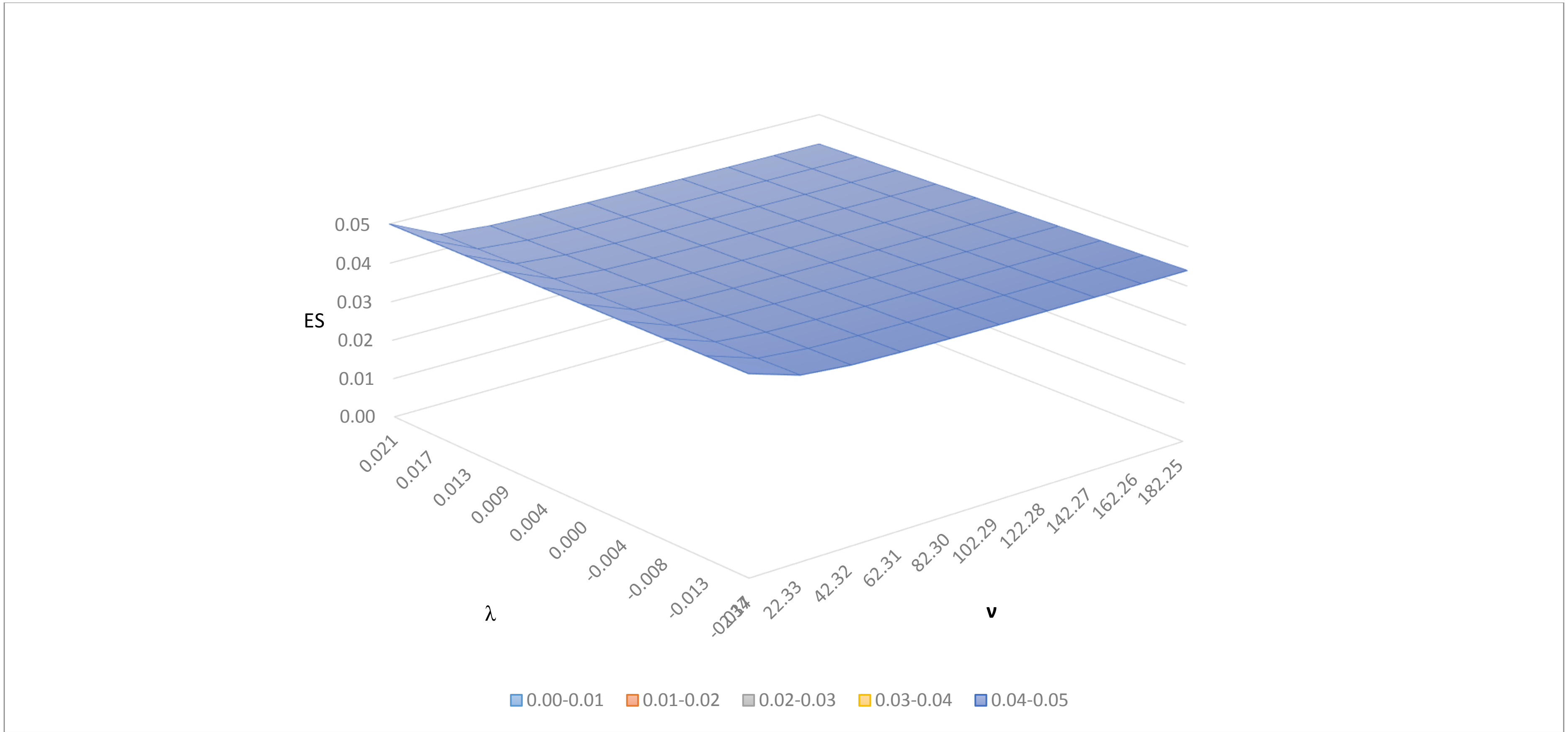


Figure 44. Skewed Generalized T Distirbution VaR/ES Surface: k and ν control the height and tail of the probabiliy density distribtion.
Panel E. VaR Surface with respect to k and ν

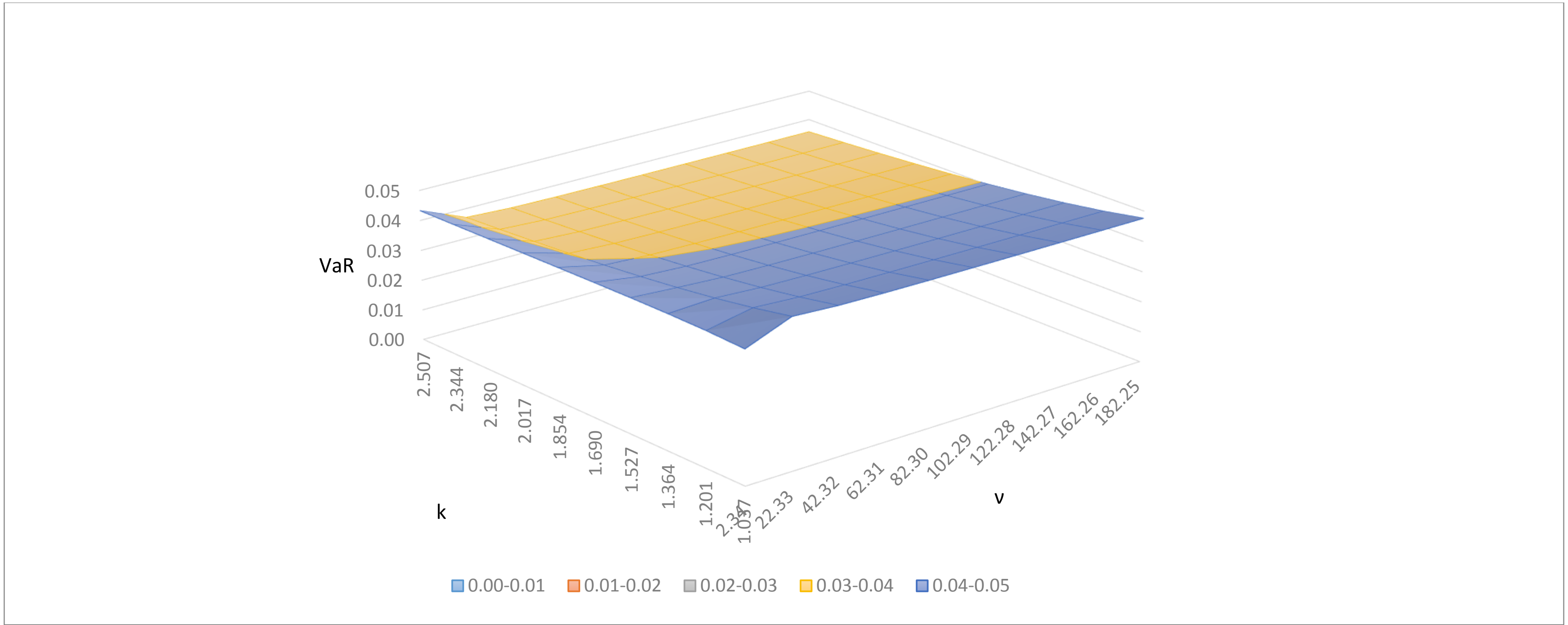


Figure 44. Skewed Generalized T Distirbution VaR/ES Surface: k and ν control the height and tail of the probabiliy density distribtion.
Panel F. ES Surface with respect to k and ν

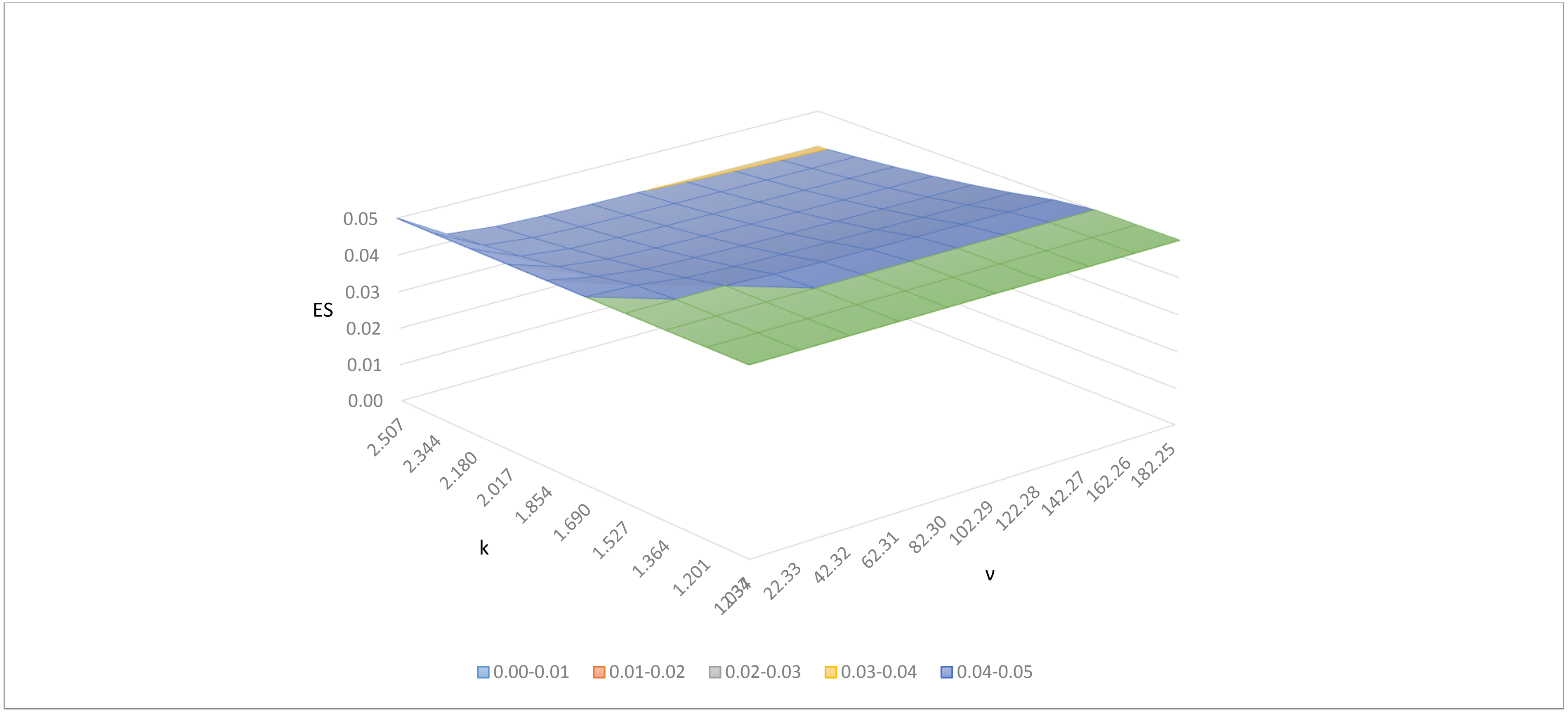


Figure 44. Skewed Generalized T Distirbution VaR/ES Surface: λ is a measure of skewness and σ is a measure of volatiliy.

Panel G. VaR Surface with respect to λ and σ

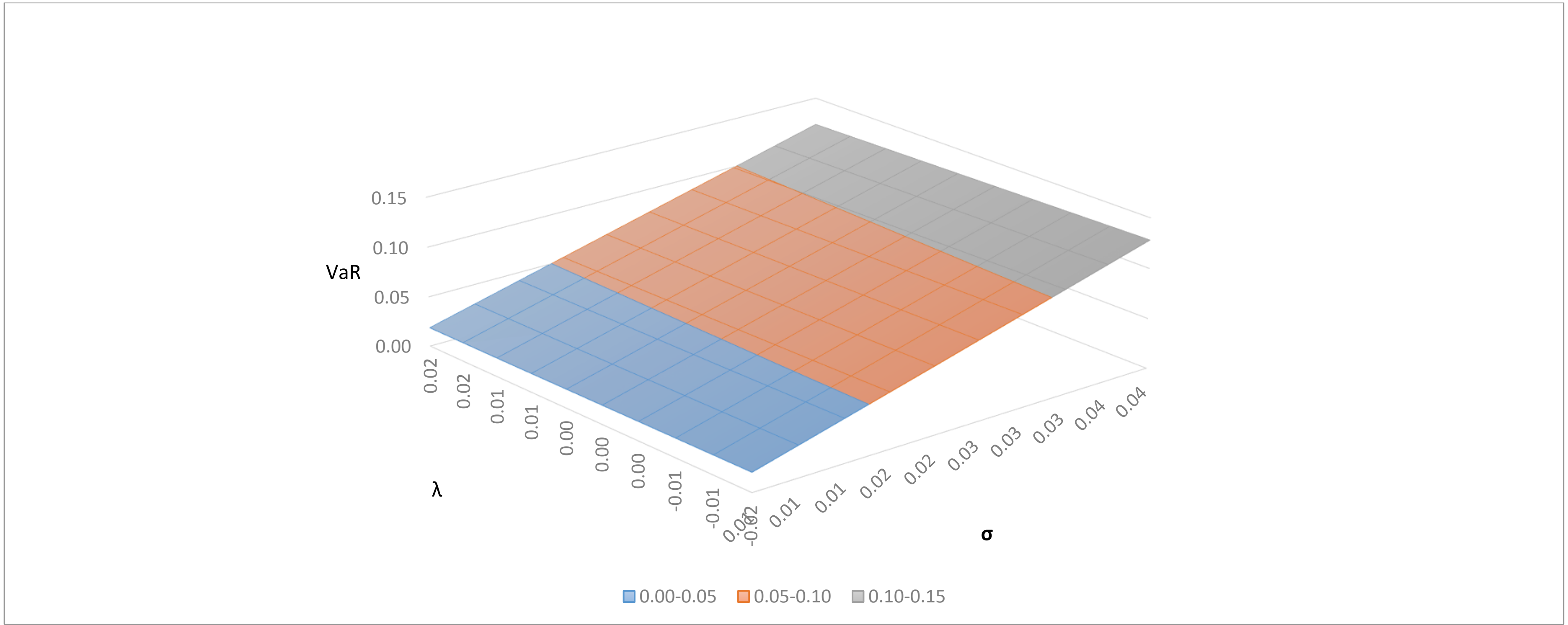


Figure 44. Skewed Generalized T Distirbution VaR/ES Surface: λ is a measure of skewness and σ is a measure of volatiliy.

Panel H. ES Surface with respect to λ and σ

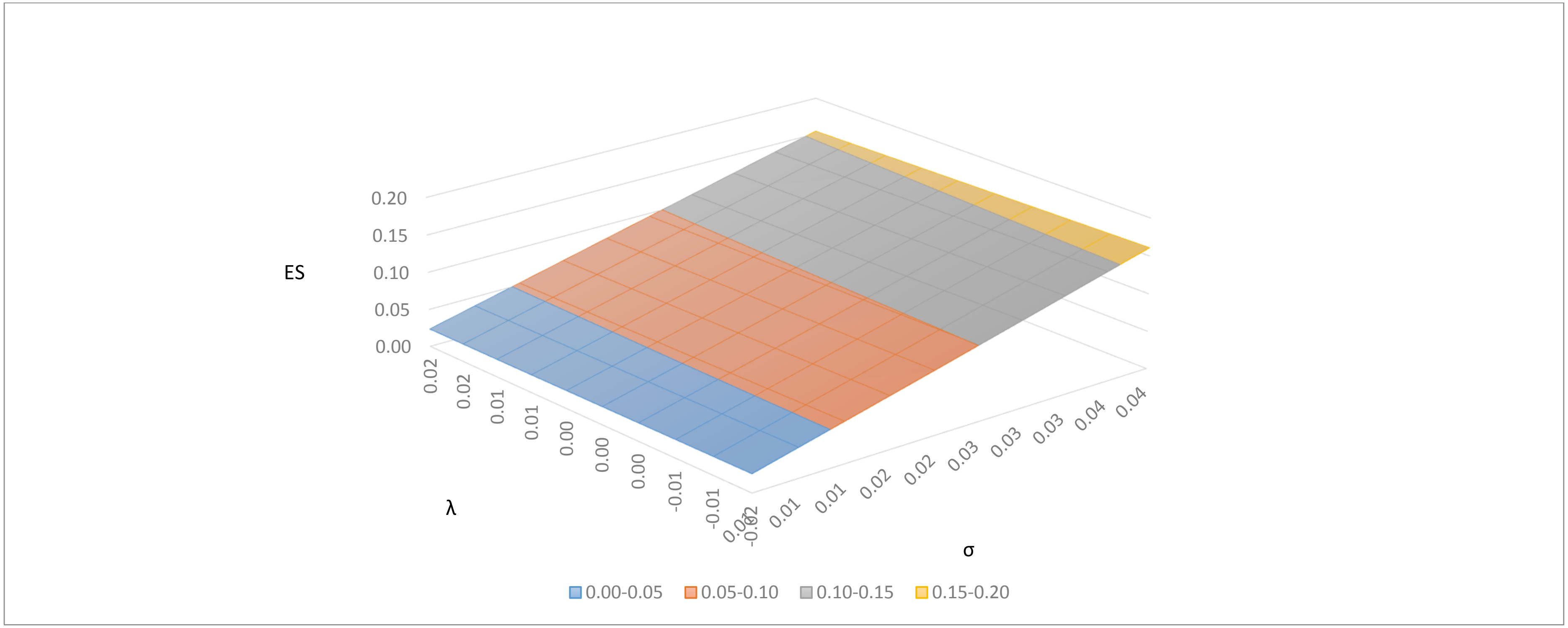


Figure 44. Skewed Generalized T Distirbution VaR/ES Surface: σ is a measure of volatiliy and k affects the height and tail of the probability density distribution.

Panel I. VaR Surface with respect to σ and k

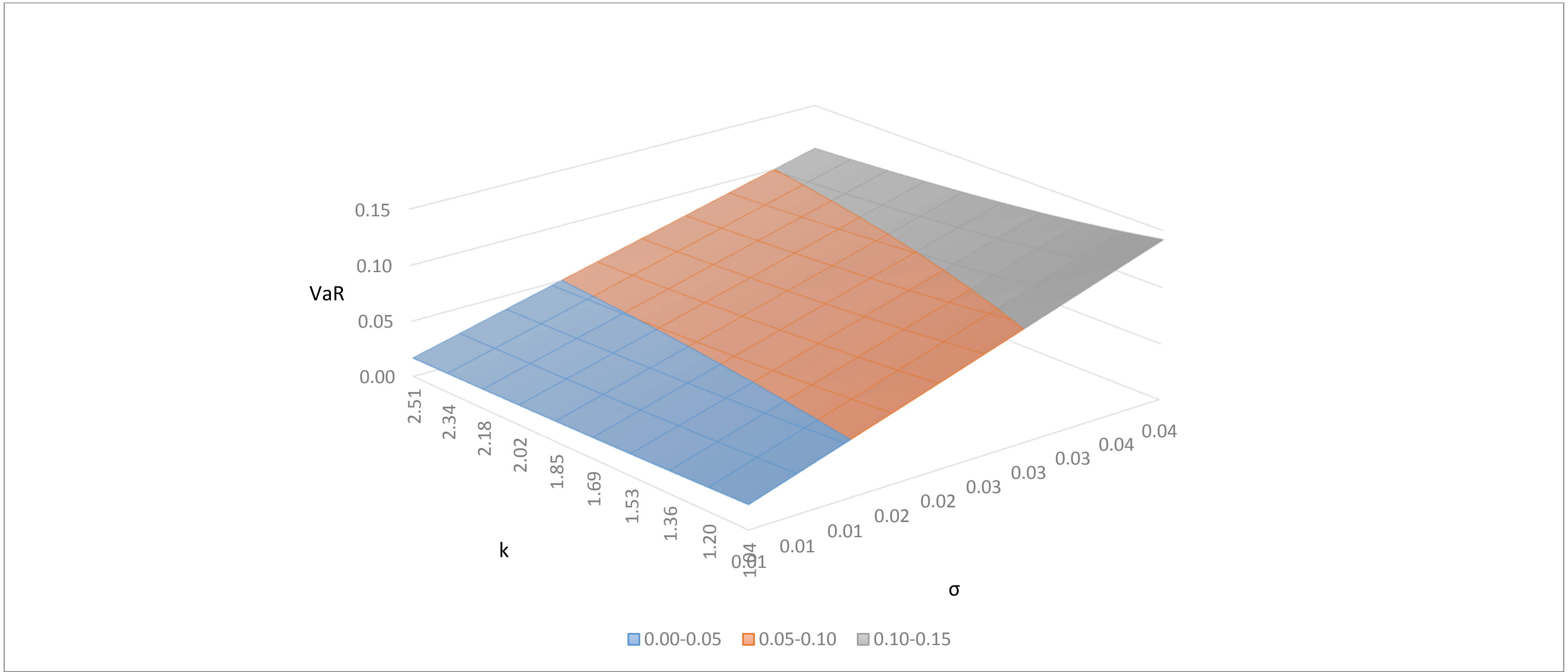


Figure 44. Skewed Generalized T Distirbution VaR/ES Surface: σ is a measure of volatiliy and k affects the height and tail of the probability density distribution.

Panel J. ES Surface with respect to σ and k

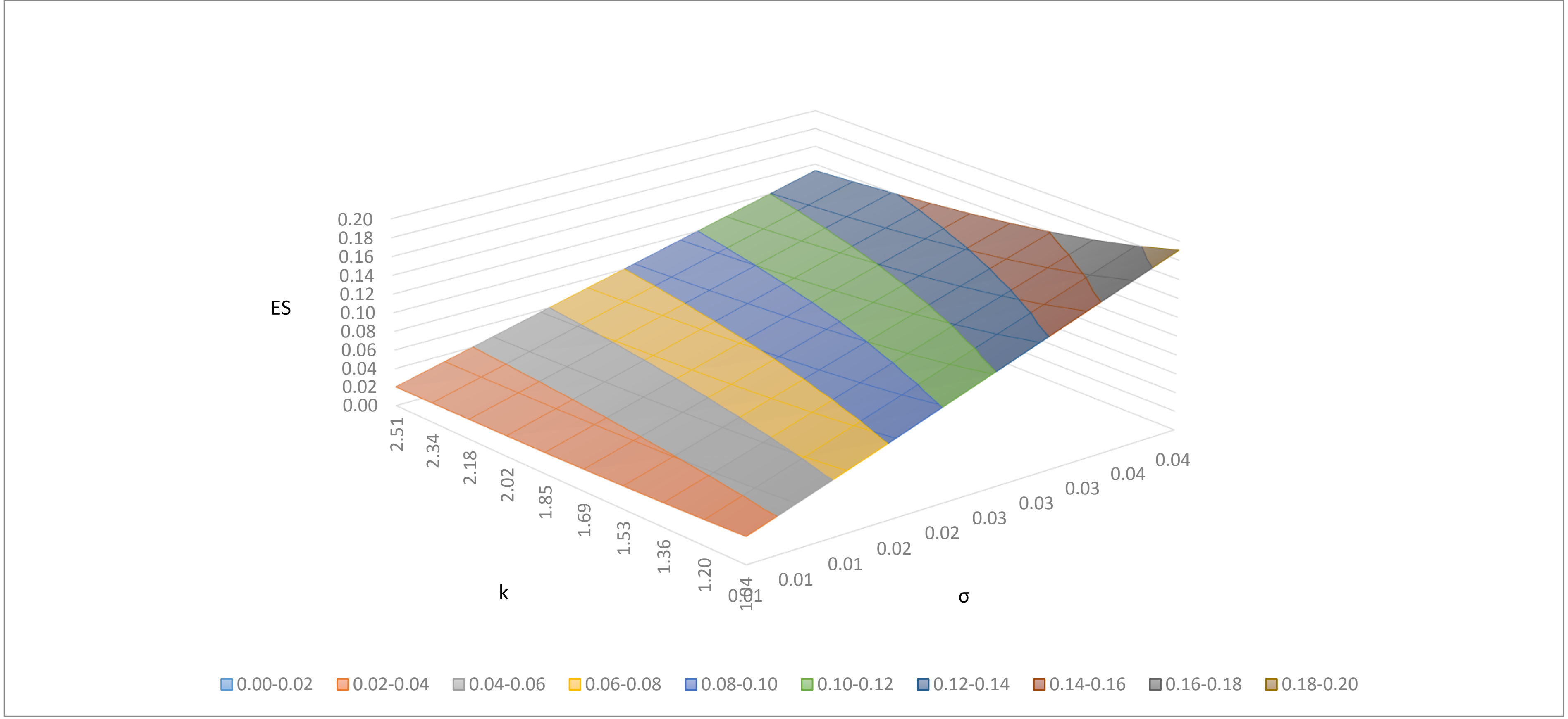


Figure 44. Skewed Generalized T Distirbution VaR/ES Surface: λ is a measure of volatiliy and k affects the height and tail of the probability density distribution.

Panel K. VaR Surface with respect to λ and k

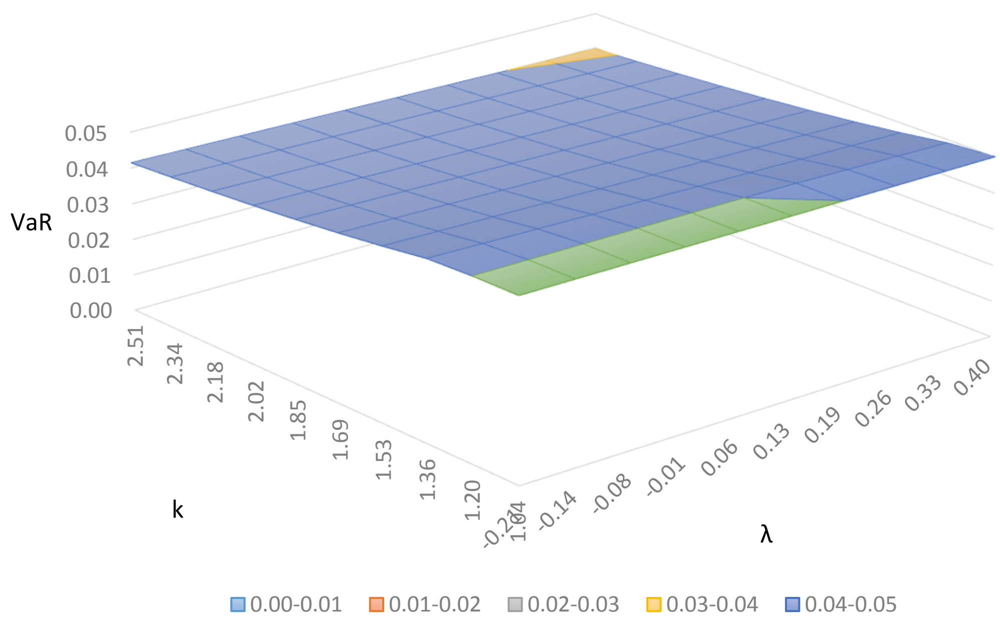


Figure 44. Skewed Generalized T Distirbution VaR/ES Surface: λ is a measure of volatiliy and k affects the height and tail of the probability density distribution.

Panel L. ES Surface with respect to λ and k

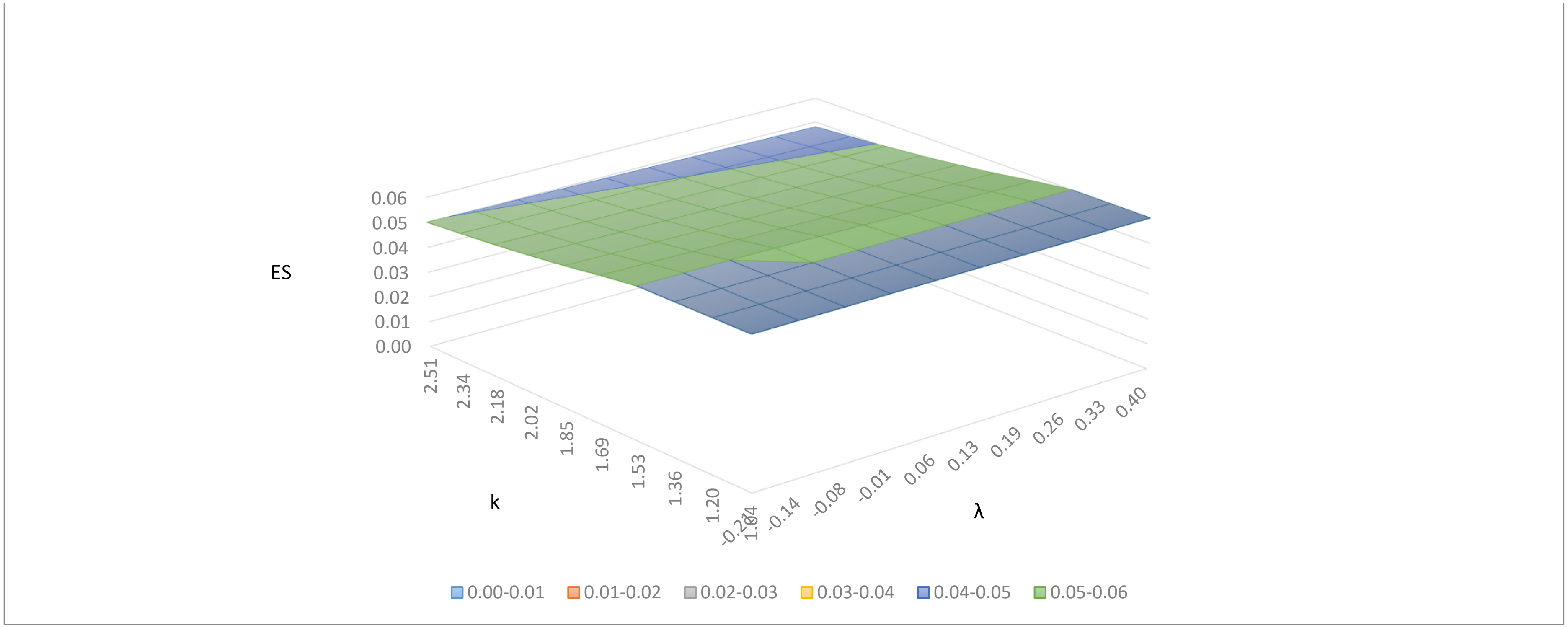


Table 23. Skewed Generalized Student's T Distribution

Panel A. VaR with respect to ν and σ

		ν									
		2.34	22.33	42.32	62.31	82.30	102.29	122.28	142.27	162.26	182.25
σ	0.01	0.0133	0.0153	0.0151	0.0151	0.0150	0.0150	0.0150	0.0150	0.0150	0.0150
	0.01	0.0216	0.0248	0.0245	0.0244	0.0244	0.0243	0.0243	0.0243	0.0243	0.0243
	0.01	0.0298	0.0343	0.0339	0.0338	0.0337	0.0337	0.0336	0.0336	0.0336	0.0336
	0.02	0.0381	0.0439	0.0433	0.0431	0.0430	0.0430	0.0429	0.0429	0.0429	0.0429
	0.02	0.0464	0.0534	0.0527	0.0525	0.0524	0.0523	0.0522	0.0522	0.0522	0.0522
	0.03	0.0546	0.0629	0.0621	0.0618	0.0617	0.0616	0.0616	0.0615	0.0615	0.0615
	0.03	0.0629	0.0724	0.0715	0.0712	0.0710	0.0709	0.0709	0.0708	0.0708	0.0708
	0.03	0.0712	0.0819	0.0809	0.0806	0.0804	0.0803	0.0802	0.0801	0.0801	0.0801
	0.04	0.0795	0.0914	0.0903	0.0899	0.0897	0.0896	0.0895	0.0894	0.0894	0.0894
	0.04	0.0877	0.1009	0.0997	0.0993	0.0990	0.0989	0.0988	0.0988	0.0987	0.0987

Panel B. ES with respect to ν and σ

		ν									
		2.34	22.33	42.32	62.31	82.30	102.29	122.28	142.27	162.26	182.25
σ	0.01	0.025	0.019	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018
	0.01	0.040	0.030	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029
	0.01	0.055	0.042	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040
	0.02	0.070	0.053	0.052	0.051	0.051	0.051	0.051	0.051	0.051	0.051
	0.02	0.085	0.064	0.063	0.062	0.062	0.062	0.062	0.062	0.062	0.062
	0.03	0.100	0.076	0.074	0.073	0.073	0.073	0.073	0.073	0.073	0.073
	0.03	0.115	0.087	0.085	0.085	0.084	0.084	0.084	0.084	0.084	0.084
	0.03	0.130	0.099	0.096	0.096	0.095	0.095	0.095	0.095	0.095	0.094
	0.04	0.146	0.110	0.108	0.107	0.106	0.106	0.106	0.106	0.106	0.105
	0.04	0.161	0.122	0.119	0.118	0.117	0.117	0.117	0.117	0.117	0.116

Table 23. Skewed Generalized Student's T Distribution VaR/ES Surface Data

Panel C. VaR with respect to λ and ν

		ν									
		2.34	22.33	42.32	62.31	82.30	102.29	122.28	142.27	162.26	182.25
λ	-0.017	0.0334	0.0381	0.0377	0.0375	0.0374	0.0373	0.0373	0.0373	0.0373	0.0372
	-0.013	0.0332	0.0379	0.0375	0.0373	0.0372	0.0372	0.0371	0.0371	0.0371	0.0371
	-0.008	0.0330	0.0377	0.0373	0.0371	0.0370	0.0370	0.0369	0.0369	0.0369	0.0369
	-0.004	0.0328	0.0376	0.0371	0.0369	0.0368	0.0368	0.0368	0.0367	0.0367	0.0367
	0.000	0.0325	0.0374	0.0369	0.0367	0.0367	0.0366	0.0366	0.0365	0.0365	0.0365
	0.004	0.0323	0.0372	0.0367	0.0365	0.0365	0.0364	0.0364	0.0364	0.0363	0.0363
	0.009	0.0321	0.0370	0.0365	0.0364	0.0363	0.0362	0.0362	0.0362	0.0362	0.0361
	0.013	0.0319	0.0368	0.0363	0.0362	0.0361	0.0360	0.0360	0.0360	0.0360	0.0360
	0.017	0.0317	0.0366	0.0361	0.0360	0.0359	0.0359	0.0358	0.0358	0.0358	0.0358
	0.021	0.0315	0.0364	0.0360	0.0358	0.0357	0.0357	0.0356	0.0356	0.0356	0.0356

Panel D. ES with respect to λ and ν

		ν									
		2.34	22.33	42.32	62.31	82.30	102.29	122.28	142.27	162.26	182.25
λ	-0.017	0.0612	0.0460	0.0449	0.0445	0.0443	0.0442	0.0441	0.0440	0.0440	0.0439
	-0.013	0.0608	0.0458	0.0447	0.0443	0.0441	0.0439	0.0439	0.0438	0.0438	0.0437
	-0.008	0.0605	0.0456	0.0444	0.0441	0.0439	0.0437	0.0437	0.0436	0.0435	0.0435
	-0.004	0.0601	0.0454	0.0442	0.0438	0.0436	0.0435	0.0434	0.0434	0.0433	0.0433
	0.000	0.0597	0.0451	0.0440	0.0436	0.0434	0.0433	0.0432	0.0432	0.0431	0.0431
	0.004	0.0594	0.0449	0.0438	0.0434	0.0432	0.0431	0.0430	0.0430	0.0429	0.0429
	0.009	0.0590	0.0447	0.0436	0.0432	0.0430	0.0429	0.0428	0.0427	0.0427	0.0427
	0.013	0.0586	0.0445	0.0434	0.0430	0.0428	0.0427	0.0426	0.0425	0.0425	0.0425
	0.017	0.0583	0.0442	0.0431	0.0428	0.0426	0.0425	0.0424	0.0423	0.0423	0.0422
	0.021	0.0579	0.0440	0.0429	0.0425	0.0424	0.0422	0.0422	0.0421	0.0421	0.0420

Table 23. Skewed Generalized Student's T Distribution VaR/ES Surface Data

Panel E. VaR with respect to ν and k

		ν									
		2.34	22.33	42.32	62.31	82.30	102.29	122.28	142.27	162.26	182.25
k	1.037	0.0433	0.0491	0.0483	0.0480	0.0478	0.0478	0.0477	0.0477	0.0476	0.0476
	1.201	0.0439	0.0467	0.0459	0.0456	0.0455	0.0454	0.0453	0.0453	0.0452	0.0452
	1.364	0.0441	0.0448	0.0440	0.0437	0.0435	0.0434	0.0434	0.0433	0.0433	0.0433
	1.527	0.0441	0.0431	0.0423	0.0420	0.0419	0.0418	0.0417	0.0417	0.0416	0.0416
	1.690	0.0440	0.0417	0.0409	0.0406	0.0405	0.0404	0.0403	0.0403	0.0403	0.0402
	1.854	0.0439	0.0405	0.0397	0.0394	0.0393	0.0392	0.0392	0.0391	0.0391	0.0391
	2.017	0.0437	0.0395	0.0387	0.0384	0.0383	0.0382	0.0381	0.0381	0.0381	0.0380
	2.180	0.0436	0.0385	0.0378	0.0375	0.0374	0.0373	0.0372	0.0372	0.0372	0.0371
	2.344	0.0434	0.0377	0.0370	0.0367	0.0366	0.0365	0.0365	0.0364	0.0364	0.0364
	2.507	0.0433	0.0370	0.0363	0.0360	0.0359	0.0358	0.0358	0.0357	0.0357	0.0357

Panel F. ES with respect to ν and k

		ν									
		2.34	22.33	42.32	62.31	82.30	102.29	122.28	142.27	162.26	182.25
k	1.037	0.0830	0.0621	0.0602	0.0596	0.0592	0.0590	0.0589	0.0588	0.0587	0.0587
	1.201	0.0825	0.0578	0.0560	0.0554	0.0551	0.0549	0.0548	0.0547	0.0546	0.0545
	1.364	0.0818	0.0544	0.0527	0.0521	0.0518	0.0516	0.0515	0.0514	0.0513	0.0513
	1.527	0.0811	0.0517	0.0500	0.0495	0.0492	0.0490	0.0489	0.0488	0.0487	0.0487
	1.690	0.0804	0.0494	0.0478	0.0473	0.0470	0.0468	0.0467	0.0466	0.0466	0.0465
	1.854	0.0798	0.0475	0.0460	0.0454	0.0452	0.0450	0.0449	0.0448	0.0448	0.0447
	2.017	0.0792	0.0459	0.0444	0.0439	0.0436	0.0435	0.0434	0.0433	0.0433	0.0432
	2.180	0.0788	0.0445	0.0430	0.0426	0.0423	0.0422	0.0421	0.0420	0.0419	0.0419
	2.344	0.0784	0.0433	0.0419	0.0414	0.0412	0.0410	0.0409	0.0409	0.0408	0.0408
	2.507	0.0780	0.0422	0.0408	0.0404	0.0402	0.0400	0.0399	0.0399	0.0398	0.0398

Table 23. Skewed Generalized Student's T Distribution VaR/ES Surface Data

Panel G. VaR with respect to λ and σ

		σ									
		0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.04	0.04
λ	-0.02	0.019	0.032	0.044	0.056	0.068	0.080	0.092	0.104	0.116	0.128
	-0.01	0.019	0.031	0.043	0.055	0.067	0.079	0.091	0.103	0.115	0.127
	-0.01	0.019	0.031	0.043	0.055	0.067	0.079	0.091	0.103	0.115	0.127
	0.00	0.019	0.031	0.043	0.055	0.067	0.079	0.090	0.102	0.114	0.126
	0.00	0.019	0.031	0.043	0.055	0.066	0.078	0.090	0.102	0.114	0.125
	0.00	0.019	0.031	0.042	0.054	0.066	0.078	0.090	0.101	0.113	0.125
	0.01	0.019	0.031	0.042	0.054	0.066	0.077	0.089	0.101	0.112	0.124
	0.01	0.019	0.030	0.042	0.054	0.065	0.077	0.089	0.100	0.112	0.123
	0.02	0.019	0.030	0.042	0.053	0.065	0.077	0.088	0.100	0.111	0.123
	0.02	0.019	0.030	0.042	0.053	0.065	0.076	0.088	0.099	0.111	0.122

Panel H. ES with respect to λ and σ

		σ									
		0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.04	0.04
λ	-0.02	0.025	0.040	0.055	0.070	0.085	0.100	0.115	0.130	0.146	0.161
	-0.01	0.024	0.039	0.055	0.070	0.085	0.100	0.115	0.130	0.145	0.160
	-0.01	0.024	0.039	0.054	0.069	0.084	0.099	0.114	0.129	0.144	0.159
	0.00	0.024	0.039	0.054	0.069	0.084	0.099	0.114	0.129	0.143	0.158
	0.00	0.024	0.039	0.054	0.069	0.083	0.098	0.113	0.128	0.143	0.158
	0.00	0.024	0.039	0.053	0.068	0.083	0.098	0.112	0.127	0.142	0.157
	0.01	0.024	0.038	0.053	0.068	0.083	0.097	0.112	0.127	0.141	0.156
	0.01	0.024	0.038	0.053	0.068	0.082	0.097	0.111	0.126	0.141	0.155
	0.02	0.024	0.038	0.053	0.067	0.082	0.096	0.111	0.125	0.140	0.154
	0.02	0.023	0.038	0.052	0.067	0.081	0.096	0.110	0.125	0.139	0.154

Table 23. Skewed Generalized Student's T Distribution VaR/ES Surface Data

Panel I. VaR with respect to σ and k

		σ									
		0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.04	0.04
k	1.04	0.022	0.035	0.048	0.062	0.075	0.089	0.102	0.115	0.129	0.142
	1.20	0.021	0.034	0.046	0.059	0.072	0.085	0.098	0.110	0.123	0.136
	1.36	0.020	0.032	0.045	0.057	0.069	0.082	0.094	0.106	0.119	0.131
	1.53	0.019	0.031	0.043	0.055	0.067	0.079	0.091	0.103	0.115	0.127
	1.69	0.019	0.030	0.042	0.053	0.065	0.077	0.088	0.100	0.111	0.123
	1.85	0.018	0.029	0.041	0.052	0.063	0.074	0.086	0.097	0.108	0.119
	2.02	0.018	0.029	0.040	0.051	0.062	0.073	0.084	0.095	0.106	0.117
	2.18	0.017	0.028	0.039	0.050	0.060	0.071	0.082	0.093	0.103	0.114
	2.34	0.017	0.028	0.038	0.049	0.059	0.070	0.080	0.091	0.101	0.112
	2.51	0.017	0.027	0.037	0.048	0.058	0.068	0.079	0.089	0.099	0.110

Panel J. ES with respect to σ and k

		σ									
		0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.04	0.04
k	1.04	0.029	0.047	0.065	0.083	0.101	0.119	0.137	0.155	0.173	0.190
	1.20	0.027	0.044	0.061	0.078	0.094	0.111	0.128	0.145	0.161	0.178
	1.36	0.026	0.042	0.057	0.073	0.089	0.105	0.121	0.137	0.153	0.168
	1.53	0.024	0.040	0.055	0.070	0.085	0.100	0.115	0.130	0.145	0.160
	1.69	0.023	0.038	0.052	0.067	0.081	0.096	0.110	0.125	0.139	0.154
	1.85	0.023	0.037	0.051	0.064	0.078	0.092	0.106	0.120	0.134	0.148
	2.02	0.022	0.035	0.049	0.062	0.076	0.089	0.103	0.116	0.130	0.143
	2.18	0.021	0.034	0.047	0.061	0.074	0.087	0.100	0.113	0.126	0.139
	2.34	0.021	0.033	0.046	0.059	0.072	0.085	0.097	0.110	0.123	0.136
	2.51	0.020	0.033	0.045	0.058	0.070	0.083	0.095	0.108	0.120	0.133

Table 23. Skewed Generalized Student's T Distribution VaR/ES Surface Data

Panel K. VaR with respect to λ and k

		λ									
		-0.21	-0.14	-0.08	-0.01	0.06	0.13	0.19	0.26	0.33	0.40
k	1.04	0.054	0.054	0.053	0.053	0.053	0.052	0.052	0.052	0.052	0.051
	1.20	0.052	0.051	0.051	0.051	0.050	0.050	0.050	0.050	0.049	0.049
	1.36	0.050	0.049	0.049	0.049	0.049	0.048	0.048	0.048	0.048	0.047
	1.53	0.048	0.048	0.047	0.047	0.047	0.047	0.046	0.046	0.046	0.046
	1.69	0.046	0.046	0.046	0.046	0.045	0.045	0.045	0.045	0.045	0.044
	1.85	0.045	0.045	0.045	0.044	0.044	0.044	0.044	0.044	0.043	0.043
	2.02	0.044	0.044	0.044	0.043	0.043	0.043	0.043	0.043	0.042	0.042
	2.18	0.043	0.043	0.043	0.042	0.042	0.042	0.042	0.042	0.041	0.041
	2.34	0.042	0.042	0.042	0.042	0.041	0.041	0.041	0.041	0.041	0.040
	2.51	0.041	0.041	0.041	0.041	0.041	0.040	0.040	0.040	0.040	0.040

Panel L. ES with respect to to λ and k

		λ									
		-0.21	-0.14	-0.08	-0.01	0.06	0.13	0.19	0.26	0.33	0.40
k	1.04	0.072	0.072	0.071	0.071	0.071	0.070	0.070	0.070	0.069	0.069
	1.20	0.067	0.067	0.067	0.066	0.066	0.066	0.065	0.065	0.065	0.064
	1.36	0.064	0.063	0.063	0.063	0.062	0.062	0.062	0.061	0.061	0.061
	1.53	0.061	0.060	0.060	0.060	0.059	0.059	0.059	0.059	0.058	0.058
	1.69	0.058	0.058	0.058	0.057	0.057	0.057	0.056	0.056	0.056	0.056
	1.85	0.056	0.056	0.055	0.055	0.055	0.055	0.054	0.054	0.054	0.054
	2.02	0.054	0.054	0.054	0.053	0.053	0.053	0.053	0.052	0.052	0.052
	2.18	0.053	0.052	0.052	0.052	0.052	0.051	0.051	0.051	0.051	0.050
	2.34	0.051	0.051	0.051	0.051	0.050	0.050	0.050	0.050	0.049	0.049
	2.51	0.050	0.050	0.050	0.049	0.049	0.049	0.049	0.048	0.048	0.048

5.2.1.5 Concluding Remarks

Overall, it can be concluded that VaR and ES are sensitive to the specification of the probability density distribution models and their parameters. The size of the effect depends on the distribution model and the market conditions. All of the results presented in Section 5.2.1.2 to Section 5.2.1.4 are based on $\alpha = 1\%$. To check the robustness of this finding, all the calculations were repeated for $\alpha = 2.5\%$ and $\alpha = 5\%$. When $\alpha = 2.5\%$ and $\alpha = 5\%$, the shapes of the VaR/ES surfaces are found to be practicially identical to the shapes obtained for $\alpha = 1\%$. The results for $\alpha = 2.5\%$ and $\alpha = 5\%$ are presented in Appendix.

When returns are normally distributed, there is a positive relationship between VaR/ES and σ. Therefore, consistent with the expectation, higher σ, i.e., higher volatility, implies more mass in the tails of the normal distribution and hence indicates higher VaR/ES. As Section 5.1.2.2 shows, there is considerable variability in the standard deviation (volatility) across countries. Moreover, as fully expected, different market regimes are characterised by considerably differences in the standard deviation. In particular, the bear markets have high σ while the bull markets have low σ. The σ of the whole sample period lies between σ of the bull markets and of the bear markets. Considering the positive relationship between VaR/ES and σ, it is important to separate the whole sample period into the bull markets and the bear markets to estimate their σ and then to calculate the bull market VaR/ES and the bear market VaR/ES respectively. Otherwise, if a single σ of the whole sample period is used, VaR/ES may be overestimated during the bull markets and underestimated during the bear markets.

In terms of ST, both VaR and ES increase as σ increases. The σ of ST can be interpreted as volatility. Section 5.1.2.2 shows that the standard deviation (volatility) differs across countries and the market regimes. Like the case of N, it is important to separate the whole sample period into the bull markets and the bear markets to estimate σ and calculate the bull market VaR/ES and the bear market VaR/ES respectively. Otherwise, if the σ is estimated for the whole sample period, VaR/ES may be overestimated during the bull markets and underestimated during the bear markets.

Unlike the simple relationship between VaR/ES and σ, the relationship between VaR/ES and ν is negative when ν is close to its lower bound 2 but positive otherwise. Given that the lower value of ν indicates fatter tails (lower degrees of freedom are associated with greater departure from N), higher VaR/ES can be expected. However, it is not appropriate to conclude that lower ν always indicates higher VaR/ES because when ν is close to its lower bound of 2, the relationship between VaR/ES and ν is negative.

The bear markets are expected to have lower ν than the whole sample period while the bull markets are expected to have higher ν than the whole sample period. When ν is far from its lower bound 2, considering the negative relationship between VaR/ES and ν, if a single ν of the whole sample period is estimated and used, VaR/ES may be overestimated during the bull markets and underestimated during the bear markets. However, the situation may be more complex when ν is getting closer to its lower bound because the relationship between VaR/ES and ν is reversed.

Following the same argument, it is even more important to consider the parameter changes caused by the change of the market regime when the stock returns follow HST and SGT. This is because HST and SGT have more parameters. Each of these parameters can impact on VaR/ES. Using models with lower number of parameters or ignoring changes of the parameter values during different market regimes is likely to enhance the possibility of underestimation or overestimation of VaR and ES.

5.2.2 VaR

Section 5.1.2 reveals that there is significant difference in the probably density models across countries and during the bull and bear markets. VaR/ES will be calculated based these different probability density distribution models. Based on these VaR/ES results, this section will discuss how VaR/ES changes for the bull and bear markets and across countries. In order to assess the reliability of HS and EVT, risk measures based on HS and EVT will be calculated and discussed alongside the probability density distribution models.

Section 5.2.2.1 discusses VaR estimates for the whole sample period for the DSEs. Then the bull and the bear markets' VaR estimates for the DSEs will be discussed. The discussion of VaRs for the ESEs will follow. Section 5.2.2.2 discusses ES results in the same way.

5.2.2.1 VaR of the developed stock exchanges

The whole sample period

Figure 45 shows the VaR estimates for the DSEs for the whole sample period for α equal 1% (Panel A), 2.5% (Panel B) and 5% (Panel C). From Figure 45, it can be seen that there are considerable differences in VaRs of different DSEs. New Zealand has the lowest VaR while Greece has the highest VaR among DSEs. This finding is consistent with the results in Section 5.1 where New Zealand is found to have the lowest σ while Greece is found to have the highest σ. As the confidence level α increases from 1% to 5%, VaR of each DSE decreases and the differences in VaRs among DSEs reduce. These conclusions are robust to the change of estimation methods.

In terms of different estimation methods, Figure 45 Panel A shows that at 1% confidence level, VaRs based on N are the lowest for all DSEs. Considerably higher values of VaRs are obtained for all the other estimation methods. VaRs based on ST are slightly higher than those based on HST and SGT. Differences of VaR given by the benchmark models (i.e., ST, HST and SGT) are small. The VaRs estimated by HS and EVT are similar in magnitude. They are also the highest among all VaR estimates. Hence, at 1% confidence level, compared with the benchmark models, N tends to underestimate VaR while HS and EVT tend to overestimate VaR. The optimal probability density distribution model for the whole sample period for each DSE can be found in Table 19. Compared with the optimal probability density distribution model, N consistently underestimates VaR. In contrast, HS and EVT overestimate VaR. For the benchmark models, compared with the optimal probability density distribution model, the other two benchmark models tend to overestimate VaR as they overestimate VaR for 12 DSEs.

Figure 45 Panel B shows that when $a = 2.5\%$, VaRs estimated by HS and EVT are still the largest. VaRs based on N, ST, HST and SGT are comparable to each other. Hence, at $a = 2.5\%$, compared with benchmark models, N works well while HS and EVT still tend to overestimate VaR. Compared with the optimal probability density distribution model, HS and EVT overestimate VaR. N and the other two benchmark models tend to perform well by giving VaR which is similar to that of the optimal probability density distribution model for the majority of the DSEs.

Figure 45 Panel C shows that when $a = 5\%$, compared with benchmark models, N, HS and EVT tend to marginally overestimate VaR. Compared with the optimal probability density distribution model, the other two benchmark models tend to perform well by giving VaR which is similar to that of the optimal probability density distribution model for the majority of the DSEs. The increase in the relative position of VaRs based on N is consistent with our expectation because N has thinner tail at the extreme low percentile (e.g. 1%) and has fatter tail at less extreme low percentile (e.g. 5%) compared with ST, HST and SGT.

The bull/bear markets

Figure 46 presents the bull markets VaRs for the DSEs for α equal to 1% (Panel A), 2.5% (Panel B) and 5% (Panel C). Figure 47 shows analogous results obtained for the bear markets. Comparing Figure 45 and Figure 46, it can be seen that each VaR of the bull markets is lower than that of the whole sample period. From Figure 46, it can be seen that during the bull markets, New Zealand has the lowest VaR while Greece has the highest VaR among the DSEs. This finding is consistent with the results of the whole sample period. There exist also considerable differences in VaRs among the DSEs during the bull markets. As the confidence level α increases from 1% to 5%, the differences in the bull markets VaRs among the DSEs reduce. These conclusions are robust to the change of estimation methods.

In terms of different estimation methods, from the bull market results of Figure 46, it can be seen that for each DSE, HS and EVT tend to deliver similar VaRs at all the three confidence levels ($\alpha = 1\%, 2.5\%, \text{and } 5\%$). VaRs based on benchmark models are not identical but the differences in VaRs given by benchmark models are small. At $\alpha = 1\%$, HS and EVT give the highest VaRs while N gives the lowest VaRs. In other words, when $\alpha = 1\%$, compared with the optimal probability distribution model, HS and EVT overestimate VaR while N underestimates VaR. At $\alpha = 2.5\%$, HS and EVT still give the highest VaRs and the VaRs given by all the probability density distribution models N, ST, HST and SGT are similar. Hence at $\alpha = 2.5\%$, compared with the optimal probability distribution model, HS and EVT still overestimate VaR while the rest models work well. When $\alpha = 5\%$, all the conclusions based on the results for $\alpha = 2.5\%$ are preserved except that N tends to deliver the highest VaRs, i.e., N tends to overestimate VaR.

With regard to the results of the bear markets, comparing Figure 45 and Figure 47, it can be seen that each VaR for the bear markets is much higher than that for the whole sample period. This finding is intuitive as the bear market is expected to have higher tail risk. During the bear markets, New Zealand still has the lowest VaR while Finland replaces Greece as the country with the highest VaR.

Based on Figure 47 Panel A, when $\alpha = 1\%$, benchmark models tend to give comparable VaRs. ST tends to give the highest VaR compared with the other two benchmark models. N gives the lowest VaR across all DSEs. HS and EVT tend to give the highest VaR with exceptions (e.g. Finland, France, Greece, and Netherlands). Hence, compared the optimal probability density, the other two probability density distribution models may overestimate or underestimate VaR depending on the stock exchange. Compared with the optimal probability density distribution model, HS and EVT tend to overestimate VaR for most of the DSEs while N underestimates VaR for all DSEs. When α increases to 2.5%, most of the conclusions for $\alpha = 1\%$ are preserved. However, the difference between VaRs based on N and benchmark models is reduced to nearly zero. Compared with benchmark models, HS and EVT still tend to overestimate VaR for most of the DSEs while N tends to work well. At $\alpha = 5\%$, N tends to give the highest VaRs and HS delivers VaR which is similar to that given by N. EVT gives VaR which is similar to those of benchmark models. The difference in VaRs among different estimation methods reduces considerably. In other word, compared with the optimal probability density distribution model, N and HS tend to overestimate VaR while EVT may overestimate or underestimate VaR depending on the exchange.

Based on Table 19, the stock returns of Finland follow SGT for the whole sample period. As the market switches from the bull market to the bear market, the Finland stock returns' distribution changes to ST from HST. It is appropriate to use SGT for the whole sample period to calculate 1% VaR. However, 1% VaR will be underestimated if SGT is still used in the bull markets when the stock returns follow HST. Similarly, 1% VaR will be underestimated if SGT is still used in the bear markets when the stock returns follow ST. Similar conclusions can be drawn for other DSEs.

Summary

In summary, no matter what estimation methods are used, as α increase from 1% to 5%, VaR decreases. This negative relationship between VaR and α is found for whole sample period and the bull/bear markets. There is considerable difference in VaRs of different DSEs. In addition, the bull market VaR is lower than the whole sample period VaR while the bear market VaR is much higher than the whole sample period VaR.

Benchmark models give comparable VaRs. The differences between VaRs given by the benchmarks models decrease as the confidence level increases. For all DSEs, compared with the optimal probability density distribution model, N tends to considerably underestimate VaR at 1% confidence level and overestimate VaR at 5% confidence level for the whole sample period and the bull/bear markets. At 2.5% confidence level, N performs well by giving VaR which is similar to that of the optimal probability density distribution model. HS and EVT tend to overestimate VaR at all confidence levels for the whole sample period and the bull markets. However, for the bear markets, HS and EVT may overestimate or underestimate VaR depending on the exchange. If a single probability density distribution model is used for the whole sample period, the bull markets and the bear markets, the VaR estimation based on this particular probability density distribution model may be biased under different market regimes.

Tail risk measures are widely used to measure the risk exposure of a trading desk in financial institutions such as investment banks and commercial banks. Then, the amount of risk capital is decided based on the magnitude of the risk measures by the financial institution as a cushion to survive adverse market conditions. These results show the diversified estimates of the tail risk measures given by estimation methods and different probability models. The implicit assumption of the extant literature is the stable probability density distribution for tail risk estimation, i.e. using the same probability density distribution regardless of different market regimes. The results of the research demonstrate the inadequacy of this implicit assumption. Let us take the US as an example of the developed countries. For the whole sample period, if the normal distribution is used to estimate VaR, the risk exposure will be underestimated at 1% confidence level and will overestimated at 5 % confidence level, leading economic inefficiency, i.e. insufficient risk capital is reserved at 1% confidence level and too much risk capital is reserved at 5% confidence level. What is more interesting is the estimation of the tail risk measure is not robust to the change of the market regimes. For instance, 1% VaR based on SGT model is estimated to be 2.3% during the bull market regime. This result implies that an investment portfolio with a position of £1,000,000 is likely to lose £ 23,000 on a daily horizon with the probability of 1 %. Alternatively, this result implies that the investment portfolio expects to result in a loss of £ 230 or more once every 100 trading days. VaR based on SGT model is estimated to be 0.051 during the bear market. This result implies that an investment portfolio with a position of £100,000 is likely to lose £ 51,000 on a daily horizon with the probability of 1 %. If the risk assessor uses the whole sample data to estimate 1% VaR, he or she will obtain the value of 3.5% (based on SGT), which indicates a likely loss of £35,000. The biased estimates of the tail risk measures will lead to the same economic inefficiency problem, i.e. insufficient risk capital is reserved during bear market period when risk capital is important to help the financial intuition survive the adverse market conditions and excess risk capital is reserved during a bull market period when less risk capital is required. This conclusion applies to all the estimation methods and probability density models considered. Therefore, it is important to consider the market regimes when estimating tail risk measures if a risk controller would like to use tail risk measures to measure the risk exposure of a trading desk.

Figure 45. Developed stock exchanges whole sample period VaRs

Panel A. 1% VaRs

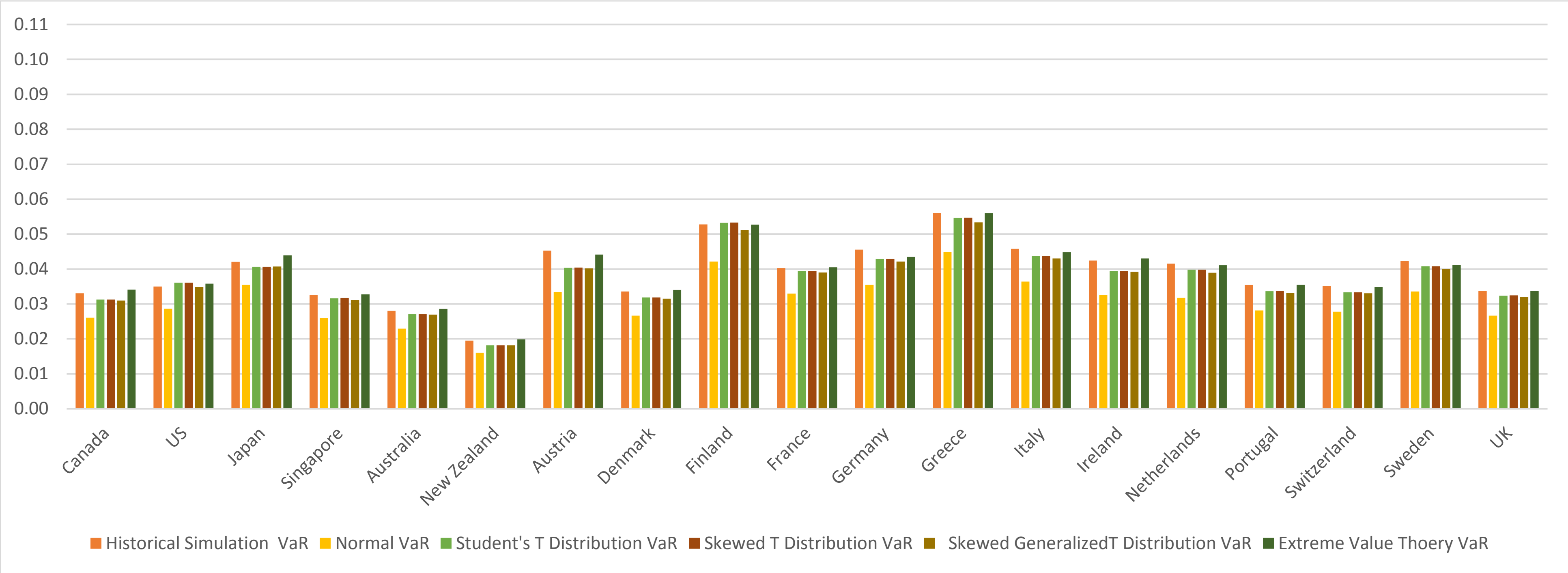


Figure 45. Developed stock exchanges whole sample period VaRs

Panel B. 2.5% VaRs

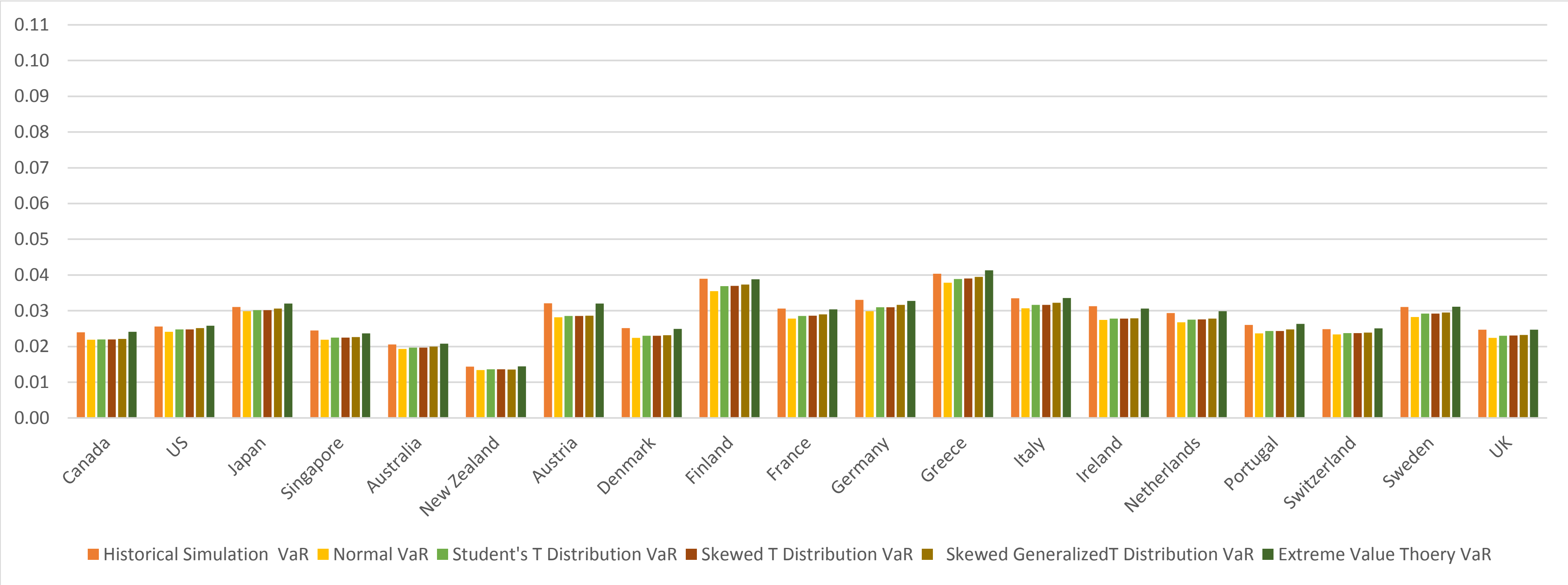


Figure 45. Developed stock exchanges whole sample period VaRs

Panel C. 5% VaRs

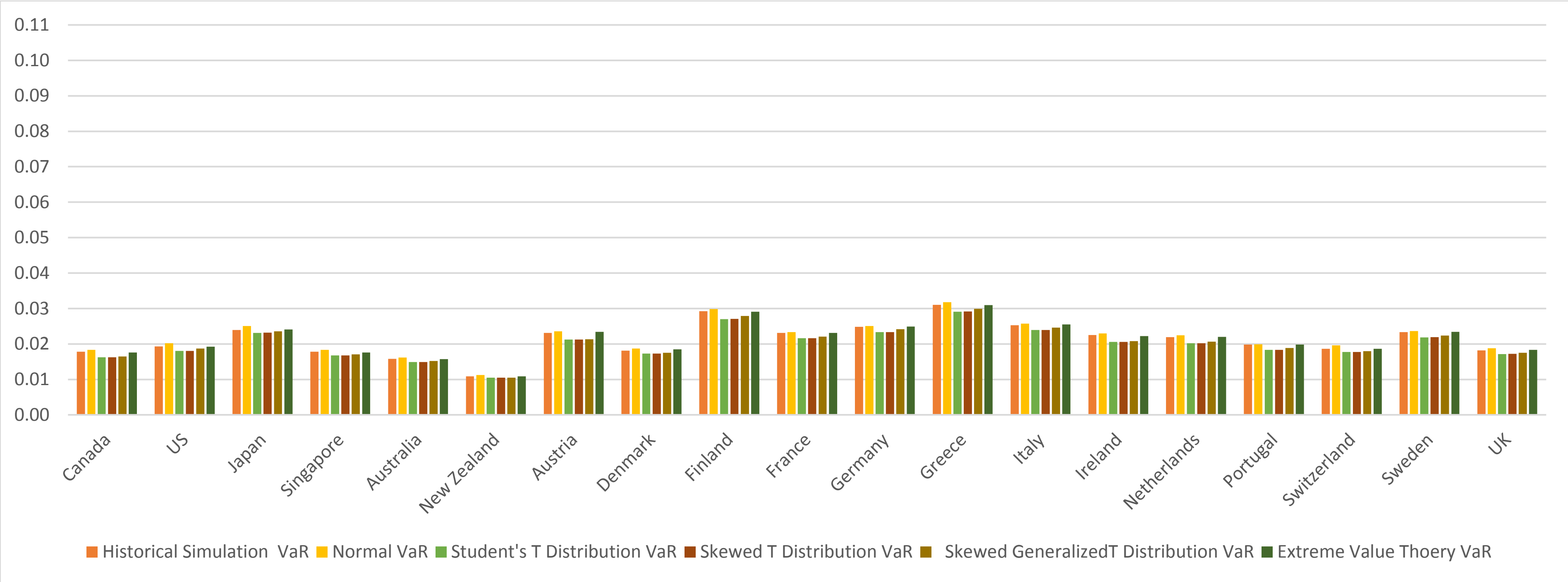


Figure 46. Developed stock exchanges the bull market VaRs

Panel A. 1% VaRs

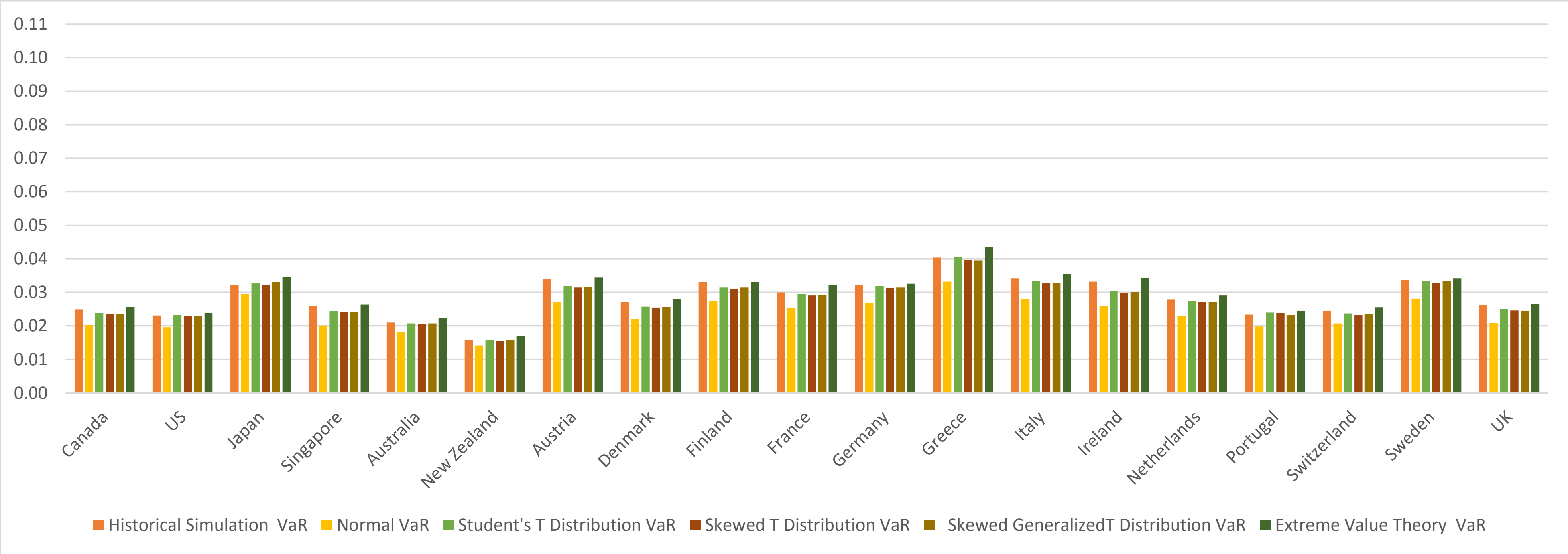


Figure 46. Developed stock exchanges the bull market VaRs

Panel B. 2.5% VaRs

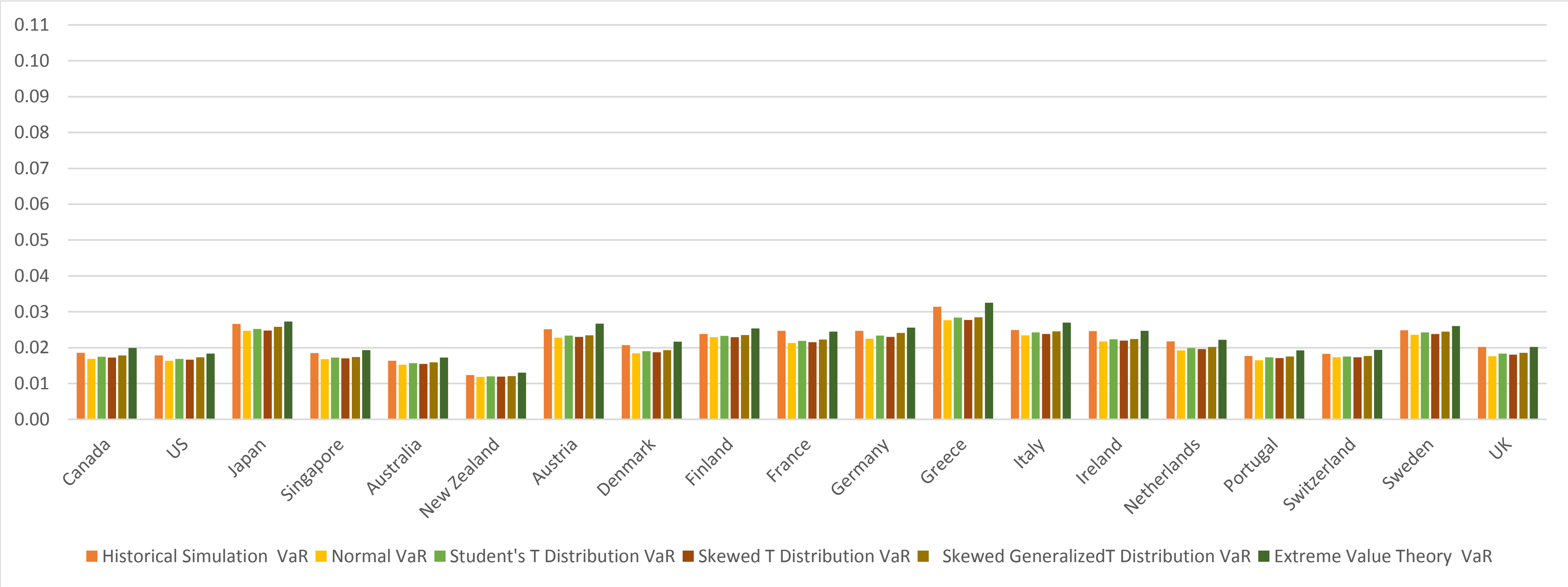


Figure 46. Developed stock exchanges the bull market VaRs

Panel C. 5% VaRs

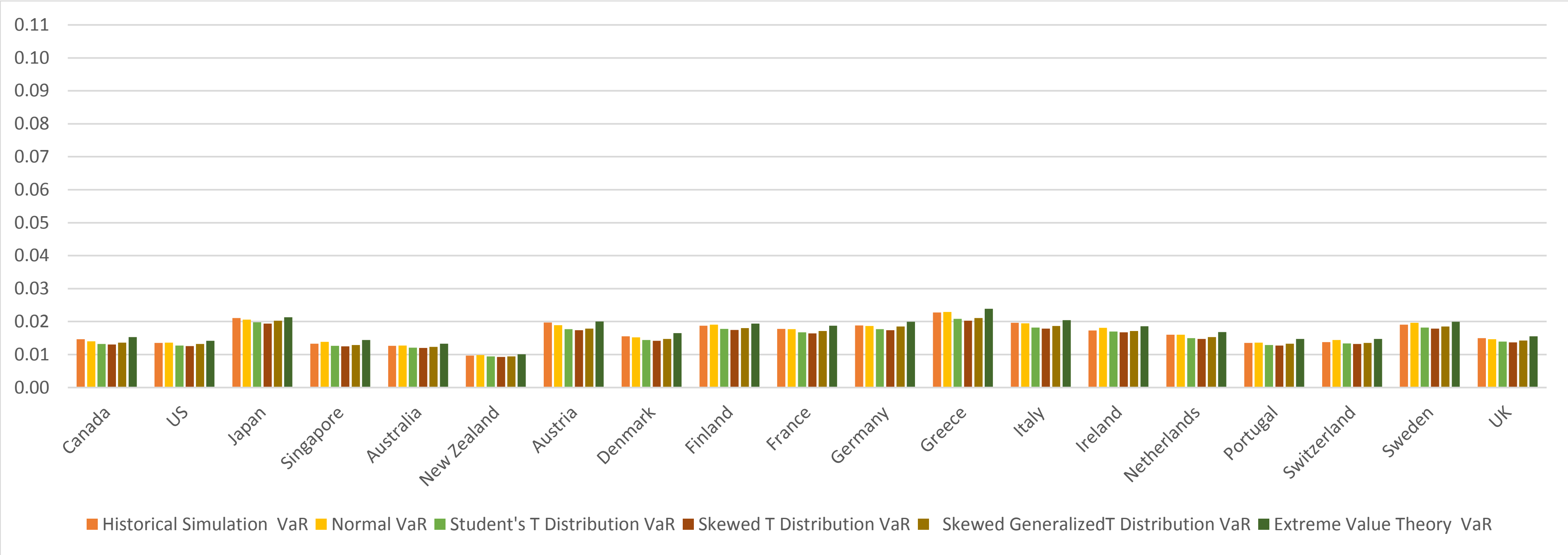


Figure 47. Developed stock exchanges the bear market VaRs
Panel A. 1% VaRs

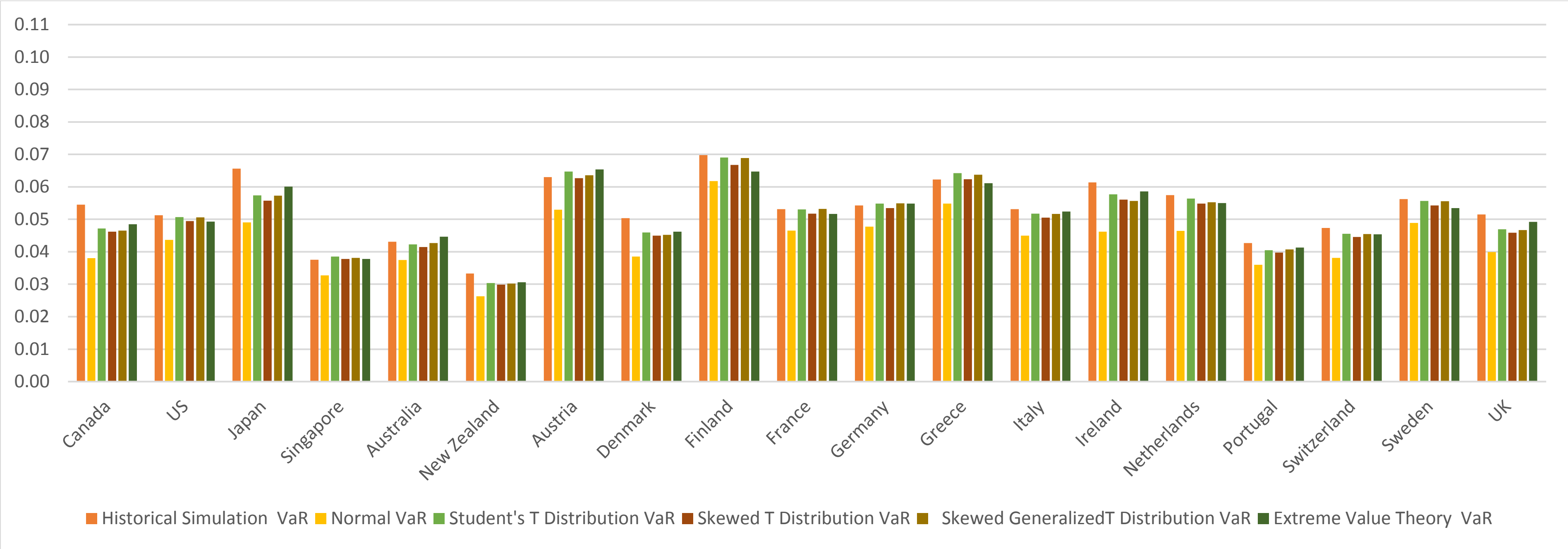


Figure 47. Developed stock exchanges the bear market VaRs

Panel B. 2.5% VaRs

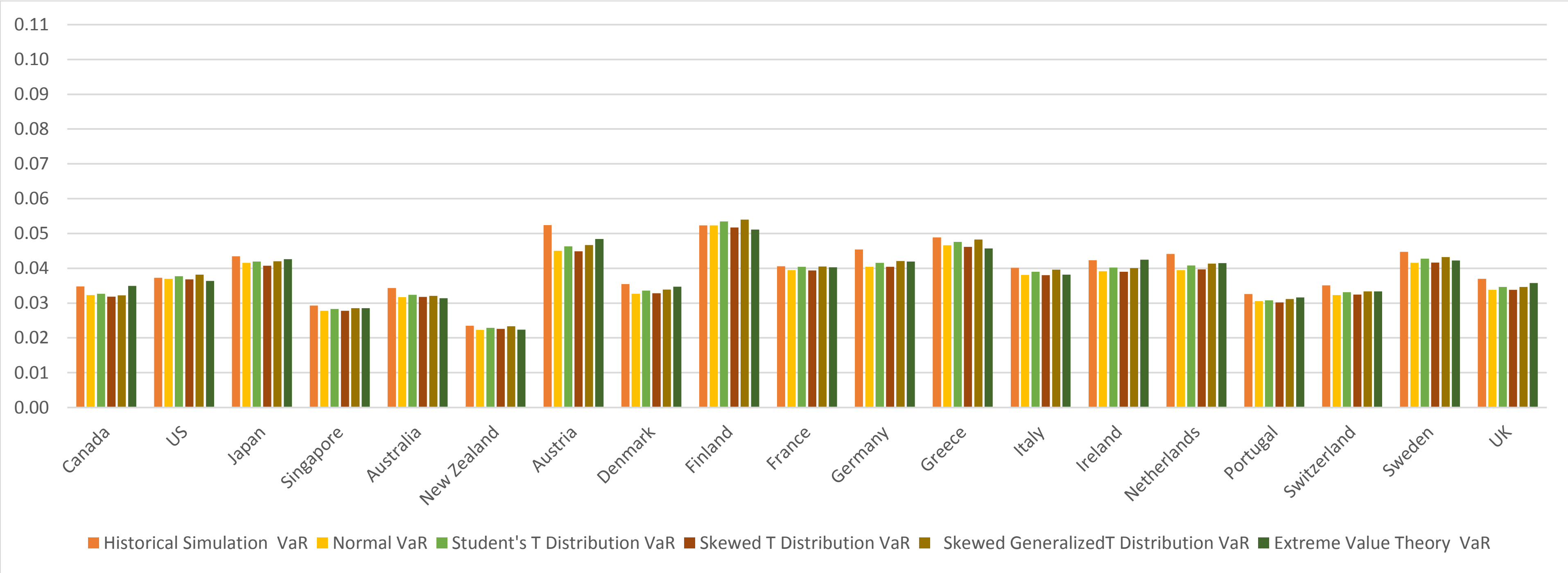
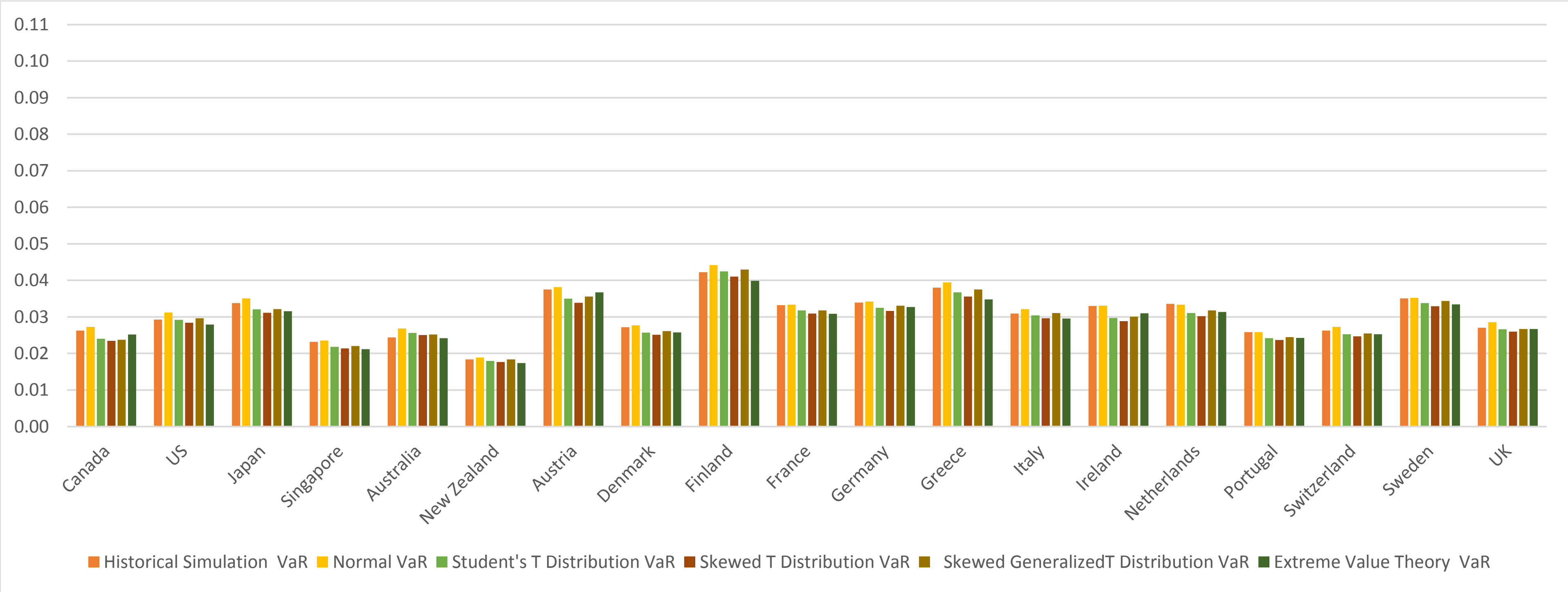


Figure 47. Developed stock exchanges the bear market VaRs

Panel C. 5% VaRs



5.2.2.2 VaR of the emerging stock exchanges

Whole sample period

Figure 48 shows the VaR estimates for the ESEs for the whole sample period for α equal 1% (Panel A), 2.5% (Panel B) and 5% (Panel C). From Figure 48, it can be seen that there are considerable differences in VaRs of different ESEs. Chile has the lowest VaR while Argentina has the highest VaR among the ESEs. This finding is consistent with the results in Section 5.1 where Chile is found to have the lowest σ while Argentina is one of the countries with highest σ. As the confidence level α increases from 1% to 5%, the VaR of each ESE decreases and the differences in VaRs among the ESEs reduce. These conclusions are robust to the change of estimation methods.

In terms of different estimation methods, Figure 48 Panel A shows that at 1% confidence level, VaRs based on N are the lowest for all ESEs. Considerably higher values of VaRs are obtained for all the other estimation methods. VaRs based on ST are slightly higher than those based on HST and SGT. The VaRs estimated by HS and EVT are similar. They are also the highest among all VaR estimates. The optimal probability density distribution model for the whole sample period for each ESE can be found in Table 19. At 1% confidence level, compared with the optimal probability density distribution model, N consistently underestimates VaR. In contrast, HS and EVT overestimate VaR. For the benchmark models, compared with the optimal probability density distribution model, the other two benchmark models tend to overestimate VaR as they overestimate VaR for 11 ESEs.

Figure 48 Panel B shows that when $a = 2.5\%$, VaRs estimated by HS and EVT are still the largest. VaRs based on N, ST, HST and SGT are comparable to each other. Hence, at $a = 2.5\%$, compared with benchmark models, N works well while HS and EVT still tend to overestimate VaR. Compared with the optimal probability density distribution model, HS and EVT overestimate VaR. N and the other two benchmark models tend to perform well by giving VaR which is similar to that of the optimal probability density distribution model for the majority of the ESEs.

Figure 48 Panel C shows that when $a = 5\%$, compared with benchmark models, N, HS and EVT tend to marginally overestimate VaR. Compared with the optimal probability density distribution model, the other two benchmark models tend to perform well by giving VaR which is similar to that of the optimal probability density distribution model for the majority of the ESEs. The increase in the relative position of VaRs based on N is consistent with our expectation because N has thinner tail at the extreme low percentile (e.g. 1%) and has fatter tail at less extreme low percentile (e.g. 5%) compared with ST, HST and SGT.

The bull/bear markets

Figure 49 presents the bull market VaRs for the ESEs for α equal to 1% (Panel A), 2.5% (Panel B) and 5% (Panel C). Figure 50 shows analogous results obtained for the bear markets. Comparing Figure 48 and Figure 49, it can be seen that each VaR of the bull markets is lower than that of the whole sample period. From Figure 49, it can be seen that during the bull markets, Chile has the lowest VaR while Argentina has the highest VaR among the ESEs. This finding is consistent with the results of the whole sample period. There exist also considerable differences in the bull market VaRs among other ESEs during the bull markets. As the confidence level α increases from 1% to 5%, the differences in the bull market VaRs among the ESEs reduce. These conclusions are robust to the change of estimation methods.

In terms of different estimation methods, from the bull market results of Figure 49, it can be seen that for each ESE, HS and EVT tend to deliver similar VaRs at all the three confidence levels ($\alpha = 1\%, 2.5\%,$ and 5%). At $\alpha = 1\%$, HS and EVT give the highest VaRs while N gives the lowest VaRs. In other words, when $\alpha = 1\%$, compared with the optimal probability distribution model, HS and EVT overestimate VaR while N underestimates VaR. At $\alpha = 2.5\%$, HS and EVT still give the highest VaRs. Hence at $\alpha = 2.5\%$, compared with the optimal probability distribution model, HS and EVT still overestimate VaR. Compared with the optimal probability distribution model, the other two probability density distribution models tend to underestimate VaR as they underestimate VaR for 13 ESEs. When $\alpha = 5\%$, all the conclusions based on the results for $\alpha = 2.5\%$ are preserved except that N tends to deliver the highest VaRs, i.e., N tends to overestimate VaR.

With regard to the results of the bear markets, comparing Figure 48 and Figure 50, it can be seen that each VaR for the bear markets is much higher than that for the whole sample period. This finding is intuitive as the bear market is expected to have higher tail risk.

During the bear markets, Chile still has the lowest VaR while Russia replaces Argentina as the country with the highest VaR.

Based on Figure 50 Panel A, when $\alpha = 1\%$ the benchmark models tend to give quite different VaRs. ST tends to give the highest VaR among benchmark models except for Pakistan and Taiwan. N gives the lowest VaR across all ESEs. There exists also considerable difference in VaR given by HS and EVT. Therefore, compared with benchmark models, N consistently underestimates VaR across all ESEs. HS overestimate VaR for all ESEs except for Pakistan, Taiwan, and Mexico. EVT may overestimate or underestimate VaR depending on the exchange. When α increases to 2.5%, most of the conclusions based on when $\alpha = 1\%$ are preserved. However, the difference between VaRs based on N and benchmark models is reduced. At $\alpha = 5\%$, the difference between VaRs given by benchmark models is reduced. Compared with benchmark models, both HS and N tend to overestimate VaR. EVT may overestimate or underestimate VaR depending on the exchange.

Based on Table 19, the stock returns of Mexico follow HST for the whole sample period. As the market switches from the bull market to the bear market, Mexico stock returns changes to ST from SGT. It is appropriate to use HST for the whole sample period to calculate 1% VaR. 1% VaR will be overestimated if HST is still used in the bull market when the stock returns follow SGT. In contrast, 1% VaR will be underestimated if SGT or HST is still used in the bear market when the stock returns follow ST. Similar conclusions can be drawn for some other ESEs.

Summary

In summary, no matter what estimation methods are adopted, as α increase from 1% to 5%, VaR decreases. This negative relationship between VaR and α is found for whole sample period and the bull/bear markets. There is considerable difference in VaRs of different ESEs. In addition, the bull market VaR is lower than the whole sample period VaR while the bear market VaR is much higher than the whole sample period VaR.

Benchmark models give different VaRs for ESEs. Compared with benchmark models, N tends to significantly underestimate VaR at 1% confidence level and overestimate VaR at 5% confidence level for the whole sample period and the bull/bear markets. At 2.5% confidence level, N performs well by giving VaR which is similar to that of the benchmark models. HS and EVT tend to overestimate VaR at all confidence levels for the whole sample period and the bull market. However, for the bear market, HS and EVT overestimate VaR for some ESEs and underestimate VaR for some other ESEs. If a single probability density distribution model is used for the whole sample period, the bull market and the bear market, the VaR estimation based on this particular probability density distribution model may be biased under different market regimes.

Figure 48. Emerging stock exchanges whole sample period VaRs

Panel A. 1% VaRs

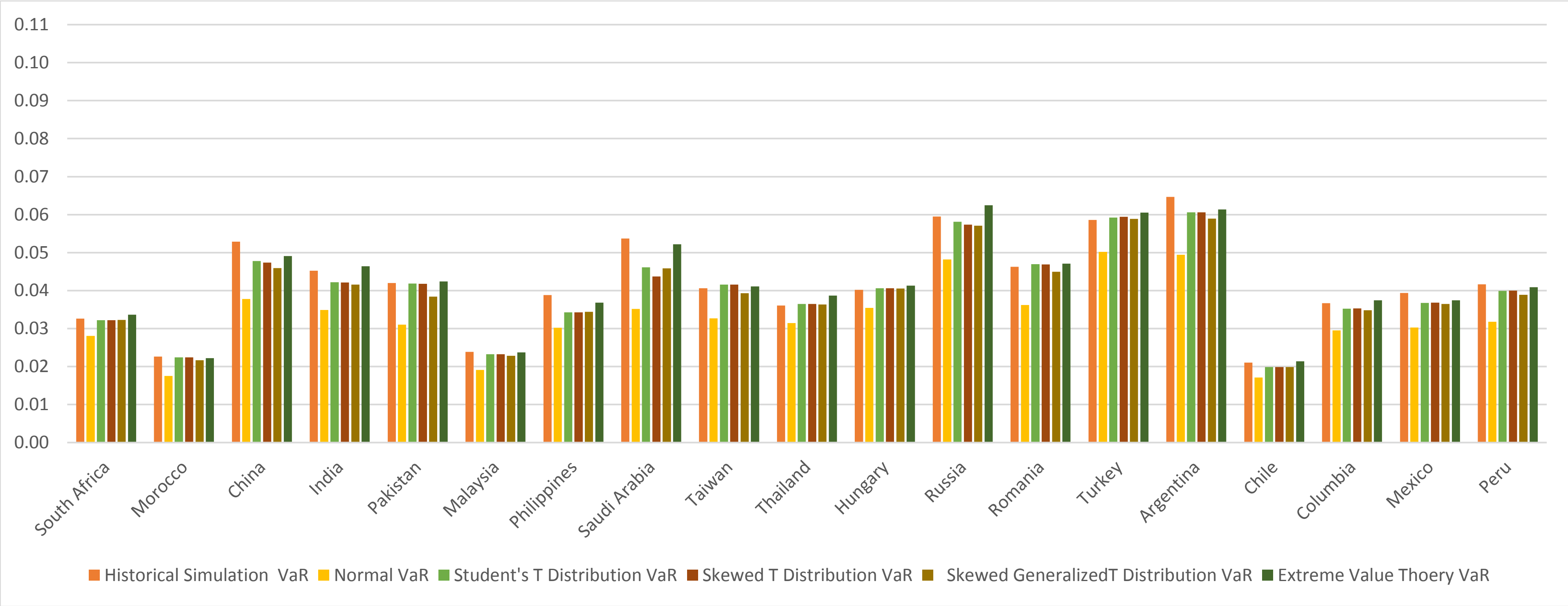


Figure 48. Emerging stock exchanges whole sample period VaRs

Panel B. 2.5% VaRs

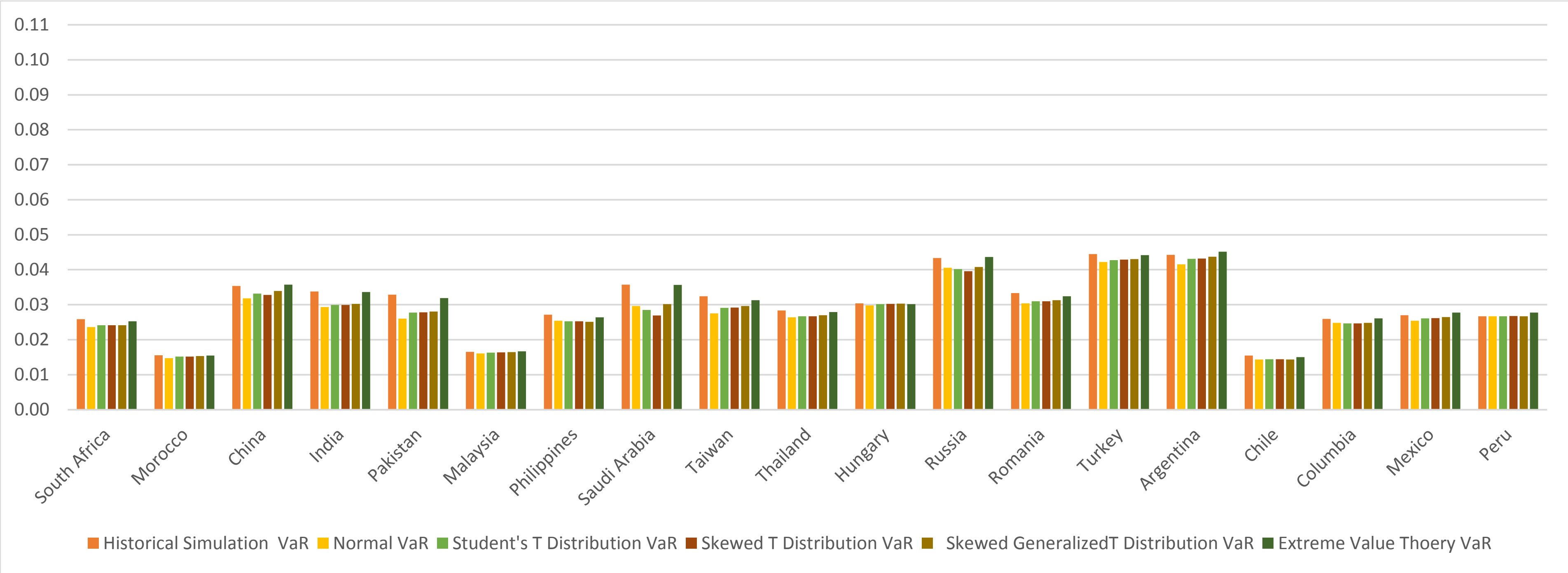


Figure 48. Emerging stock exchanges whole sample period VaRs
Panel C. 5% VaRs

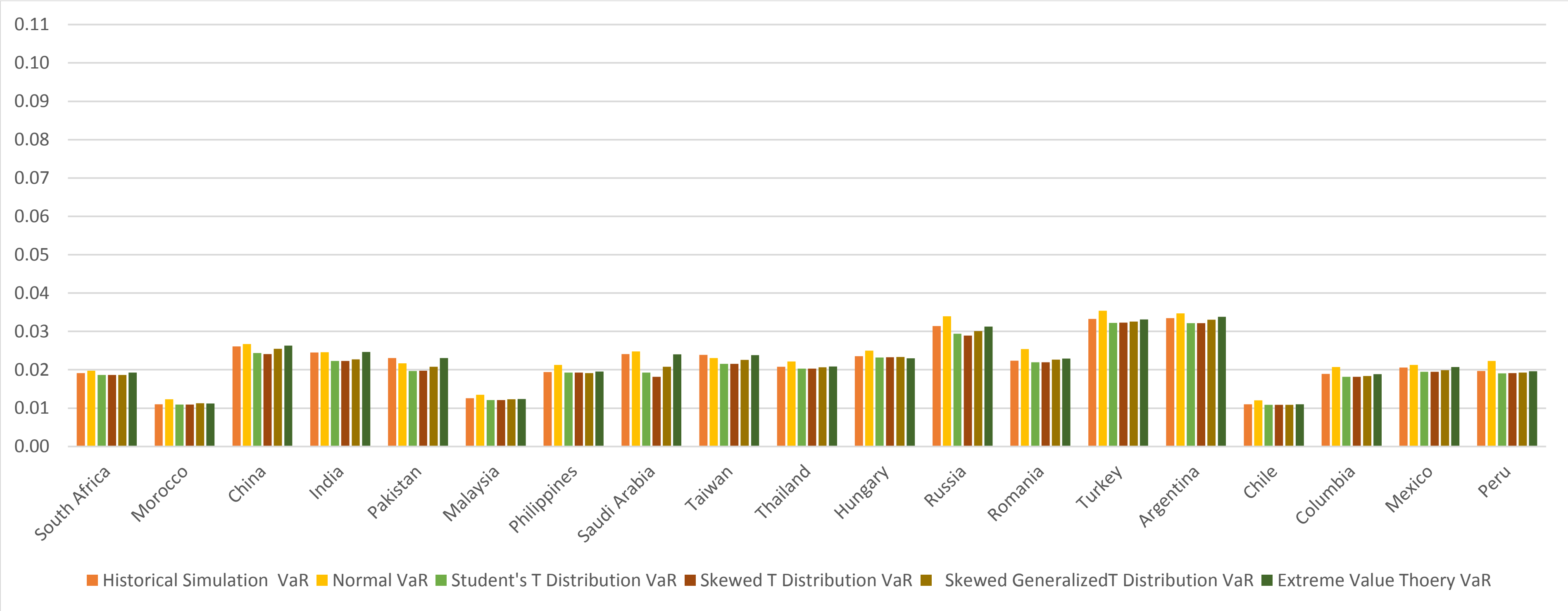


Figure 49. Emerging stock exchanges bull market VaRs
Panel A. 1% VaRs

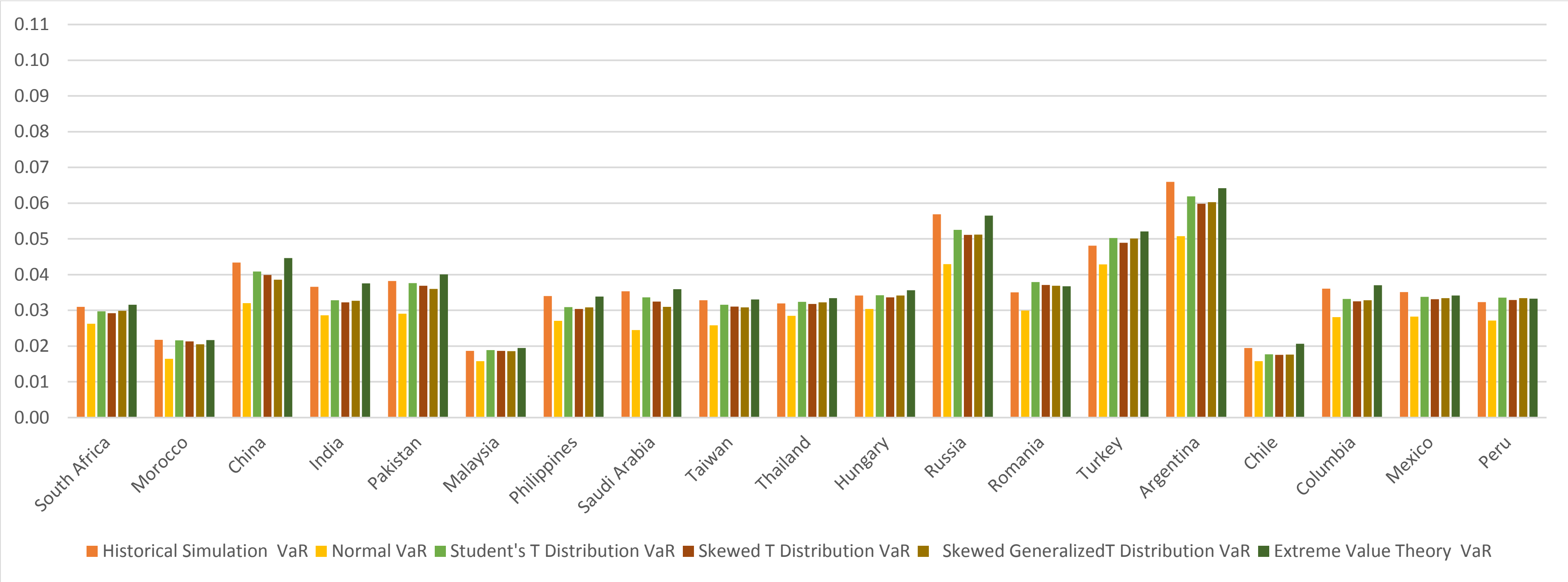


Figure 49. Emerging stock exchanges bull market VaRs
Panel B. 2.5% VaRs

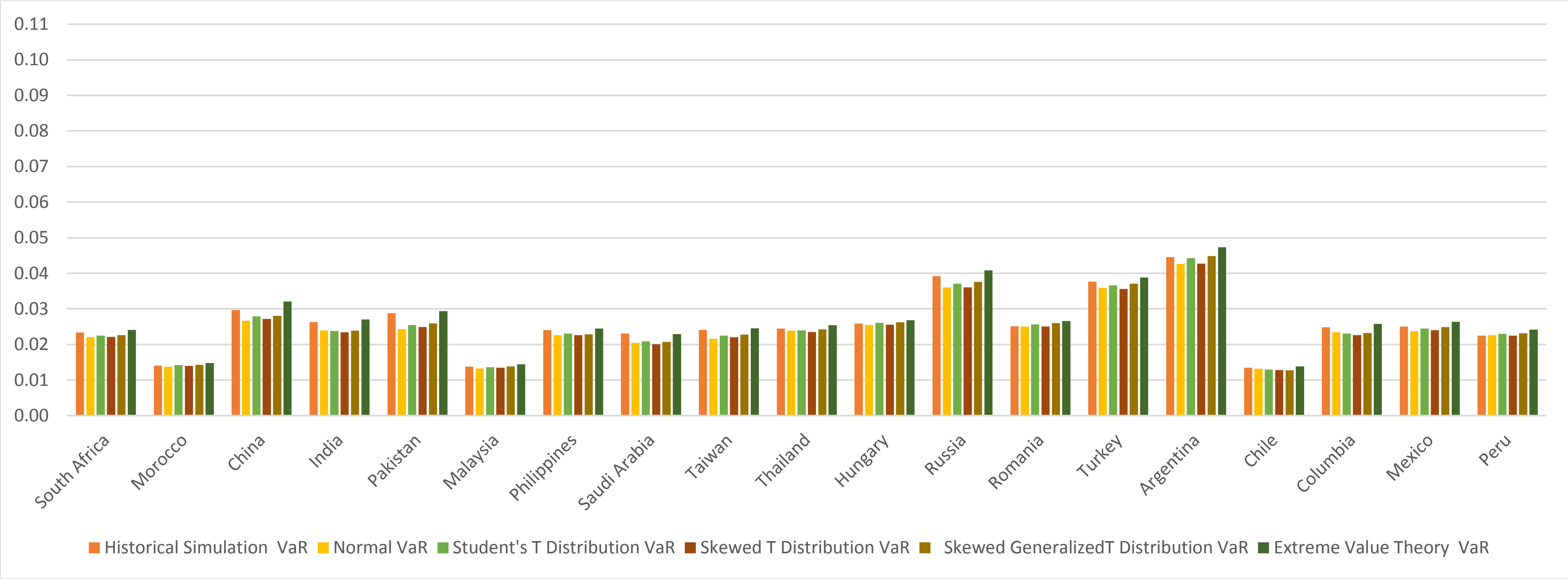


Figure 49. Emerging stock exchanges bull market VaRs
Panel C. 5% VaRs

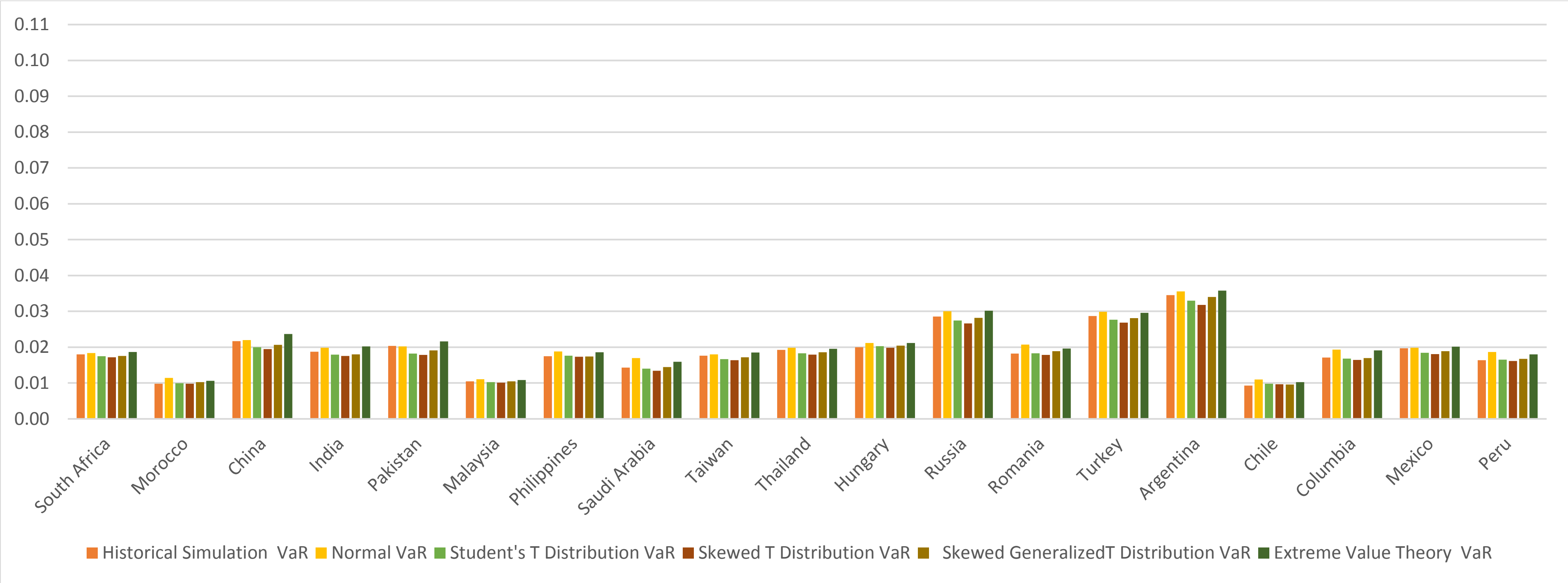


Figure 50. Emerging stock exchanges bear market VaRs

Panel A. 1% VaRs

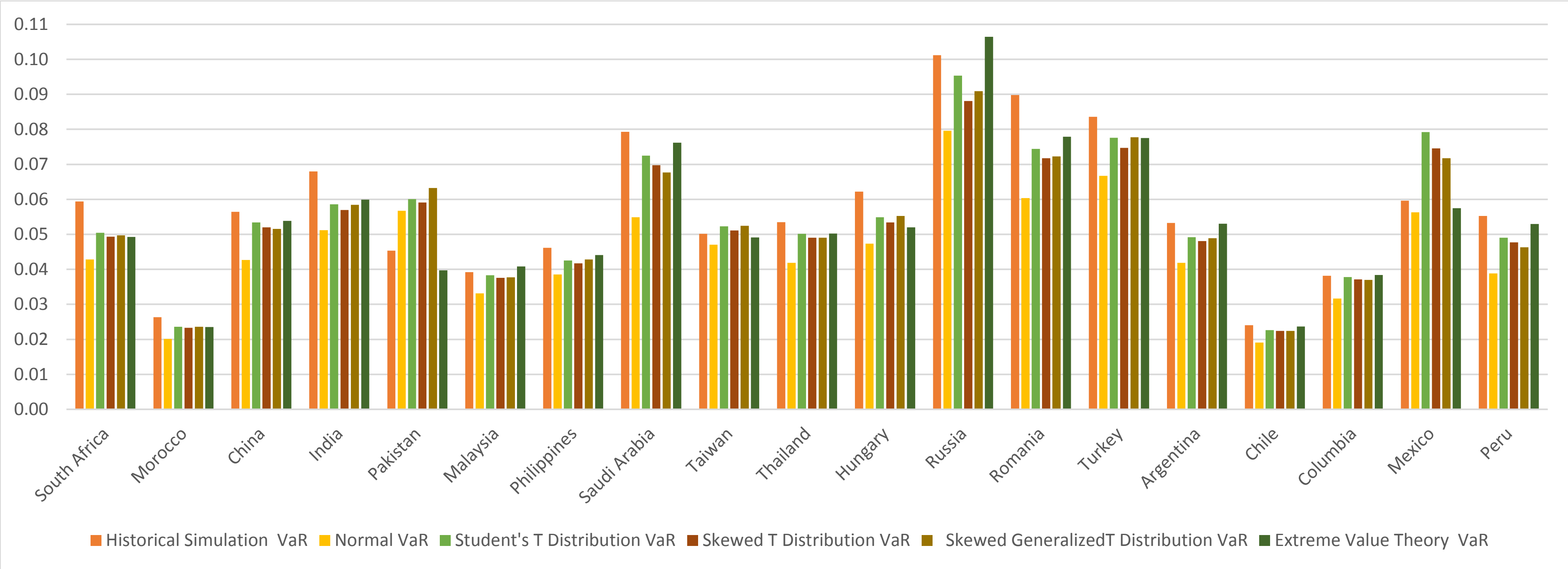


Figure 50. Emerging stock exchanges bear market VaRs
Panel B. 2.5% VaRs

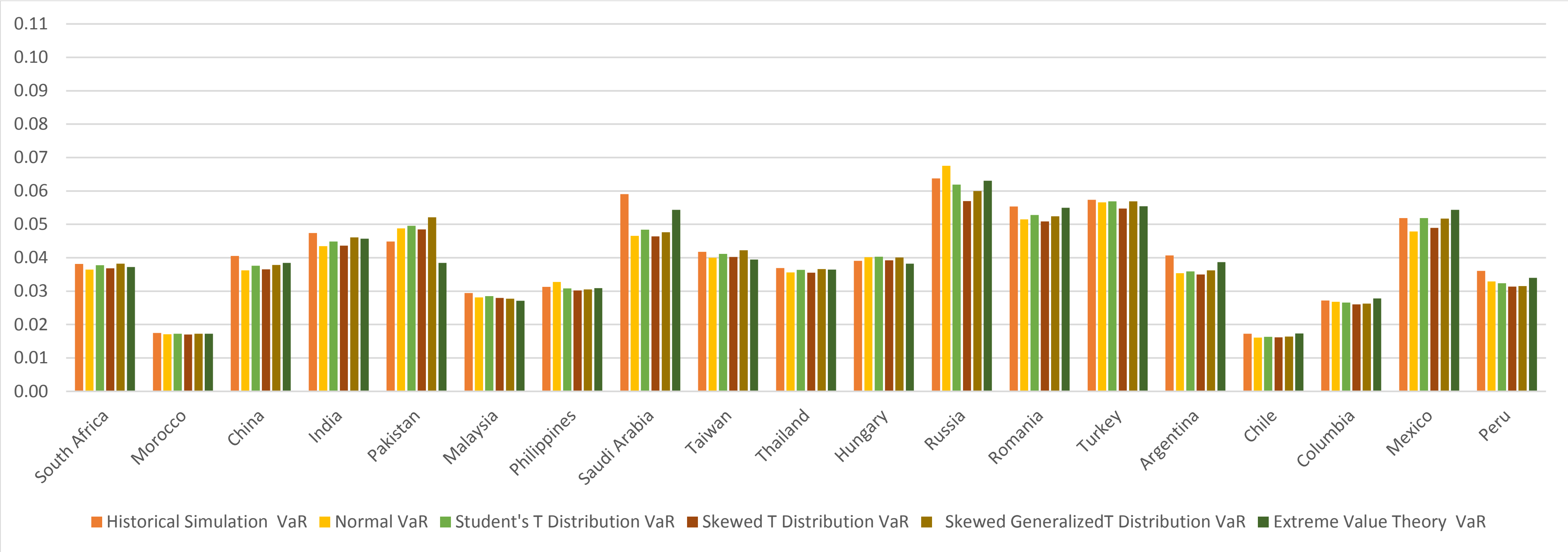
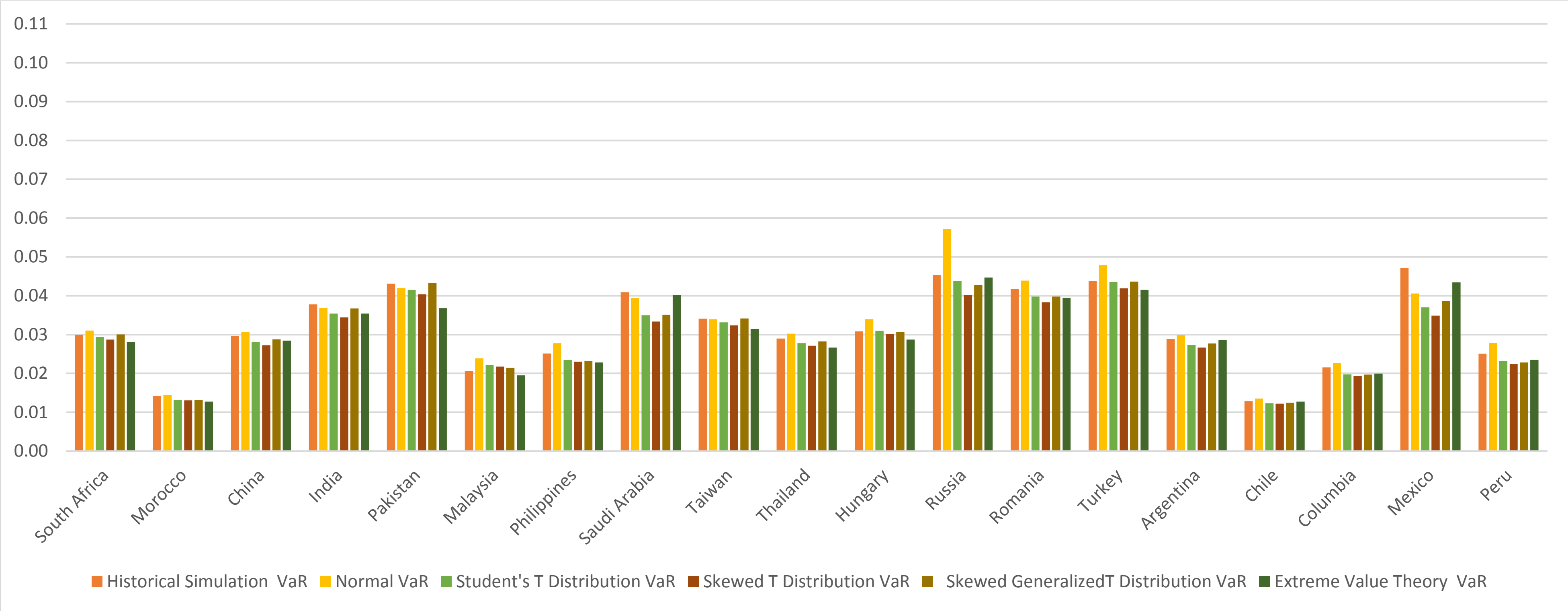


Figure 50. Emerging stock exchanges bear market VaRs
Panel C. 5% VaRs



5.2.3 ES

5.2.3.1 ES of the developed stock exchanges

The whole sample period

Figure 51 shows the ES estimates for the DSEs for the whole sample period for α equal 1% (Panel A), 2.5% (Panel B) and 5% (Panel C). From Figure 51, it can be seen that there are considerable differences in ESs of different DSEs. New Zealand has the lowest ES while Finland has the highest ES among DSEs. This finding is consistent with the results in Section 5.1 where New Zealand is found to have the lowest σ while Finalnd is found to have the very high σ. As the confidence level α increases from 1% to 5%, ES of each DSE decreases the differences in ESs among the DSEs reduce. These conclusions are robust to the change of estimation methods.

In terms of different estimation methods, Figure 51 Panel A shows that at 1% confidence level, ESs based on N are the lowest for all DSEs. Considerably higher values of ESs are obtained for all the other estimation methods. With regarding to the benchmark models, the differences of ES given by ST and HST are small. However, ES given by SGT can be considerably smaller than those given by ST and SHT. The ESs estimated by HS and EVT are similar in magnitude. The optimal probability density distribution model for the whole sample period for each DSE can be found in Table 19. At 1% confidence level, compared with the optimal probability density distribution model, N consistently underestimates ES. In contrast, HS and EVT may overestimate or underestimate ES depending on the exchange. For the benchmark models, compared with the optimal probability density distribution model, the other two benchmark models tend to overestimate ES as they overestimate ES for 12 DSEs. Figure 51 Panel B shows that when $\alpha = 2.5\%$, most of the conclusions based on the results for $\alpha = 1\%$ are preserved. Figure 51 Panel C shows that when $\alpha = 5\%$, benchmark models give similar ESs. Compared with benchmark models, N consistently underestimate ES. HS and EVT overestimate ES. The difference between ESs given by different estimation methods reduces. The underestimate of ES by N is consistent with our expectation because N has thin tail compared with ST, HST and SGT after the extreme low percentile (e.g. 5%) and hence tend to underestimate ES which is the opposite number of the expectation of all values lower than the percentile.

The bull/bear markets

Figure 52 presents the bull market ESs for the DSEs for α equal to 1% (Panel A), 2.5% (Panel B) and 5% (Panel C). Figure 53 shows analogous results obtained for the bear markets. Comparing Figure 51 and Figure 52, it can be seen that each ES of the bull markets is lower than that of the whole sample period. From Figure 52, it can be seen that during the bull market, New Zealand has the lowest ES while Greece has the highest ES among DSEs. This finding is consistent with the results of the whole sample period. There exist also considerable differences in the bull market ESs among other DSEs during the bull market. As the confidence level α increases from 1% to 5%, the differences in the bull market ESs among the DSEs reduce. These conclusions are robust to the change of estimation methods.

In terms of different estimation methods, from the bull market results of Figure 52, it can be seen that for each DSE, HS and EVT tend to deliver similar ESs at all the three confidence levels ($\alpha = 1\%, 2.5\%, \text{and } 5\%$). With regarding to the benchmark models, the differences of ES given by ST and HST are small. However, ES given by SGT can be significantly smaller than those given by ST and SHT. As α increases, the differences between ESs given by benchmark models decrease. N consistently underestimates ES for all three confidence levels. At $\alpha = 1\%$ and $\alpha = 2.5\%$, compared with benchmark models, HS and EVT slightly overestimate ES for some DSEs and slightly underestimate ES for some other DSEs. When $\alpha = 5\%$, HS and EVT consistently overestimate ES for all DSEs.

With regard to the results of the bear markets, comparing Figure 51 and Figure 53, it can be seen that each ES for the bear markets is much higher than that for the whole sample period. This finding is intuitive as the bear market is expected to have higher tail risk. During the bear market, New Zealand still has the lowest ES while ES of Austria increases significantly and even replaces Greece as the country with the highest ES at $\alpha = 1\%$.

In terms of different estimation methods, from the bear market results of Figure 52, it can be seen that for each DSE, HS and EVT tend to deliver similar ESs at all the three confidence levels ($\alpha = 1\%, 2.5\%, \text{and } 5\%$). With regarding to the benchmark models, the differences of ES given by ST, HST and SGT can be significant and these difference reduce as α increases. N consistently underestimates ES for all three confidence levels.

At $\alpha = 1\%$, compared with the optimal probability density distribution model, HS and EVT tend to underestimate ES for all DSEs except for Japan, Singapore, and Portugal. At $\alpha = 2.5\%$ and 5%, HS and EVT perform well by giving ESs which are similar to those given by benchmark models.

Based on Table 19, the stock returns of Finland follow SGT for the whole sample period. As the market switches from the bull market to the bear market, the Finland stock returns changes to ST from HST. It is appropriate to use SGT for the whole sample period to calculate 1% ES. 1% ES will be underestimated if SGT is still used in the bull market when the stock returns follow HST. And 1% ES will be significantly underestimated if SGT is still used in the bear market when the stock returns follow ST. Similar conclusions can be drawn for other DSEs.

Summary

In summary, no matter what estimation methods are adopted, as α increase from 1% to 5%, ES decreases. This negative relationship between ES and α is found for whole sample period and the bull/bear markets. There is considerable difference in ESs of different DSEs. In addition, the bull market ES is lower than the whole sample period ES while the bear market ES is much higher than the whole sample period ES.

N consistently underestimates ES at all three confidence levels for the whole sample period and the bull/bear markets. There exist considerable difference among ES given by benchmark models at $\alpha = 1\%$ and this difference reduces significantly as α increases. HS and EVT consistently give similar ESs. However, HS and EVT may overestimate ES or underestimate ES for different DSEs. If a single probability density distribution model is used for the whole sample period, the bull market and the bear market, the ES estimation based on this particular probability density distribution model may be biased under different market regimes.

Figure 51. Developed stock exchanges whole sample period ESs

Panel A. 1% ESs

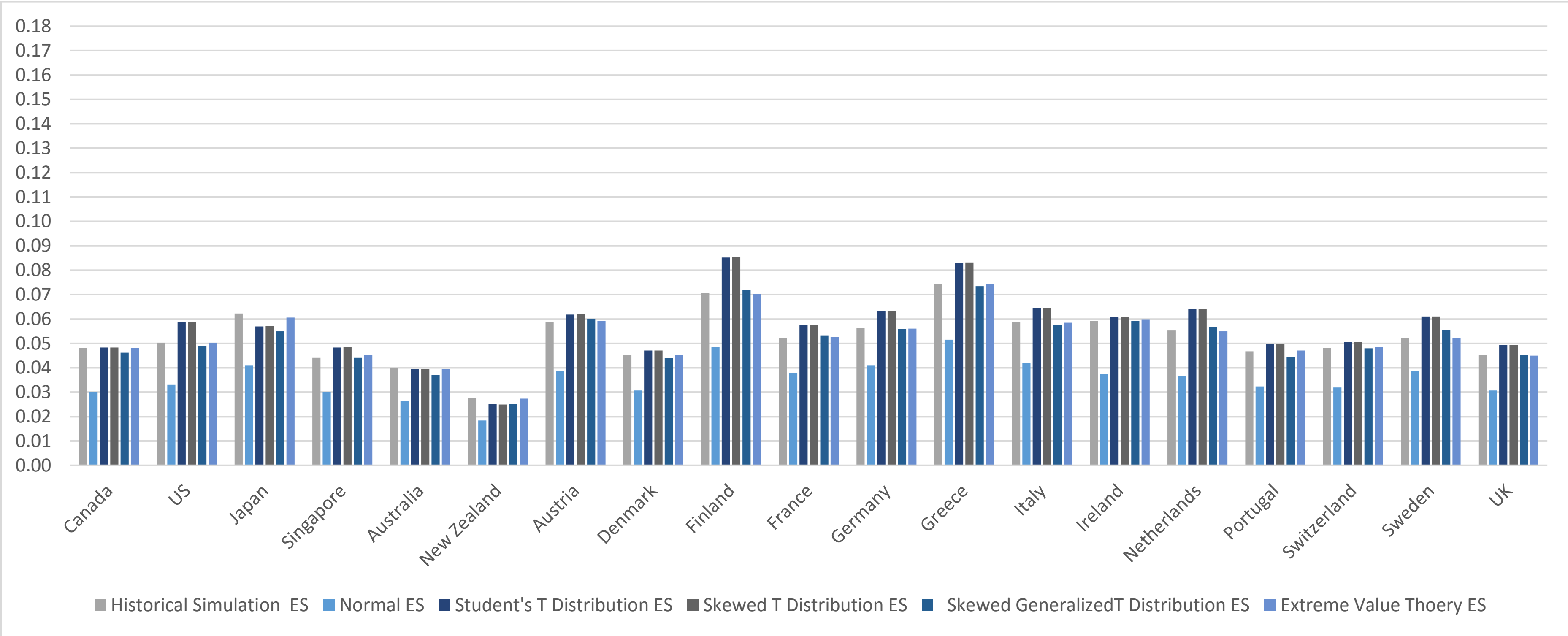


Figure 51. Developed stock exchanges whole sample period ESs

Panel B. 2.5% ESs

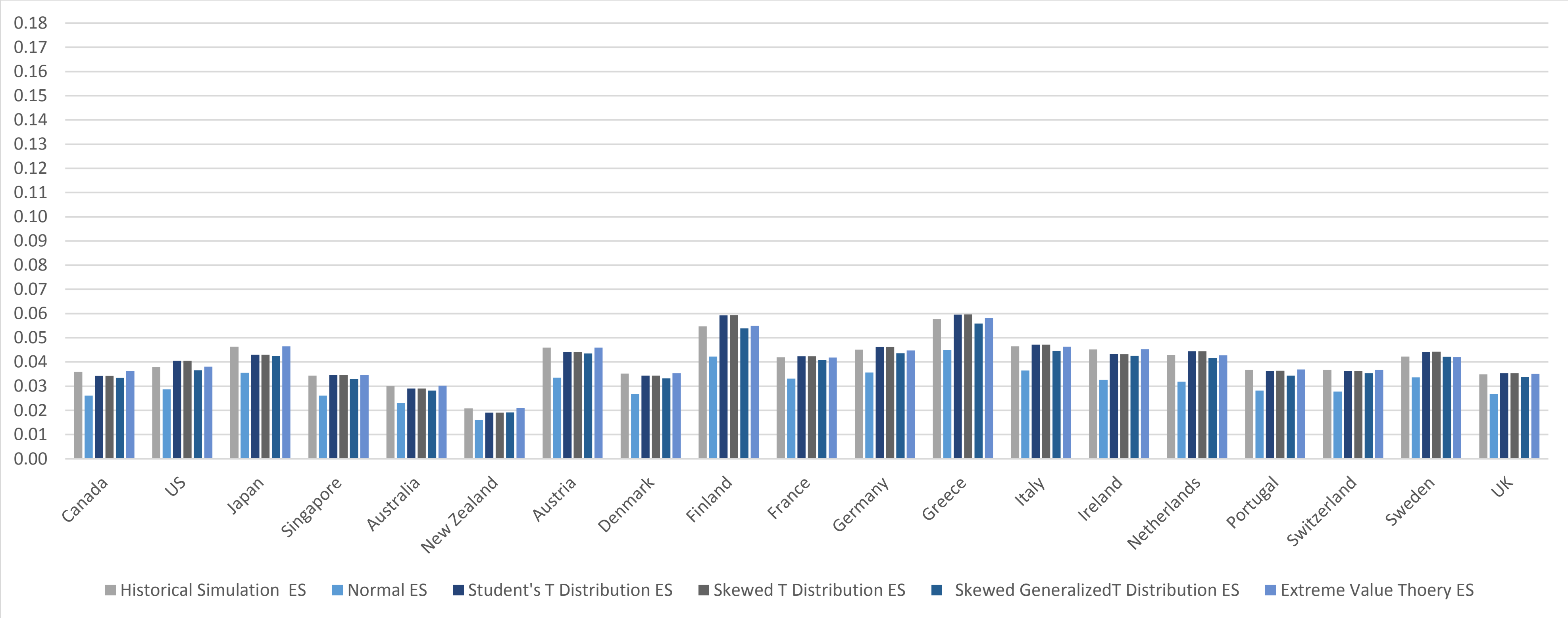


Figure 51. Developed stock exchanges whole sample period ESs

Panel C. 5% ESs

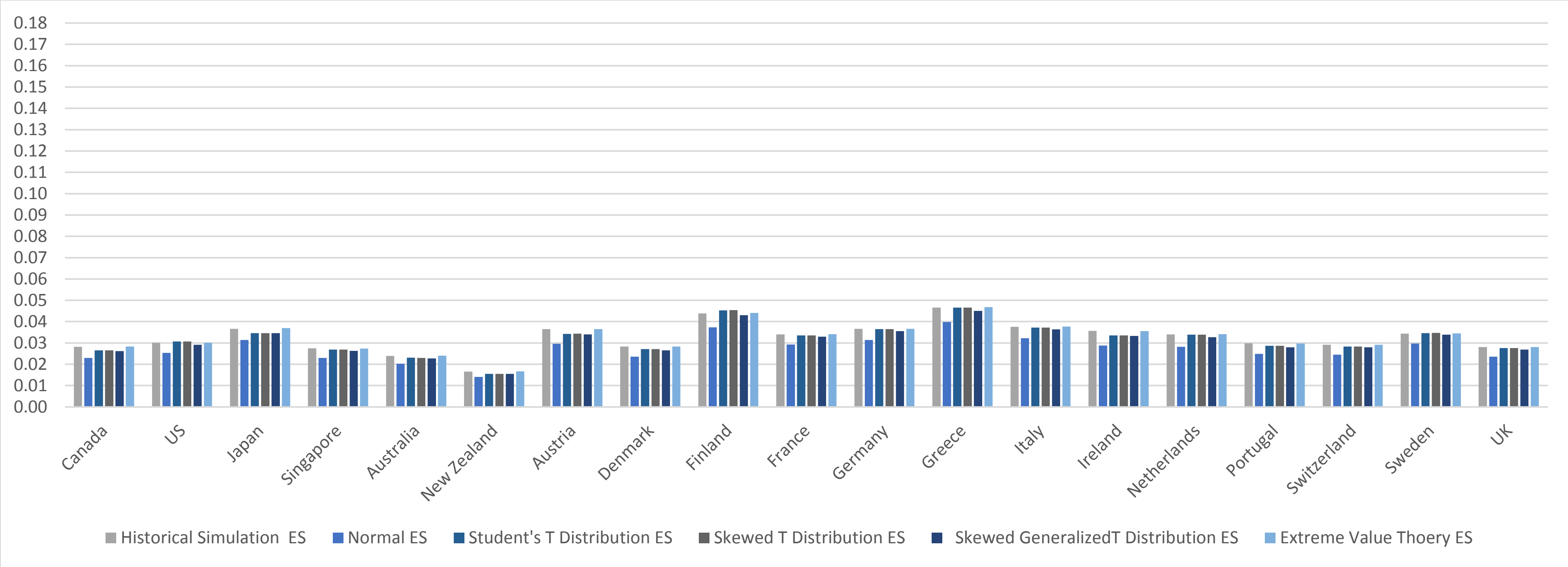


Figure 52. Developed stock exchanges bull market ESs

Panel A. 1% ESs

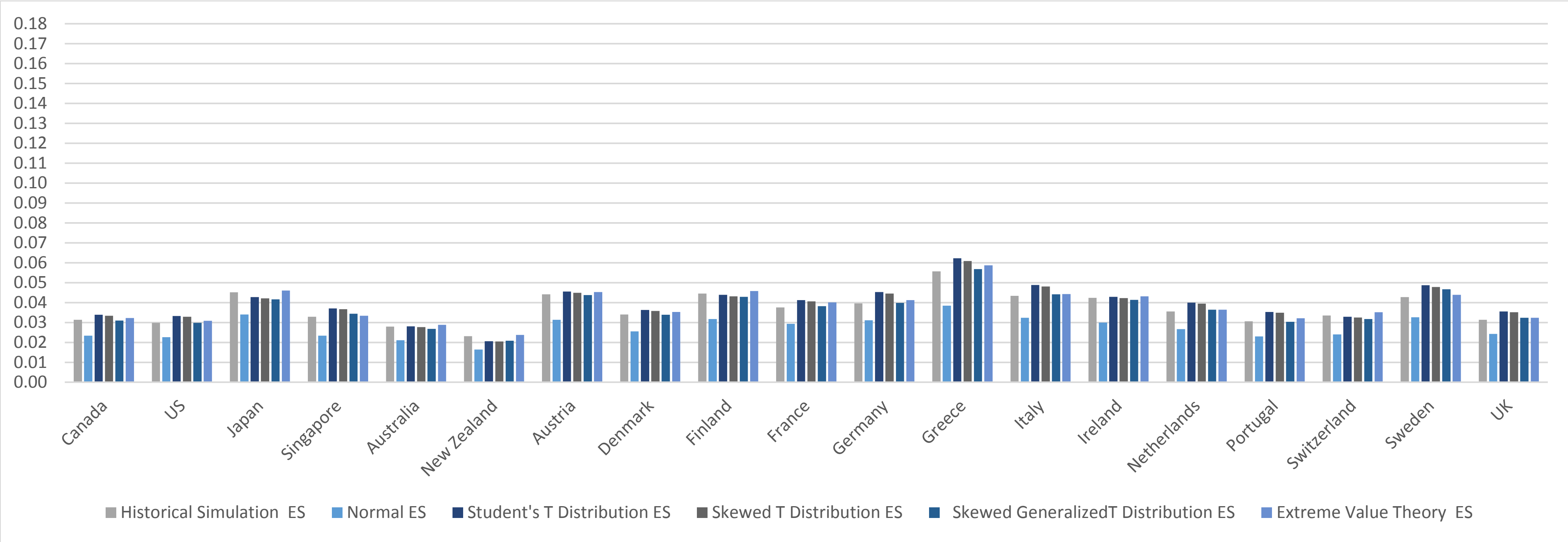


Figure 52. Developed stock exchanges bull market ESs
Panel B. 2.5% ESs

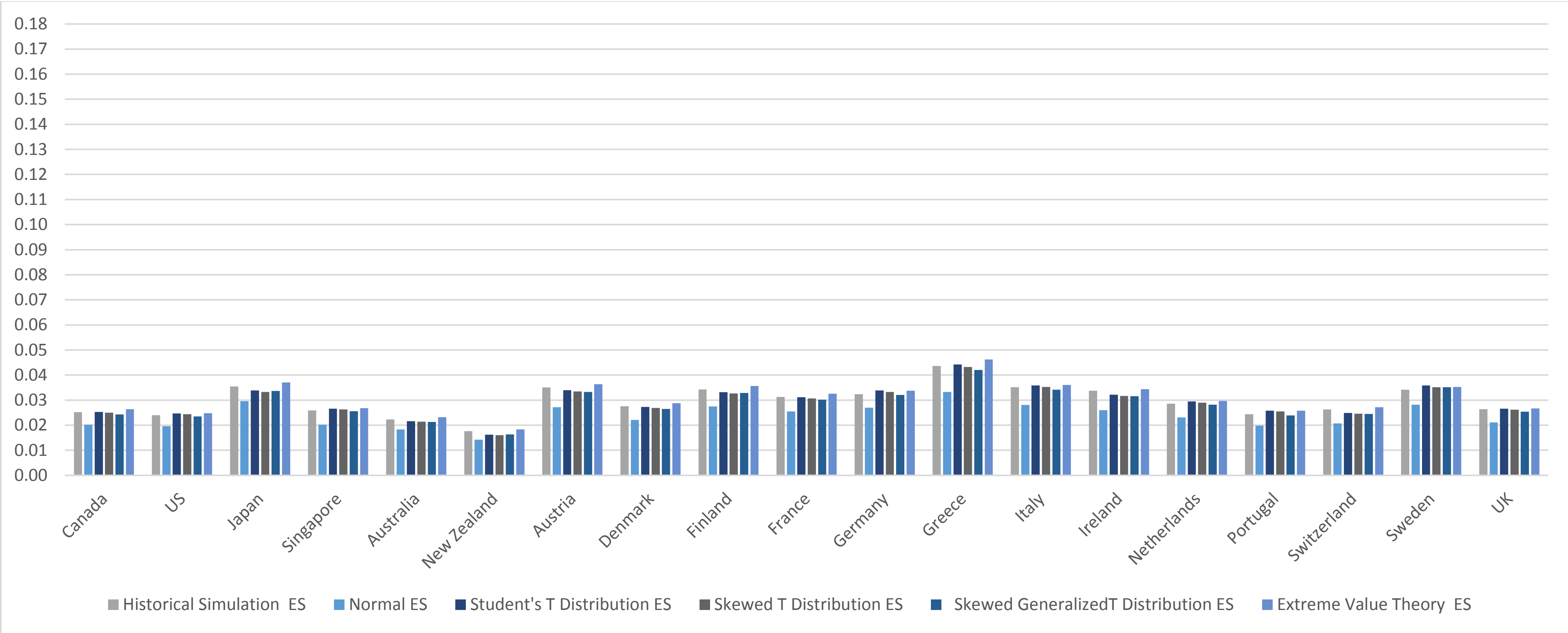


Figure 52. Developed stock exchanges bull market ESs

Panel C. 5% ESs

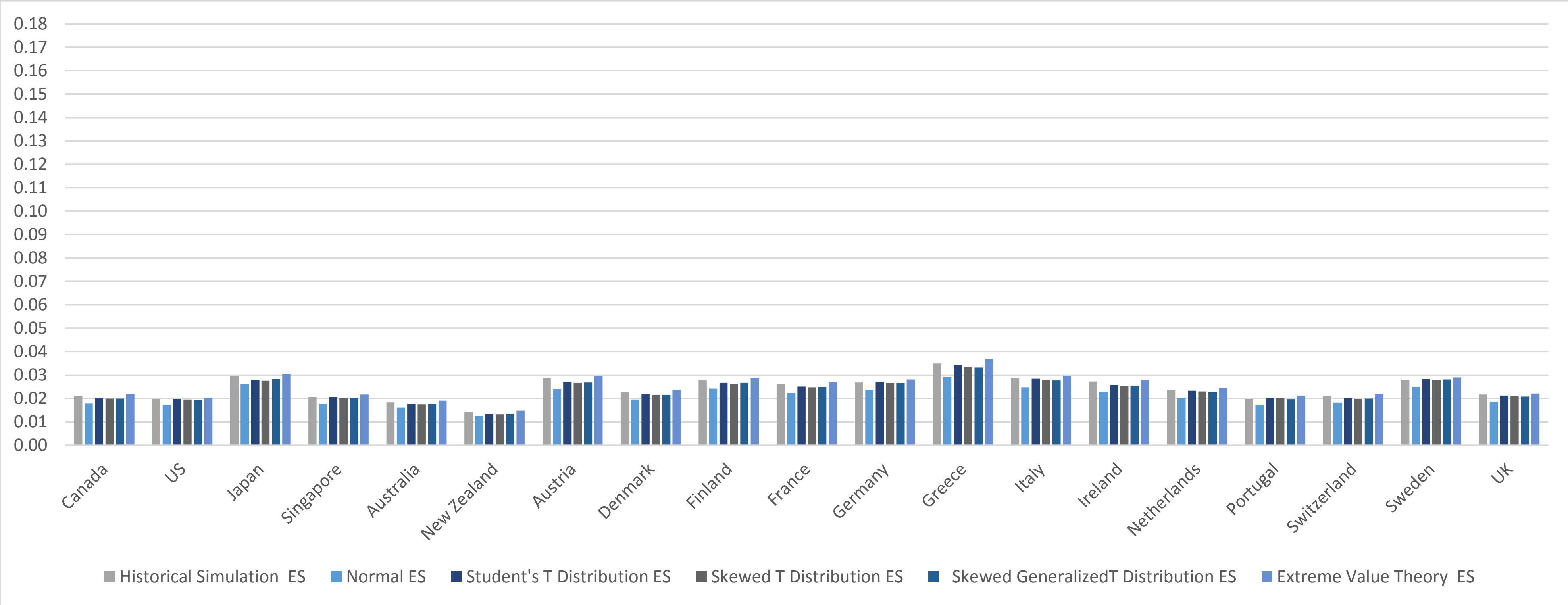


Figure 53. Developed stock exchanges bear market ESs

Panel A. 1% ESs

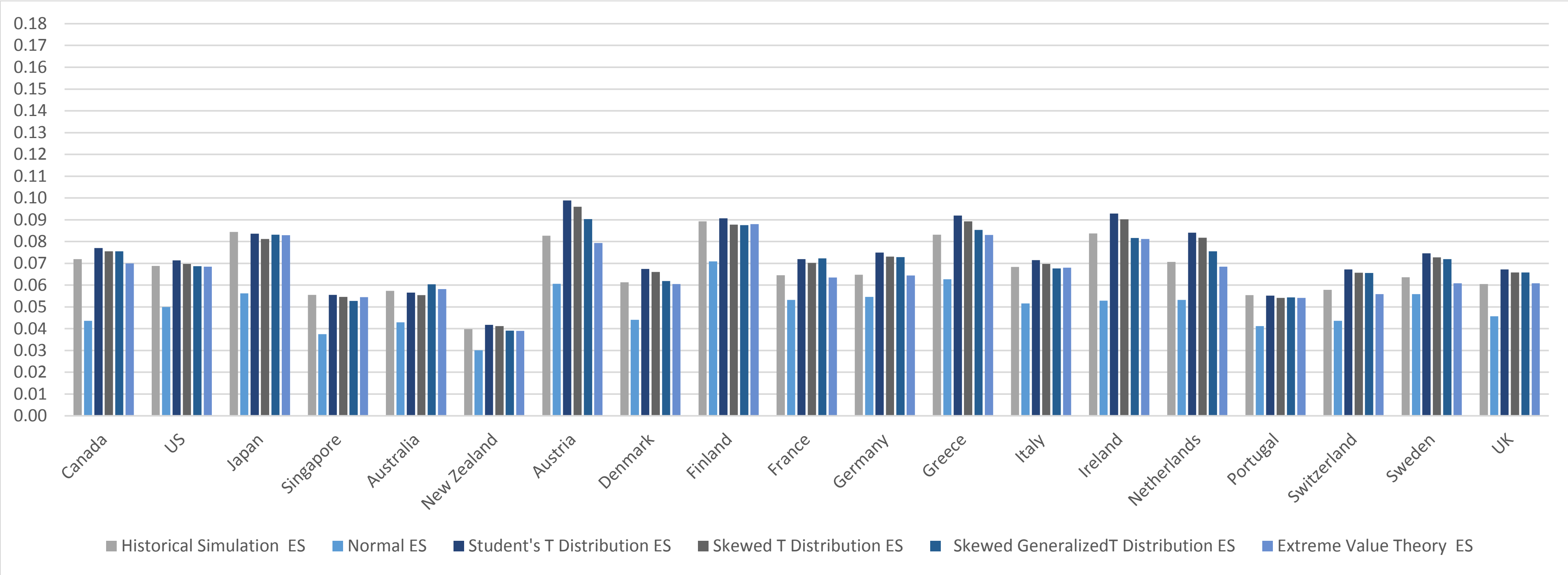


Figure 53. Developed stock exchanges bear market ESs

Panel B. 2.5% ESs Bear Market

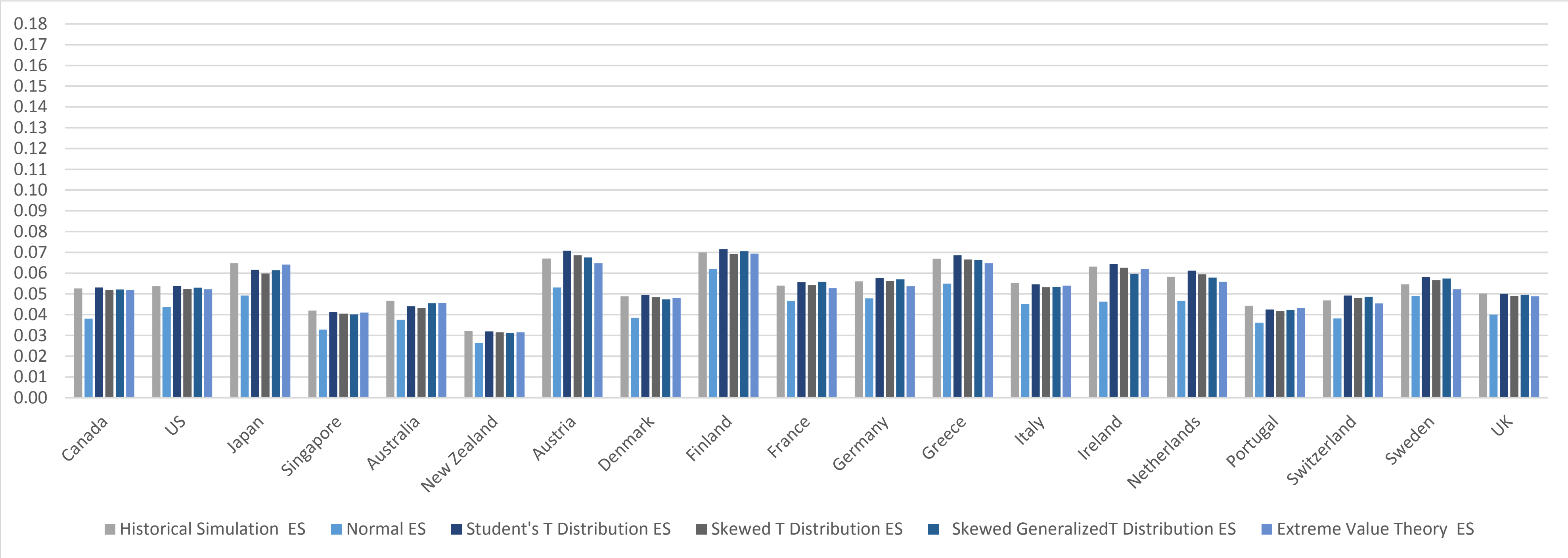
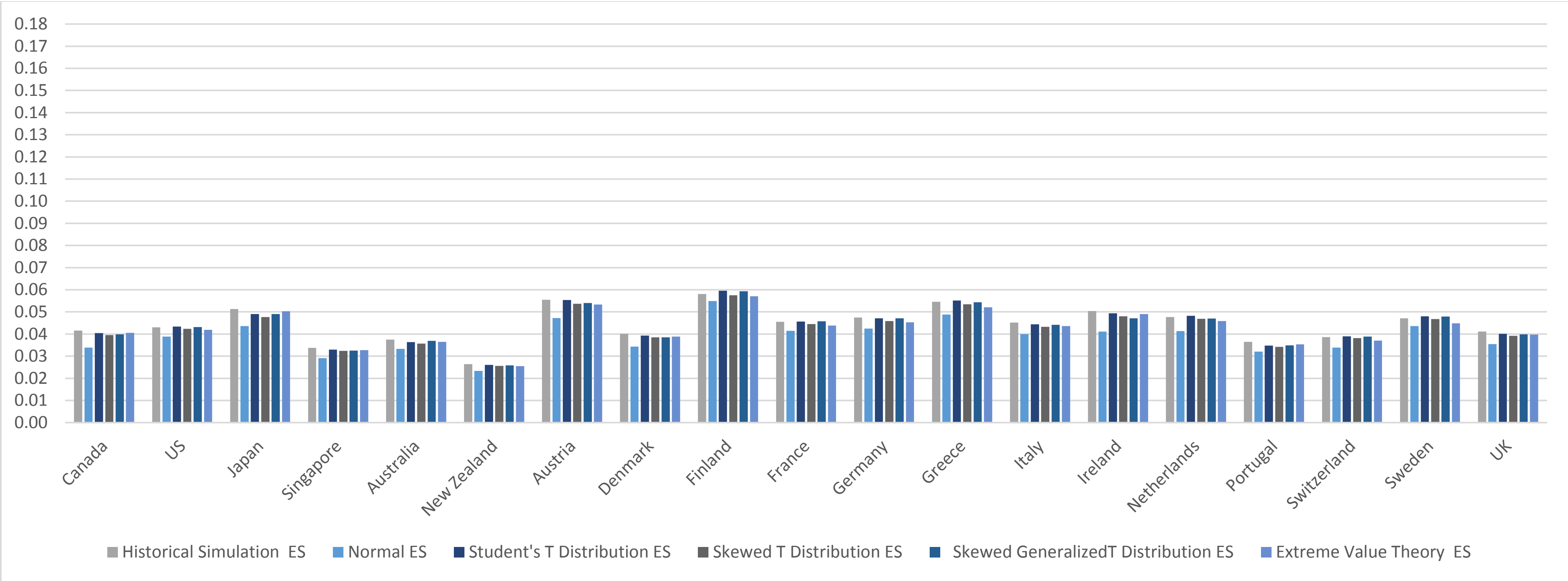


Figure 53. Developed stock exchanges bear market ESs
Panel C. 5% ESs



5.2.3.2 ES for emerging stock exchanges

The whole sample period

Figure 54 shows the ES estimates for the ESEs for the whole sample period for α equal 1% (Panel A), 2.5% (Panel B) and 5% (Panel C). From Figure 54, considerable differences can be found in ESs of different ESEs. For instance, Chile has the lowest ES while Saudi Arabia has the highest ES among the ESEs. This finding is consistent with the results in Section 5.1 where Chile is found to have the lowe σ while Saudi Arabia is found to have the very high σ. As the confidence level α is increased from 1% to 5%, ES of each ESE decreases the differences in ESs among the ESEs reduce. These conclusions are robust to the change of estimation methods. In terms of different estimation methods, Figure 54 Panel A shows that at 1% confidence level, ESs based on N are the lowest for all ESEs. Considerably higher values of ESs are obtained for all the other estimation methods. There exist considerable differences of ESs estimates given by the benchmark models. The ESs estimated by HS and EVT are similar in terms of the magnitude. Therefore, at 1% confidence level, compared with the benchmark models, N consistently underestimates ES. HS and EVT tend to underestimate ES for most of the ESEs. Figure 54 Panel B shows that when $a = 2.5\%$, N consistently underestimates ES. The differences of ESs given by benchmark models is found to be reduced. ESs estimated by HS and EVT become comparable to those given by benchmark models. Hence, at $a = 2.5\%$, compared with benchmark models, N underestimates ES. HS and EVT may underestimate or overestimate ES depending on the exchange. Figure 54 Panel C shows that when $a = 5\%$, benchmark models give similar ESs. Compared with benchmark models, N consistently underestimates ES. HS and EVT may underestimate or overestimate ES depending on the exchange. The underestimate of ES by N is consistent with our expectation because N has thin tail compared with ST, HST and SGT after the extreme low percentile (e.g. 5%) and hence tend to underestimate ES which is the opposite number of the expectation of all values lower than the percentile.

The bull/bear markets

Figure 55 demonstrates the bull market ESs for the ESEs for α equal to 1% (Panel A), 2.5% (Panel B) and 5% (Panel C). Figure 56 presents analogous results obtained for the bear markets. If we compare Figure 54 and Figure 55, we can find that each ES of the bull market is lower than that of the whole sample period. From Figure 55, it can be seen that during the bull market, Chile still has the lowest ES while Argentina has the highest ES among the ESEs. This finding is not consistent with the results of the whole sample period. There exist also considerable differences in the bull market ESs among other ESEs during the bull market. As the confidence level α increases from 1% to 5%, the differences in the bull market ESs among the ESEs reduce. These conclusions are robust to the change of estimation methods. In terms of different estimation methods, from the bull market results of Figure 55, it can be seen that for each ESE, HS and EVT tend to deliver similar ESs at all the three confidence levels ($\alpha = 1\%, 2.5\%,$ and 5%). The differences of ES given by benchmark models are significant and these differences reduce as α increases. N consistently underestimates ES for all three confidence levels. At $\alpha = 1\%$ and $\alpha = 2.5\%$ compared with benchmark models, HS and EVT tend to underestimate ES for the majority of the ESEs. When $\alpha = 5\%$, HS and EVT give ESs which are similar to those given by benchmark models but tend to overestimate ES for some ESEs.

In terms of the results of the bear market, by comparing Figure 54 and Figure 56, we can find that each ES for the bear markets is much higher than that for the whole sample period. Intuitively the bear market is expected to have higher tail risk. During the bear market, both Morocco and Chile have the lowest ES while ES of Russia increases significantly and even replaces Argentina as the country with the highest ES. Regarding different estimation methods, from the bear market results of Figure 56, it can be seen that for each ESE, HS and EVT tend to deliver similar ESs at all the three confidence levels ($\alpha = 1\%, 2.5\%,$ and 5%). With regard to the benchmark models, the differences of ES given by ST, HST and SGT can be considerable at all three confidence levels. N consistently underestimates ES for all three confidence levels. At $\alpha = 1\%$, compared with the optimal probability density distribution model, HS and EVT underestimate ES for 11 ESEs and overestimate ES for the rest of the ESEs. At $\alpha = 2.5\%$ and 5%, HS and EVT may overestimate ES for some ESEs and underestimate ES for other ESEs.

Based on Table 19, the stock returns of Russia follow SGT for the whole sample period. As the market switches from the bull market to the bear market, Russian stock returns changes from SGT to HST. It is appropriate to use SGT for the whole sample period to calculate 1% ES. However, 1% ES will be significantly underestimated if SGT is still used in the bear market when the stock returns follow HST. Similar conclusions can be drawn for other ESEs.

Summary

To summarize, as α increase from 1% to 5%, ES decreases and this conclusion is robust to the estimation methods used. This negative relationship between ES and α is found also robust to different samples, i.e., the whole sample period and the bull/bear markets. There exists considerable difference in ESs of different ESEs. In addition, the bull market ES is lower than the whole sample period ES while the bear market ES is much higher than the whole sample period ES. In terms of the estimation methods, N consistently underestimates ES at all three confidence levels for the whole sample period and the bull/bear markets. There exists considerable difference among ES given by benchmark models and this difference reduces significantly as α increases. Similar ES are given by HS and EVT consistently. However, HS and EVT may overestimate ES or underestimate ES under different circumstances for different ESEs. If a single probability density distribution model is used for the whole sample period, for the bull market and for the bear markets, the ES estimation based on this particular probability density distribution model may be biased under different market regimes.

Figure 54. Emerging stock exchanges whole sample period ESs

Panel A. 1% ESs

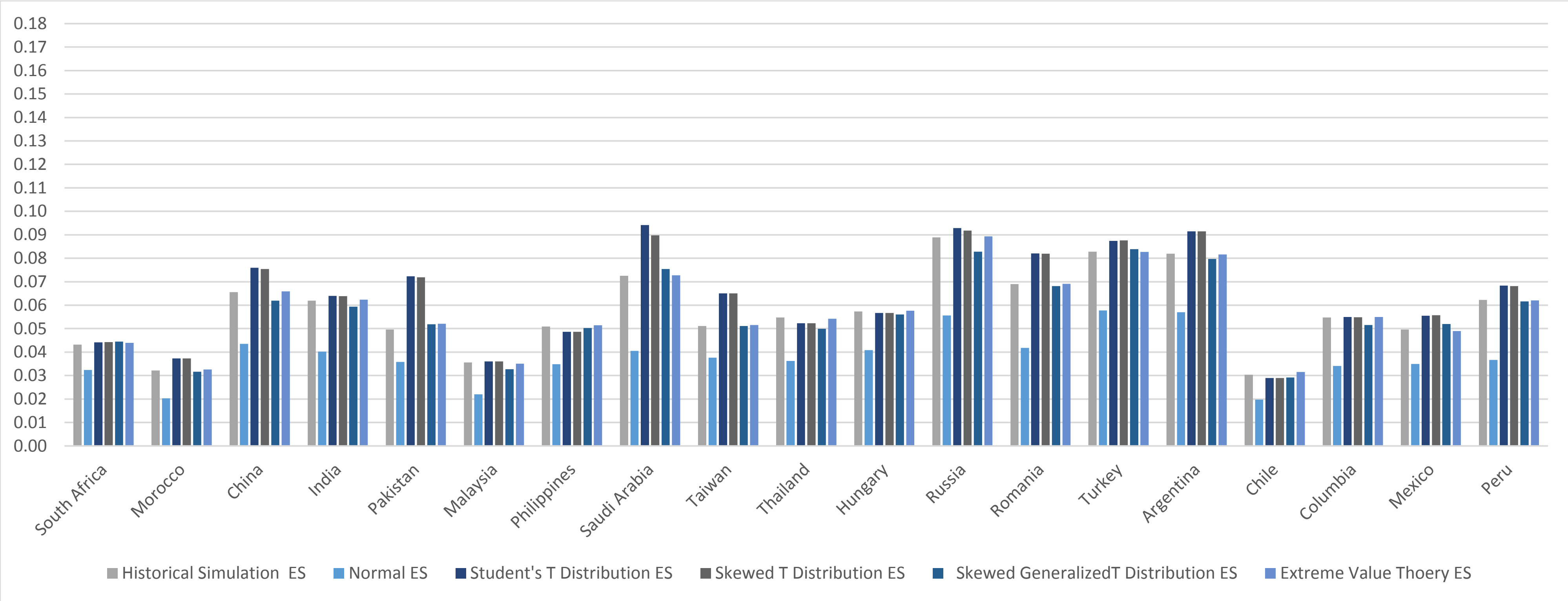


Figure 54. Emerging stock exchanges whole sample period ESs

Panel B. 2.5% ESs

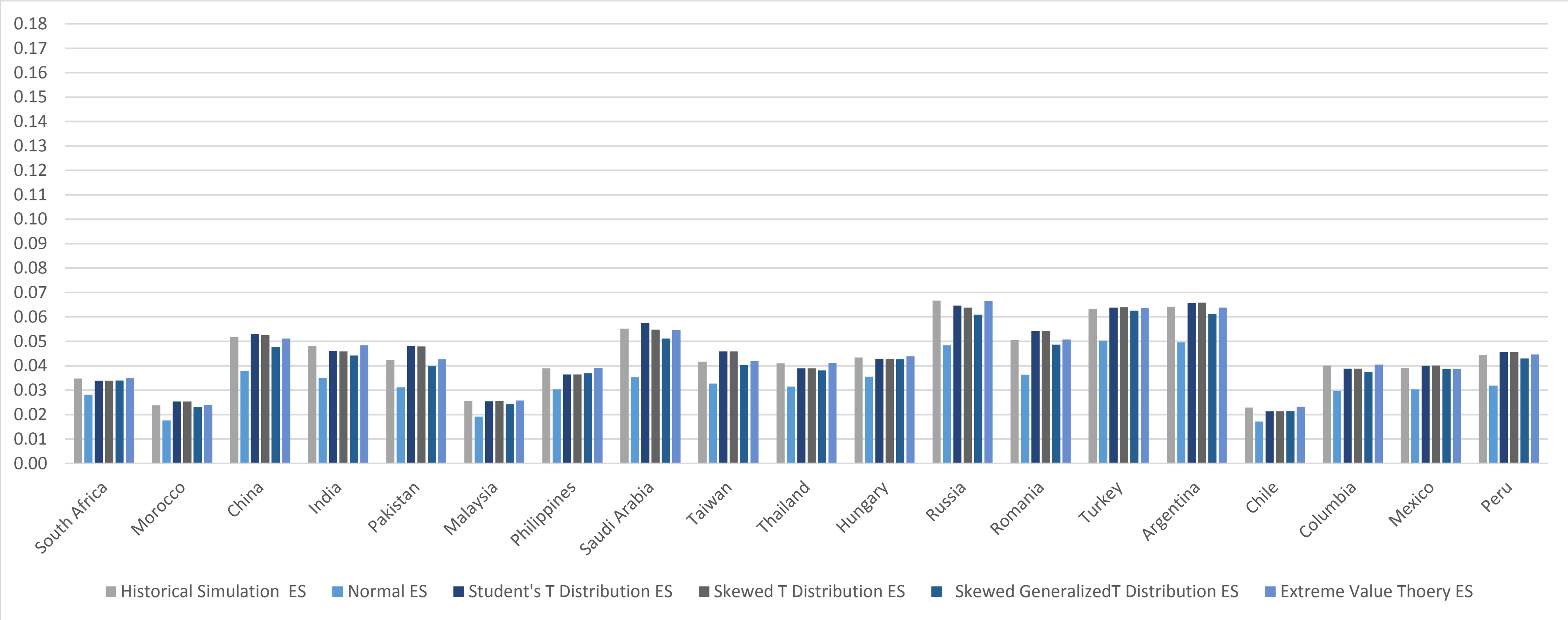


Figure 54. Emerging stock exchanges whole sample period ESs

Panel C. 5% ESs

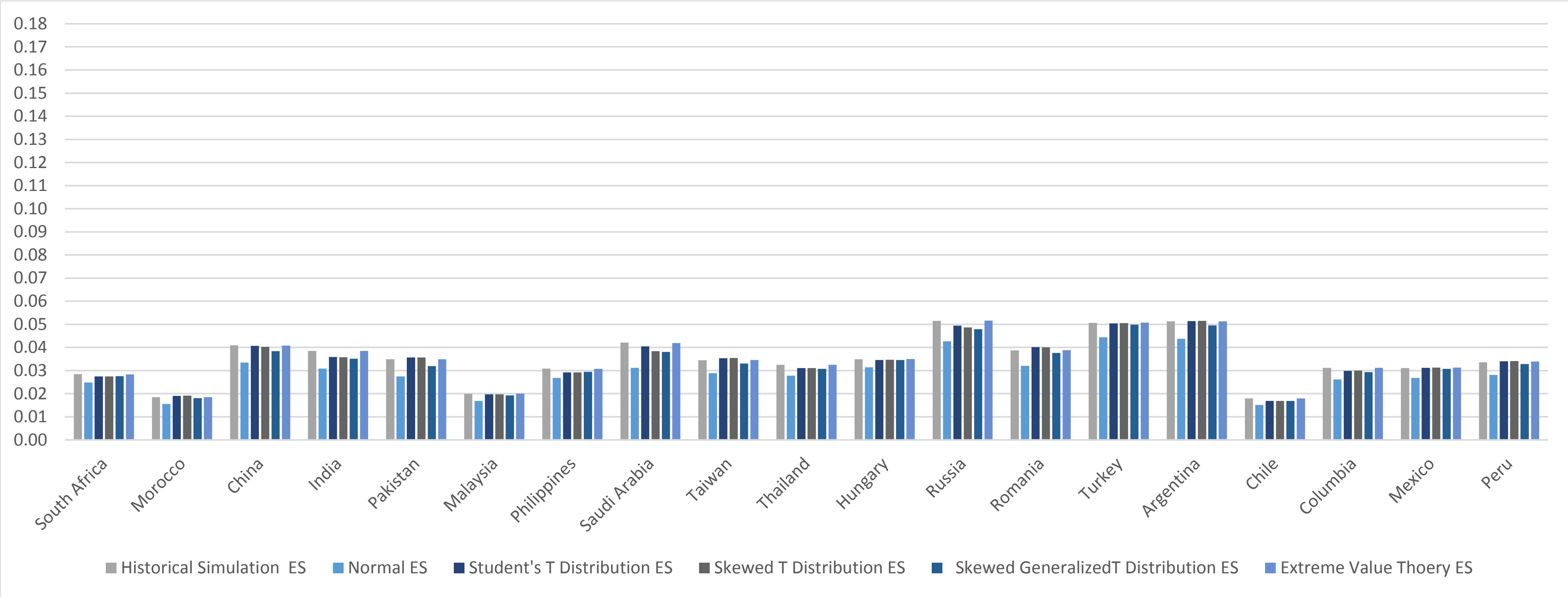


Figure 55. Emerging stock exchanges bull market ESs
Panel A. 1% ESs

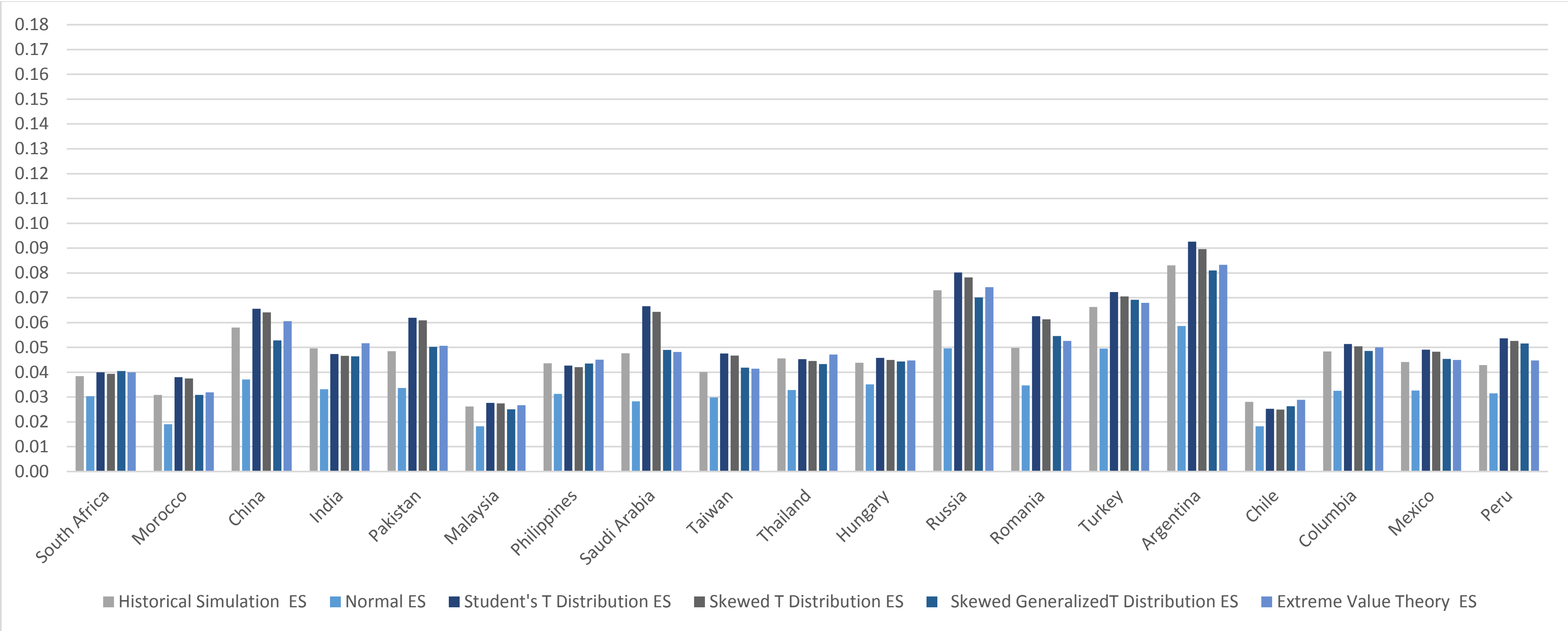


Figure 55. Emerging stock exchanges bull market ESs

Panel B. 2.5% ESs

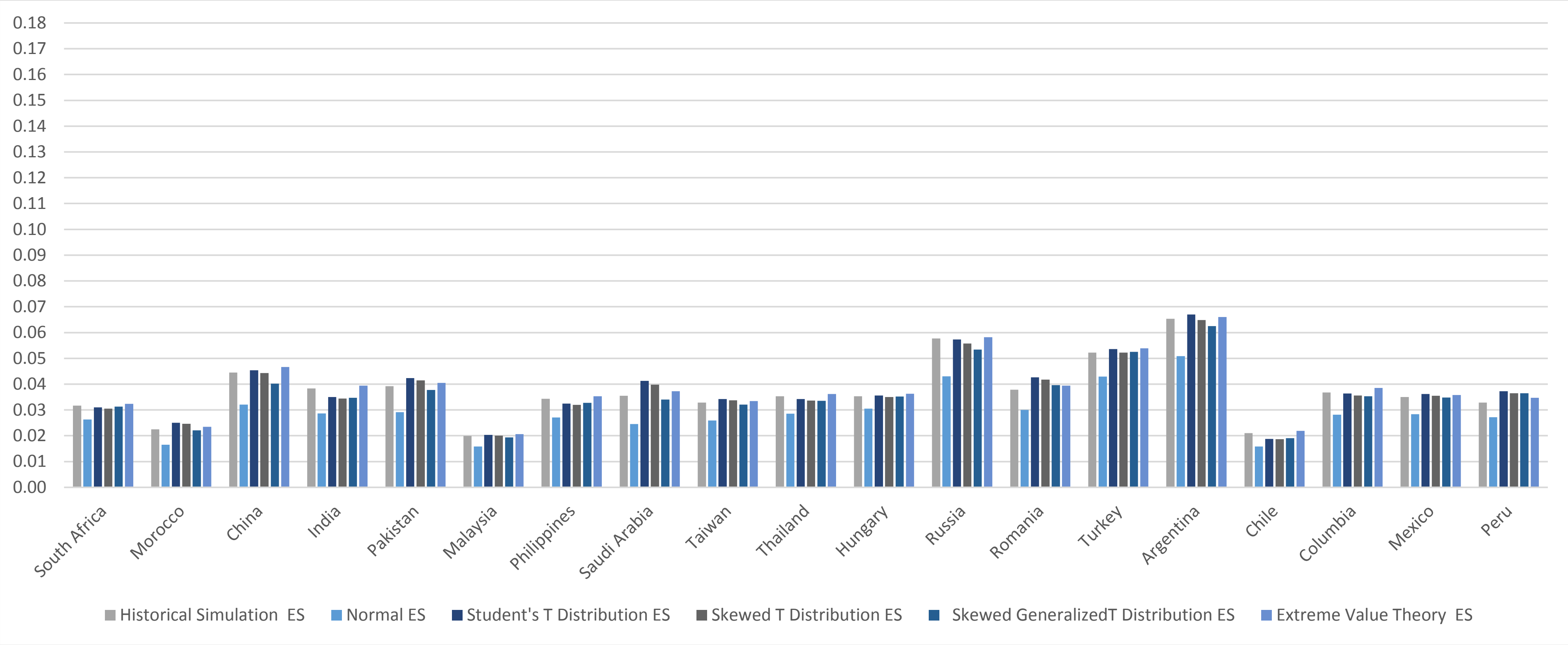


Figure 55. Emerging stock exchanges bull market ESs

Panel C. 5% ESs

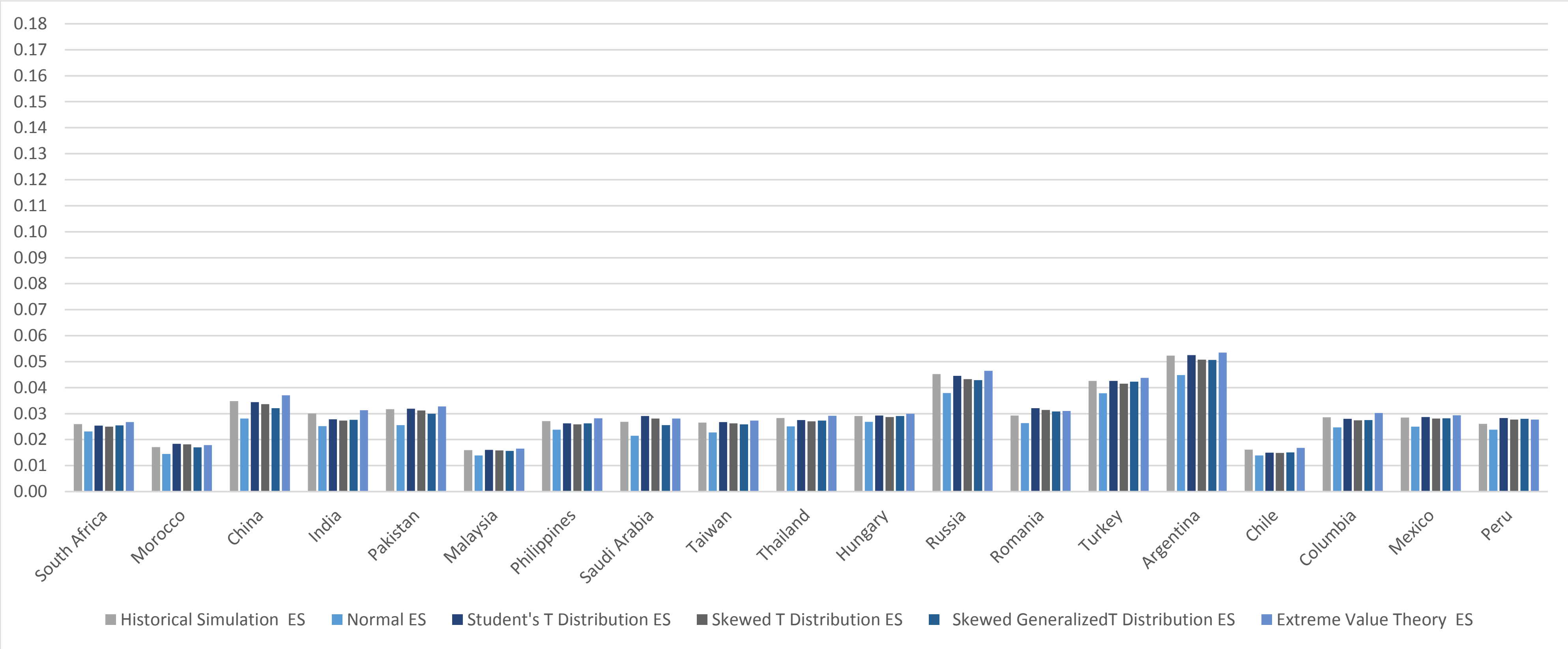


Figure 56. Emerging stock exchanges bear market ESs
Panel A. 1% ESs

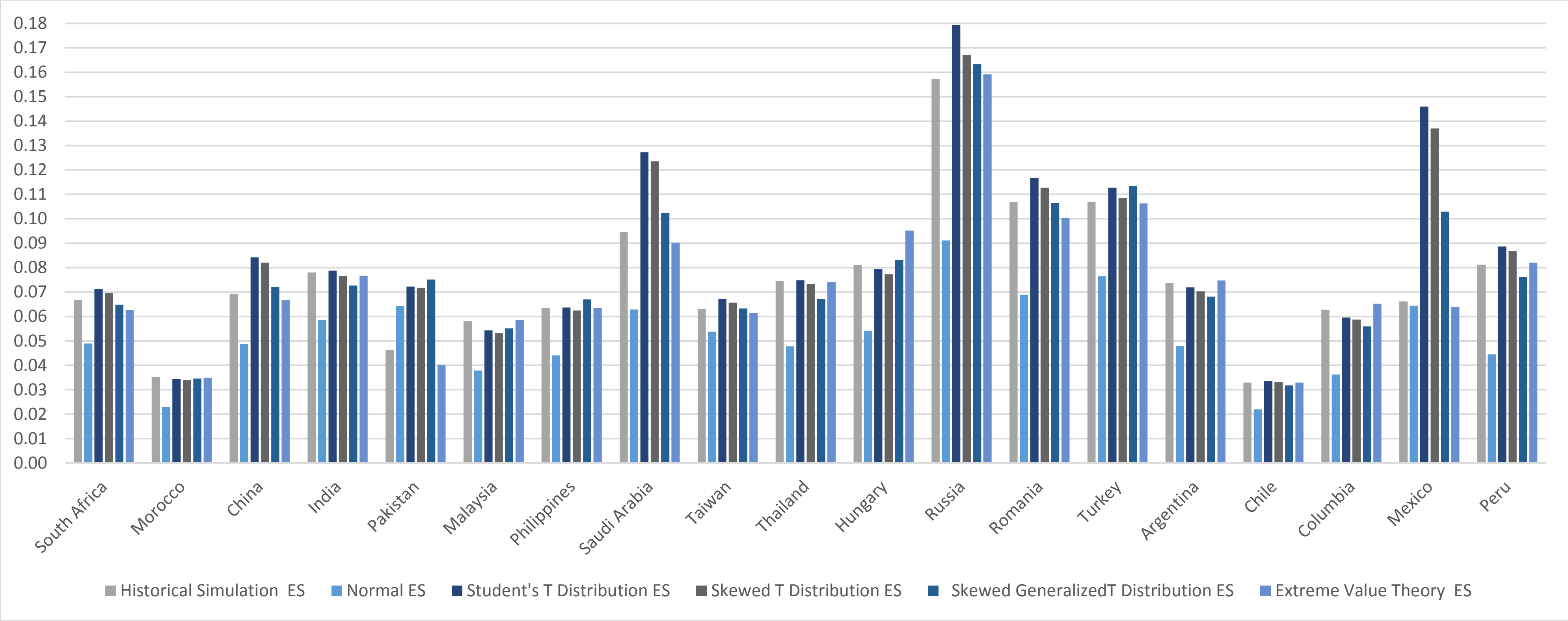


Figure 56. Emerging stock exchanges bear market ESs
Panel B. 2.5% ESs

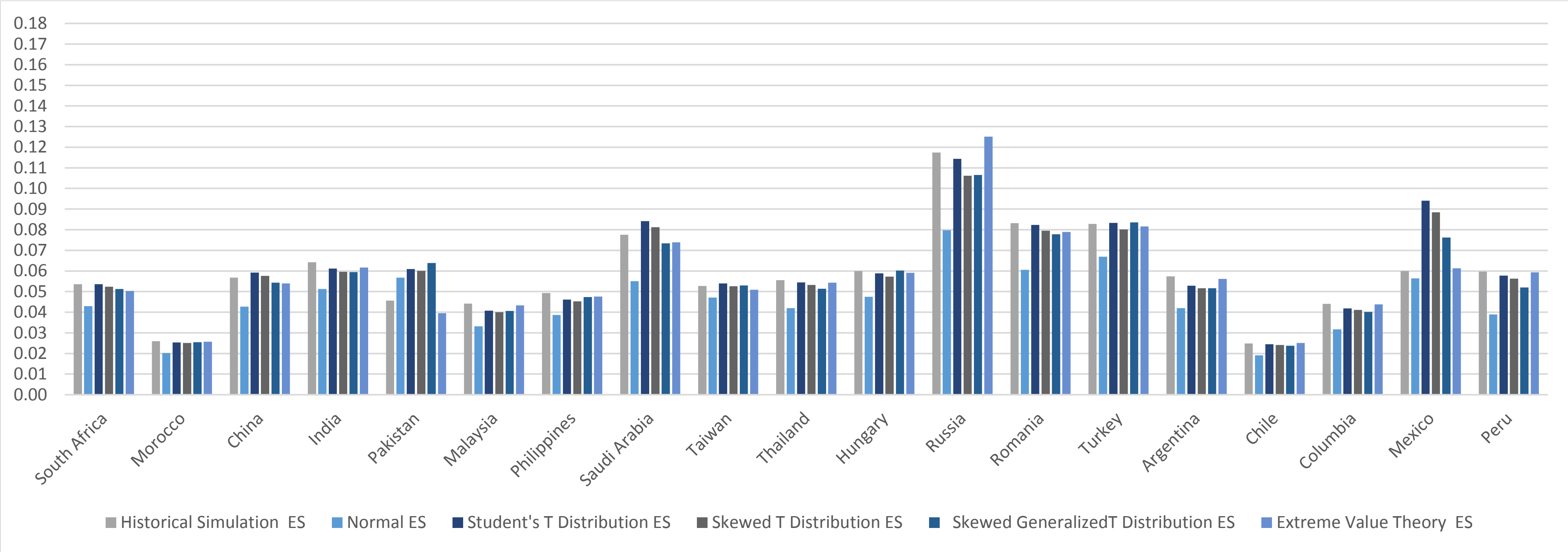
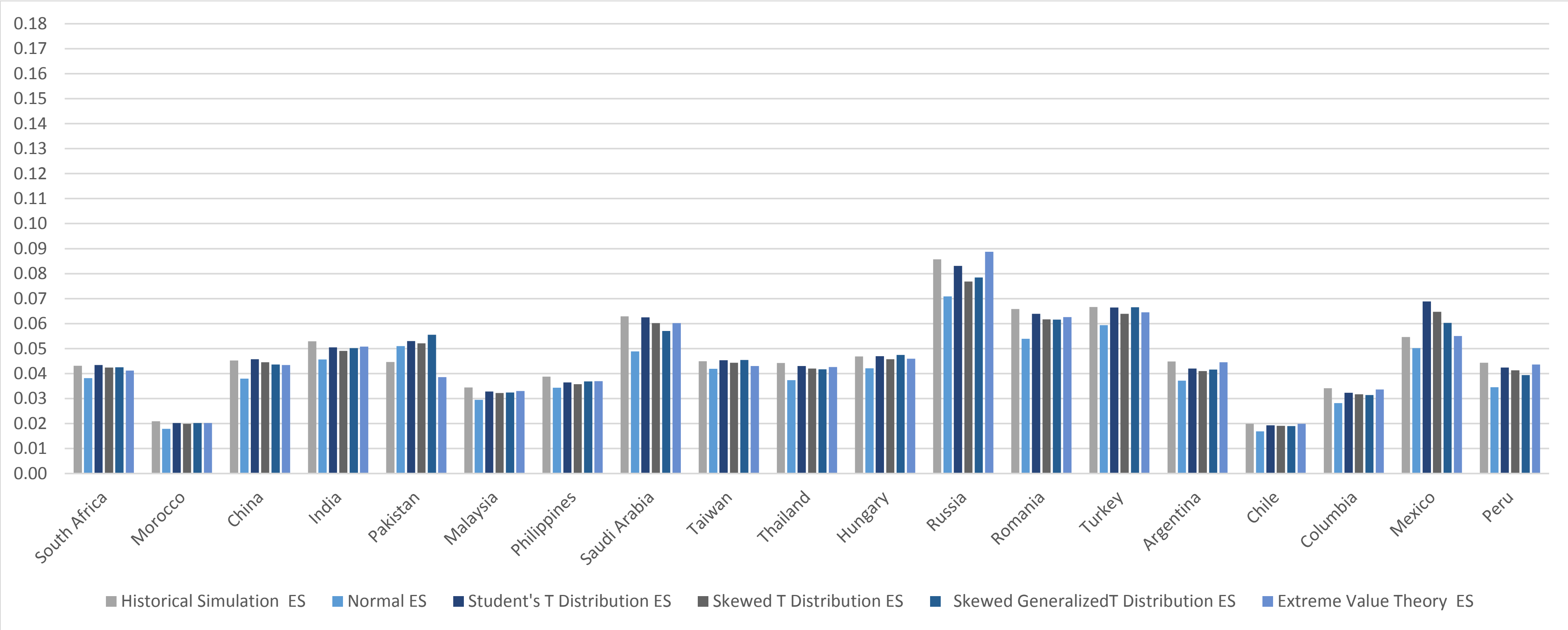


Figure 56. Emerging stock exchanges bear market ESs

Panel C. 5% ESs



5.2.4 Concluding Remarks

Summarizing the result and discussion in the Section 5.2.1 and Section 5.2.2, the following conclusions can be drawn for VaR/ES:

1. Based on the simulation analysis, the parameters of different probability density models have significant influences on the VaR/ES. The parameters of probability density models are found to be different during different market regimes and across different countries. Therefore, it is important to consider how VaR/ES would be affected by the parameter changes of probability density models. Using restrictive models with less number of parameters or ignoring the parameter changes during different market regimes is likely to lead to the biasedness of the estimation of VaR and ES in practice. For all models, as the confidence level increases, VaR/ES decreases.

2. There exist considerable differences in VaR/ES among different countries and during different market regimes. These differences reduce as confidence level α increases. And these differences tend to become larger during the bear market than the whole sample period and the bull market.

3. At each confidence level, the bull market VaR/ES is smaller than the whole sample period VaR/ES. And the bear market VaR/ES is significantly larger than the whole sample period VaR/ES.

4. There are differences among VaR/ESs given by benchmark models although benchmark models tend to comparable VaR/ESs. These differences tend to be larger for emerging stock exchanges, during the bear market and at the lower confidence level. It is inappropriate to use a single probability density distribution model for the whole sample period, the bull market and the bear market as the VaR/ES estimation based on a particular probability density distribution model may be biased under different market regimes.

5. Compared with the benchmark models, N underestimates VaR at 1% confidence level and the magnitude of the underestimation is larger during the bear market than during the bull market. At 2.5% confidence level, N performs well by giving VaR which is similar to those given by the benchmark models. However, at 5% confidence level, N overestimates VaR compared with the benchmark models. In contrast, N underestimates ES consistently compared with benchmark models in all circumstances.

6. HS and EVT consistently produce similar values of VaR and ES. HS and EVT tend to overestimate VaR at all confidence levels for the whole sample period and the bull market. However, for the bear market, HS and EVT may overestimate or underestimate VaR depending on the exchange. In terms of ES, the performance of HS and EVT seems unstable. Compared with the optimal probability density distribution models, HS and EVT may overestimate or underestimate ES depending on the stock exchange.

5.3 Conditional Forecasting and Backtesting of VaR and ES

The first 60% of the whole sample observations are used to estimate the parameters of the conditional models. The remaining are used to conduct the out-of-sample forecasting and backtesting. The backtesting results are shown in Table 24 to Table 35. According to the results, the following conclusions can be drawn:

The proposed strategy (i.e. two different distributions in each market regime) successfully passes the unconditional coverage test for all developed and emerging stock exchanges considered in this research. This conclusion is true for all different models considered (RiskMetrics, Normal-GARCH, Student's T-GACRH, Skewed T-GACRH and SGT-GARCH). This result indicates that the proposed strategy provides statistically accurate estimation of VaR.

In terms of the results of the independence test, At 5% conference level, all models pass the independence test for all counties indicating that the proposed strategy provides statistically independence estimation of 5% VaR. At 1% conference level, RiskMetrics passes the independence test for all counties except for Australia. As the dynamic model of the volatility becomes more complex, heterogenous results are found. The results of the independence test of Normal-GARCH, Student's T-GACRH, Skewed T-GACRH and SGT-GARCH are heterogenous and these models tend to performance better in the independence test in developed countries than developing countries. The SGT-GARCH model does not perform well for the independence test of VaR for all developed and emerging stock exchanges. This result indicates that the proposed strategy with simple dynamic model of the volatility provides statistically independence estimation of 1% VaR.

The results of the backtesting of ES indicate that most models provide accurate estimates of ES for all the countries at both 1% and 5% confidence levels. Compare with RiskMetrics and Normal-GARCH, Student's T-GACRH, Skewed T-GACRH and SGT-GARCH tend to provide accurate estimates of ES. SGT-GARCH tends to be the optimal model in emerging stock exchanges.

Table 24. Unconditional Coverage Test of Daily VaR 1% of Developed Stock Exchanges

Test Statistics	Probability Density Model	Canada	US	Japan	Singapore	Australia	NZ	Austria	Denmark	Finland	France
Test Statistics	RISKMETRICS	33.23	31.01	19.38	20.26	26.01	10.39	15.07	17.05	15.33	21.51
	N	5.03	0.66	4.90	16.10	13.76	2.72	23.65	5.81	3.73	4.43
	T	13.12	1.18	2.02	32.20	16.88	5.41	23.65	11.07	13.09	7.44
	ST	10.56	6.64	7.05	24.63	33.17	27.32	9.76	8.10	19.91	2.32
	SGT	32.32	32.44	20.42	32.20	33.17	27.32	31.16	21.89	32.28	33.83
P- Value	RISKMETRICS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	N	0.98	0.58	0.97	1.00	1.00	0.90	1.00	0.98	0.95	0.96
	T	1.00	0.72	0.84	1.00	1.00	0.98	1.00	1.00	1.00	0.99
	ST	1.00	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	0.87
	SGT	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Note: Table 24 presents the unconditional coverage test of daily VaR 1% for the 19 DSEs. The test statistics and the associated p values are reported. The data source is DataStream.

Table 24 (Cont.). Unconditional Coverage Test of Daily 1% VaR of Developed Stock Exchanges

Test Statistics	Probability Density Model	Germany	Greece	Italy	Ireland	NL	Portugal	Switzerland	Sweden	UK
Test Statistics	RISKMETRICS	35.54	10.13	18.97	26.43	28.90	13.26	18.29	14.83	34.40
	N	4.21	0.48	11.17	2.90	5.75	5.63	6.64	15.37	8.71
	T	11.27	5.68	16.92	10.95	21.18	13.40	16.29	15.37	20.39
	ST	17.03	1.00	8.95	0.02	17.34	4.01	32.44	4.19	32.82
	SGT	33.35	24.78	33.21	32.88	33.73	24.70	32.44	22.19	32.82
P- Value	RISKMETRICS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	N	0.96	0.51	1.00	0.91	0.98	0.98	0.99	1.00	1.00
	T	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	ST	1.00	0.68	1.00	0.13	1.00	0.95	1.00	0.96	1.00
	SGT	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Note: Table 24 presents the unconditional coverage test of daily VaR 1% for the 19 DSEs. The test statistics and the associated p values are reported. The data source is DataStream.

Table 25. Unconditional Coverage Test of Daily 1% VaR of Emerging Stock Exchanges

Test Statistics	Probability Density Model	South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
Test Statistics	RISKMETRICS	19.03	4.15	32.72	12.09	38.16	20.66	17.68	23.99	20.27	26.99
	N	31.86	21.55	1.58	23.69	30.81	23.17	22.87	23.34	2.17	22.68
	T	31.86	21.55	8.42	23.69	30.81	23.17	30.31	30.81	7.52	30.11
	ST	3.54	21.55	0.93	23.69	30.81	18.47	18.19	18.63	30.91	22.68
	SGT	31.86	21.55	29.15	31.20	30.81	30.63	30.31	30.81	23.43	30.11
P- Value	RISKMETRICS	1.00	0.96	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	N	1.00	1.00	0.79	1.00	1.00	1.00	1.00	1.00	0.86	1.00
	T	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00
	ST	0.94	1.00	0.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	SGT	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Note: Table 25 presents the unconditional coverage test of daily VaR 1% for the 19 ESEs. The test statistics and the associated p values are reported. The data source is DataStream.

Table 25 (Cont.). Unconditional Coverage Test of Daily 1% VaR of Emerging Stock Exchanges

Test Statistics	Probability Density Model	Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
	RISKMETRICS	7.64	15.67	15.65	18.67	30.49	12.93	14.42	25.18	14.24
	N	12.79	20.83	24.45	10.43	9.24	31.76	22.49	3.82	31.90
Test Statistics	T	12.79	25.69	32.00	24.58	18.26	31.76	22.49	20.09	31.90
	ST	31.88	33.33	24.45	19.79	22.94	24.22	22.49	1.19	24.35
	SGT	31.88	33.33	32.00	32.14	30.39	31.76	22.49	32.48	31.90
	RISKMETRICS	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	N	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00
P- Value	T	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	ST	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.72	1.00
	SGT	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Note: Table 25 presents the unconditional coverage test of daily VaR 1% for the 19 ESEs. The test statistics and the associated p values are reported. The data source is DataStream.

Table 26. Independence Test of Daily 1% VaR of Developed Stock Exchanges											
Test Statistics	Probability Density Model	Canada	US	Japan	Singapore	Australia	NZ	Austria	Denmark	Finland	France
Test Statistics	RISKMETRICS	2.48	0.55	1.66	1.18	0.00	0.37	1.69	1.85	4.32	0.01
	N	0.08	0.21	0.03	0.01	0.02	0.08	0.00	0.03	0.10	0.10
	T	0.02	0.18	0.07	0.00	0.01	0.04	0.00	0.01	0.02	0.06
	ST	0.03	5.33	0.02	0.00	0.00	0.00	0.03	0.02	0.00	0.14
	SGT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P- Value	RISKMETRICS	0.88	0.54	0.80	0.72	0.02	0.46	0.81	0.83	0.96	0.08
	N	0.22	0.35	0.14	0.08	0.11	0.23	0.03	0.14	0.25	0.24
	T	0.11	0.33	0.21	0.00	0.08	0.17	0.03	0.07	0.11	0.19
	ST	0.14	0.98	0.11	0.03	0.00	0.00	0.14	0.10	0.06	0.30
	SGT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: Table 26 presents the independence test of daily VaR 1% for the 19 DSEs. The test statistics and the associated p values are reported. The data source is DataStream.

Table 26 (Cont.). Independence Test of Daily 1% VaR of Developed Stock Exchanges

Test Statistics	Probability Density Model	Germany	Greece	Italy	Ireland	NL	Portugal	Switzerland	Sweden	UK
Test Statistics	RISKMETRICS	2.63	0.39	0.03	5.38	0.63	2.20	3.79	2.11	7.09
	N	0.10	0.16	0.03	0.12	0.08	0.04	0.06	0.00	0.04
	T	0.03	0.04	0.01	0.03	0.00	0.01	0.01	0.00	0.00
	ST	0.01	3.78	0.04	1.90	0.01	0.06	0.00	0.05	0.00
	SGT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P- Value	RISKMETRICS	0.89	0.47	0.15	0.98	0.57	0.86	0.95	0.85	0.99
	N	0.25	0.31	0.14	0.27	0.22	0.16	0.20	0.03	0.17
	T	0.14	0.16	0.08	0.14	0.06	0.06	0.08	0.03	0.06
	ST	0.08	0.95	0.17	0.83	0.08	0.19	0.00	0.17	0.00
	SGT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: Table 26 presents the independence test of daily VaR 1% for the 19 DSEs. The test statistics and the associated p values are reported. The data source is DataStream.

Table 27. Independence Test of Daily 1% VaR of Emerging Stock Exchanges

Test Statistics	Probability Density Model	South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
Test Statistics	RISKMETRICS	0.04	4.50	0.02	0.21	1.69	3.53	11.42	5.97	3.57	2.09
	N	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.13	0.00
	T	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.05	0.00
	ST	0.10	0.00	0.17	0.00	0.00	0.01	0.01	0.01	0.00	0.00
	SGT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P- Value	RISKMETRICS	0.16	0.97	0.10	0.35	0.81	0.94	1.00	0.99	0.94	0.85
	N	0.00	0.00	0.29	0.03	0.00	0.03	0.03	0.03	0.28	0.03
	T	0.00	0.00	0.15	0.03	0.00	0.03	0.00	0.00	0.17	0.00
	ST	0.25	0.00	0.32	0.03	0.00	0.06	0.06	0.06	0.00	0.03
	SGT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00

Note: Table 27 presents the independence test of daily VaR 1% for the 19 ESEs. The test statistics and the associated p values are reported. The data source is DataStream.

Table 27(Cont.). Independence Test of Daily 1% VaR of Emerging Stock Exchanges

Test Statistics	Probability Density Model	Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
	RISKMETRICS	1.01	0.09	1.60	3.75	0.61	4.85	9.29	2.03	1.76
	N	0.02	0.00	0.00	0.03	0.03	0.00	0.00	0.10	0.00
Test Statistics	T	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
	ST	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.18	0.00
	SGT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	RISKMETRICS	0.68	0.23	0.79	0.95	0.57	0.97	1.00	0.85	0.82
	N	0.11	0.06	0.03	0.14	0.14	0.00	0.00	0.25	0.00
P- Value	T	0.11	0.03	0.00	0.03	0.06	0.00	0.00	0.06	0.00
	ST	0.00	0.00	0.03	0.06	0.03	0.03	0.00	0.33	0.03
	SGT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: Table 27 presents the independence test of daily VaR 1% for the 19 ESEs. The test statistics and the associated p values are reported. The data source is DataStream.

Table 28. Unconditional Coverage Test of Daily 1% ES of Developed Stock Exchanges

Test Statistics	Probability Density Model	Canada	US	Japan	Singapore	Australia	NZ	Austria	Denmark	Finland	France
Test Statistics	RISKMETRICS	-0.013	-0.025	-0.018	-0.007	-0.009	-0.002	-0.005	-0.010	-0.009	-0.013
	N	0.003	-0.001	0.001	0.005	0.001	0.002	0.003	0.002	0.001	-0.001
	T	-0.004	-0.001	0.005	0.001	0.002	0.006	-0.002	0.001	0.004	0.002
	ST	0.003	0.002	0.004	0.003	-0.001	0.003	0.003	0.004	0.002	-0.002
	SGT	0.003	-0.001	0.002	0.006	0.003	0.002	0.005	0.002	0.002	0.001
Distance from 1	RISKMETRICS	1.013	1.025	1.018	1.007	1.009	1.002	1.005	1.010	1.009	1.013
	N	0.997	1.001	0.999	0.995	0.999	0.998	0.997	0.998	0.999	1.001
	T	1.004	1.001	0.995	0.999	0.998	0.994	1.002	0.999	0.996	0.998
	ST	0.997	0.998	0.996	0.997	1.001	0.997	0.997	0.996	0.998	1.002
	SGT	0.997	1.001	0.998	0.994	0.997	0.998	0.995	0.998	0.998	0.999

Note: Table 28 presents the unconditional coverage test of daily 1% ES for the 19 DSEs. The data source is DataStream.

Table 28 (Cont.). Unconditional Coverage Test of Daily 1% ES of Developed Stock Exchanges

Test Statistics	Probability Density Model	Germany	Greece	Italy	Ireland	NL	Portugal	Switzerland	Sweden	UK
Test Statistics	RISKMETRICS	-0.007	-0.003	-0.010	-0.002	-0.017	-0.013	-0.019	-0.012	-0.023
	N	0.001	0.005	0.000	0.002	-0.001	0.003	0.000	0.000	-0.003
	T	0.002	0.003	0.002	0.002	0.001	0.001	0.003	0.000	-0.001
	ST	0.003	0.006	0.003	0.002	0.000	0.006	0.003	0.000	0.002
	SGT	0.002	0.005	0.001	0.003	0.000	0.004	0.001	0.001	-0.004
Distance from 1	RISKMETRICS	1.007	1.003	1.010	1.002	1.017	1.013	1.019	1.012	1.023
	N	0.999	0.995	1.000	0.998	1.001	0.997	1.000	1.000	1.003
	T	0.998	0.997	0.998	0.998	0.999	0.999	0.997	1.000	1.001
	ST	0.997	0.994	0.997	0.998	1.000	0.994	0.997	1.000	0.998
	SGT	0.998	0.995	0.999	0.997	1.000	0.996	0.999	0.999	1.004

Note: Table 28 presents the unconditional coverage test of daily 1% ES for the 19 DSEs. The data source is DataStream.

Table 29. Unconditional Coverage Test of Daily 1% ES of Emerging Stock Exchanges											
Test Statistics	Probability Density Model	South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
Test Statistics	RISKMETRICS	-0.018	0.011	0.001	-0.009	-0.019	-0.018	-0.007	0.000	-0.009	-0.003
	N	-0.001	-0.004	0.003	0.001	0.000	0.001	0.004	0.008	0.001	0.005
	T	-0.002	-0.002	0.003	0.003	0.000	-0.001	-0.001	0.007	0.003	0.007
	ST	0.002	-0.001	0.003	0.001	0.001	0.003	0.002	0.007	-0.003	0.000
	SGT	-0.001	-0.004	0.005	0.002	0.001	0.001	0.004	0.011	0.003	0.004
Distance from 1	RISKMETRICS	1.018	0.989	0.999	1.009	1.019	1.018	1.007	1.000	1.009	1.003
	N	1.001	1.004	0.997	0.999	1.000	0.999	0.996	0.992	0.999	0.995
	T	1.002	1.002	0.997	0.997	1.000	1.001	1.001	0.993	0.997	0.993
	ST	0.998	1.001	0.997	0.999	0.999	0.997	0.998	0.993	1.003	1.000
	SGT	1.001	1.004	0.995	0.998	0.999	0.999	0.996	0.989	0.997	0.996

Note: Table 29 presents the unconditional coverage test of daily 1% ES for the 19 ESEs. The data source is DataStream.

Table 29 (Cont.). Unconditional Coverage Test of Daily 1% ES of Emerging Stock Exchanges

Test Statistics	Probability Density Model	Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
Test Statistics	RISKMETRICS	-0.005	-0.007	-0.006	0.005	-0.009	-0.007	-0.018	-0.012	-0.011
	N	0.001	0.002	0.002	0.004	0.001	0.000	0.001	0.000	0.003
	T	0.003	-0.001	0.000	0.001	0.001	-0.001	0.000	-0.001	0.006
	ST	0.001	0.002	0.002	0.005	0.005	0.001	0.001	0.001	0.002
	SGT	0.001	0.002	0.003	0.006	0.002	0.000	0.001	0.000	0.004
Distance from 1	RISKMETRICS	1.005	1.007	1.006	0.995	1.009	1.007	1.018	1.012	1.011
	N	0.999	0.998	0.998	0.996	0.999	1.000	0.999	1.000	0.997
	T	0.997	1.001	1.000	0.999	0.999	1.001	1.000	1.001	0.994
	ST	0.999	0.998	0.998	0.995	0.995	0.999	0.999	0.999	0.998
	SGT	0.999	0.998	0.997	0.994	0.998	1.000	0.999	1.000	0.996

Note: Table 29 presents the Unconditional coverage test of daily 1% ES for the 19 ESEs. The data source is DataStream.

Table 30. Unconditional Coverage Test of Daily 5% VaR of Developed Stock Exchanges

Test Statistics	Probability Density Model	Canada	US	Japan	Singapore	Australia	NZ	Austria	Denmark	Finland	France
Test Statistics	RISKMETRICS	15.47	12.17	9.05	7.45	6.49	9.44	8.66	11.10	9.76	3.74
	N	1.48	1.28	0.03	37.12	10.88	0.06	6.26	0.12	2.45	0.86
	T	0.96	1.28	4.34	164.34	12.65	0.06	7.62	8.33	126.49	0.01
	ST	2.12	22.18	0.17	30.25	16.66	0.00	9.94	0.24	0.42	0.13
	SGT	164.96	154.69	104.23	164.34	97.85	139.42	159.01	111.72	164.75	86.04
P- Value	RISKMETRICS	1.00	1.00	1.00	0.99	0.99	1.00	1.00	1.00	1.00	0.95
	N	0.78	0.74	0.14	1.00	1.00	0.19	0.99	0.28	0.88	0.65
	T	0.67	0.74	0.96	1.00	1.00	0.20	0.99	1.00	1.00	0.08
	ST	0.85	1.00	0.32	1.00	1.00	0.00	1.00	0.37	0.48	0.28
	SGT	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Note: Table 30 presents the unconditional coverage test of daily VaR 5% for the 19 DSEs. The test statistics and the associated p values are reported. The data source is DataStream.

Table 30 (Cont.). Unconditional Coverage Test of Daily 5% VaR of Developed Stock Exchanges										
Test Statistics	Probability Density Model	Germany	Greece	Italy	Ireland	NL	Portugal	Switzerland	Sweden	UK
Test Statistics	RISKMETRICS	5.22	2.08	3.63	2.46	8.40	5.40	7.06	6.12	12.79
	N	0.11	0.23	0.76	1.29	4.32	9.87	2.59	5.55	0.87
	T	170.19	19.47	24.05	0.65	92.69	126.08	1.87	103.13	28.83
	ST	0.63	0.78	0.41	0.04	1.03	30.96	1.56	1.71	0.09
	SGT	170.19	2.47	169.47	118.73	172.14	126.08	121.79	113.26	167.52
P- Value	RISKMETRICS	0.98	0.85	0.94	0.88	1.00	0.98	0.99	0.99	1.00
	N	0.26	0.37	0.62	0.74	0.96	1.00	0.89	0.98	0.65
	T	1.00	1.00	1.00	0.58	1.00	1.00	0.83	1.00	1.00
	ST	0.57	0.62	0.48	0.16	0.69	1.00	0.79	0.81	0.24
	SGT	1.00	0.88	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Note: Table 30 presents the unconditional coverage test of daily VaR 5% for the 19 DSEs. The test statistics and the associated p values are reported. The data source is DataStream.

Table 31. Unconditional Coverage Test of Daily 5% VaR of Emerging Stock Exchanges

Test Statistics	Probability Density Model	South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
Test Statistics	RISKMETRICS	12.70	0.78	4.14	7.38	8.03	4.09	4.04	0.54	2.58	10.67
	N	7.96	86.38	4.83	24.54	40.47	19.16	33.25	32.97	16.27	56.41
	T	162.60	109.97	111.51	133.39	32.97	156.34	26.65	61.73	96.02	36.30
	ST	8.71	109.97	28.17	45.91	157.27	8.28	25.14	59.02	10.37	30.93
	SGT	162.60	109.97	88.17	159.21	157.27	156.34	97.57	114.10	74.07	142.94
P- Value	RISKMETRICS	1.00	0.62	0.96	0.99	1.00	0.96	0.96	0.54	0.89	1.00
	N	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	T	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	ST	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	SGT	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Note: Table 31 presents the unconditional coverage test of daily VaR 5% for the 19 ESEs. The test statistics and the associated p values are reported. The data source is DataStream.

Table 31(Cont.). Unconditional Coverage Test of Daily 5% VaR of Emerging Stock Exchanges										
Test Statistics	Probability Density Model	Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
Test Statistics	RISKMETRICS	0.42	0.12	0.03	0.83	3.51	3.21	2.99	3.62	10.50
	N	17.23	48.70	46.43	40.72	1.07	77.51	104.64	14.22	88.55
	T	27.81	33.43	69.16	44.77	0.03	71.20	104.64	165.78	130.50
	ST	63.02	36.88	46.43	44.77	82.12	50.06	104.64	9.72	104.75
	SGT	162.70	170.09	163.32	164.04	37.18	162.09	114.79	165.78	162.80
P- Value	RISKMETRICS	0.48	0.27	0.15	0.64	0.94	0.93	0.92	0.94	1.00
	N	1.00	1.00	1.00	1.00	0.70	1.00	1.00	1.00	1.00
	T	1.00	1.00	1.00	1.00	0.13	1.00	1.00	1.00	1.00
	ST	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	SGT	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Note: Table 31 presents the unconditional coverage test of daily VaR 5% for the 19 ESEs. The test statistics and the associated p values are reported. The data source is DataStream.

Table 32. Independence Test of Daily 5% VaR of Developed Stock Exchanges

Test Statistics	Probability Density Model	Canada	US	Japan	Singapore	Australia	NZ	Austria	Denmark	Finland	France
Test Statistics	RISKMETRICS	0.83	0.13	0.12	1.44	0.22	8.03	12.67	4.29	13.17	0.12
	N	0.30	0.01	0.05	1.78	0.02	3.95	5.39	4.53	15.96	0.10
	T	0.01	0.50	0.11	0.00	2.45	6.77	6.02	2.33	0.03	0.68
	ST	0.43	2.23	0.24	1.18	0.17	5.32	7.06	4.21	7.42	0.32
	SGT	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	2.16
P- Value	RISKMETRICS	0.64	0.28	0.27	0.77	0.36	1.00	1.00	0.96	1.00	0.27
	N	0.41	0.06	0.17	0.82	0.10	0.95	0.98	0.97	1.00	0.25
	T	0.09	0.52	0.26	0.00	0.88	0.99	0.99	0.87	0.14	0.59
	ST	0.49	0.86	0.37	0.72	0.32	0.98	0.99	0.96	0.99	0.43
	SGT	0.00	0.03	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.86

Note: Table 32 presents the independence test of daily VaR 5% for the 19 DSEs. The test statistics and the associated p values are reported. The data source is DataStream.

Table 32 (Cont.). Independence Test of Daily 5% VaR of Developed Stock Exchanges										
Test Statistics	Probability Density Model	Germany	Greece	Italy	Ireland	NL	Portugal	Switzerland	Sweden	UK
Test Statistics	RISKMETRICS	11.72	6.41	0.16	10.39	4.18	42.23	1.49	0.86	7.22
	N	0.34	5.33	2.53	3.87	0.06	4.28	1.58	0.27	1.79
	T	0.00	3.98	0.01	4.85	0.24	0.00	1.31	0.00	0.01
	ST	1.67	2.28	0.91	5.53	0.78	0.48	1.18	1.92	3.94
	SGT	0.00	8.48	0.00	5.36	0.00	0.00	5.99	0.00	0.00
P- Value	RISKMETRICS	1.00	0.99	0.31	1.00	0.96	1.00	0.78	0.65	0.99
	N	0.44	0.98	0.89	0.95	0.20	0.96	0.79	0.39	0.82
	T	0.00	0.95	0.09	0.97	0.37	0.00	0.75	0.03	0.06
	ST	0.80	0.87	0.66	0.98	0.62	0.51	0.72	0.83	0.95
	SGT	0.00	1.00	0.00	0.98	0.00	0.00	0.99	0.00	0.00

Note: Table 32 presents the independence test of daily VaR 5% for the 19 DSEs. The test statistics and the associated p values are reported. The data source is DataStream.

Table 33. Independence Test of Daily 5% VaR of Emerging Stock Exchanges

Test Statistics	Probability Density Model	South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
Test Statistics	RISKMETRICS	0.59	13.03	0.04	0.09	3.85	2.91	8.02	5.79	5.25	1.12
	N	0.00	0.02	1.60	0.00	0.31	0.54	4.63	1.66	3.86	4.54
	T	0.00	0.00	0.03	0.01	0.11	0.00	6.60	1.26	10.64	2.15
	ST	0.00	0.00	7.78	0.96	0.00	0.66	6.23	9.39	4.68	1.60
	SGT	0.00	0.00	0.14	0.00	0.00	0.00	4.16	0.05	12.77	0.00
P- Value	RISKMETRICS	0.56	1.00	0.17	0.23	0.95	0.91	1.00	0.98	0.98	0.71
	N	0.01	0.10	0.79	0.02	0.42	0.54	0.97	0.80	0.95	0.97
	T	0.00	0.00	0.15	0.09	0.26	0.00	0.99	0.74	1.00	0.86
	ST	0.05	0.00	0.99	0.67	0.00	0.58	0.99	1.00	0.97	0.79
	SGT	0.00	0.00	0.29	0.00	0.00	0.00	0.96	0.17	1.00	0.03

Note: Table 33 presents the independence test of daily VaR 5% for the 19 ESEs. The test statistics and the associated p values are reported. The data source is DataStream.

Table 33 (Cont.). Independence Test of Daily 5% VaR of Emerging Stock Exchanges

Test Statistics	Probability Density Model	Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
Test Statistics	RISKMETRICS	1.28	0.54	0.37	0.96	2.02	8.06	8.90	2.66	8.79
	N	0.31	2.66	0.42	0.23	1.28	2.05	0.00	0.13	0.21
	T	0.01	0.04	1.49	1.07	2.22	1.65	0.00	0.00	0.02
	ST	1.17	1.55	2.76	2.55	2.73	23.18	0.00	0.52	0.10
	SGT	0.00	0.00	0.00	0.00	2.17	0.00	0.00	0.00	0.00
P- Value	RISKMETRICS	0.74	0.54	0.46	0.67	0.84	1.00	1.00	0.90	1.00
	N	0.42	0.90	0.48	0.37	0.74	0.85	0.03	0.28	0.36
	T	0.07	0.15	0.78	0.70	0.86	0.80	0.03	0.00	0.11
	ST	0.72	0.79	0.90	0.89	0.90	1.00	0.03	0.53	0.25
	SGT	0.00	0.00	0.00	0.00	0.86	0.00	0.00	0.00	0.00

Note: Table 33 presents the independence test of daily VaR 5% for the 19 ESEs. The test statistics and the associated p values are reported. The data source is DataStream.

Table 34. Unconditional Coverage Test of Daily 5% ES of Developed Stock Exchanges

Test Statistics	Probability Density Model	Canada	US	Japan	Singapore	Australia	NZ	Austria	Denmark	Finland	France
Test Statistics	RISKMETRICS	-0.013	-0.025	-0.018	-0.007	-0.009	-0.002	-0.005	-0.010	-0.009	-0.013
	N	0.004	0.000	0.007	0.011	0.006	0.003	0.006	0.002	0.004	0.000
	T	0.004	0.000	0.002	0.007	0.002	0.003	0.004	0.003	0.001	0.000
	ST	0.007	0.005	0.007	0.006	0.002	0.007	0.009	0.007	0.005	0.001
	SGT	0.004	-0.001	0.003	0.007	0.003	0.003	0.006	0.003	0.002	0.001
Distance from 1	RISKMETRICS	1.013	1.025	1.018	1.007	1.009	1.002	1.005	1.010	1.009	1.013
	N	0.996	1.000	0.993	0.989	0.994	0.997	0.994	0.998	0.996	1.000
	T	0.996	1.000	0.998	0.993	0.998	0.997	0.996	0.997	0.999	1.000
	ST	0.993	0.995	0.993	0.994	0.998	0.993	0.991	0.993	0.995	0.999
	SGT	0.996	1.001	0.997	0.993	0.997	0.997	0.994	0.997	0.998	0.999

Note: Table 34 presents the unconditional coverage test of daily 5% ES for the 19 DSEs. The data source is DataStream.

Table 34 (Cont.). Unconditional Coverage Test of Daily 5% ES of Developed Stock Exchanges

Test Statistics	Probability Density Model	Germany	Greece	Italy	Ireland	NL	Portugal	Switzerland	Sweden	UK
Test Statistics	RISKMETRICS	-0.007	-0.003	-0.010	-0.002	-0.017	-0.013	-0.019	-0.012	-0.023
	N	0.005	0.012	0.004	0.004	0.003	0.007	0.000	0.004	-0.002
	T	0.001	0.005	-0.001	0.004	-0.001	0.004	0.000	0.001	-0.005
	ST	0.005	0.015	0.006	0.004	0.004	0.010	0.007	0.003	0.003
	SGT	0.003	0.006	0.001	0.004	0.001	0.005	0.001	0.001	-0.005
Distance from 1	RISKMETRICS	1.007	1.003	1.010	1.002	1.017	1.013	1.019	1.012	1.023
	N	0.995	0.988	0.996	0.996	0.997	0.993	1.000	0.996	1.002
	T	0.999	0.995	1.001	0.996	1.001	0.996	1.000	0.999	1.005
	ST	0.995	0.985	0.994	0.996	0.996	0.990	0.993	0.997	0.997
	SGT	0.997	0.994	0.999	0.996	0.999	0.995	0.999	0.999	1.005

Note: Table 34 presents the unconditional coverage test of daily 5% ES for the 19 DSEs. The data source is DataStream.

Table 35. Unconditional Coverage Test of Daily 5% ES of Emerging Stock Exchanges											
Test Statistics	Probability Density Model	South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
Test Statistics	RISKMETRICS	-0.018	0.011	0.001	-0.009	-0.019	-0.018	-0.007	0.000	-0.009	-0.003
	N	0.003	-0.006	0.005	0.002	0.001	0.003	0.006	0.012	0.002	0.010
	T	-0.002	-0.006	-0.001	0.002	0.002	0.001	0.005	0.010	0.003	0.009
	ST	0.003	-0.003	0.007	0.004	0.002	0.006	0.005	0.012	-0.001	0.004
	SGT	-0.002	-0.006	0.007	0.003	0.001	0.002	0.005	0.014	0.004	0.005
Distance from 1	RISKMETRICS	1.018	0.989	0.999	1.009	1.019	1.018	1.007	1.000	1.009	1.003
	N	0.997	1.006	0.995	0.998	0.999	0.997	0.994	0.988	0.998	0.990
	T	1.002	1.006	1.001	0.998	0.998	0.999	0.995	0.990	0.997	0.991
	ST	0.997	1.003	0.993	0.996	0.998	0.994	0.995	0.988	1.001	0.996
	SGT	1.002	1.006	0.993	0.997	0.999	0.998	0.995	0.986	0.996	0.995

Note: Table 35 presents the unconditional coverage test of daily 5% ES for the 19 ESEs. The data source is DataStream.

Table 35 (Cont.). Unconditional Coverage Test of Daily 5% ES of Emerging Stock Exchanges

Test Statistics	Probability Density Model	Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
Test Statistics	RISKMETRICS	-0.005	-0.007	-0.006	0.005	-0.009	-0.007	-0.018	-0.012	-0.011
	N	0.001	0.004	0.004	0.006	0.001	0.001	0.001	0.002	0.004
	T	0.000	0.003	0.003	0.006	-0.001	0.000	0.002	0.000	0.002
	ST	0.002	0.003	0.003	0.007	0.006	0.002	0.003	0.002	0.004
	SGT	0.001	0.003	0.004	0.007	0.002	0.001	0.002	0.000	0.005
Distance from 1	RISKMETRICS	1.005	1.007	1.006	0.995	1.009	1.007	1.018	1.012	1.011
	N	0.999	0.996	0.996	0.994	0.999	0.999	0.999	0.998	0.996
	T	1.000	0.997	0.997	0.994	1.001	1.000	0.998	1.000	0.998
	ST	0.998	0.997	0.997	0.993	0.994	0.998	0.997	0.998	0.996
	SGT	0.999	0.997	0.996	0.993	0.998	0.999	0.998	1.000	0.995

Note: Table 35 presents the unconditional coverage test of daily 5% ES for the 19 ESEs. The data source is DataStream.

5.3 Robustness Discussion

The bull/bear market regime separation results presented in Section 5.1.2 were obtained for the
LT method with the threshold values of $\pm 20\%$, (i.e., $\eta_1 = 20\%$, $\eta_2 = 20\%$). These threshold values are used to follow Lunde and Timmermann (2004). To test the robustness of this method, i.e., to check whether the choice of the threshold has not result in the separation of the bull and the bear markets that drive the results, a narrow threshold level was also adopted. More precisely, all the calculations are repeated for ($\eta_1 = 15\%$, $\eta_2 = 15\%$). These narrow threshold values are prone to produce shorter bull and bear market periods but more bull/bear market switches. The change of the threshold values is found to have no effect on the results and to preserve the conclusions.

In order to test the robustness of the conclusions drawn on the performance of the EVT, different values of γ, the threshold used for EVT were used. More precisely, the calculations were repeated for γ equal 1%, 3%, 5%, 7.5% and 10%. When γ is smaller than 5%, the parameters of Generalized Pareto Distribution cannot be reliably estimated because of the scarcity of data. With regard to the values of γ which are larger than 5%, the same conclusion on the performance of EVT based on when γ equal 5% can be dawn can be drawn[12]. Therefore, the assessment of the performance of EVT is robust to the change of the threshold choice.

Following the same idea of the bull-bear market separation, I separate the market regime into two categories based on the volatility (standard deviation) and skewness. To be more specific, the quarterly standard deviation and skewness are calculated based on daily data over a quarter. Then the quarterly standard deviation and quarterly skewness are separated into two categories: the high category and the low category. The market regime of a daily observation is then decided based on whether a particular date is in the high category or in the low category. To save space, the results are included in the appendix. From the results (Tables 32-59 and Figures 63-79), it can be found that the main conclusions discussed in this dissertation are robust to the alternative ways of

[12] The detailed results are available but not presented in the text to save space.

categorising/estimating the market regimes.

To add alternative sampling frequency, I reconducted the analysis using weekly data of the same sample. High frequency is not widely available for the countries considered in this research. If monthly data or less frequent data were to be used, there would be too few observations to conduct the parameter estimation and backtesting. Therefore, I considered weekly data as the alternative sampling frequency. To save space, the results are included in the appendix and the results (Tables 63-75 and Figures 80-106) indicate that the main conclusions based on daily data can be drawn on the weekly data.

Spain is not included in the sample due to data unavailability. The stock markets of the Portugal, Greece, Italy and Ireland during the period of the recent financial crisis are identified by the Bull/Bear market separation method in the research as the bear market period and is hence analysed and discussed accordingly. Based on the results of Tables 11-19, Tables 32-75, Figures 45-56, and Figures 63-106), the analysis of the sample with or without Portugal, Greece, Italy and Ireland leads to the conclusions which are consistent with the main conclusions of this dissertation. Therefore, the fact that five countries (i.e. Portugal, Greece, Spain, Italy and Ireland) have been in crisis over the recent years does not affect the results.

6 Conclusions

In summary, this research addresses the following questions (i) what specifications of the distribution of stock returns best fit the empirical data, (ii) are there systematic differences between the best-fit distributions for bull and bear markets, and similarly developed and emerging stock exchanges, and (iii) how does this knowledge of the best fit of the distributions help in assessing the accuracy of VaR and ES estimations using Historical Simulation (HS) and the Extreme Value Theory (EVT). It is important to answer these questions because the specification of the probability density distribution of stock returns is crucial in financial modelling. Because calculations of VaR and ES rely on the specification of the underlying probability density distribution, it is important to understand how changing the underlying probability density distribution specification affects VaR and ES and how robust the VaR and ES estimation methods are to the changes in the underlying probability density distributions.

To answer these questions, this research investigates the probability density distributions of daily equity returns from 01 January 2000 to 31 December 2016 as a whole period and then separately for the bull and bear sub-periods. The sample includes 19 developed stock exchanges and 19 emerging stock exchanges. The bull/bear market separation results indicate that all the countries in the sample experienced considerable declines of stock market indexes during the 2008 financial crisis. In addition, the dotcom bubble burst of 2000 affected all of the stock markets except for four developed ones (Australia, New Zealand, Austria, Denmark) and eight emerging ones (Saudi Arabia, Russia, Romania, Argentina, Chile, Columbia, Mexico and Peru). In addition to these two crashes, different stock exchanges suffered different country or region specific stock market shocks (e.g., the European debt crisis around 2014).

In terms of the best-fit probability density distribution of stock returns, this research indicates that the skewed generalized t distribution provides the best fit to the empirical data for most of the countries in the sample. In addition, the probability density distribution of stock returns changes as the market regime switches between the bull market and the bear market for the majority of the stock exchanges. This is consistent with the argument that mixtures of distributions may be more suitable than a single probability density distribution model to describe distributions of daily equity returns.

To be more specific, the change of the probability density distributions of stock returns are observed for 16 out of 19 developed markets and also in 8 out of 19 emerging markets. This implies that the probability density distributions of emerging stock market returns tend to be more persistent than the developed stock markets. In addition, it is interesting to note that the probability density distribution of stock returns become "simpler" when the market switches from the bull market to the bear market.

Following the results that the probability density distribution specifications of stock returns vary across countries and the probability density distribution of stock returns specifications change as the stock market regime switches, the relationship between VaR/ES and the probability density model parameters is discussed. VaR and ES are calculated using several estimation methods to investigate how the changes in the probability density models affect VaR/ES and how well different models estimate VaR/ES. The results confirm that for each confidence level (1%, 2.5% and 5%) the bear markets are riskier than the bull markets as indicated by the higher VaR and ES. There are also considerable differences in VaR and ES across countries. On average, the developed markets are less risky than the emerging markets but there are some exceptions. For example, Greece is more risky than Malaysia as indicated by VaR and ES.

In terms of VaR/ES estimations, comparable values of VaR and ES have been obtained for the student's t distribution, Hansen's skewed t distribution and the skewed generalized t distribution (referred to as the benchmark models), although, for some countries the differences between VaRs/ESs obtained for these three benchmark models are considerable. The differences across VaRs obtained for these three probability density distribution models are more pronounced in the bear markets. The differences across ESs obtained for these three probability density distribution models increase with the decrease in the confidence levels as well as in the bear markets. This is consistent with the notion that the correct specification of the tail of the distribution is important, and this importance increases in the bear markets.

In comparison with the benchmark models, the normal distribution underestimates VaR at the 1% confidence level and the magnitude of the underestimation is larger during the bear markets than during the bull markets. At the 2.5% confidence level, the normal distribution produces VaR which is similar to those obtained for the benchmark models. However, at the 5% confidence level, the normal distribution overestimates VaR compared with the benchmark models. In the case of ES, the normal distribution underestimates its values for all the confidence levels during the bull and the bear markets. These results are consistent with the expectation that the normal distribution is a poor proxy for the empirical data. It is, however, interesting that for the 2.5% confidence level the normal distribution may not be bad model to calculate VaR.

HS and EVT consistently produce similar values of VaR and of ES. HS and EVT's estimation results are not always reliable compared with the student's t distribution, Hansen's skewed t distribution and the skewed generalized t distribution. No robust and general conclusion can be drawn on HS and EVT because the performance of HS and EVT is relatively specific to the particular stock exchange and the market regime. HS and EVT tend to overestimate VaR at all confidence levels for the whole sample period and the bull markets. However, for the bear markets, HS and EVT may overestimate or underestimate VaR depending on the exchange. In terms of ES, the performance of HS and EVT seems unstable. HS and EVT may overestimate or underestimate ES depending on the stock exchange.

Overall, this research provides significant insights and has important managerial implications. The first result of this research is the empirical evidence of the statistically significant heterogeneity of the probability density of stock market returns during different market regimes and across the developed stock exchanges and the emerging stock exchanges. The empirical probability density distributions of stock returns are fundamental chrematistics of stock returns which can be used to calibrate asset pricing models and to be used as empirical evidence for further research on the stock market. Hence the result on the probability density of stock market returns can be used as the empirical evidence by scholars for the further academic research on financial modelling, asset pricing and financial risk forecasting. What is more important, the results of this research, in some degree, challenge the iid assumption which is widely used in finance research by demonstrating the empirical evidence that the probability density distribution of stock market returns is not stable during different market regimes. In addition, heterogeneity of the probability density of stock market returns in the developed stock exchanges and the emerging stock exchanges is a caveat that the results of research on probability density of stock market returns in developed markets may not suitable for the emerging markets. The second result of this research is the theoretical analysis and the graphical demonstration on how the tail risk measures rely on the underlying probability density models. This result provides important managerial implications for risk managers and regulators who use VaR and ES for investment decision making, to set capital requirements for banks and other financial institutions, and to conduct stress test. First, the simulation results of this research provide a comprehensive and intuitive demonstration on how the estimates of VaR and ES are affected by the shape of the probability density distributions, i.e. the values of the parameters specifying the probability density models. The third result of this research is the empirical estimates of VaR and ES by different models during different market regimes across both developed markets and emerging markets. This result demonstrates how significant difference of the tail risk of different market regimes and hence indicates that the data drawn from different market regimes used by the same model deliver significantly different estimates of the tail risk. These results emphasize the importance of separating the market regimes appropriately for tail risk measure estimation. In addition, the results show different estimation methods of tail risk measures produce quite different estimates of the tail risk. This information can be used for risk managers and regulators to select the optimal tail risk estimate models according to the stock exchange and the market condition. The forth result of this research is an innovative conditional forecasting strategy for VaR and ES. This innovative forecasting strategy is applied with a wide range of popular conditional models of stock returns over a broad sample of stock exchanges. This novel forecasting strategy can be used by investors to assess the risk exposure of the trading positions to achieve more accurate and reliable risk management. In addition, the innovative conditional tail risk forecasting strategy can be considered by regulators for making risk management policies and rules for banking regulation.

There are some limits of the current research. In terms of the data and methodology, the backtesting of the ES may be improved by using rigours statistical tests on the unconditional coverage. The independence of ES may be tested by statistical tests. Alterative market categorization methods can be considered and used in the future research. The market categorization may be decided by the combination of the statistical moments. In addition, high frequency data may be used to calculate the statistical moments of the daily data or weekly data and the market regimes can be categorized based on these statistical moments calculated from high frequency data. More advanced structure of the dynamics of the first moment may be modelled to improve this research.

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8 Appendix

8.1 Devotional Risk Measures and Coherent Risk Measures

8.1.1 Deviational Risk Measure

Suppose that the value of the investment is represented by the random number X as defined. A general deviational risk measure φ satisfies four axioms:

D1. Positiveness: $\varphi(X) > 0, for\ all\ X\ \varphi(C) > 0, for\ X = C$

D2. Positive homogeneity: $X \in V, \varphi(0) = 0\ , C > 0 \to \varphi(C \cdot X) = C \cdot \varphi(X)$

This axiom indicates that if the investment value triples (C=3) then the portfolio risk triples.

D3. Convexity/Subadditivity: $\varphi(X_1 + X_2) \leq \varphi(X_1) + \varphi(X_2)$

This axiom indicates that the risk to the investment of the sum of X_1 *and* X_2 *cannot be worse than the sum of the two individual investment risks (diversification principle).*

D4. Translation invariance: $\varphi(X + C) = \varphi(X)\ for\ all\ X\ and\ constants\ C$

Deviational risk measure reflects the uncertainty associated with the investment$X$*. Therefore, adding a cash to the current investment will no change the overall uncertainty/fluctuation of the investment.*

8.1.2 Coherent Risk Measure

A general Coherent Risk Measure satisfies the four axioms:

C1. Monotonicity: $X_1, X_2 \in V, X_1 \leq X_2 \to\ \varphi(X_1) \geq \varphi(X_2)$

Monotonicity indicates that if investment X_1 *value never exceeds the values of investment* X_2 *(e.g., is always negative, hence its losses will be equal or larger), the risk of* X_2 *should never exceed that of* X_1

C2. Convexity/Subadditivity: $\varphi(X_1 + X_2) \leq \varphi(X_1) + \varphi(X_2)$

This axiom indicates that the risk to the investment of the sum of X_1 *and* X_2 *cannot be worse than the sum of the two individual investment risks (diversification principle).*

C3. Positive homogeneity: $X \in V, C > 0 \rightarrow \varphi(C \cdot X) = C \cdot \varphi(X)$

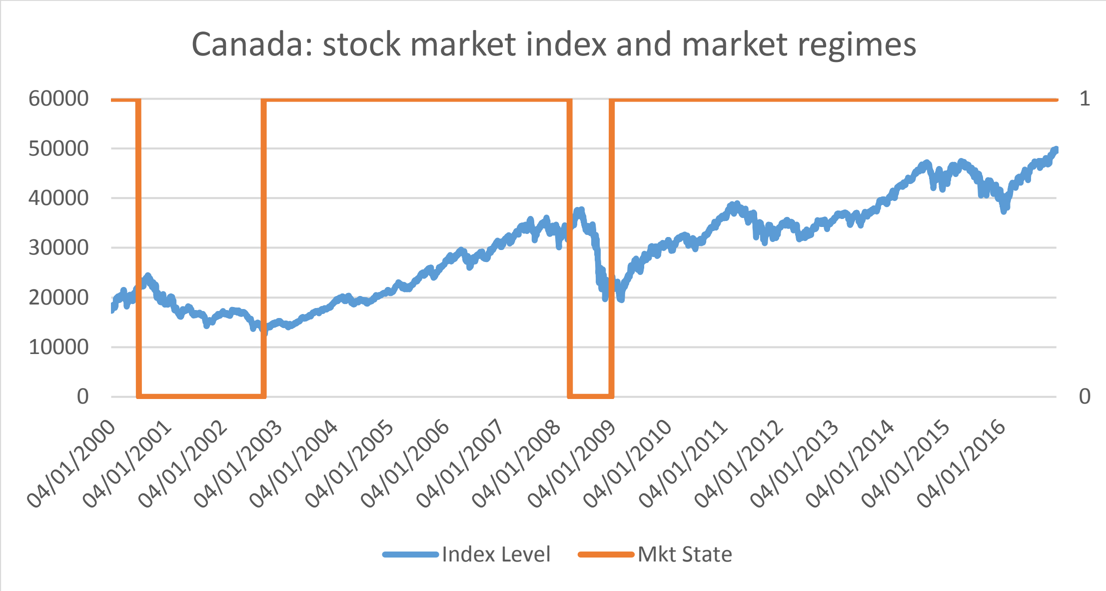
This axiom indicates that if the investment value triples (C=3) then the portfolio risk triples.

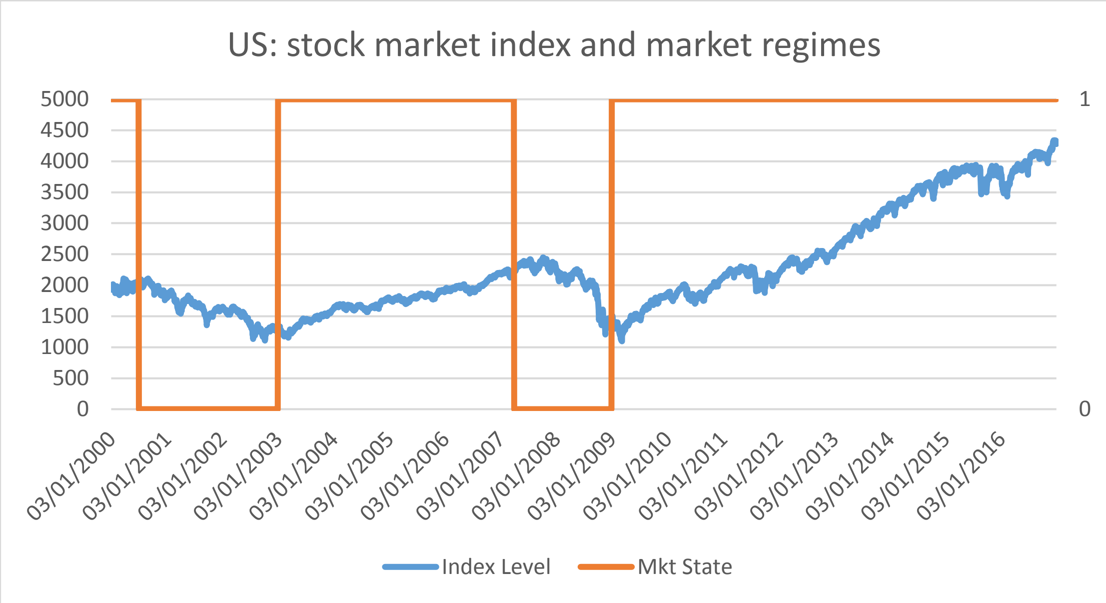
C4. Translation invariance: $X \in V, C \in R \rightarrow \varphi(X + C) = \varphi(X) - C$

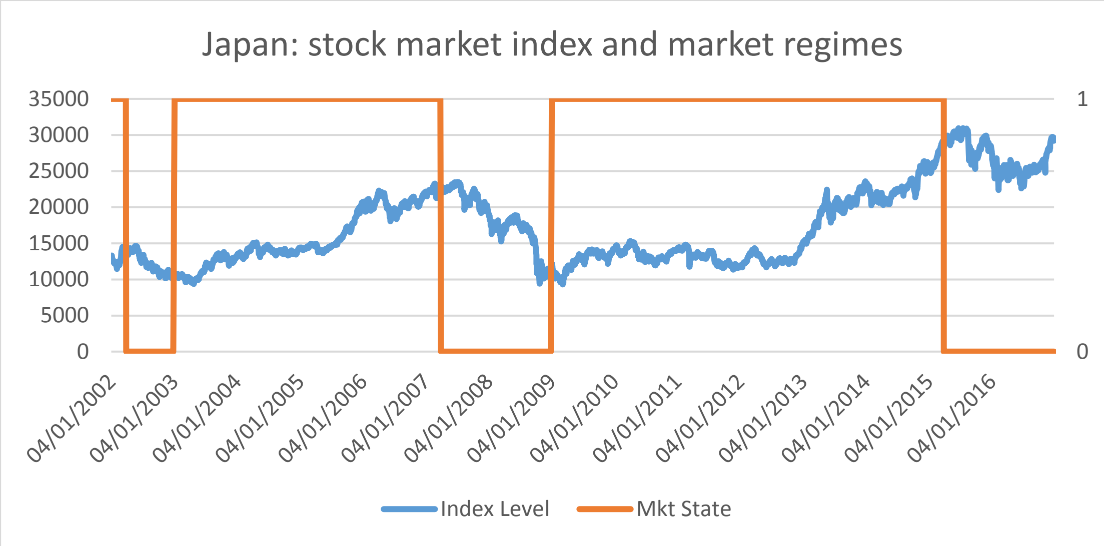
This axiom means that adding C to the current investment is like adding cash (cash acts as insurance), so the risk of the new investment X+C should be less than the risk of X by the amount of cash, C

8.2 Bull/Bear Market Regime Separation

The original LT based bull and bear market separation results for developed stock exchanges. In these figures, the blue lines are the daily movement of the market index for the country for the whole sample period 1 January 2000 and 31 January 2016. The left-hand vertical axis indicates the value of the index and the right-hand side vertical axis indicates the market regimes with 1 denoting bull market regime and 0 denoting bear market regime.






Japan: stock market index and market regimes
35000
30000
25000
20000
15000
10000
5000
0
1
0
04/01/2002
04/01/2003
04/01/2004
04/01/2005
04/01/2006
04/01/2007
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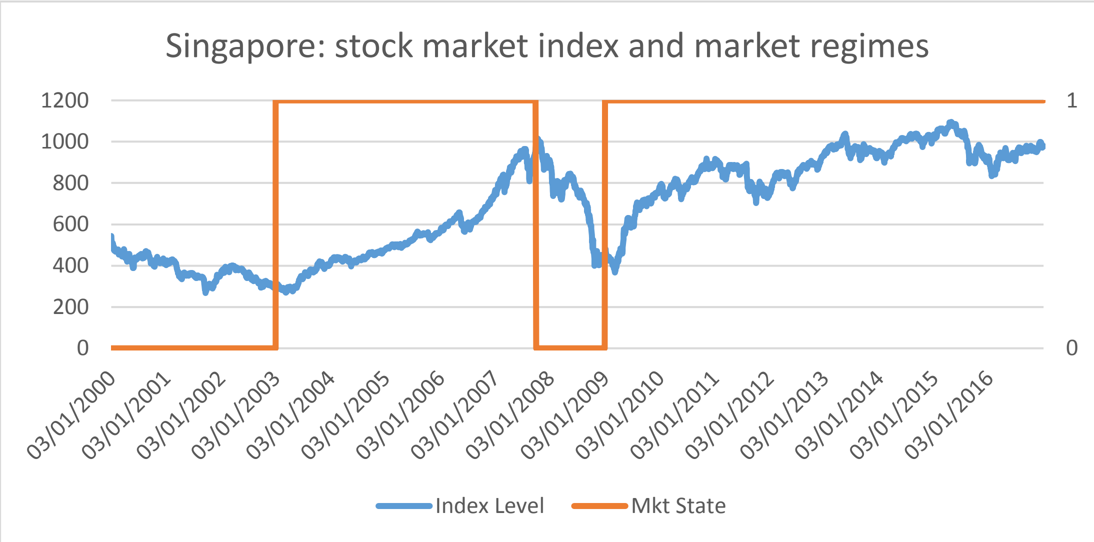
04/01/2009
04/01/2010
04/01/2011
04/01/2012
04/01/2013
04/01/2014
04/01/2015
04/01/2016
Index Level
Mkt State


Singapore: stock market index and market regimes
1200
1000
800
600
400
200
0
1
0
03/01/2000
03/01/2001
03/01/2002
03/01/2003
03/01/2004
03/01/2005
03/01/2006
03/01/2007
03/01/2008
03/01/2009
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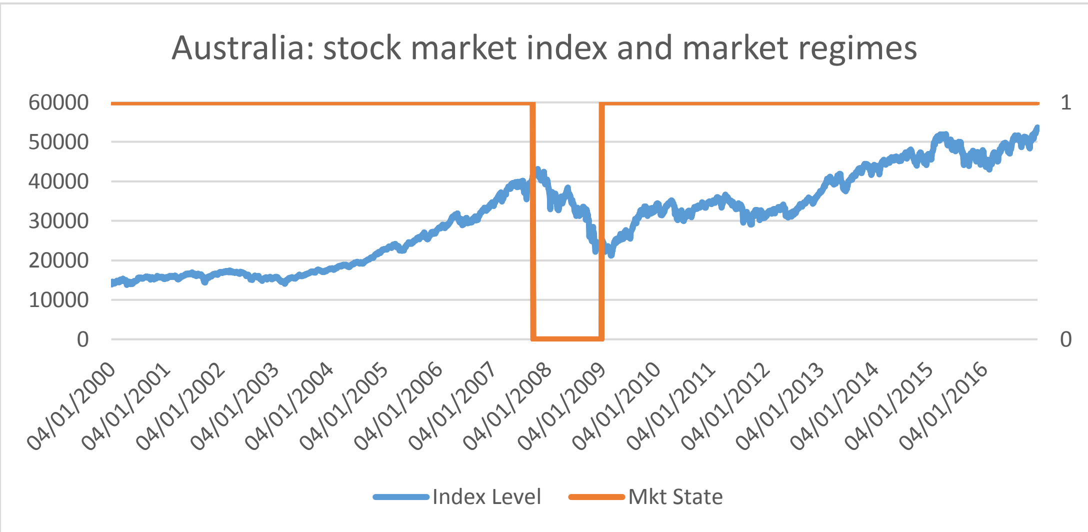
03/01/2013
03/01/2014
03/01/2015
03/01/2016
Index Level
Mkt State


Australia: stock market index and market regimes
60000
50000
40000
30000
20000
10000
0
1
0
04/01/2000
04/01/2001
04/01/2002
04/01/2003
04/01/2004
04/01/2005
04/01/2006
04/01/2007
04/01/2008
04/01/2009
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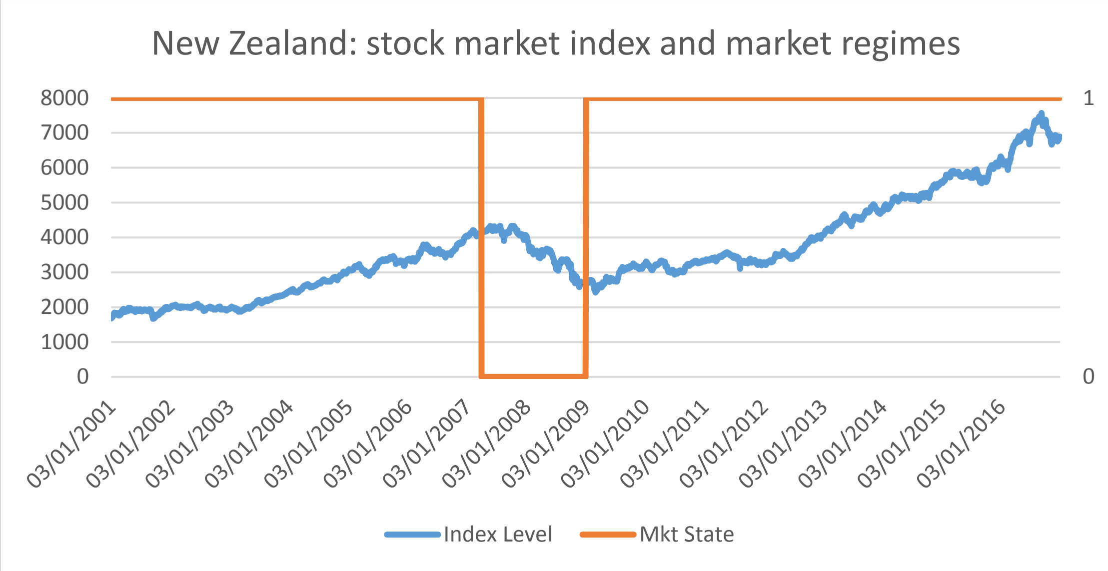
04/01/2012
04/01/2013
04/01/2014
04/01/2015
04/01/2016
Index Level
Mkt State


New Zealand: stock market index and market regimes
8000
7000
6000
5000
4000
3000
2000
1000
0
1
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03/01/2001
03/01/2002
03/01/2003
03/01/2004
03/01/2005
03/01/2006
03/01/2007
03/01/2008
03/01/2009
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03/01/2015
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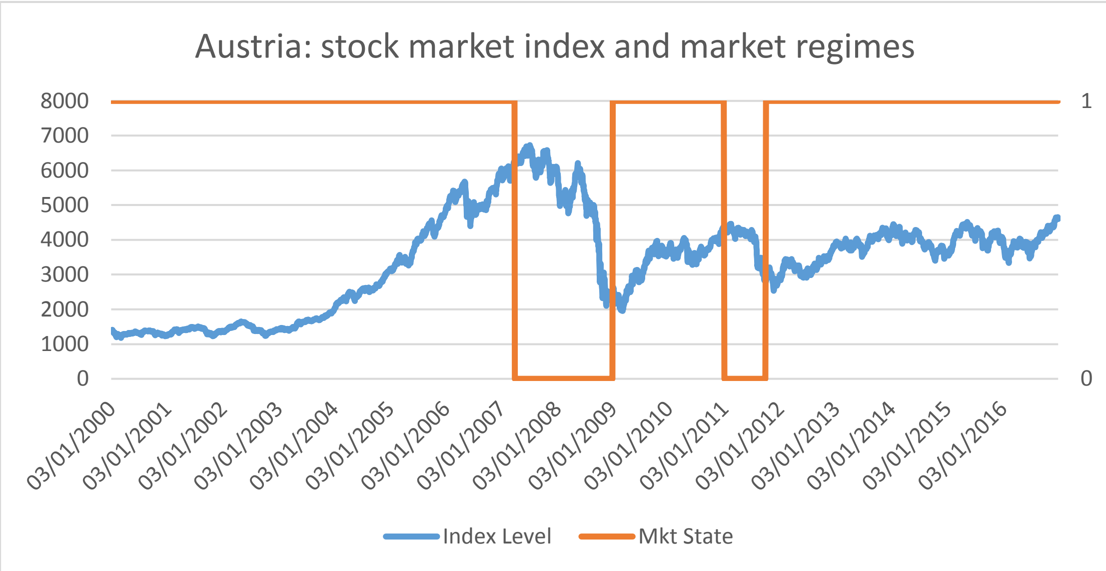
Index Level
Mkt State


Austria: stock market index and market regimes
8000
7000
6000
5000
4000
3000
2000
1000
0
1
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03/01/2000
03/01/2001
03/01/2002
03/01/2003
03/01/2004
03/01/2005
03/01/2006
03/01/2007
03/01/2008
03/01/2009
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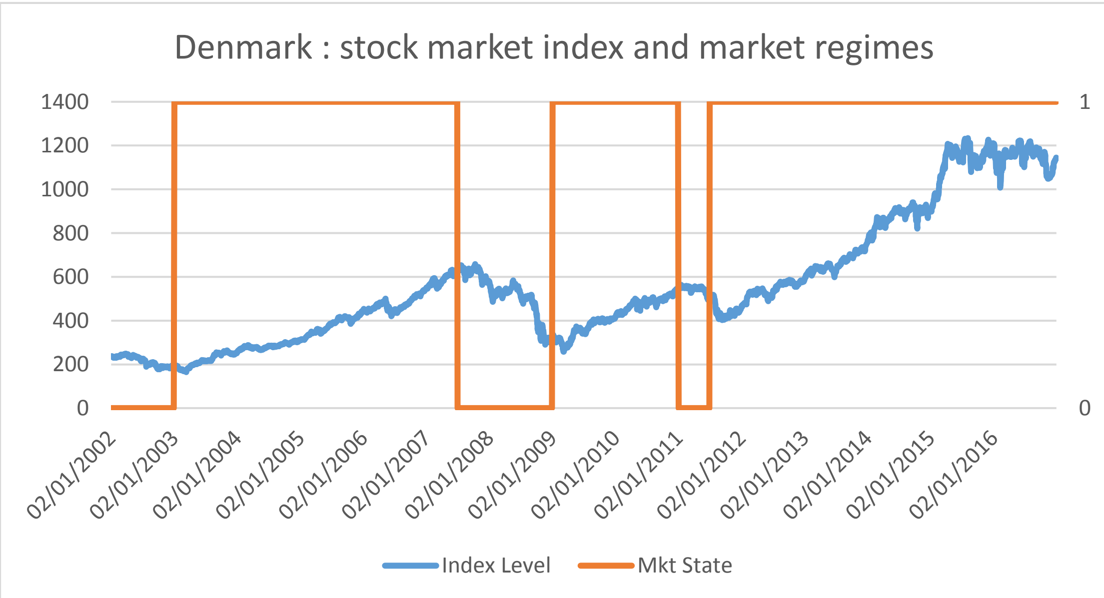
03/01/2015
03/01/2016
Index Level
Mkt State


Denmark : stock market index and market regimes
1400
1200
1000
800
600
400
200
0
1
0
02/01/2002
02/01/2003
02/01/2004
02/01/2005
02/01/2006
02/01/2007
02/01/2008
02/01/2009
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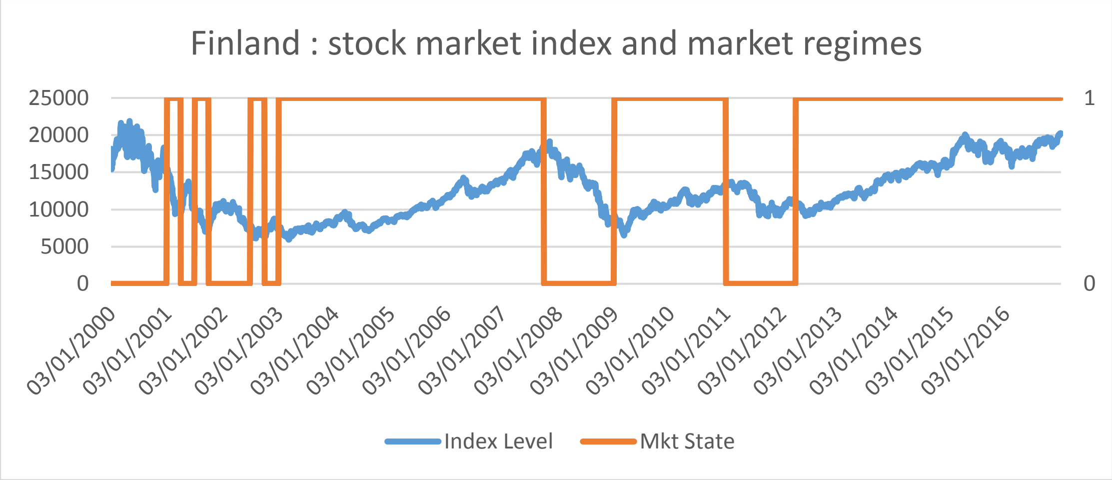
02/01/2011
02/01/2012
02/01/2013
02/01/2014
02/01/2015
02/01/2016
Index Level
Mkt State


Finland : stock market index and market regimes
25000
20000
15000
10000
5000
0
1
0
03/01/2000
03/01/2001
03/01/2002
03/01/2003
03/01/2004
03/01/2005
03/01/2006
03/01/2007
03/01/2008
03/01/2009
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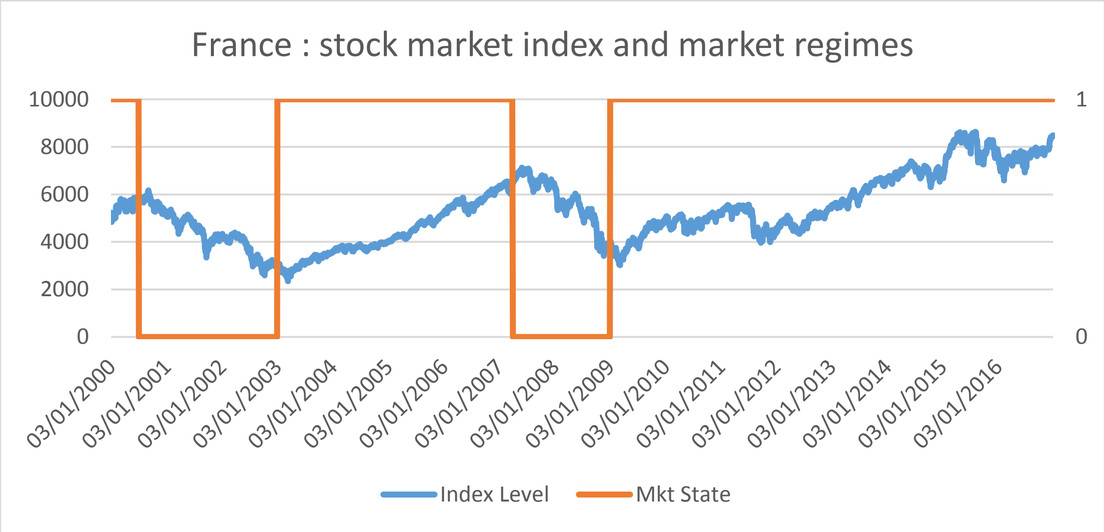
03/01/2014
03/01/2015
03/01/2016
Index Level
Mkt State


France : stock market index and market regimes
10000
8000
6000
4000
2000
0
1
0
03/01/2000
03/01/2001
03/01/2002
03/01/2003
03/01/2004
03/01/2005
03/01/2006
03/01/2007
03/01/2008
03/01/2009
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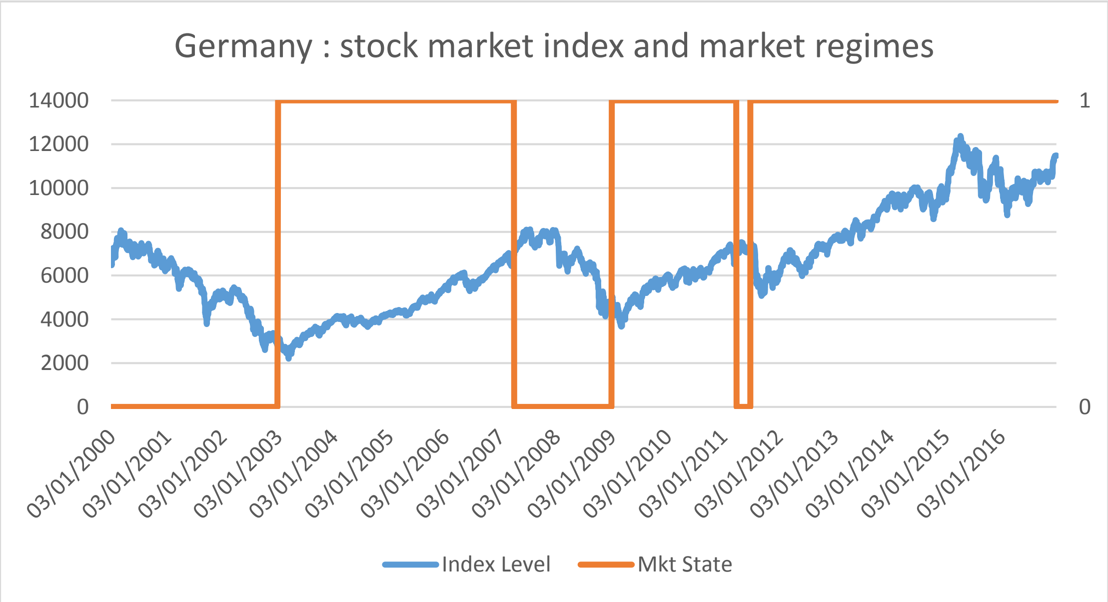
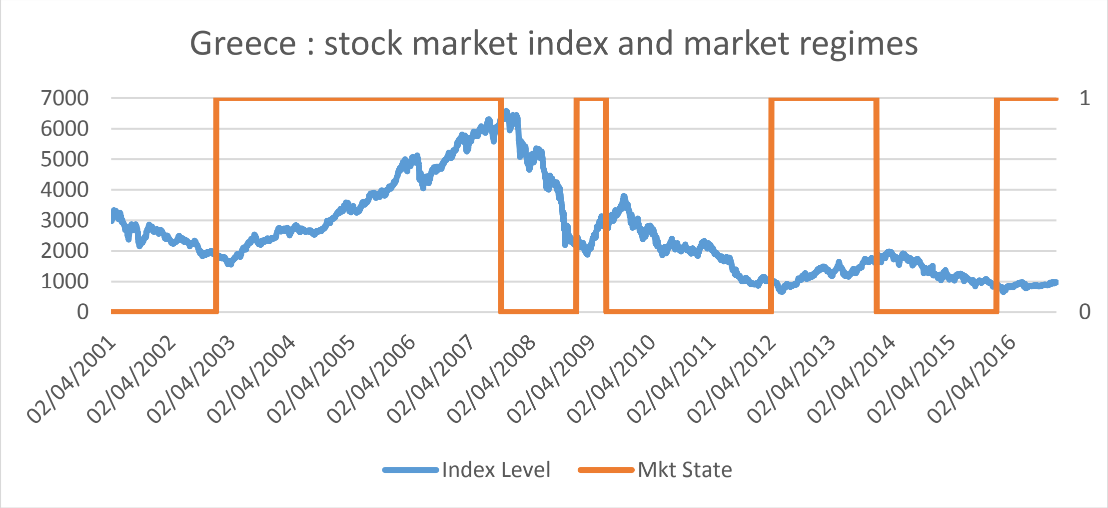
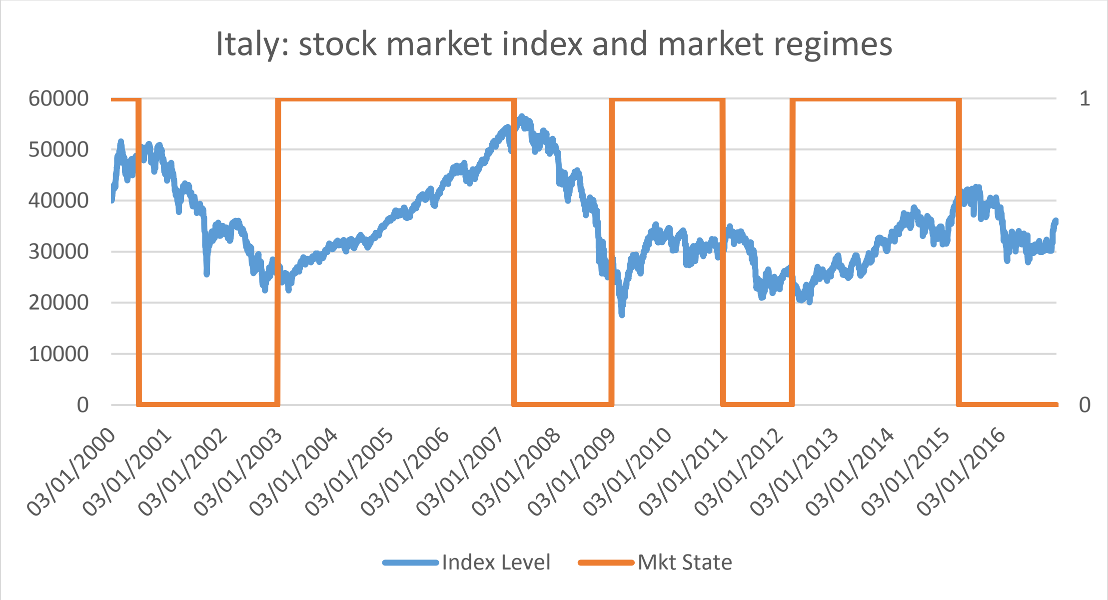
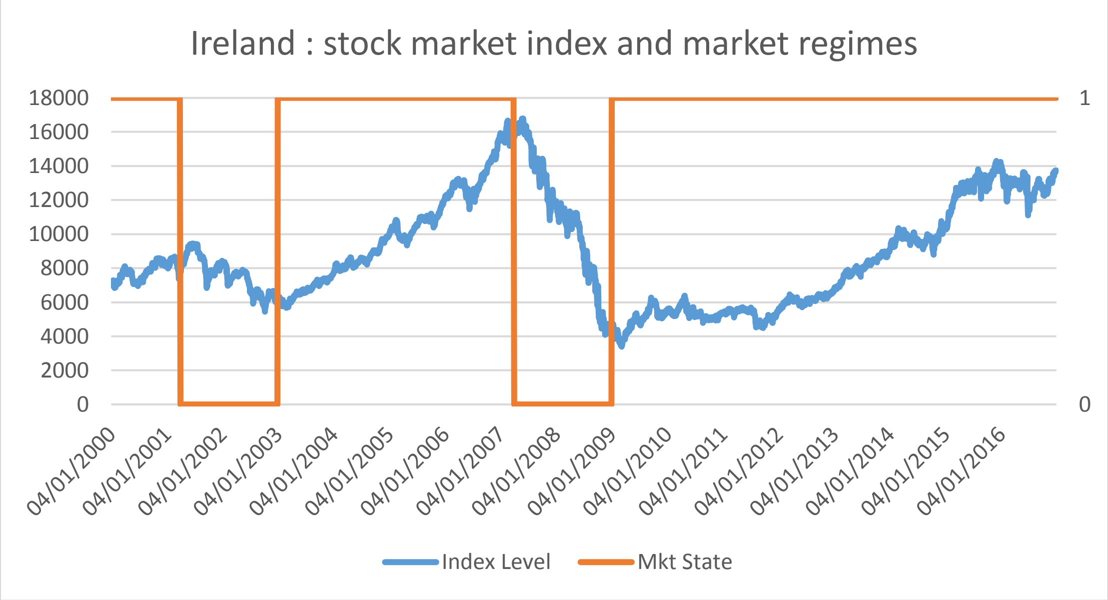
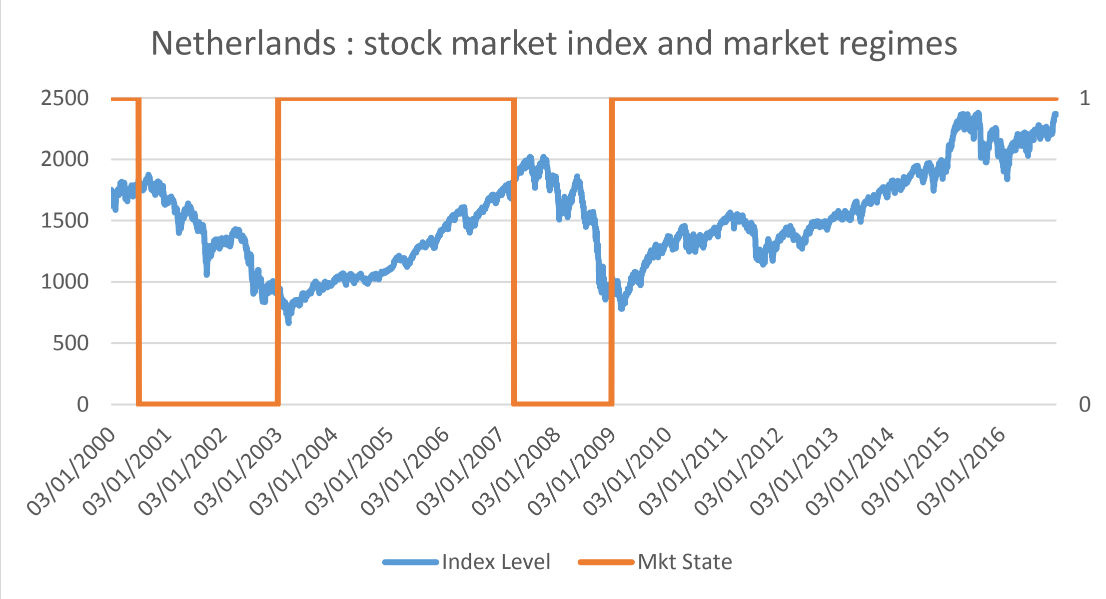
03/01/2011
03/01/2012
03/01/2013
03/01/2014
03/01/2015
03/01/2016
Index Level
Mkt State

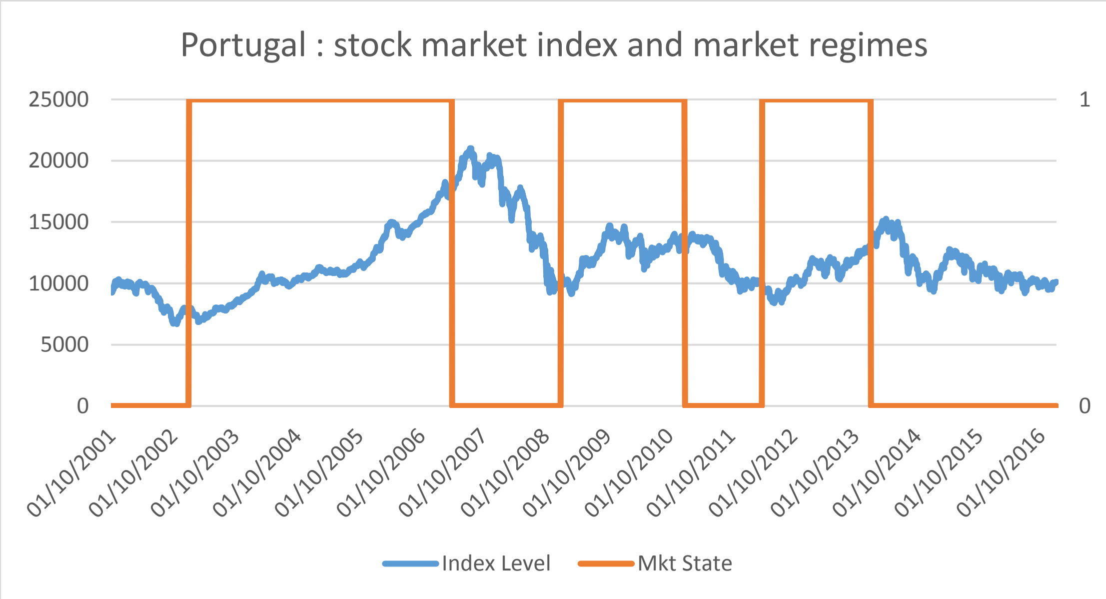

Germany : stock market index and market regimes
14000
12000
10000
8000
6000
4000
2000
0
1
0
03/01/2000
03/01/2001
03/01/2002
03/01/2003
03/01/2004
03/01/2005
03/01/2006
03/01/2007
03/01/2008
03/01/2009
03/01/2010
03/01/2011
03/01/2012
03/01/2013
03/01/2014
03/01/2015
03/01/2016
Index Level
Mkt State


Greece : stock market index and market regimes
7000
6000
5000
4000
3000
2000
1000
0
1
0
02/04/2001
02/04/2002
02/04/2003
02/04/2004
02/04/2005
02/04/2006
02/04/2007
02/04/2008
02/04/2009
02/04/2010
02/04/2011
02/04/2012
02/04/2013
02/04/2014
02/04/2015
02/04/2016
Index Level
Mkt State


Italy: stock market index and market regimes
60000
50000
40000
30000
20000
10000
0
1
0
03/01/2000
03/01/2001
03/01/2002
03/01/2003
03/01/2004
03/01/2005
03/01/2006
03/01/2007
03/01/2008
03/01/2009
03/01/2010
03/01/2011
03/01/2012
03/01/2013
03/01/2014
03/01/2015
03/01/2016
Index Level
Mkt State


Ireland : stock market index and market regimes
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
1
0
04/01/2000
04/01/2001
04/01/2002
04/01/2003
04/01/2004
04/01/2005
04/01/2006
04/01/2007
04/01/2008
04/01/2009
04/01/2010
04/01/2011
04/01/2012
04/01/2013
04/01/2014
04/01/2015
04/01/2016
Index Level
Mkt State


Netherlands : stock market index and market regimes
2500
2000
1500
1000
500
0
1
0
03/01/2000
03/01/2001
03/01/2002
03/01/2003
03/01/2004
03/01/2005
03/01/2006
03/01/2007
03/01/2008
03/01/2009
03/01/2010
03/01/2011
03/01/2012
03/01/2013
03/01/2014
03/01/2015
03/01/2016
Index Level
Mkt State


Portugal : stock market index and market regimes
25000
20000
15000
10000
5000
0
1
0
01/10/2001
01/10/2002
01/10/2003
01/10/2004
01/10/2005
01/10/2006
01/10/2007
01/10/2008
01/10/2009
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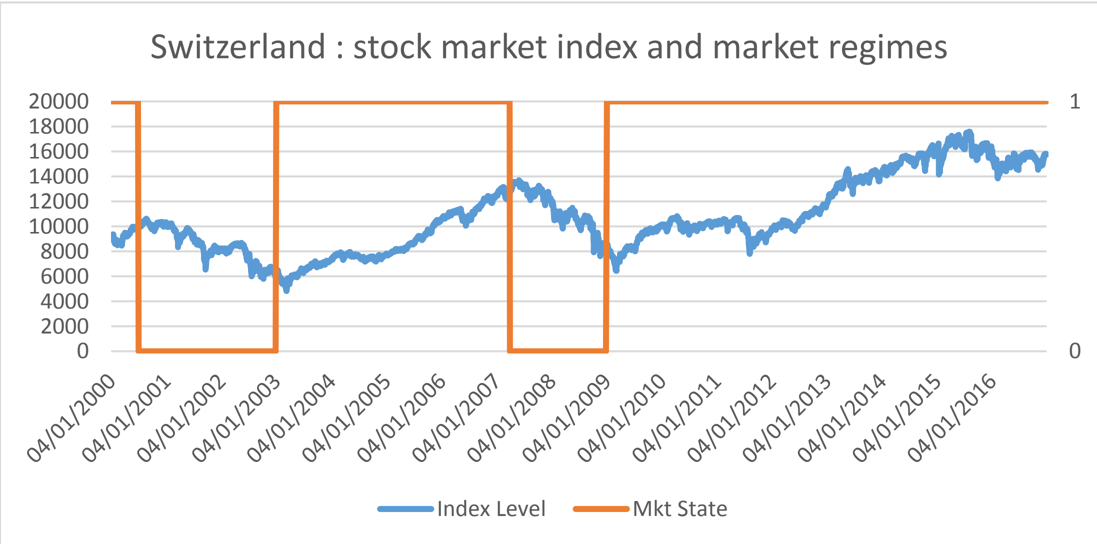
01/10/2011
01/10/2012
01/10/2013
01/10/2014
01/10/2015
01/10/2016
Index Level
Mkt State


Switzerland : stock market index and market regimes
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
1
0
04/01/2000
04/01/2001
04/01/2002
04/01/2003
04/01/2004
04/01/2005
04/01/2006
04/01/2007
04/01/2008
04/01/2009
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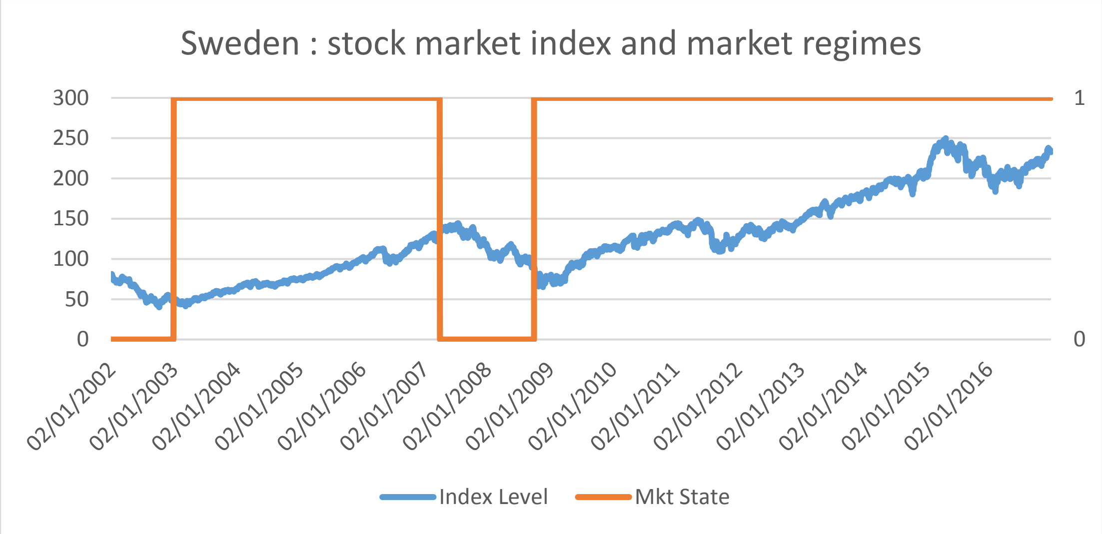
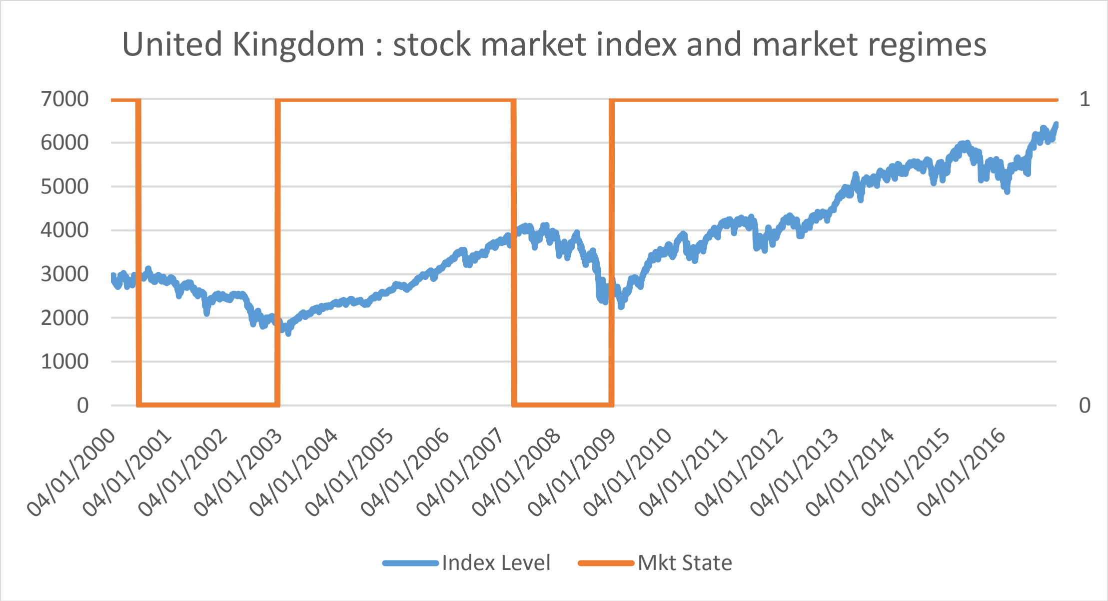
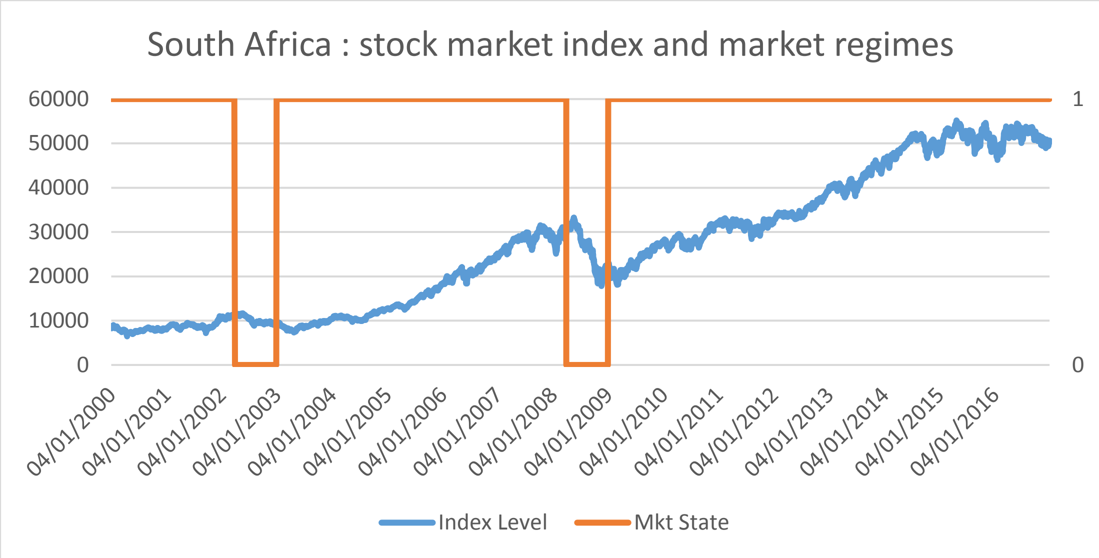
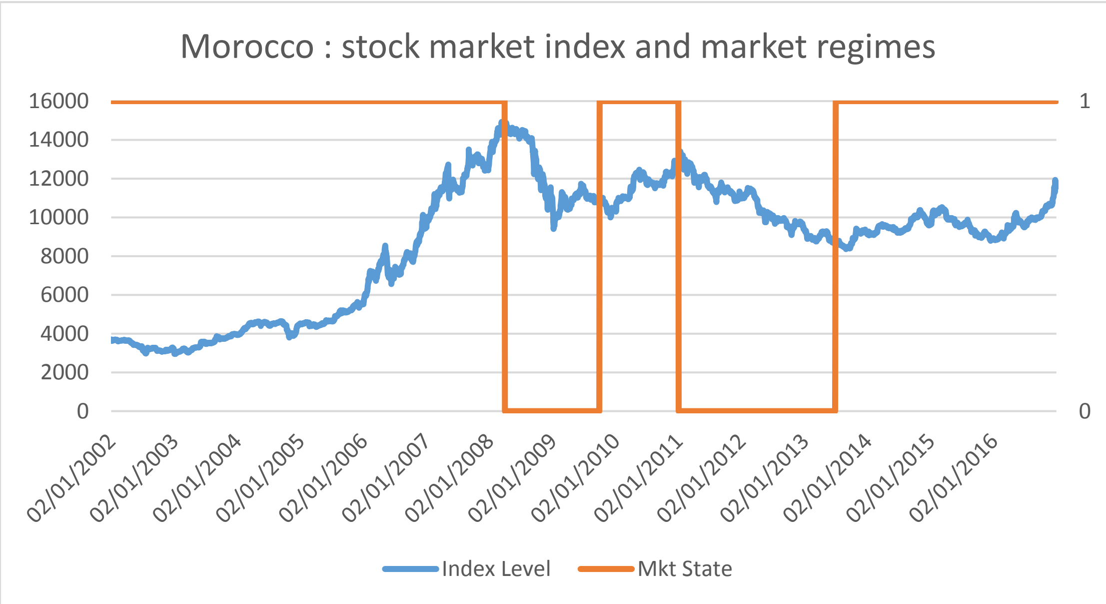
04/01/2012
04/01/2013
04/01/2014
04/01/2015
04/01/2016
Index Level
Mkt State

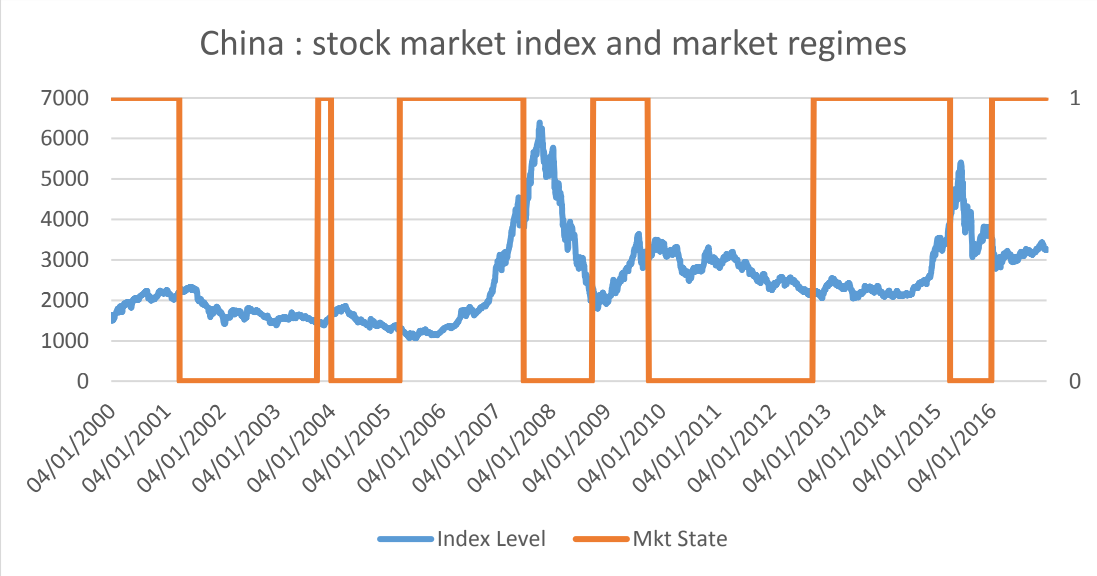

Sweden : stock market index and market regimes
300
250
200
150
100
50
0
1
0
02/01/2002
02/01/2003
02/01/2004
02/01/2005
02/01/2006
02/01/2007
02/01/2008
02/01/2009
02/01/2010
02/01/2011
02/01/2012
02/01/2013
02/01/2014
02/01/2015
02/01/2016
Index Level
Mkt State


United Kingdom : stock market index and market regimes
7000
6000
5000
4000
3000
2000
1000
0
1
0
04/01/2000
04/01/2001
04/01/2002
04/01/2003
04/01/2004
04/01/2005
04/01/2006
04/01/2007
04/01/2008
04/01/2009
04/01/2010
04/01/2011
04/01/2012
04/01/2013
04/01/2014
04/01/2015
04/01/2016
Index Level
Mkt State

The original LT based bull and bear market separation results for emerging stock exchanges. In the figures, the blue lines are the daily movement of the market index for the country for the whole sample period 1 January 2000 and 31 January 2016. The left-hand vertical axis indicates the value of the index and the right-hand side vertical axis indicates the market regimes with 1 denoting bull market regime and 0 denoting bear market regime.






China : stock market index and market regimes
7000
6000
5000
4000
3000
2000
1000
0
1
0
04/01/2000
04/01/2001
04/01/2002
04/01/2003
04/01/2004
04/01/2005
04/01/2006
04/01/2007
04/01/2008
04/01/2009
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04/01/2012
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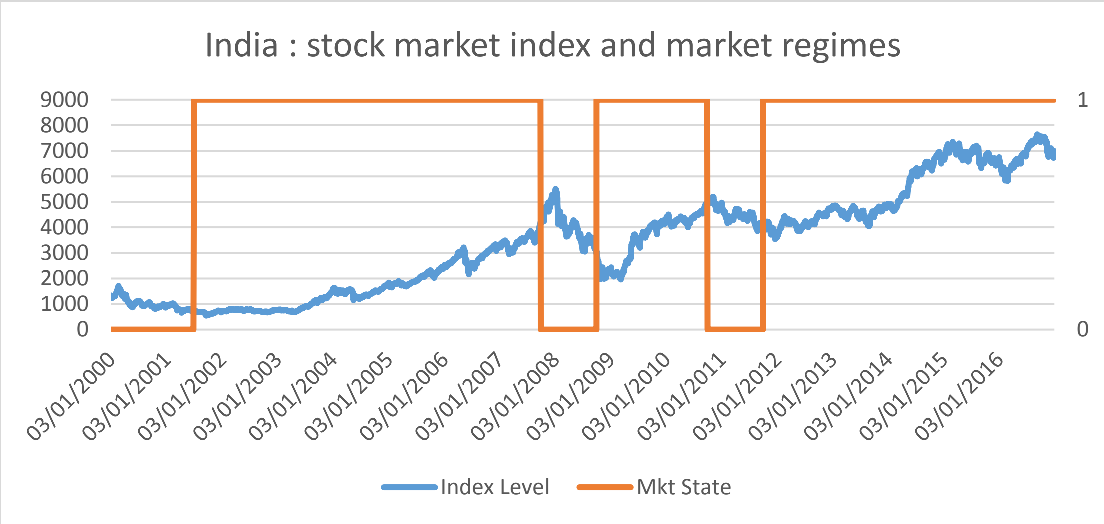
04/01/2014
04/01/2015
04/01/2016
Index Level
Mkt State


India : stock market index and market regimes
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
1
0
03/01/2000
03/01/2001
03/01/2002
03/01/2003
03/01/2004
03/01/2005
03/01/2006
03/01/2007
03/01/2008
03/01/2009
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03/01/2011
03/01/2012
03/01/2013
03/01/2014
03/01/2015
03/01/2016
Index Level
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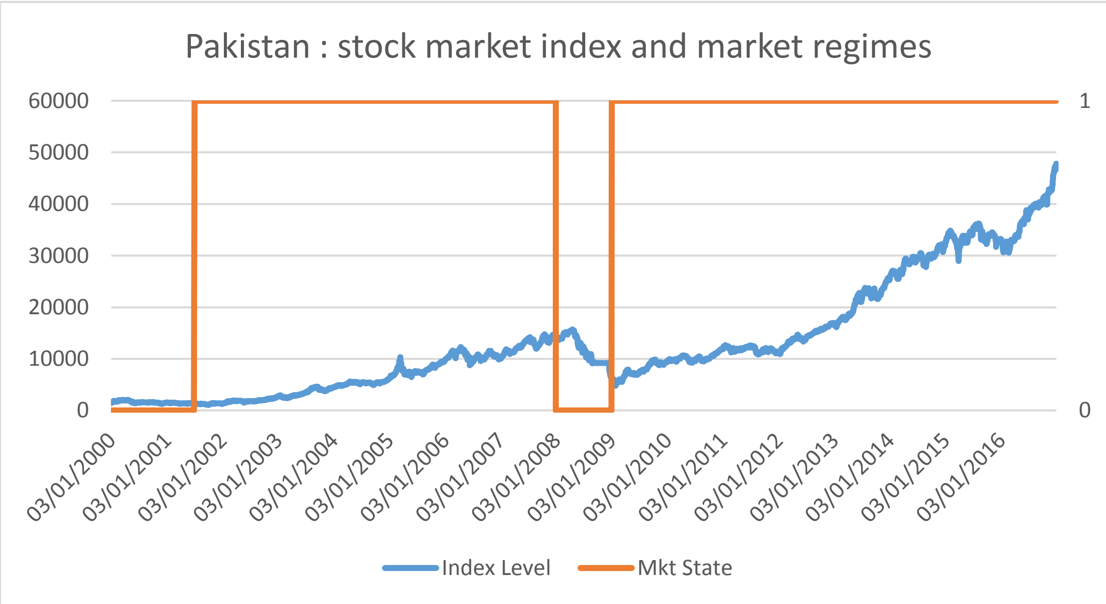
Pakistan : stock market index and market regimes
60000
50000
40000
30000
20000
10000
0
1
0
03/01/2000
03/01/2001
03/01/2002
03/01/2003
03/01/2004
03/01/2005
03/01/2006
03/01/2007
03/01/2008
03/01/2009
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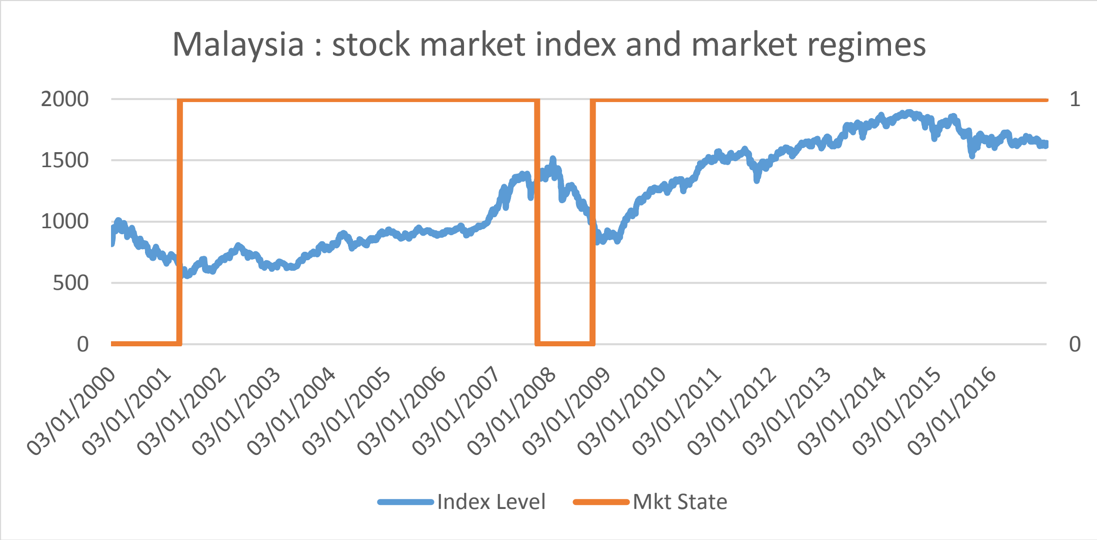
03/01/2012
03/01/2013
03/01/2014
03/01/2015
03/01/2016
Index Level
Mkt State


Malaysia : stock market index and market regimes
2000
1500
1000
500
0
1
0
03/01/2000
03/01/2001
03/01/2002
03/01/2003
03/01/2004
03/01/2005
03/01/2006
03/01/2007
03/01/2008
03/01/2009
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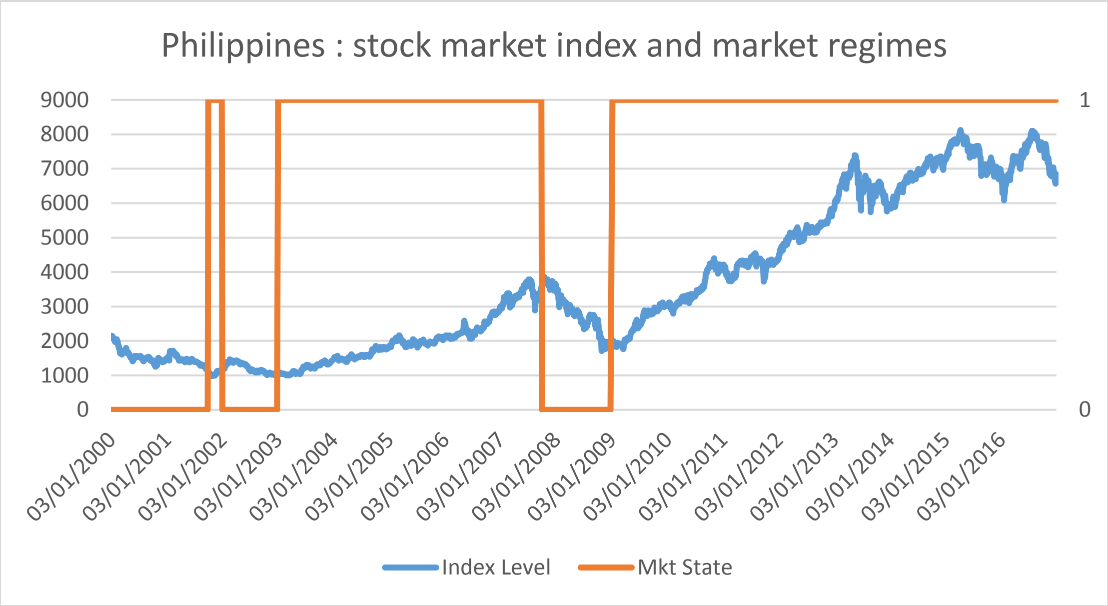
03/01/2012
03/01/2013
03/01/2014
03/01/2015
03/01/2016
Index Level
Mkt State


Philippines : stock market index and market regimes
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
1
0
03/01/2000
03/01/2001
03/01/2002
03/01/2003
03/01/2004
03/01/2005
03/01/2006
03/01/2007
03/01/2008
03/01/2009
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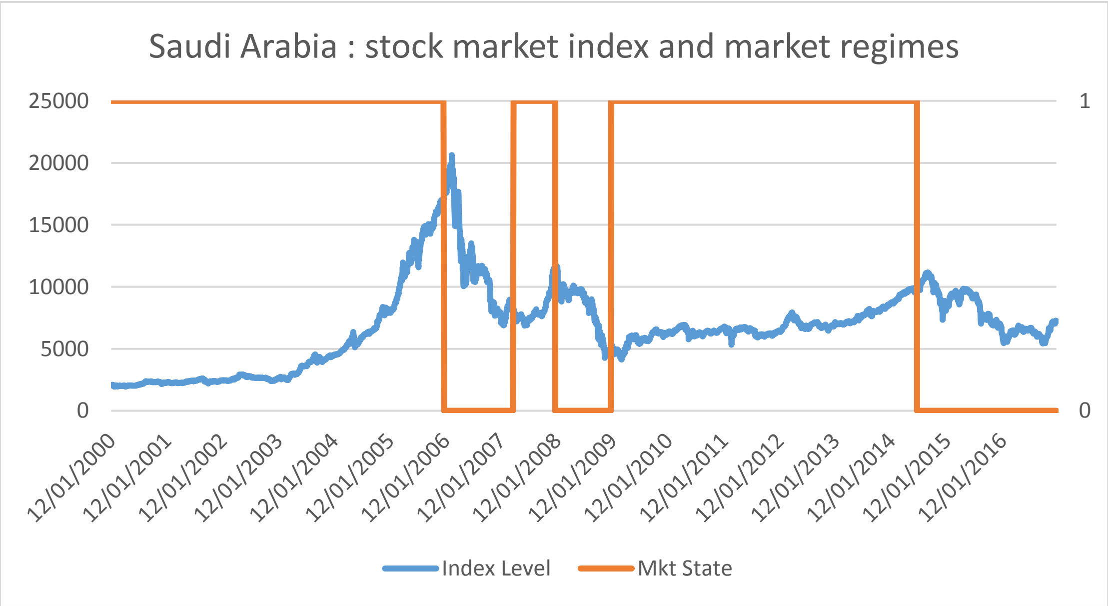
03/01/2012
03/01/2013
03/01/2014
03/01/2015
03/01/2016
Index Level
Mkt State


Saudi Arabia : stock market index and market regimes
25000
20000
15000
10000
5000
0
1
0
12/01/2000
12/01/2001
12/01/2002
12/01/2003
12/01/2004
12/01/2005
12/01/2006
12/01/2007
12/01/2008
12/01/2009
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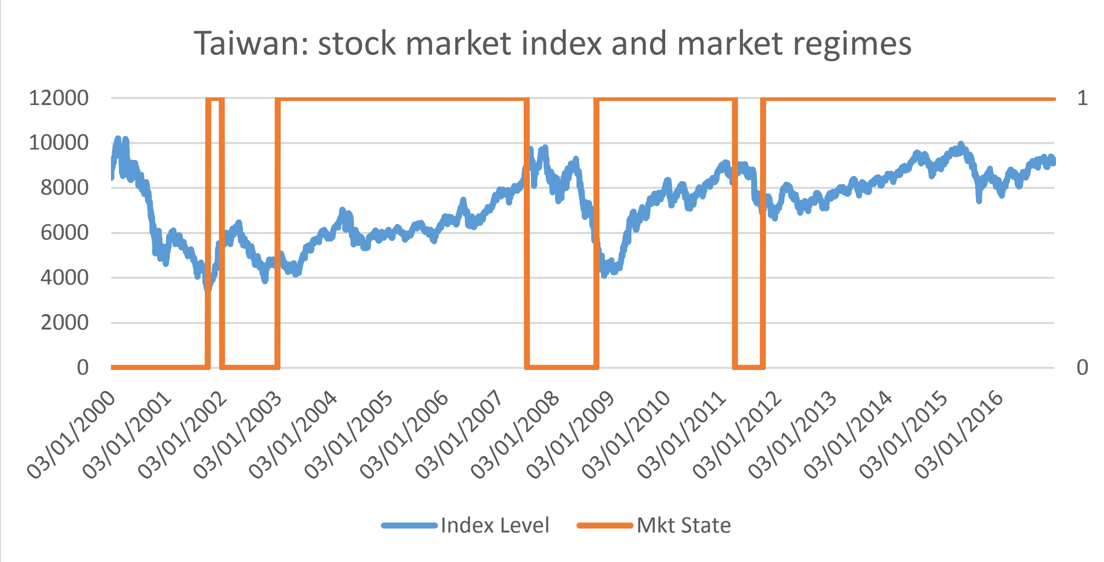
12/01/2012
12/01/2013
12/01/2014
12/01/2015
12/01/2016
Index Level
Mkt State


Taiwan: stock market index and market regimes
12000
10000
8000
6000
4000
2000
0
1
0
03/01/2000
03/01/2001
03/01/2002
03/01/2003
03/01/2004
03/01/2005
03/01/2006
03/01/2007
03/01/2008
03/01/2009
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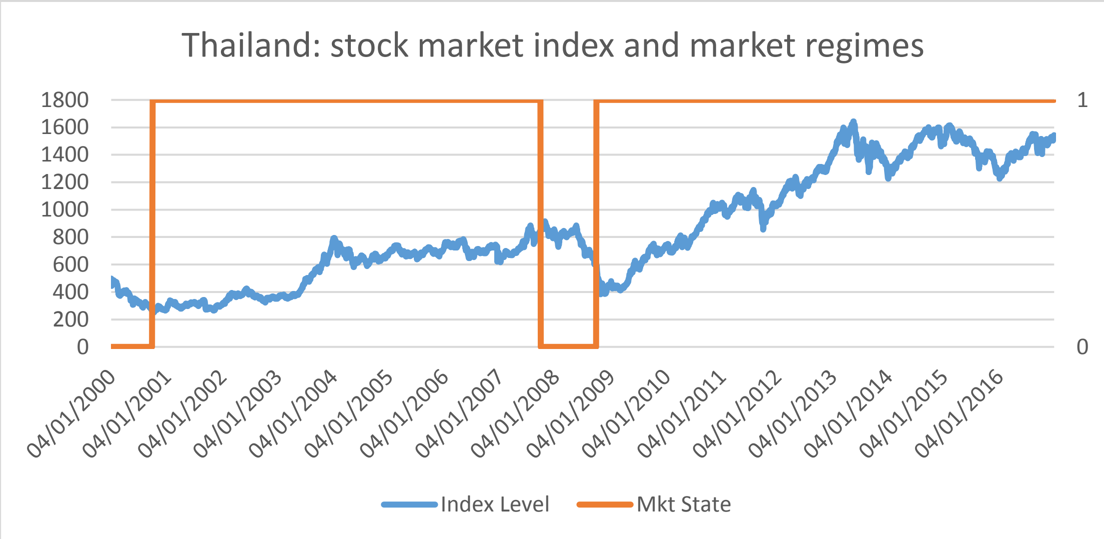
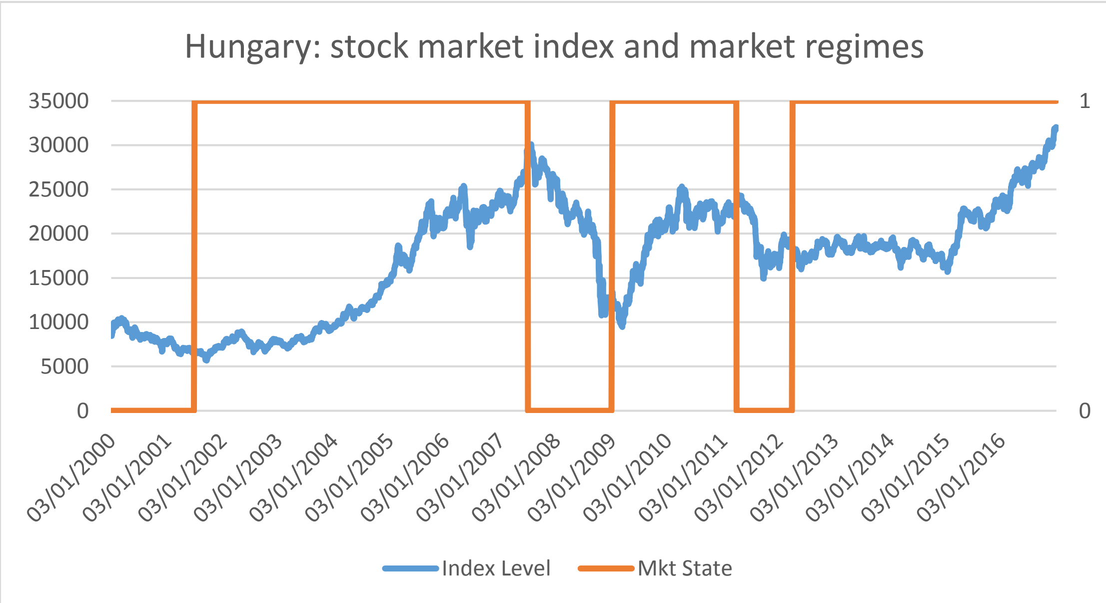
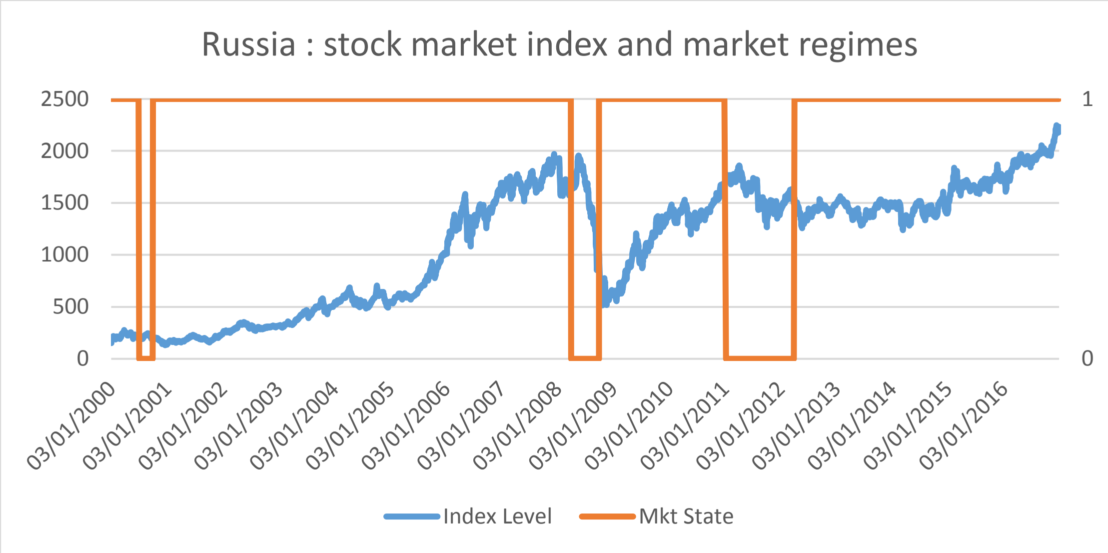
03/01/2011
03/01/2012
03/01/2013
03/01/2014
03/01/2015
03/01/2016
Index Level
Mkt State


Thailand: stock market index and market regimes
1800
1600
1400
1200
1000
800
600
400
200
0
1
0
04/01/2000
04/01/2001
04/01/2002
04/01/2003
04/01/2004
04/01/2005
04/01/2006
04/01/2007
04/01/2008
04/01/2009
04/01/2010
04/01/2011
04/01/2012
04/01/2013
04/01/2014
04/01/2015
04/01/2016
Index Level
Mkt State


Hungary: stock market index and market regimes
35000
30000
25000
20000
15000
10000
5000
0
1
0
03/01/2000
03/01/2001
03/01/2002
03/01/2003
03/01/2004
03/01/2005
03/01/2006
03/01/2007
03/01/2008
03/01/2009
03/01/2010
03/01/2011
03/01/2012
03/01/2013
03/01/2014
03/01/2015
03/01/2016
Index Level
Mkt State


Russia : stock market index and market regimes
2500
2000
1500
1000
500
0
1
0
03/01/2000
03/01/2001
03/01/2002
03/01/2003
03/01/2004
03/01/2005
03/01/2006
03/01/2007
03/01/2008
03/01/2009
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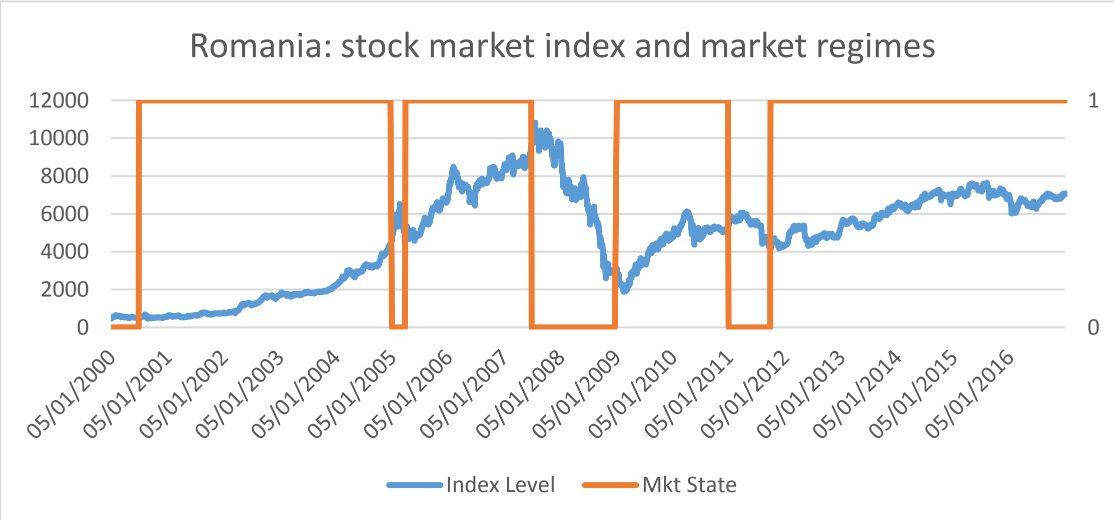
03/01/2012
03/01/2013
03/01/2014
03/01/2015
03/01/2016
Index Level
Mkt State


Romania: stock market index and market regimes
12000
10000
8000
6000
4000
2000
0
1
0
05/01/2000
05/01/2001
05/01/2002
05/01/2003
05/01/2004
05/01/2005
05/01/2006
05/01/2007
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05/01/2009
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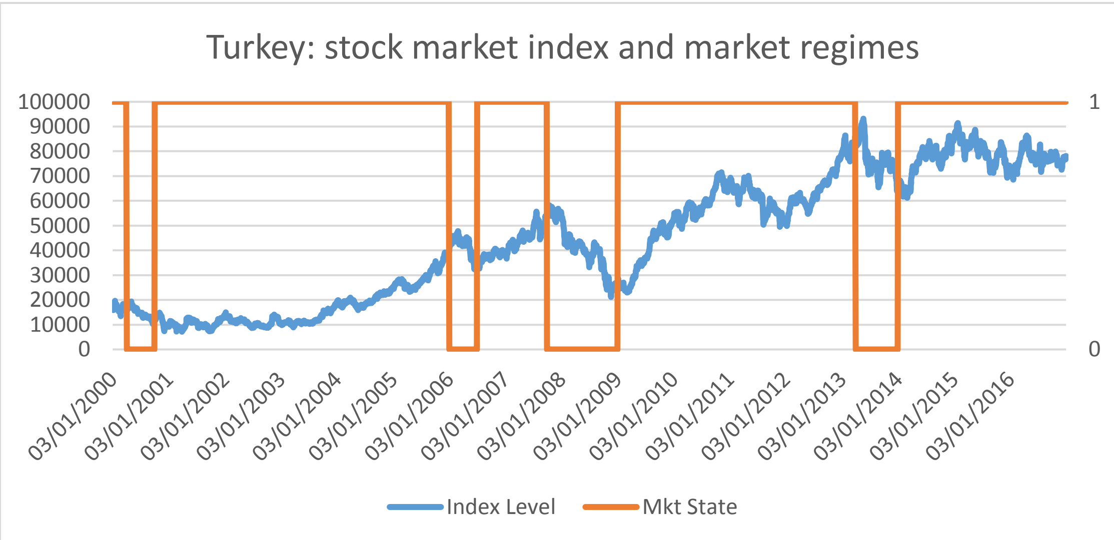
05/01/2012
05/01/2013
05/01/2014
05/01/2015
05/01/2016
Index Level
Mkt State


Turkey: stock market index and market regimes
100000
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
1
0
03/01/2000
03/01/2001
03/01/2002
03/01/2003
03/01/2004
03/01/2005
03/01/2006
03/01/2007
03/01/2008
03/01/2009
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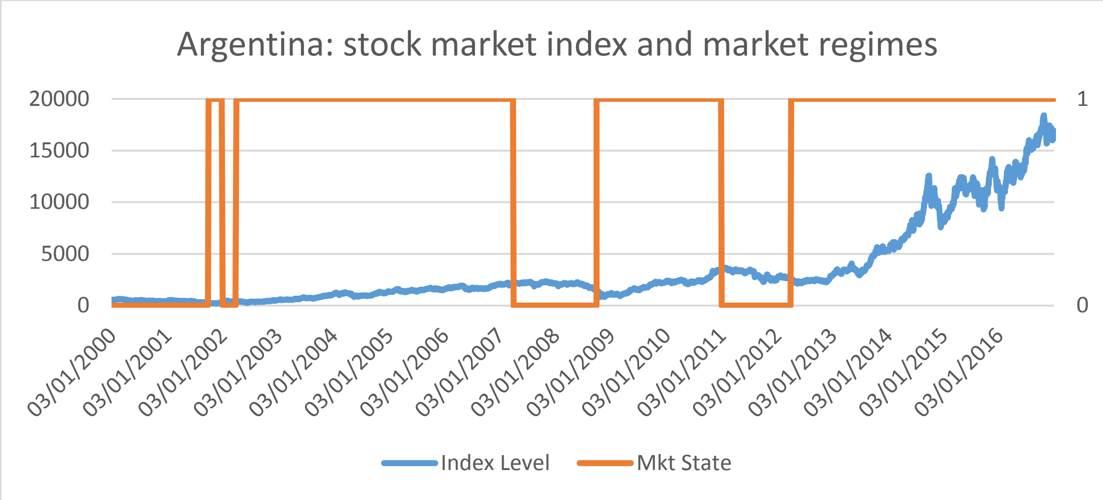
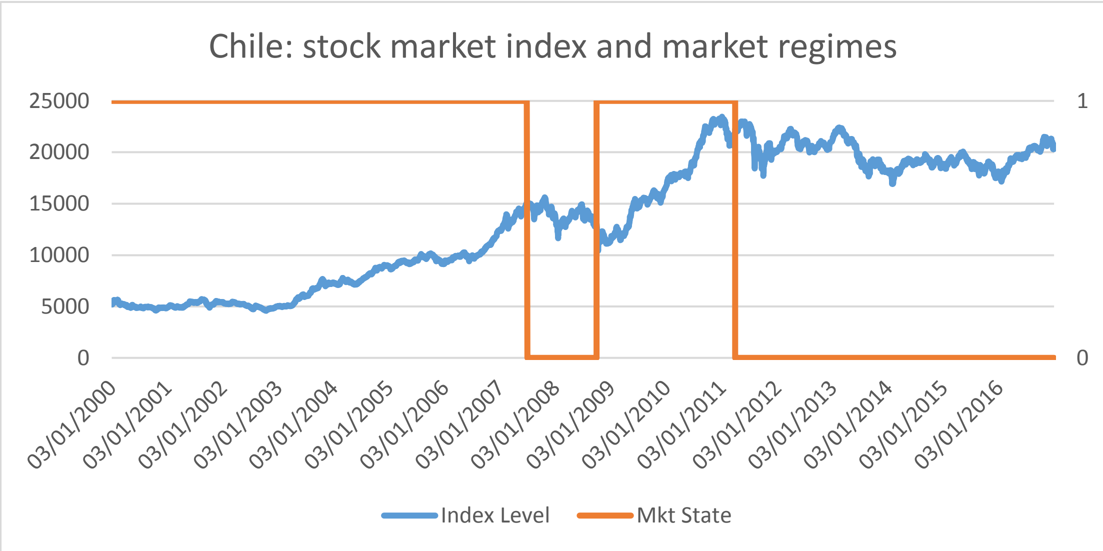
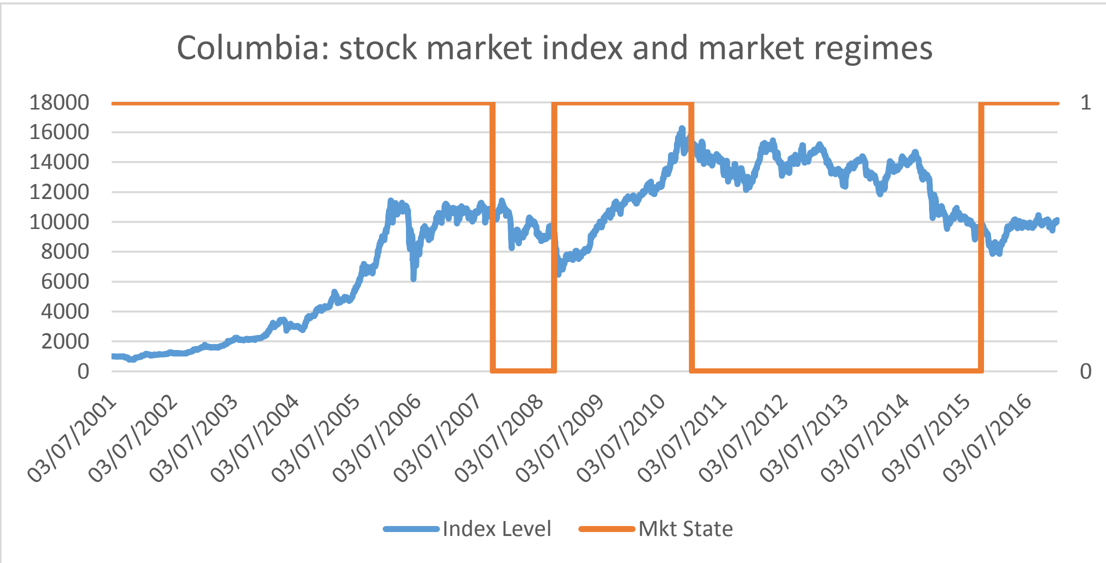
03/01/2012
03/01/2013
03/01/2014
03/01/2015
03/01/2016
Index Level
Mkt State


Argentina: stock market index and market regimes
20000
15000
10000
5000
0
1
0
03/01/2000
03/01/2001
03/01/2002
03/01/2003
03/01/2004
03/01/2005
03/01/2006
03/01/2007
03/01/2008
03/01/2009
03/01/2010
03/01/2011
03/01/2012
03/01/2013
03/01/2014
03/01/2015
03/01/2016
Index Level
Mkt State


Chile: stock market index and market regimes
25000
20000
15000
10000
5000
0
1
0
03/01/2000
03/01/2001
03/01/2002
03/01/2003
03/01/2004
03/01/2005
03/01/2006
03/01/2007
03/01/2008
03/01/2009
03/01/2010
03/01/2011
03/01/2012
03/01/2013
03/01/2014
03/01/2015
03/01/2016
Index Level
Mkt State


Columbia: stock market index and market regimes
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16000
14000
12000
10000
8000
6000
4000
2000
0
1
0
03/07/2001
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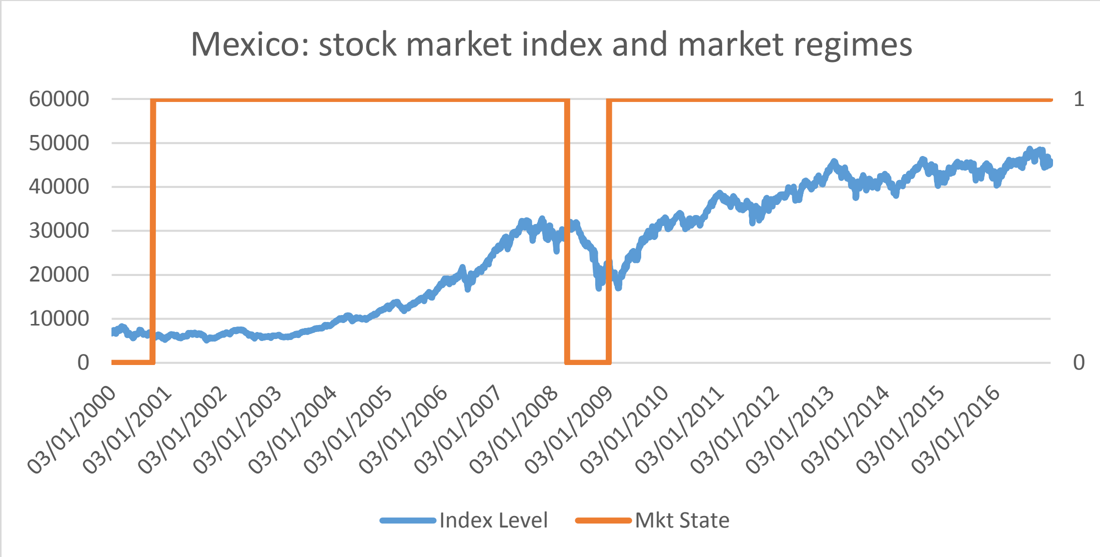
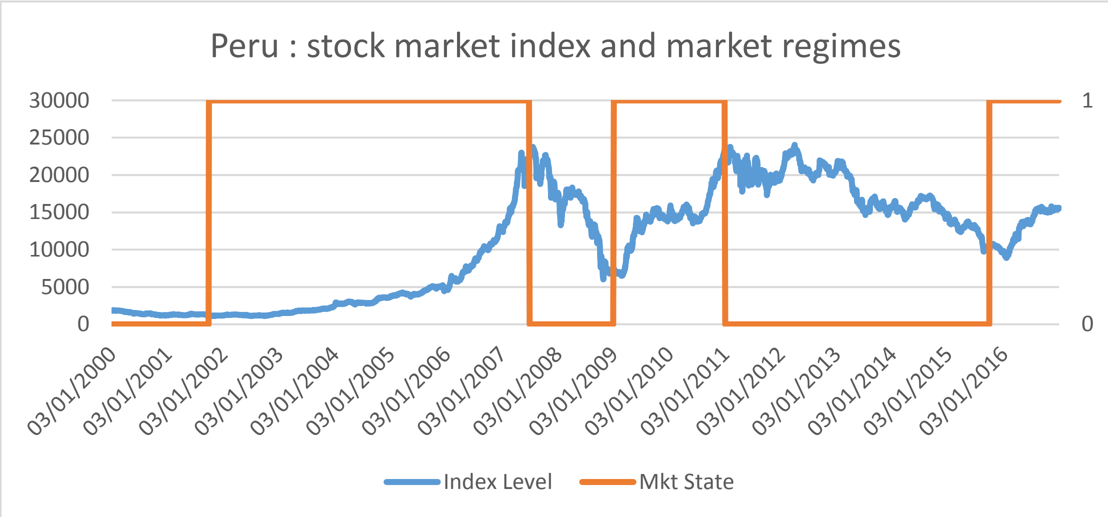
03/07/2006
03/07/2007
03/07/2008
03/07/2009
03/07/2010
03/07/2011
03/07/2012
03/07/2013
03/07/2014
03/07/2015
03/07/2016
Index Level
Mkt State


Mexico: stock market index and market regimes
60000
50000
40000
30000
20000
10000
0
1
0
03/01/2000
03/01/2001
03/01/2002
03/01/2003
03/01/2004
03/01/2005
03/01/2006
03/01/2007
03/01/2008
03/01/2009
03/01/2010
03/01/2011
03/01/2012
03/01/2013
03/01/2014
03/01/2015
03/01/2016
Index Level
Mkt State


Peru : stock market index and market regimes
30000
25000
20000
15000
10000
5000
0
1
0
03/01/2000
03/01/2001
03/01/2002
03/01/2003
03/01/2004
03/01/2005
03/01/2006
03/01/2007
03/01/2008
03/01/2009
03/01/2010
03/01/2011
03/01/2012
03/01/2013
03/01/2014
03/01/2015
03/01/2016
Index Level
Mkt State

8.3 VaR/ES and Probability Density Distributions

This section provides the simulation results of the relationship between VaR/ES and parameters of Student's t distribution, Hansen's t distribution, and skewed generalized t distribution for $\alpha = 2.5\%$ and $\alpha = 5\%$

8.3.1 $\alpha = 2.5\%$

8.3.1.1 Student's t distribution

Figure 57. Student T Distribution VaR/ES Surface
Panel A. VaR Surface with respect to ν and σ

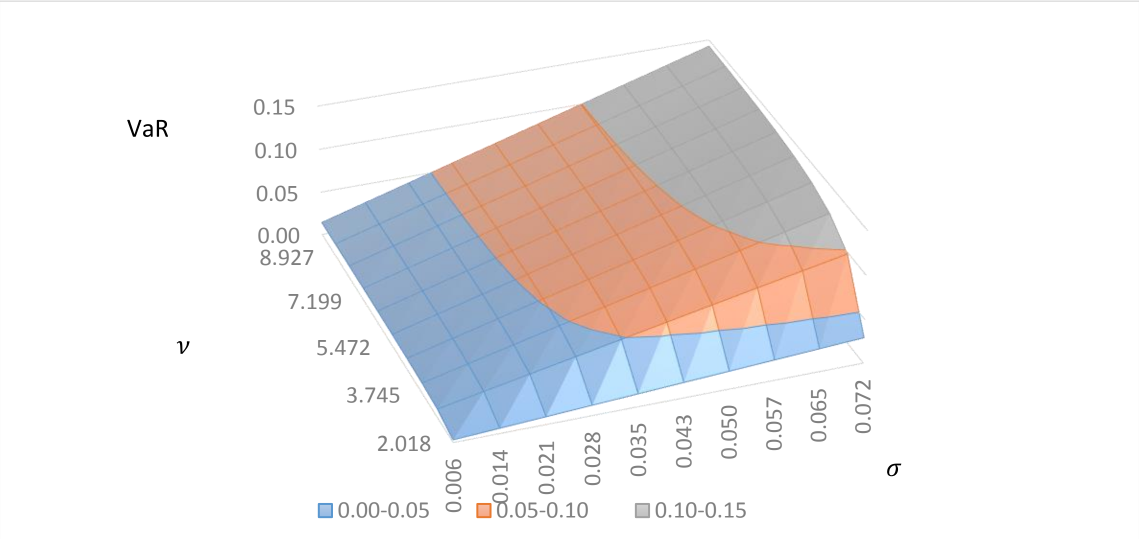


Figure 57. Student's T Distribution VaR/ES Surface
Panel B. ES Surface with respect to ν and σ

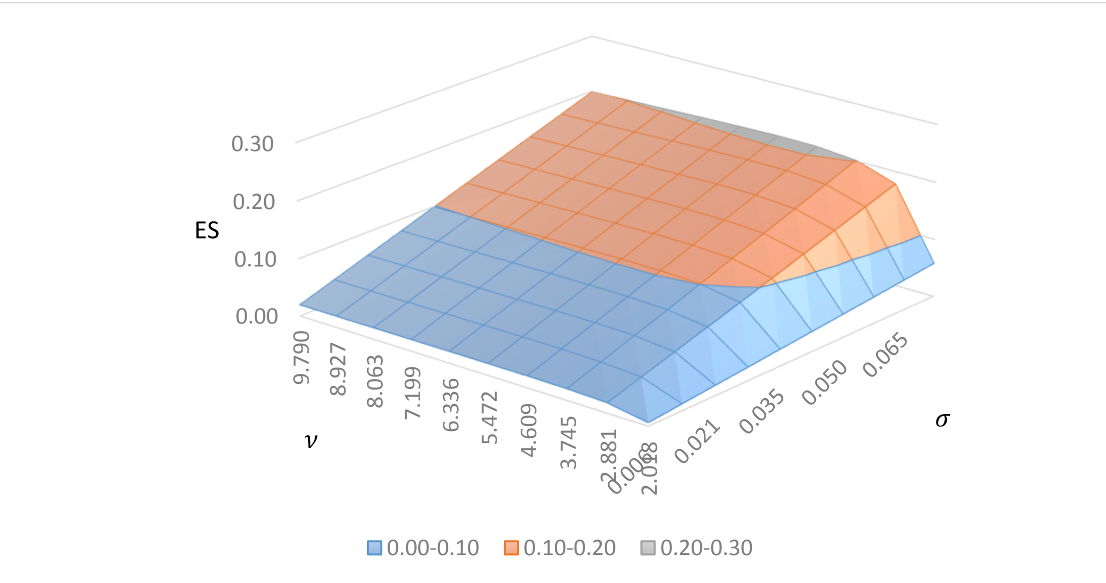


Table 24. Student's T Distribution VaR/ES Surface Data

Panel A. VaR with respect to ν and σ

		ν									
		2.018	2.881	3.745	4.609	5.472	6.336	7.199	8.063	8.927	9.790
σ	0.006	0.003	0.010	0.012	0.013	0.013	0.014	0.014	0.014	0.014	0.014
	0.014	0.006	0.020	0.024	0.026	0.027	0.027	0.028	0.028	0.028	0.028
	0.021	0.009	0.029	0.036	0.039	0.040	0.041	0.042	0.042	0.043	0.043
	0.028	0.012	0.039	0.047	0.051	0.054	0.055	0.056	0.056	0.057	0.057
	0.035	0.015	0.049	0.059	0.064	0.067	0.069	0.070	0.070	0.071	0.071
	0.043	0.017	0.059	0.071	0.077	0.080	0.082	0.084	0.085	0.085	0.086
	0.050	0.020	0.069	0.083	0.090	0.094	0.096	0.098	0.099	0.099	0.100
	0.057	0.023	0.078	0.095	0.103	0.107	0.110	0.112	0.113	0.114	0.114
	0.065	0.026	0.088	0.107	0.116	0.121	0.124	0.126	0.127	0.128	0.128
	0.072	0.029	0.098	0.119	0.129	0.134	0.138	0.140	0.141	0.142	0.143

Panel B. ES with respect to ν and σ

		ν									
		2.018	2.881	3.745	4.609	5.472	6.336	7.199	8.063	8.927	9.790
σ	0.006	0.006	0.018	0.020	0.020	0.021	0.020	0.020	0.020	0.020	0.020
	0.014	0.012	0.035	0.040	0.041	0.041	0.041	0.041	0.040	0.040	0.040
	0.021	0.017	0.053	0.060	0.062	0.062	0.062	0.061	0.061	0.060	0.059
	0.028	0.023	0.071	0.080	0.083	0.083	0.082	0.082	0.081	0.080	0.079
	0.035	0.029	0.089	0.100	0.103	0.104	0.103	0.102	0.101	0.100	0.099
	0.043	0.035	0.107	0.121	0.124	0.125	0.124	0.123	0.121	0.120	0.119
	0.050	0.041	0.125	0.141	0.145	0.145	0.145	0.143	0.142	0.140	0.139
	0.057	0.046	0.143	0.161	0.166	0.166	0.165	0.164	0.162	0.160	0.159
	0.065	0.052	0.160	0.181	0.186	0.187	0.186	0.184	0.182	0.180	0.179
	0.072	0.058	0.178	0.201	0.207	0.208	0.207	0.205	0.203	0.201	0.199

8.3.1.2 Hansen's skewed t distribution

Figure 58. Skewed T Distribution VaR/ES Surface

Panel A. VaR Surface with respect to ν and σ

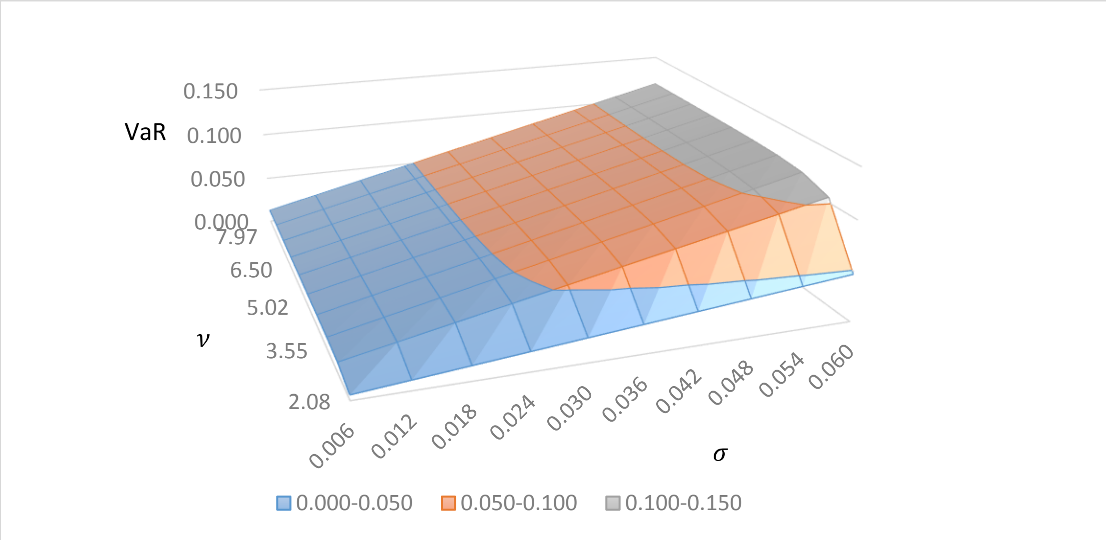


Figure 58. Skewed T Distribution VaR/ES Surface
Panel B. ES Surface with respect to ν and σ

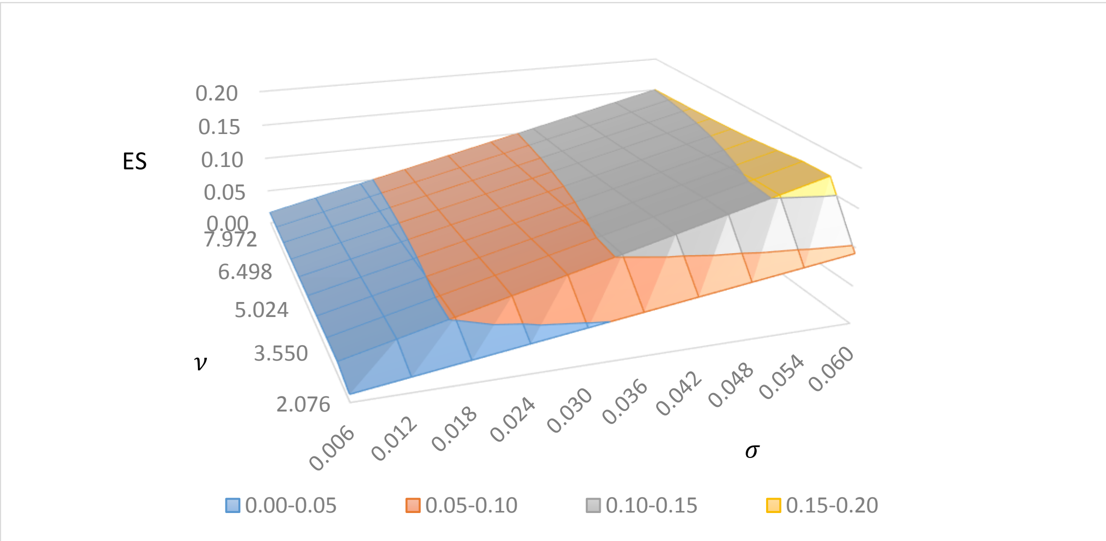


Figure 58. Skewed T Distribution VaR/ES Surface
Panel C. VaR Surface with respect to ν and λ

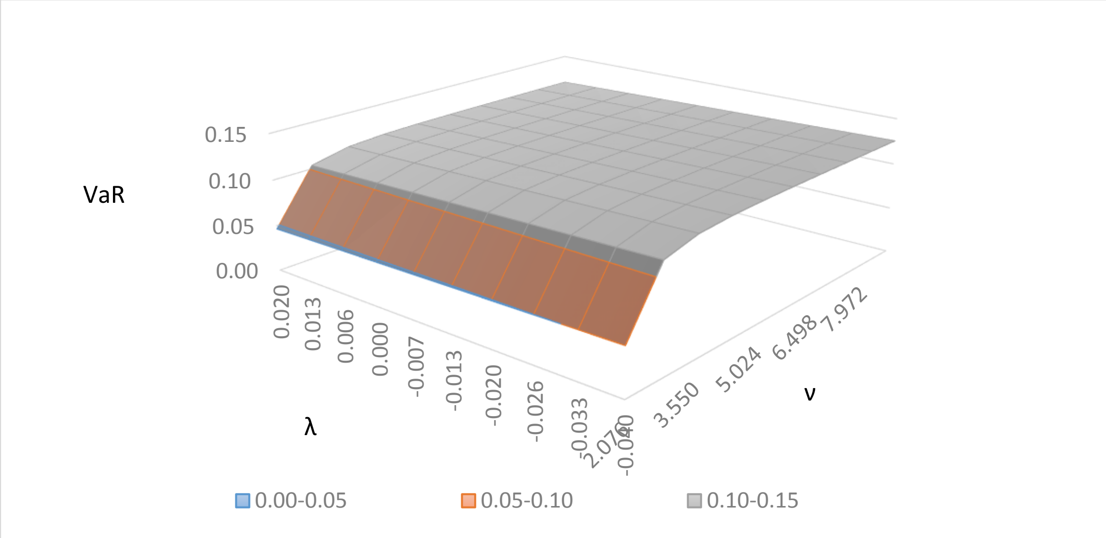


Figure 58. Skewed T Distribution VaR/ES Surface

Panel D. ES Surface with respect to ν and λ

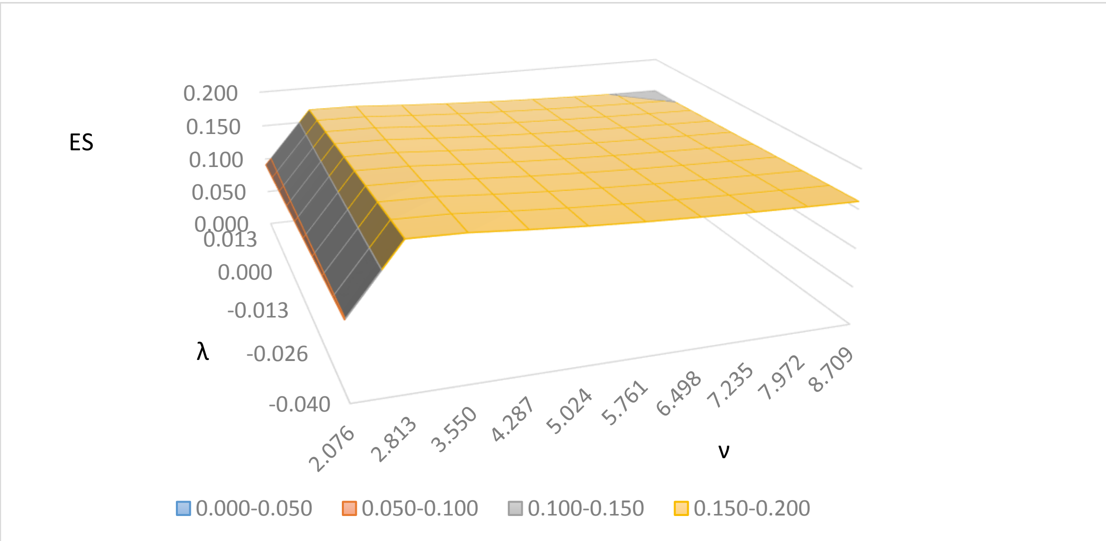


Figure 58. Skewed T Distribution VaR/ES Surface

Panel E. VaR Surface with respect to σ and λ

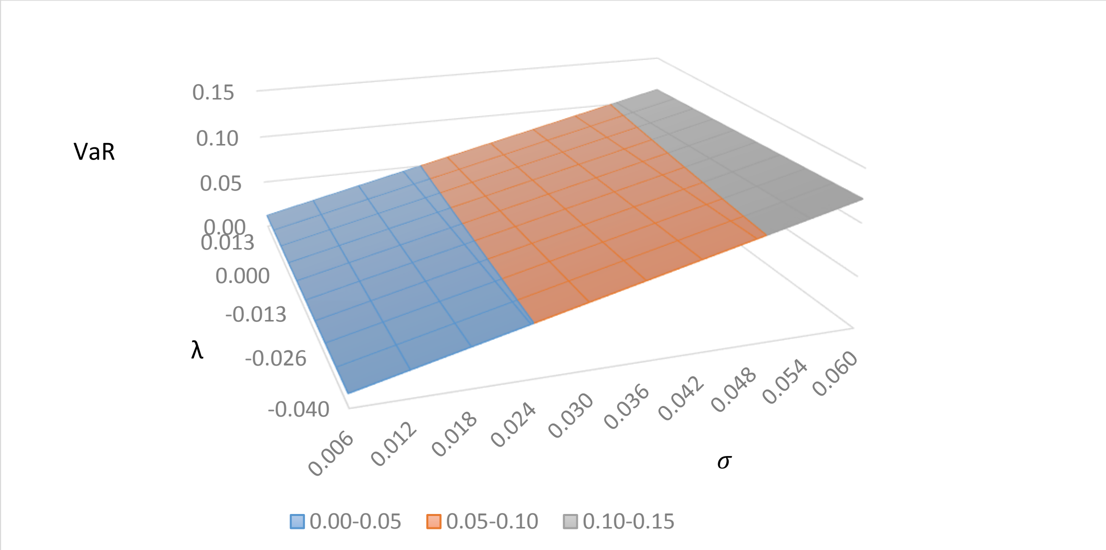


Figure 58. Skewed T Distribution VaR/ES Surface

Panel F. ES Surface with respect to σ and λ

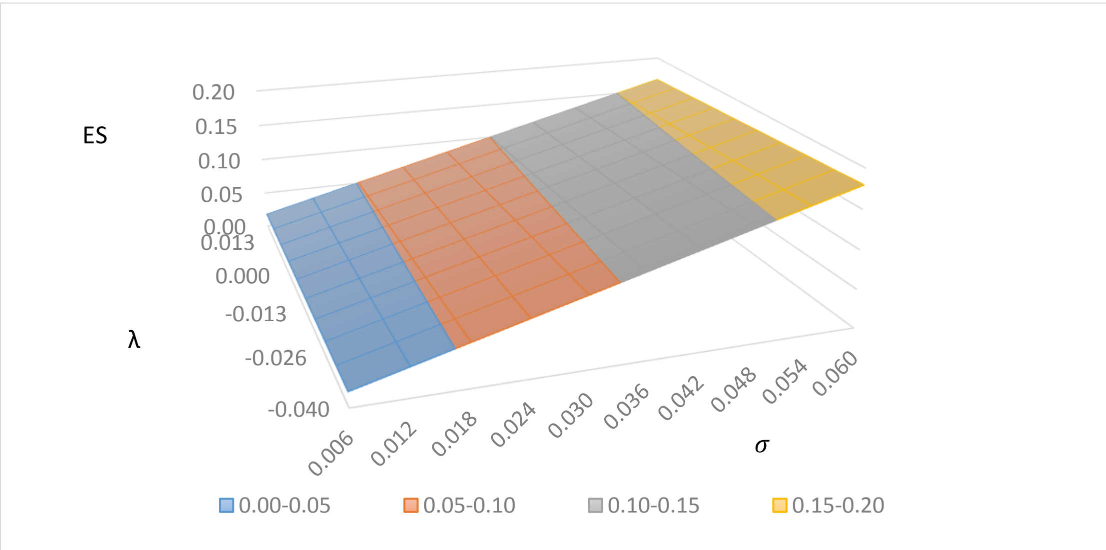


Table 25. Skewed Student's T Distribution VaR/ES Surface Data

Panel A. VaR with respect to ν and σ

		ν									
		2.08	2.81	3.55	4.29	5.02	5.76	6.50	7.24	7.97	8.71
σ	0.006	0.005	0.011	0.012	0.012	0.013	0.013	0.013	0.013	0.013	0.013
	0.012	0.010	0.022	0.023	0.024	0.024	0.024	0.024	0.024	0.024	0.024
	0.018	0.014	0.032	0.035	0.036	0.036	0.036	0.036	0.036	0.036	0.036
	0.024	0.019	0.042	0.046	0.047	0.048	0.048	0.048	0.048	0.048	0.048
	0.030	0.024	0.053	0.057	0.059	0.059	0.059	0.059	0.059	0.059	0.059
	0.036	0.028	0.063	0.069	0.070	0.071	0.071	0.071	0.071	0.071	0.071
	0.042	0.033	0.074	0.080	0.082	0.083	0.083	0.083	0.083	0.083	0.083
	0.048	0.038	0.084	0.091	0.094	0.094	0.095	0.095	0.095	0.095	0.095
	0.054	0.042	0.094	0.103	0.105	0.106	0.106	0.106	0.106	0.106	0.106
	0.060	0.047	0.105	0.114	0.117	0.118	0.118	0.118	0.118	0.118	0.118

Panel B. ES with respect to ν and σ

		ν									
		2.076	2.813	3.550	4.287	5.024	5.761	6.498	7.235	7.972	8.709
σ	0.006	0.010	0.018	0.018	0.017	0.017	0.017	0.016	0.016	0.016	0.016
	0.012	0.019	0.035	0.035	0.034	0.033	0.032	0.032	0.031	0.031	0.031
	0.018	0.028	0.052	0.051	0.050	0.049	0.048	0.047	0.047	0.046	0.046
	0.024	0.037	0.069	0.068	0.066	0.065	0.064	0.063	0.062	0.061	0.061
	0.030	0.046	0.085	0.085	0.083	0.081	0.079	0.078	0.077	0.076	0.076
	0.036	0.056	0.102	0.102	0.099	0.097	0.095	0.093	0.092	0.091	0.091
	0.042	0.065	0.119	0.118	0.115	0.113	0.110	0.109	0.107	0.106	0.105
	0.048	0.074	0.136	0.135	0.132	0.128	0.126	0.124	0.123	0.121	0.120
	0.054	0.083	0.153	0.152	0.148	0.144	0.142	0.140	0.138	0.136	0.135
	0.060	0.092	0.170	0.169	0.164	0.160	0.157	0.155	0.153	0.151	0.150

Table 25. Skewed Student's T Distribution VaR/ES Surface Data

Panel C. VaR with respect to ν and λ

		ν									
		2.076	2.813	3.550	4.287	5.024	5.761	6.498	7.235	7.972	8.709
λ	-0.040	0.051	0.112	0.122	0.125	0.125	0.126	0.126	0.126	0.126	0.126
	-0.033	0.050	0.111	0.121	0.124	0.124	0.125	0.125	0.125	0.125	0.125
	-0.026	0.050	0.110	0.120	0.123	0.123	0.124	0.124	0.124	0.124	0.124
	-0.020	0.049	0.109	0.119	0.121	0.122	0.123	0.123	0.123	0.123	0.123
	-0.013	0.049	0.108	0.118	0.120	0.121	0.122	0.122	0.122	0.122	0.122
	-0.007	0.048	0.107	0.117	0.119	0.120	0.121	0.121	0.121	0.121	0.121
	0.000	0.048	0.107	0.116	0.118	0.119	0.120	0.120	0.120	0.120	0.120
	0.006	0.047	0.106	0.115	0.117	0.118	0.119	0.119	0.119	0.119	0.119
	0.013	0.047	0.105	0.114	0.116	0.117	0.118	0.118	0.118	0.118	0.118
	0.020	0.046	0.104	0.113	0.115	0.116	0.117	0.117	0.117	0.117	0.117

Panel D. ES with respect to ν and λ

		ν									
		2.076	2.813	3.550	4.287	5.024	5.761	6.498	7.235	7.972	8.709
λ	-0.040	0.099	0.181	0.180	0.175	0.171	0.167	0.165	0.162	0.161	0.159
	-0.033	0.098	0.180	0.178	0.173	0.169	0.166	0.163	0.161	0.160	0.158
	-0.026	0.097	0.178	0.177	0.172	0.168	0.165	0.162	0.160	0.158	0.157
	-0.020	0.096	0.177	0.175	0.171	0.167	0.163	0.161	0.159	0.157	0.156
	-0.013	0.095	0.175	0.174	0.169	0.165	0.162	0.160	0.158	0.156	0.155
	-0.007	0.095	0.174	0.173	0.168	0.164	0.161	0.158	0.156	0.155	0.153
	0.000	0.094	0.172	0.171	0.166	0.162	0.159	0.157	0.155	0.153	0.152
	0.006	0.093	0.171	0.170	0.165	0.161	0.158	0.156	0.154	0.152	0.151
	0.013	0.092	0.169	0.168	0.164	0.160	0.157	0.154	0.153	0.151	0.150
	0.020	0.091	0.168	0.167	0.162	0.158	0.155	0.153	0.151	0.150	0.149

Table 25. Skewed Student's T Distribution VaR/ES Surface Data

Panel E. VaR with respect to σ and λ

		σ									
		0.006	0.012	0.018	0.024	0.030	0.036	0.042	0.048	0.054	0.060
λ	-0.040	0.0130	0.0252	0.0373	0.0494	0.0615	0.0736	0.0858	0.0979	0.1100	0.1221
	-0.033	0.0129	0.0250	0.0370	0.0490	0.0610	0.0730	0.0850	0.0971	0.1091	0.1211
	-0.026	0.0128	0.0247	0.0367	0.0486	0.0605	0.0724	0.0843	0.0962	0.1082	0.1201
	-0.020	0.0127	0.0245	0.0363	0.0482	0.0600	0.0718	0.0836	0.0954	0.1072	0.1190
	-0.013	0.0126	0.0243	0.0360	0.0477	0.0595	0.0712	0.0829	0.0946	0.1063	0.1180
	-0.007	0.0125	0.0241	0.0357	0.0473	0.0589	0.0705	0.0822	0.0938	0.1054	0.1170
	0.000	0.0124	0.0239	0.0354	0.0469	0.0584	0.0699	0.0814	0.0929	0.1044	0.1159
	0.006	0.0123	0.0237	0.0351	0.0465	0.0579	0.0693	0.0807	0.0921	0.1035	0.1149
	0.013	0.0122	0.0235	0.0348	0.0461	0.0574	0.0687	0.0800	0.0913	0.1026	0.1139
	0.020	0.0121	0.0233	0.0345	0.0456	0.0568	0.0680	0.0792	0.0904	0.1016	0.1128

Panel F. ES with respect to σ and λ

		σ									
		0.006	0.012	0.018	0.024	0.030	0.036	0.042	0.048	0.054	0.060
λ	-0.040	0.0191	0.0369	0.0548	0.0726	0.0904	0.1082	0.1261	0.1439	0.1617	0.1795
	-0.033	0.0189	0.0366	0.0543	0.0720	0.0897	0.1074	0.1250	0.1427	0.1604	0.1781
	-0.026	0.0188	0.0363	0.0539	0.0714	0.0889	0.1065	0.1240	0.1416	0.1591	0.1766
	-0.020	0.0186	0.0360	0.0534	0.0708	0.0882	0.1056	0.1230	0.1404	0.1578	0.1752
	-0.013	0.0185	0.0357	0.0530	0.0702	0.0875	0.1047	0.1220	0.1392	0.1565	0.1737
	-0.007	0.0183	0.0354	0.0525	0.0696	0.0867	0.1038	0.1209	0.1380	0.1551	0.1722
	0.000	0.0182	0.0351	0.0521	0.0690	0.0860	0.1029	0.1199	0.1368	0.1538	0.1707
	0.006	0.0180	0.0348	0.0516	0.0684	0.0852	0.1020	0.1188	0.1356	0.1525	0.1693
	0.013	0.0179	0.0345	0.0512	0.0678	0.0845	0.1011	0.1178	0.1345	0.1511	0.1678
	0.020	0.0177	0.0342	0.0507	0.0672	0.0837	0.1002	0.1167	0.1333	0.1498	0.1663

8.3.1.3 Skewed Generalized t distribution

Figure 59. Skewed Generalized T Distirbution VaR/ES Surface

Panel A. VaR Surface with respect to ν and σ

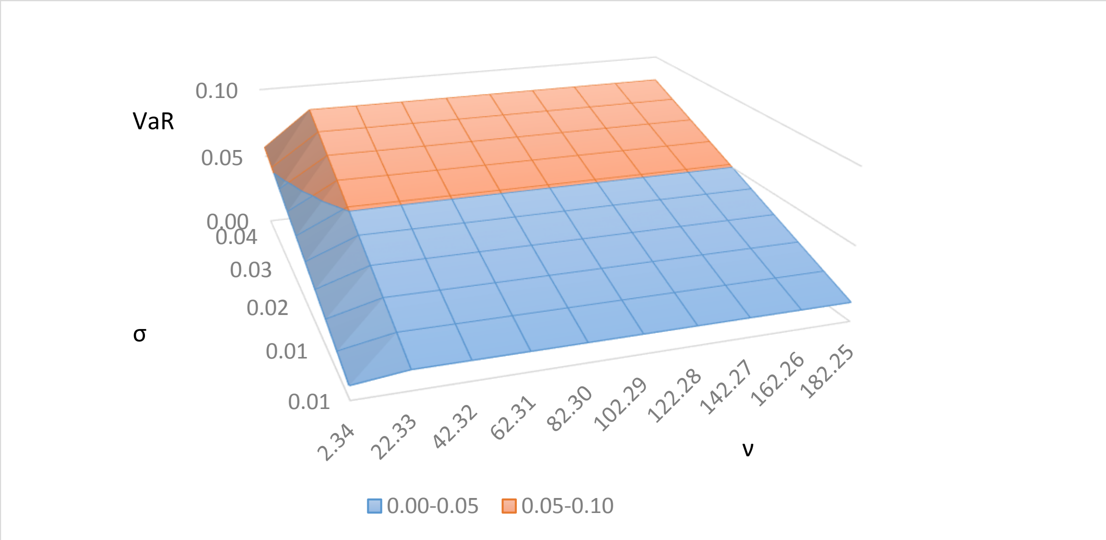


Figure 59. Skewed Generalized T Distirbution VaR/ES Surface

Panel B. ES Surface with respect to ν and σ

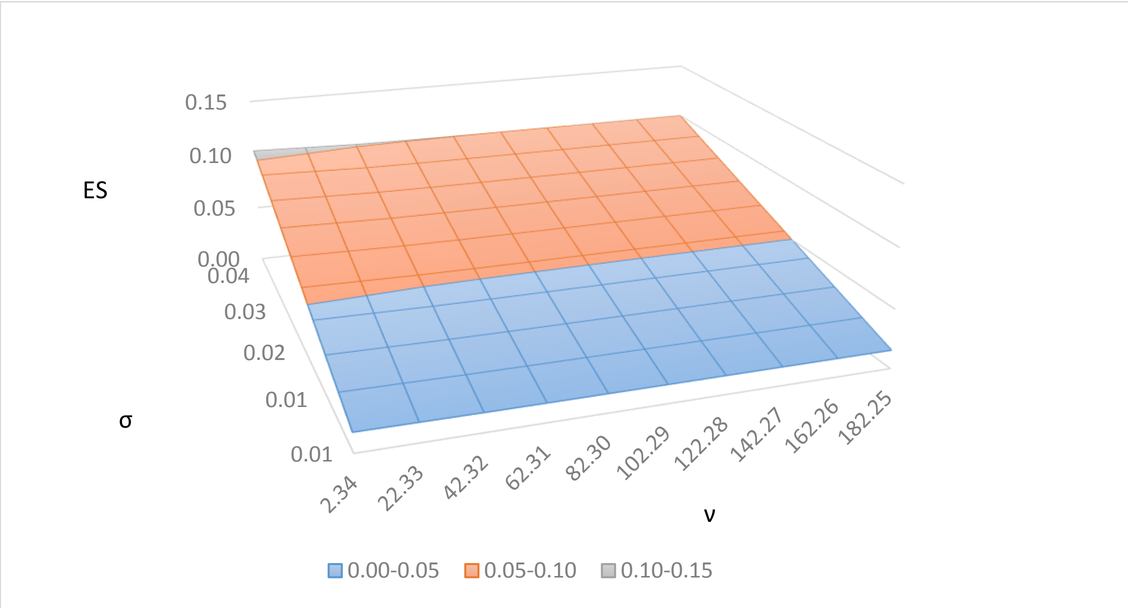


Figure 59. Skewed Generalized T Distirbution VaR/ES Surface

Panel C. VaR Surface with respect to λ and ν

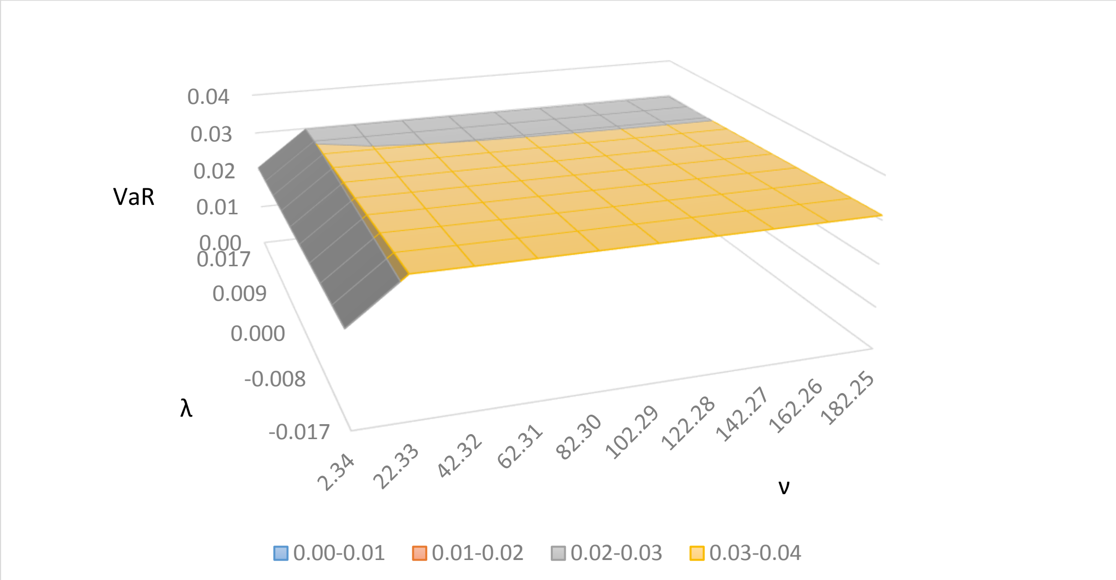


Figure 59. Skewed Generalized T Distirbution VaR/ES Surface

Panel D. ES Surface with respect to λ and ν

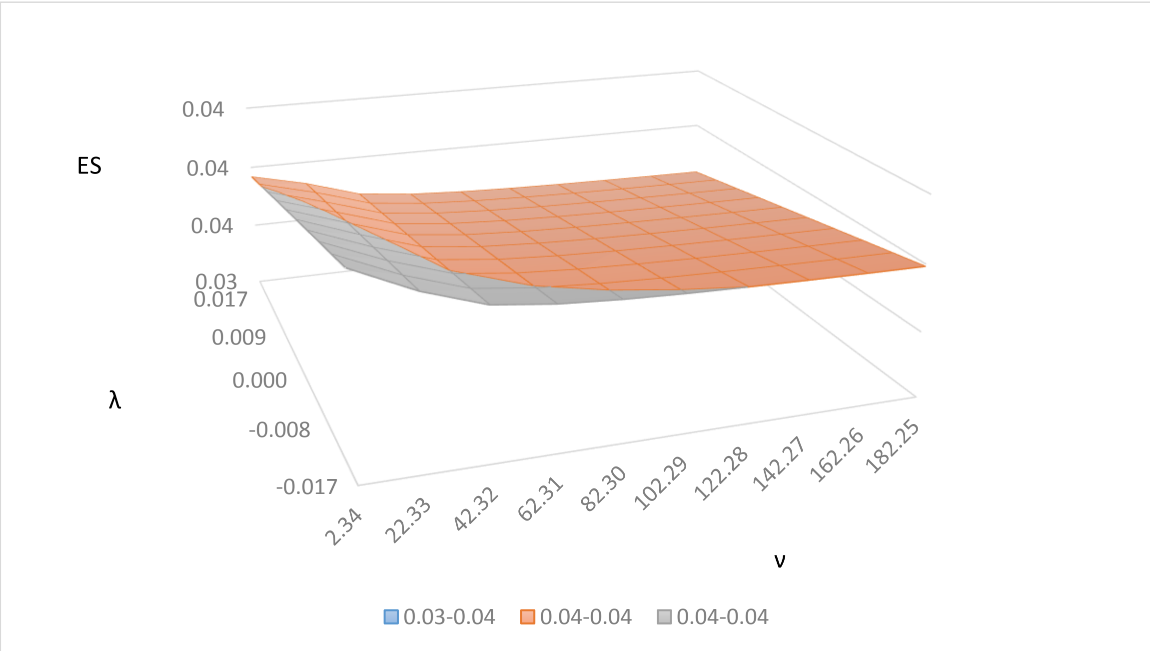


Figure 59. Skewed Generalized T Distirbution VaR/ES Surface

Panel E. VaR Surface with respect to k and ν

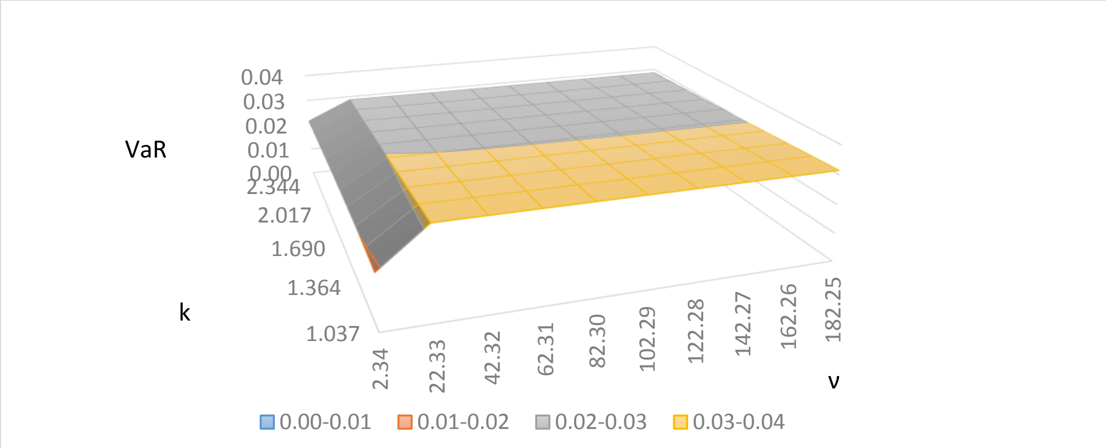


Figure 59. Skewed Generalized T Distirbution VaR/ES Surface

Panel F. ES Surface with respect to k and ν

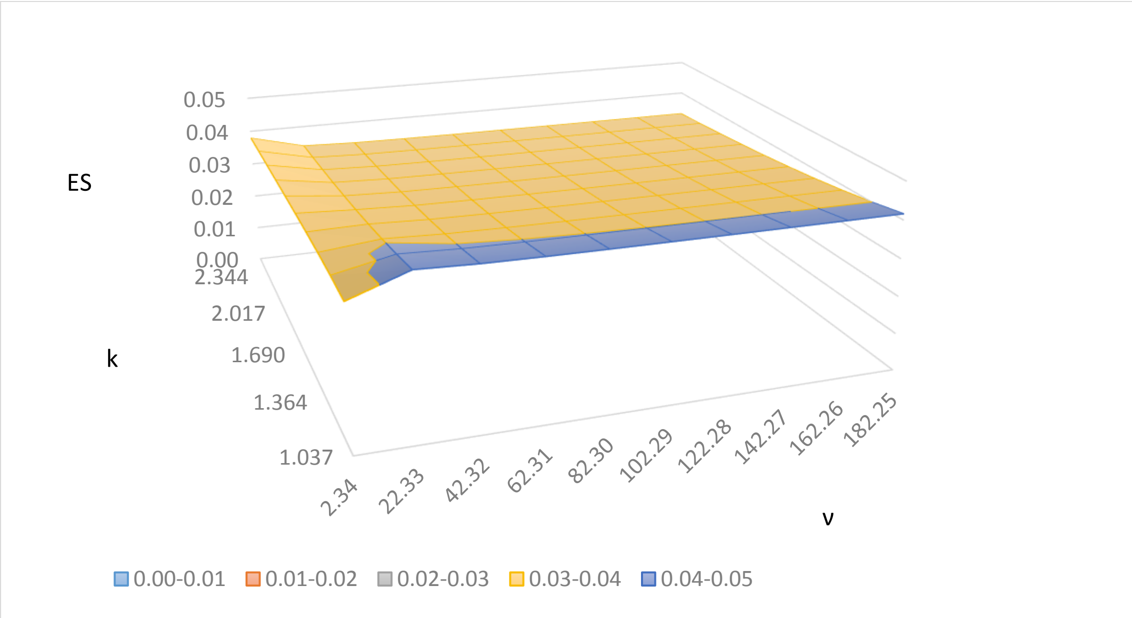


Figure 59. Skewed Generalized T Distirbution VaR/ES Surface

Panel G. VaR Surface with respect to λ and σ

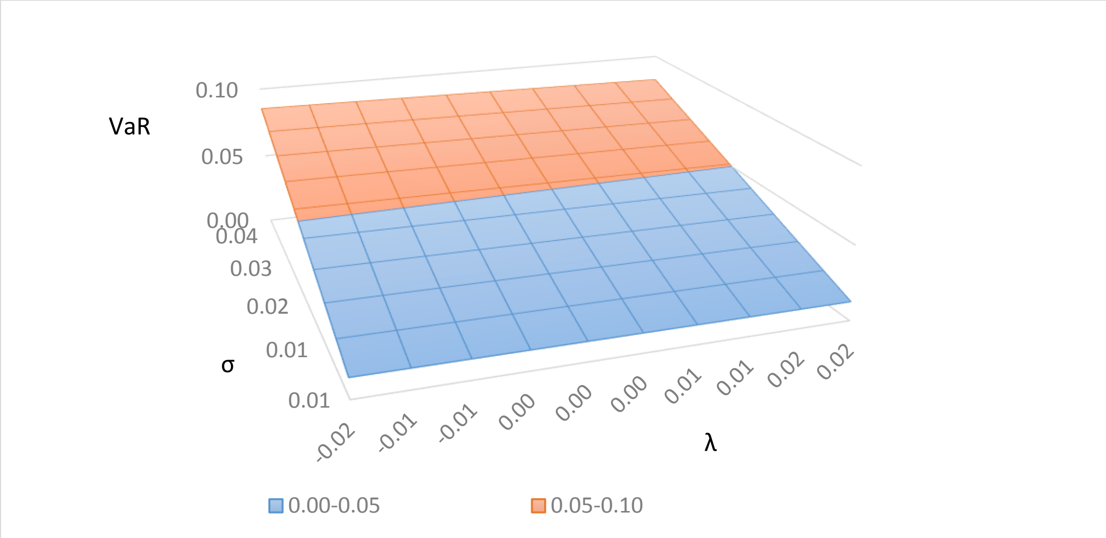


Figure 59. Skewed Generalized T Distirbution VaR/ES Surface

Panel H. ES Surface with respect to λ and σ

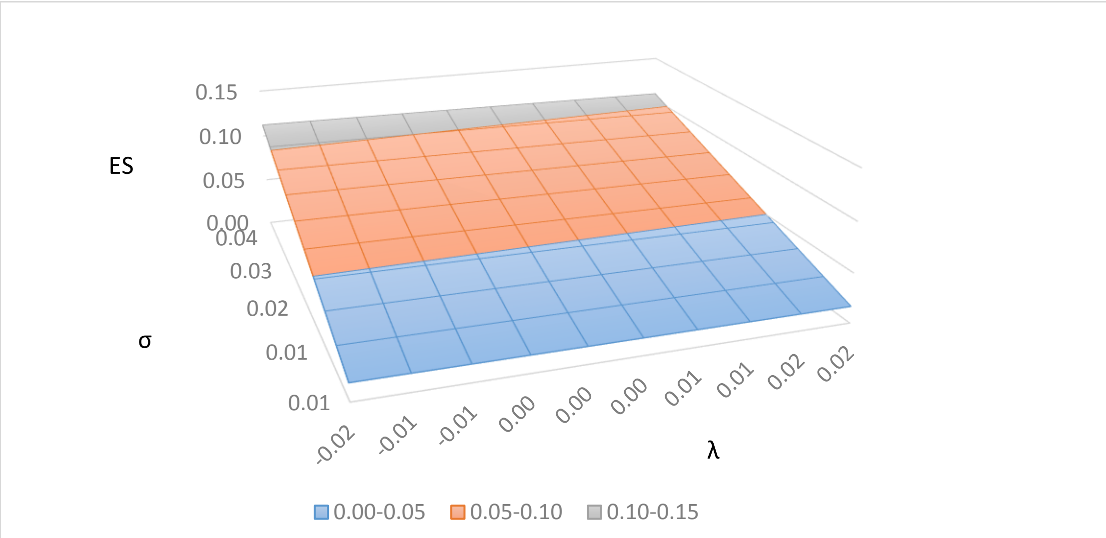


Figure 59. Skewed Generalized T Distirbution VaR/ES Surface

Panel I. VaR Surface with respect to σ and k

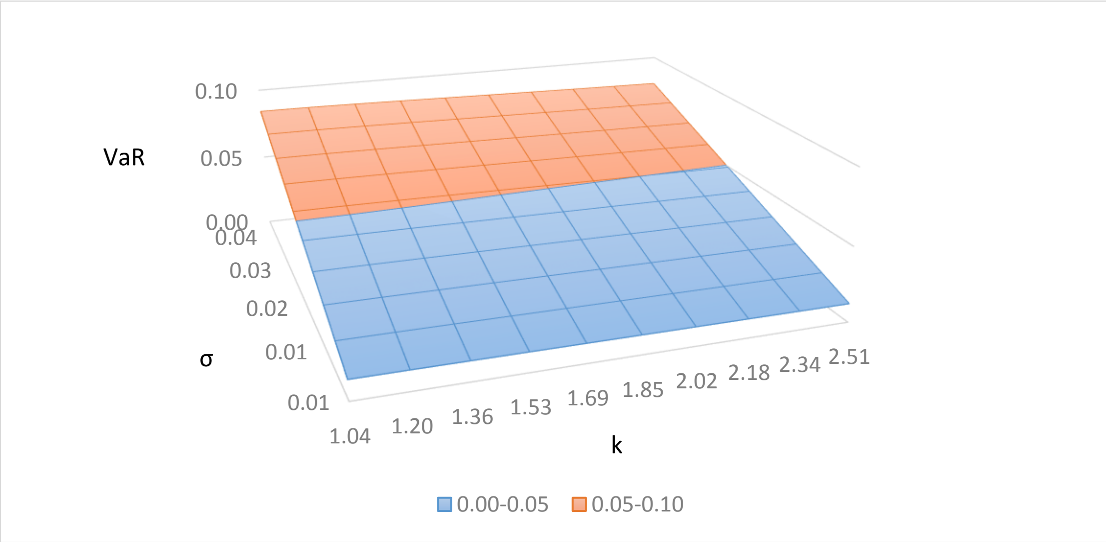


Figure 59. Skewed Generalized T Distirbution VaR/ES Surface

Panel J. ES Surface with respect to σ and k

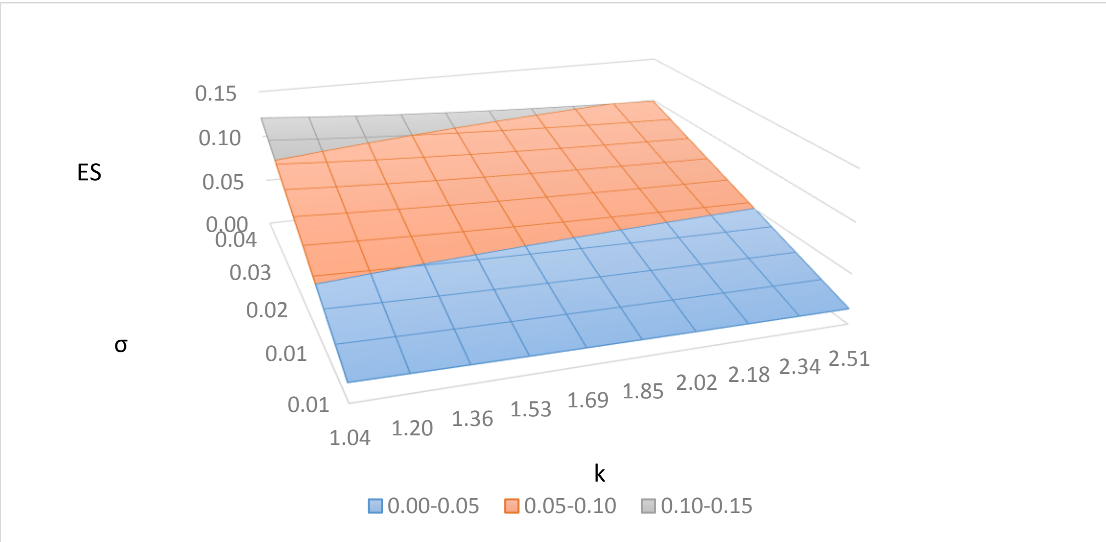


Figure 59. Skewed Generalized T Distirbution VaR/ES Surface

Panel K. VaR Surface with respect to λ and k

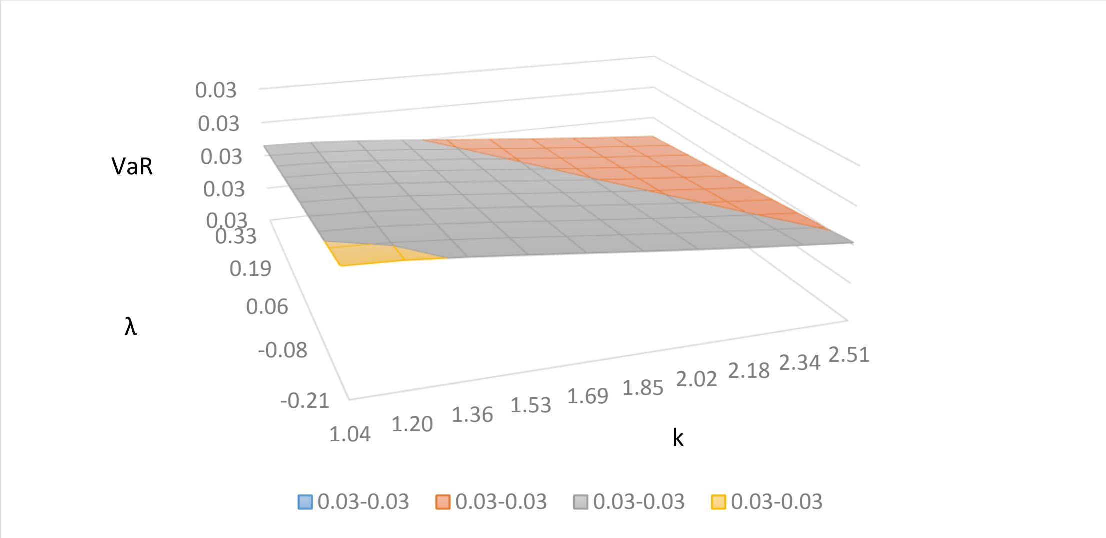


Figure 59. Skewed Generalized T Distirbution VaR/ES Surface

Panel L. ES Surface with respect to λ and k

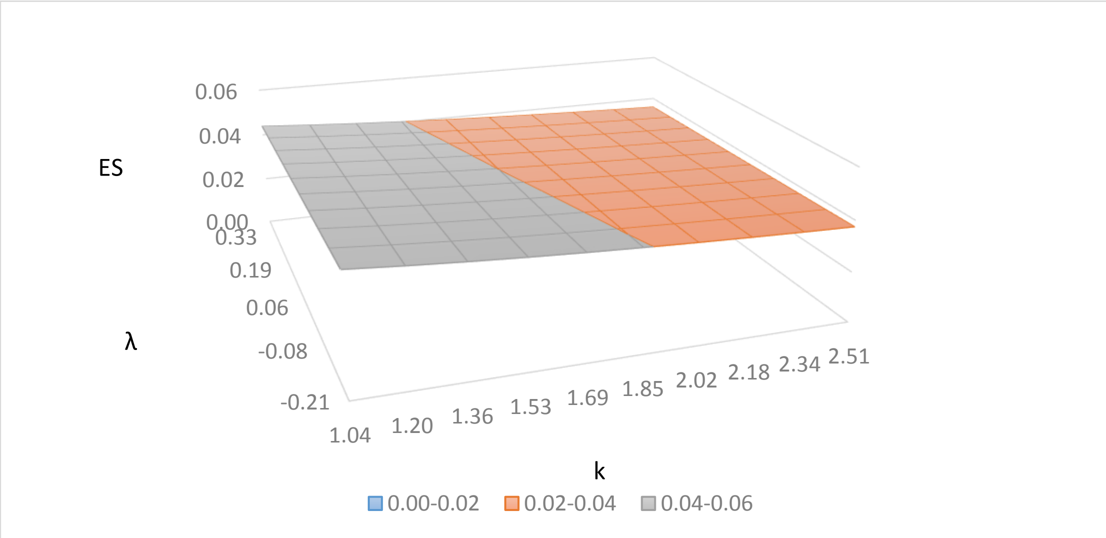


Table 26. Skewed Generalized Student's T Distribution

Panel A. VaR with respect to ν and σ

		ν									
		2.34	22.33	42.32	62.31	82.30	102.29	122.28	142.27	162.26	182.25
σ	0.01	0.0089	0.0128	0.0128	0.0127	0.0127	0.0127	0.0127	0.0127	0.0127	0.0127
	0.01	0.0142	0.0205	0.0204	0.0204	0.0204	0.0204	0.0204	0.0204	0.0204	0.0204
	0.01	0.0195	0.0282	0.0281	0.0280	0.0280	0.0280	0.0280	0.0280	0.0280	0.0280
	0.02	0.0249	0.0358	0.0357	0.0357	0.0357	0.0357	0.0357	0.0356	0.0356	0.0356
	0.02	0.0302	0.0435	0.0434	0.0433	0.0433	0.0433	0.0433	0.0433	0.0433	0.0433
	0.03	0.0355	0.0512	0.0511	0.0510	0.0510	0.0509	0.0509	0.0509	0.0509	0.0509
	0.03	0.0408	0.0589	0.0587	0.0587	0.0586	0.0586	0.0586	0.0586	0.0586	0.0586
	0.03	0.0461	0.0666	0.0664	0.0663	0.0663	0.0662	0.0662	0.0662	0.0662	0.0662
	0.04	0.0514	0.0743	0.0740	0.0740	0.0739	0.0739	0.0739	0.0738	0.0738	0.0738
	0.04	0.0568	0.0819	0.0817	0.0816	0.0816	0.0815	0.0815	0.0815	0.0815	0.0815

Panel B. ES with respect to ν and σ

		ν									
		2.34	22.33	42.32	62.31	82.30	102.29	122.28	142.27	162.26	182.25
σ	0.01	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016
	0.01	0.026	0.026	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
	0.01	0.036	0.035	0.035	0.034	0.034	0.034	0.034	0.034	0.034	0.034
	0.02	0.045	0.045	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044
	0.02	0.055	0.054	0.054	0.053	0.053	0.053	0.053	0.053	0.053	0.053
	0.03	0.065	0.064	0.063	0.063	0.063	0.062	0.062	0.062	0.062	0.062
	0.03	0.075	0.074	0.073	0.072	0.072	0.072	0.072	0.072	0.072	0.072
	0.03	0.084	0.083	0.082	0.082	0.081	0.081	0.081	0.081	0.081	0.081
	0.04	0.094	0.093	0.091	0.091	0.091	0.091	0.090	0.090	0.090	0.090
	0.04	0.104	0.102	0.101	0.100	0.100	0.100	0.100	0.100	0.100	0.100

Table 26. Skewed Generalized Student's T Distribution VaR/ES Surface Data

Panel C. VaR with respect to λ and ν

		ν									
		2.34	22.33	42.32	62.31	82.30	102.29	122.28	142.27	162.26	182.25
λ	-0.017	0.0218	0.0313	0.0312	0.0311	0.0311	0.0311	0.0311	0.0311	0.0311	0.0311
	-0.013	0.0217	0.0311	0.0310	0.0310	0.0310	0.0309	0.0309	0.0309	0.0309	0.0309
	-0.008	0.0216	0.0309	0.0308	0.0308	0.0308	0.0308	0.0308	0.0308	0.0308	0.0308
	-0.004	0.0214	0.0308	0.0307	0.0307	0.0306	0.0306	0.0306	0.0306	0.0306	0.0306
	0.000	0.0213	0.0306	0.0305	0.0305	0.0305	0.0305	0.0304	0.0304	0.0304	0.0304
	0.004	0.0212	0.0305	0.0304	0.0303	0.0303	0.0303	0.0303	0.0303	0.0303	0.0303
	0.009	0.0210	0.0303	0.0302	0.0302	0.0301	0.0301	0.0301	0.0301	0.0301	0.0301
	0.013	0.0209	0.0301	0.0300	0.0300	0.0300	0.0300	0.0300	0.0300	0.0300	0.0300
	0.017	0.0208	0.0300	0.0299	0.0298	0.0298	0.0298	0.0298	0.0298	0.0298	0.0298
	0.021	0.0206	0.0298	0.0297	0.0297	0.0297	0.0297	0.0296	0.0296	0.0296	0.0296

Panel D. ES with respect to λ and ν

		ν									
		2.34	22.33	42.32	62.31	82.30	102.29	122.28	142.27	162.26	182.25
λ	-0.017	0.0398	0.0390	0.0384	0.0382	0.0381	0.0380	0.0380	0.0380	0.0379	0.0379
	-0.013	0.0396	0.0388	0.0382	0.0380	0.0379	0.0379	0.0378	0.0378	0.0378	0.0377
	-0.008	0.0394	0.0386	0.0380	0.0378	0.0377	0.0377	0.0376	0.0376	0.0376	0.0376
	-0.004	0.0391	0.0384	0.0379	0.0376	0.0375	0.0375	0.0374	0.0374	0.0374	0.0374
	0.000	0.0389	0.0382	0.0377	0.0375	0.0374	0.0373	0.0373	0.0372	0.0372	0.0372
	0.004	0.0386	0.0380	0.0375	0.0373	0.0372	0.0371	0.0371	0.0370	0.0370	0.0370
	0.009	0.0384	0.0378	0.0373	0.0371	0.0370	0.0369	0.0369	0.0369	0.0368	0.0368
	0.013	0.0382	0.0376	0.0371	0.0369	0.0368	0.0367	0.0367	0.0367	0.0366	0.0366
	0.017	0.0379	0.0375	0.0369	0.0367	0.0366	0.0365	0.0365	0.0365	0.0365	0.0364
	0.021	0.0377	0.0373	0.0367	0.0365	0.0364	0.0364	0.0363	0.0363	0.0363	0.0362

Table 26. Skewed Generalized Student's T Distribution VaR/ES Surface Data

Panel E. VaR with respect to ν and k

		ν									
		2.34	22.33	42.32	62.31	82.30	102.29	122.28	142.27	162.26	182.25
k	1.037	0.0187	0.0314	0.0315	0.0315	0.0315	0.0315	0.0315	0.0315	0.0315	0.0315
	1.201	0.0197	0.0311	0.0311	0.0311	0.0311	0.0311	0.0311	0.0311	0.0311	0.0311
	1.364	0.0203	0.0308	0.0307	0.0307	0.0307	0.0307	0.0307	0.0307	0.0307	0.0307
	1.527	0.0207	0.0304	0.0304	0.0303	0.0303	0.0303	0.0303	0.0303	0.0303	0.0303
	1.690	0.0210	0.0301	0.0300	0.0300	0.0299	0.0299	0.0299	0.0299	0.0299	0.0299
	1.854	0.0212	0.0298	0.0297	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296
	2.017	0.0214	0.0295	0.0294	0.0293	0.0293	0.0293	0.0293	0.0293	0.0293	0.0293
	2.180	0.0214	0.0292	0.0291	0.0290	0.0290	0.0290	0.0290	0.0290	0.0290	0.0290
	2.344	0.0215	0.0289	0.0288	0.0288	0.0288	0.0287	0.0287	0.0287	0.0287	0.0287
	2.507	0.0216	0.0287	0.0286	0.0285	0.0285	0.0285	0.0285	0.0285	0.0285	0.0285

Panel F. ES with respect to ν and k

		ν									
		2.34	22.33	42.32	62.31	82.30	102.29	122.28	142.27	162.26	182.25
k	1.037	0.0372	0.0426	0.0421	0.0419	0.0418	0.0417	0.0417	0.0416	0.0416	0.0416
	1.201	0.0378	0.0410	0.0404	0.0402	0.0401	0.0401	0.0400	0.0400	0.0400	0.0400
	1.364	0.0381	0.0396	0.0391	0.0389	0.0388	0.0387	0.0387	0.0386	0.0386	0.0386
	1.527	0.0382	0.0385	0.0379	0.0377	0.0376	0.0375	0.0375	0.0375	0.0375	0.0374
	1.690	0.0382	0.0375	0.0369	0.0367	0.0366	0.0366	0.0365	0.0365	0.0365	0.0364
	1.854	0.0382	0.0366	0.0360	0.0359	0.0358	0.0357	0.0357	0.0356	0.0356	0.0356
	2.017	0.0381	0.0358	0.0353	0.0351	0.0350	0.0349	0.0349	0.0349	0.0349	0.0348
	2.180	0.0381	0.0352	0.0346	0.0344	0.0343	0.0343	0.0343	0.0342	0.0342	0.0342
	2.344	0.0380	0.0346	0.0340	0.0339	0.0338	0.0337	0.0337	0.0336	0.0336	0.0336
	2.507	0.0379	0.0340	0.0335	0.0333	0.0333	0.0332	0.0332	0.0331	0.0331	0.0331

Table 26. Skewed Generalized Student's T Distribution VaR/ES Surface Data

Panel G. VaR with respect to λ and σ

		σ									
		0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.04	0.04
λ	-0.02	0.013	0.021	0.029	0.037	0.045	0.053	0.061	0.069	0.077	0.085
	-0.01	0.013	0.021	0.029	0.037	0.045	0.053	0.061	0.069	0.077	0.085
	-0.01	0.013	0.021	0.029	0.037	0.045	0.053	0.061	0.069	0.077	0.084
	0.00	0.013	0.021	0.029	0.037	0.045	0.053	0.060	0.068	0.076	0.084
	0.00	0.013	0.021	0.029	0.037	0.044	0.052	0.060	0.068	0.076	0.084
	0.00	0.013	0.021	0.029	0.036	0.044	0.052	0.060	0.068	0.075	0.083
	0.01	0.013	0.021	0.028	0.036	0.044	0.052	0.059	0.067	0.075	0.083
	0.01	0.013	0.021	0.028	0.036	0.044	0.051	0.059	0.067	0.074	0.082
	0.02	0.013	0.020	0.028	0.036	0.043	0.051	0.059	0.066	0.074	0.082
	0.02	0.013	0.020	0.028	0.036	0.043	0.051	0.058	0.066	0.074	0.081

Panel H. ES with respect to λ and σ

		σ									
		0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.04	0.04
λ	-0.02	0.017	0.028	0.039	0.049	0.060	0.070	0.081	0.091	0.102	0.112
	-0.01	0.017	0.028	0.038	0.049	0.059	0.070	0.080	0.091	0.101	0.112
	-0.01	0.017	0.028	0.038	0.049	0.059	0.069	0.080	0.090	0.101	0.111
	0.00	0.017	0.028	0.038	0.048	0.059	0.069	0.079	0.090	0.100	0.110
	0.00	0.017	0.027	0.038	0.048	0.058	0.069	0.079	0.089	0.100	0.110
	0.00	0.017	0.027	0.038	0.048	0.058	0.068	0.079	0.089	0.099	0.109
	0.01	0.017	0.027	0.037	0.048	0.058	0.068	0.078	0.088	0.099	0.109
	0.01	0.017	0.027	0.037	0.047	0.057	0.068	0.078	0.088	0.098	0.108
	0.02	0.017	0.027	0.037	0.047	0.057	0.067	0.077	0.087	0.097	0.108
	0.02	0.017	0.027	0.037	0.047	0.057	0.067	0.077	0.087	0.097	0.107

Table 26. Skewed Generalized Student's T Distribution VaR/ES Surface Data

Panel H. VaR with respect to σ and k

		σ									
		0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.04	0.04
k	1.04	0.013	0.021	0.029	0.037	0.045	0.053	0.061	0.068	0.076	0.084
	1.20	0.013	0.021	0.029	0.037	0.045	0.053	0.060	0.068	0.076	0.084
	1.36	0.013	0.021	0.029	0.037	0.044	0.052	0.060	0.068	0.076	0.084
	1.53	0.013	0.021	0.028	0.036	0.044	0.052	0.060	0.067	0.075	0.083
	1.69	0.013	0.021	0.028	0.036	0.044	0.051	0.059	0.067	0.074	0.082
	1.85	0.013	0.020	0.028	0.036	0.043	0.051	0.059	0.066	0.074	0.081
	2.02	0.013	0.020	0.028	0.035	0.043	0.050	0.058	0.066	0.073	0.081
	2.18	0.013	0.020	0.028	0.035	0.043	0.050	0.058	0.065	0.073	0.080
	2.34	0.012	0.020	0.027	0.035	0.042	0.050	0.057	0.065	0.072	0.080
	2.51	0.012	0.020	0.027	0.035	0.042	0.049	0.057	0.064	0.072	0.079

Panel I. ES with respect to σ and k

		σ									
		0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.04	0.04
k	1.04	0.019	0.030	0.041	0.053	0.064	0.075	0.087	0.098	0.110	0.121
	1.20	0.018	0.029	0.040	0.051	0.062	0.073	0.084	0.095	0.106	0.117
	1.36	0.018	0.028	0.039	0.050	0.060	0.071	0.081	0.092	0.103	0.113
	1.53	0.017	0.028	0.038	0.048	0.059	0.069	0.079	0.090	0.100	0.110
	1.69	0.017	0.027	0.037	0.047	0.057	0.067	0.077	0.087	0.098	0.108
	1.85	0.016	0.026	0.036	0.046	0.056	0.066	0.076	0.086	0.095	0.105
	2.02	0.016	0.026	0.035	0.045	0.055	0.065	0.074	0.084	0.094	0.103
	2.18	0.016	0.025	0.035	0.044	0.054	0.063	0.073	0.082	0.092	0.101
	2.34	0.016	0.025	0.034	0.044	0.053	0.062	0.072	0.081	0.091	0.100
	2.51	0.015	0.025	0.034	0.043	0.052	0.061	0.071	0.080	0.089	0.098

Table 26. Skewed Generalized Student's T Distribution VaR/ES Surface Data

Panel J. VaR with respect to λ and k

		λ									
		-0.21	-0.14	-0.08	-0.01	0.06	0.13	0.19	0.26	0.33	0.40
k	1.04	0.032	0.032	0.032	0.032	0.032	0.031	0.031	0.031	0.031	0.031
	1.20	0.032	0.032	0.032	0.032	0.031	0.031	0.031	0.031	0.031	0.031
	1.36	0.032	0.032	0.032	0.031	0.031	0.031	0.031	0.031	0.031	0.030
	1.53	0.032	0.031	0.031	0.031	0.031	0.031	0.031	0.030	0.030	0.030
	1.69	0.031	0.031	0.031	0.031	0.031	0.031	0.030	0.030	0.030	0.030
	1.85	0.031	0.031	0.031	0.031	0.030	0.030	0.030	0.030	0.030	0.030
	2.02	0.031	0.031	0.031	0.030	0.030	0.030	0.030	0.030	0.030	0.029
	2.18	0.031	0.030	0.030	0.030	0.030	0.030	0.030	0.029	0.029	0.029
	2.34	0.030	0.030	0.030	0.030	0.030	0.030	0.029	0.029	0.029	0.029
	2.51	0.030	0.030	0.030	0.030	0.030	0.029	0.029	0.029	0.029	0.029

Panel K. ES with respect to to λ and k

		λ									
		-0.21	-0.14	-0.08	-0.01	0.06	0.13	0.19	0.26	0.33	0.40
k	1.04	0.046	0.046	0.046	0.045	0.045	0.045	0.045	0.044	0.044	0.044
	1.20	0.045	0.044	0.044	0.044	0.044	0.043	0.043	0.043	0.043	0.042
	1.36	0.043	0.043	0.043	0.043	0.042	0.042	0.042	0.042	0.041	0.041
	1.53	0.042	0.042	0.042	0.041	0.041	0.041	0.041	0.041	0.040	0.040
	1.69	0.041	0.041	0.041	0.040	0.040	0.040	0.040	0.040	0.039	0.039
	1.85	0.040	0.040	0.040	0.040	0.039	0.039	0.039	0.039	0.039	0.038
	2.02	0.039	0.039	0.039	0.039	0.039	0.038	0.038	0.038	0.038	0.038
	2.18	0.039	0.038	0.038	0.038	0.038	0.038	0.037	0.037	0.037	0.037
	2.34	0.038	0.038	0.038	0.037	0.037	0.037	0.037	0.037	0.037	0.036
	2.51	0.037	0.037	0.037	0.037	0.037	0.037	0.036	0.036	0.036	0.036

8.3.2 $\alpha = 5\%$

8.3.2.1 Student's t distribution

Figure 60. Student's T Distribution VaR/ES Surface
Panel A. VaR Surface with respect to ν and σ

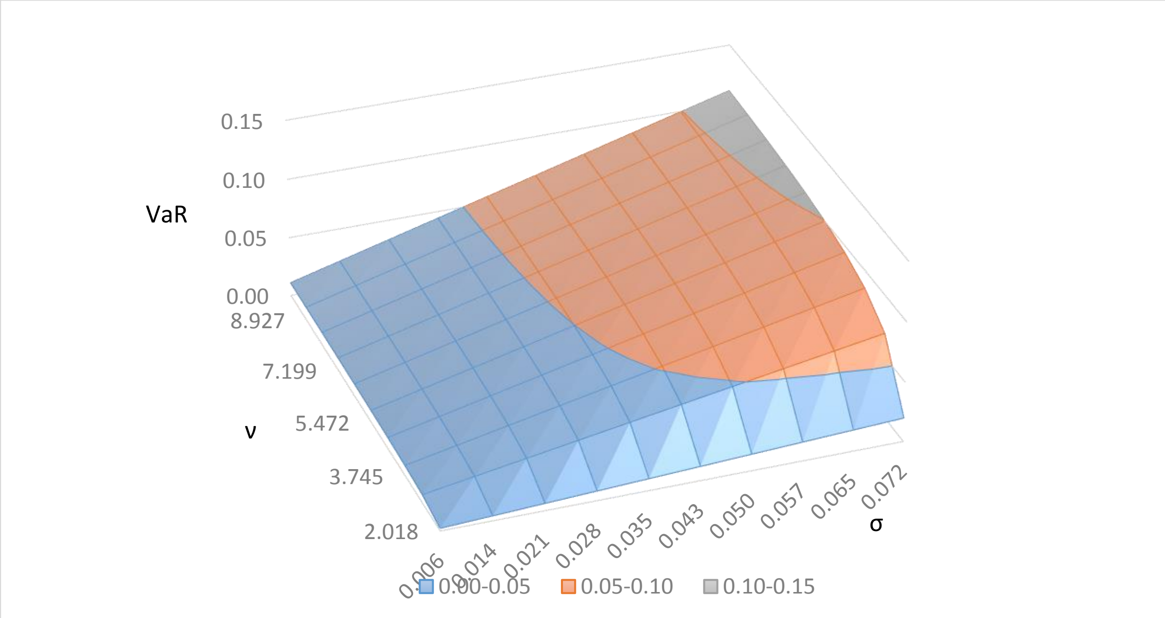


Figure 60. Student's T Distribution VaR/ES Surface
Panel B. ES Surface with respect to ν and σ

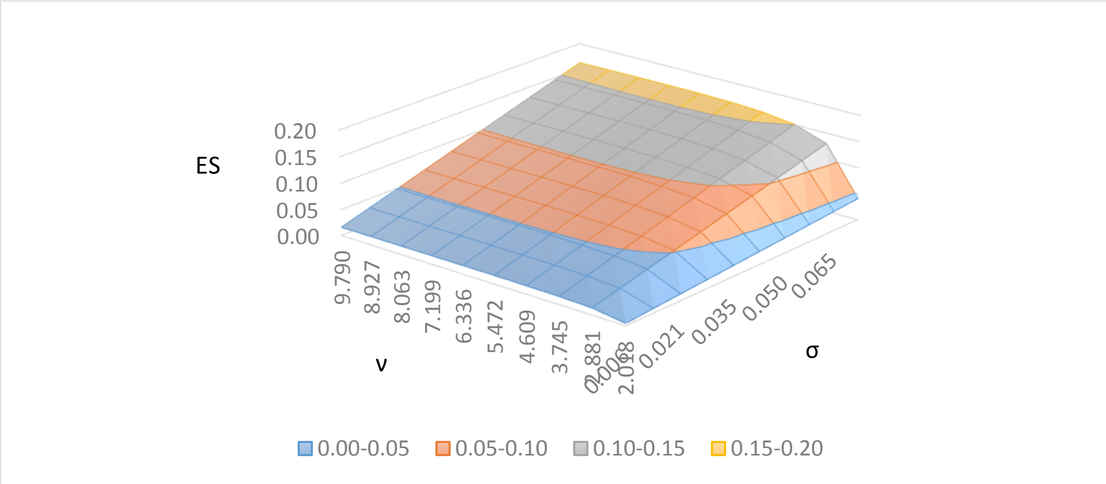


Table 27. Student's T Distribution VaR/ES Surface Data

Panel A. VaR with respect to ν and σ

		ν									
		2.018	2.881	3.745	4.609	5.472	6.336	7.199	8.063	8.927	9.790
σ	0.006	0.002	0.007	0.009	0.009	0.010	0.010	0.011	0.011	0.011	0.011
	0.014	0.004	0.014	0.017	0.019	0.020	0.021	0.021	0.022	0.022	0.022
	0.021	0.006	0.021	0.026	0.028	0.030	0.031	0.032	0.032	0.033	0.033
	0.028	0.008	0.028	0.034	0.038	0.040	0.041	0.042	0.043	0.044	0.044
	0.035	0.010	0.034	0.043	0.047	0.050	0.052	0.053	0.054	0.055	0.055
	0.043	0.012	0.041	0.051	0.057	0.060	0.062	0.064	0.065	0.066	0.066
	0.050	0.014	0.048	0.060	0.066	0.070	0.072	0.074	0.076	0.077	0.078
	0.057	0.016	0.055	0.068	0.075	0.080	0.083	0.085	0.087	0.088	0.089
	0.065	0.018	0.062	0.077	0.085	0.090	0.093	0.096	0.097	0.099	0.100
	0.072	0.020	0.069	0.085	0.094	0.100	0.104	0.106	0.108	0.110	0.111

Panel B. ES with respect to ν and σ

		ν									
		2.018	2.881	3.745	4.609	5.472	6.336	7.199	8.063	8.927	9.790
σ	0.006	0.004	0.013	0.015	0.016	0.016	0.016	0.016	0.016	0.016	0.016
	0.014	0.008	0.026	0.030	0.032	0.032	0.032	0.032	0.032	0.032	0.032
	0.021	0.012	0.039	0.045	0.047	0.048	0.049	0.049	0.049	0.049	0.048
	0.028	0.016	0.052	0.060	0.063	0.064	0.065	0.065	0.065	0.065	0.065
	0.035	0.021	0.065	0.075	0.079	0.081	0.081	0.081	0.081	0.081	0.081
	0.043	0.025	0.078	0.090	0.095	0.097	0.098	0.098	0.098	0.097	0.097
	0.050	0.029	0.091	0.105	0.111	0.113	0.114	0.114	0.114	0.114	0.113
	0.057	0.033	0.104	0.120	0.127	0.129	0.130	0.130	0.130	0.130	0.129
	0.065	0.037	0.117	0.136	0.142	0.145	0.146	0.147	0.146	0.146	0.146
	0.072	0.041	0.130	0.151	0.158	0.161	0.163	0.163	0.163	0.162	0.162

8.3.2.2 Hansen's skewed t distribution

Figure 61. Skewed T Distribution VaR/ES Surface

Panel A. VaR Surface with respect to ν and σ

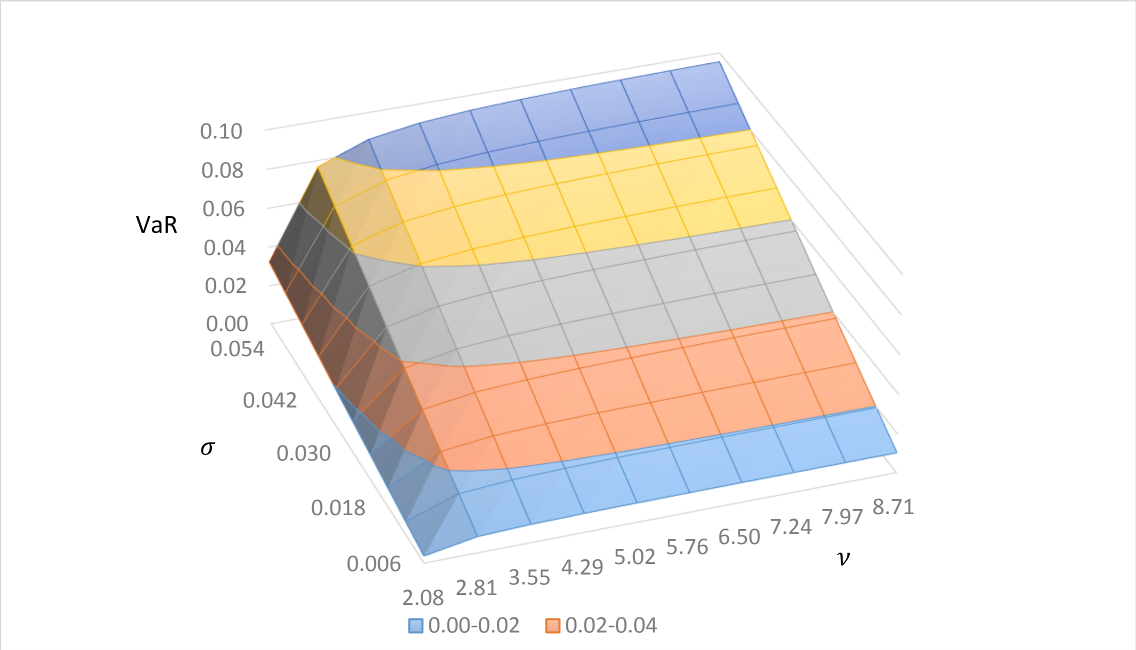


Figure 61. Skewed T Distribution VaR/ES Surface
Panel B. ES Surface with respect to ν and σ

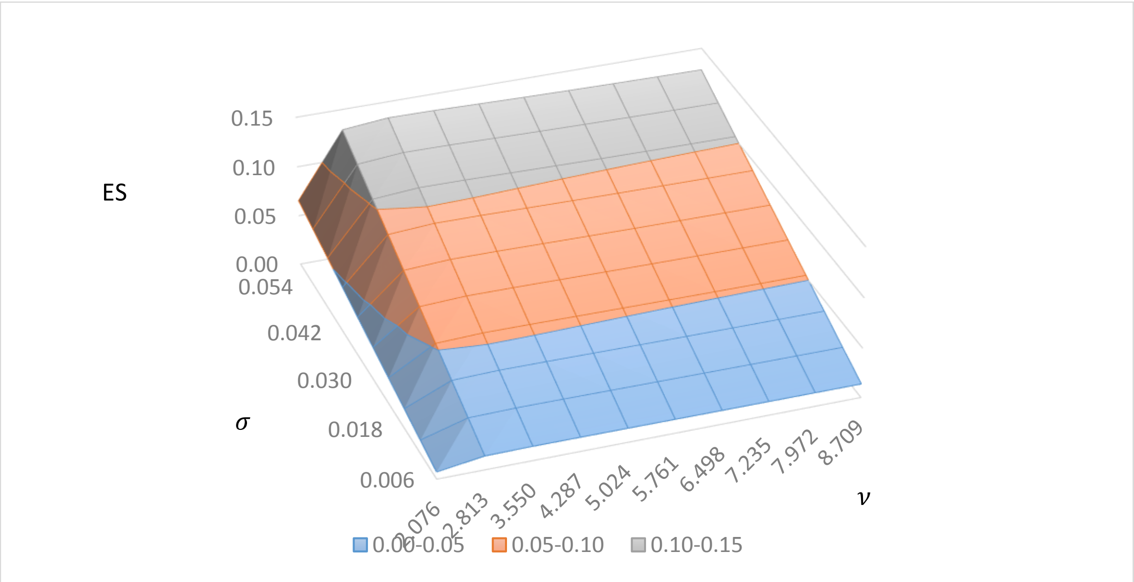


Figure 61. Skewed T Distribution VaR/ES Surface
Panel C. VaR Surface with respect to ν and λ

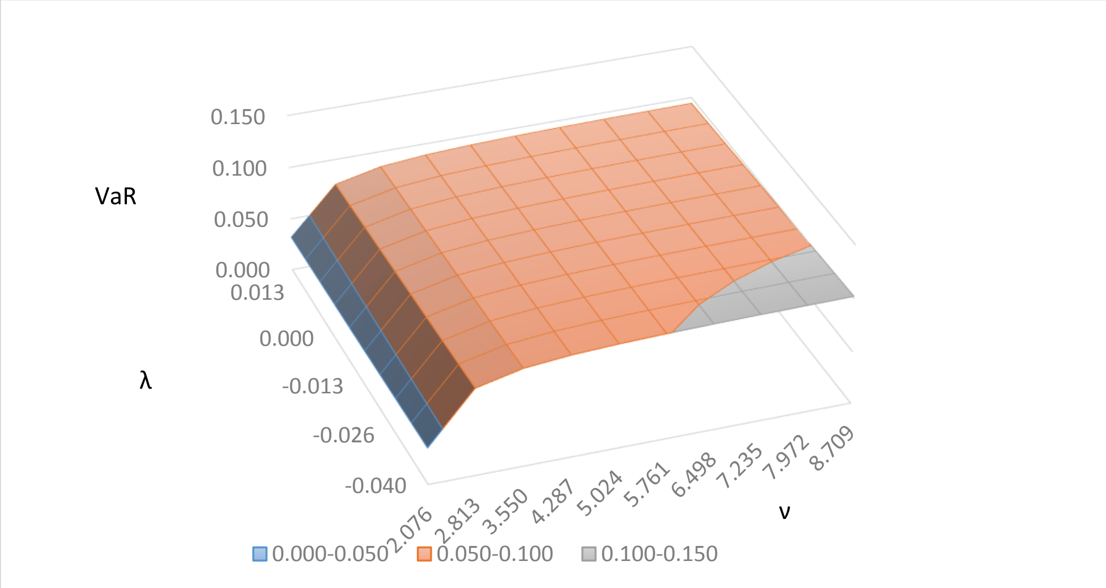


Figure 61. Skewed T Distribution VaR/ES Surface

Panel D. ES Surface with respect to ν and λ

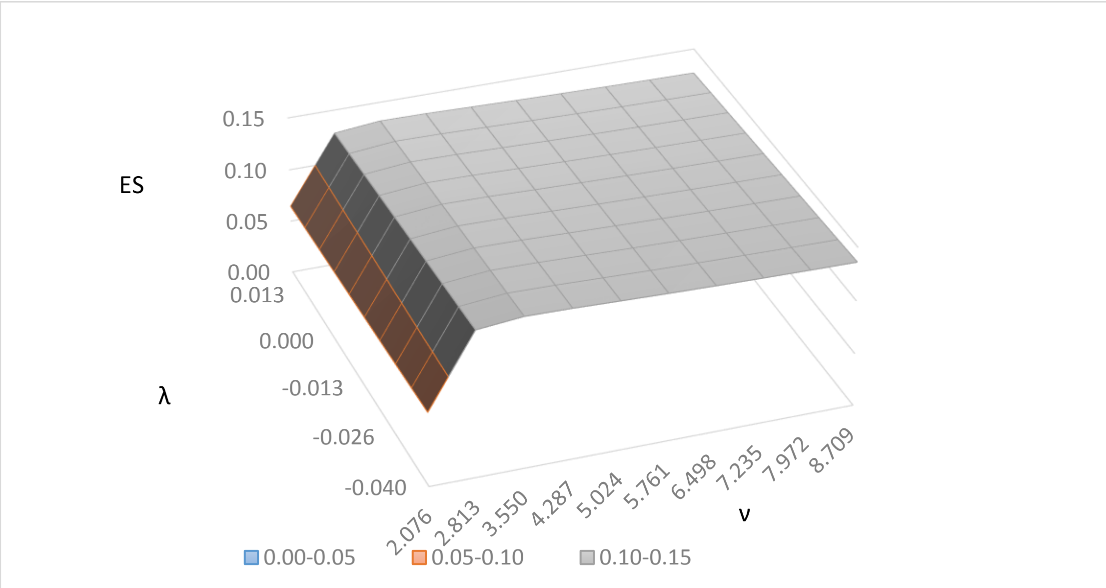


Figure 61. Skewed T Distribution VaR/ES Surface

Panel E. VaR Surface with respect to σ and λ

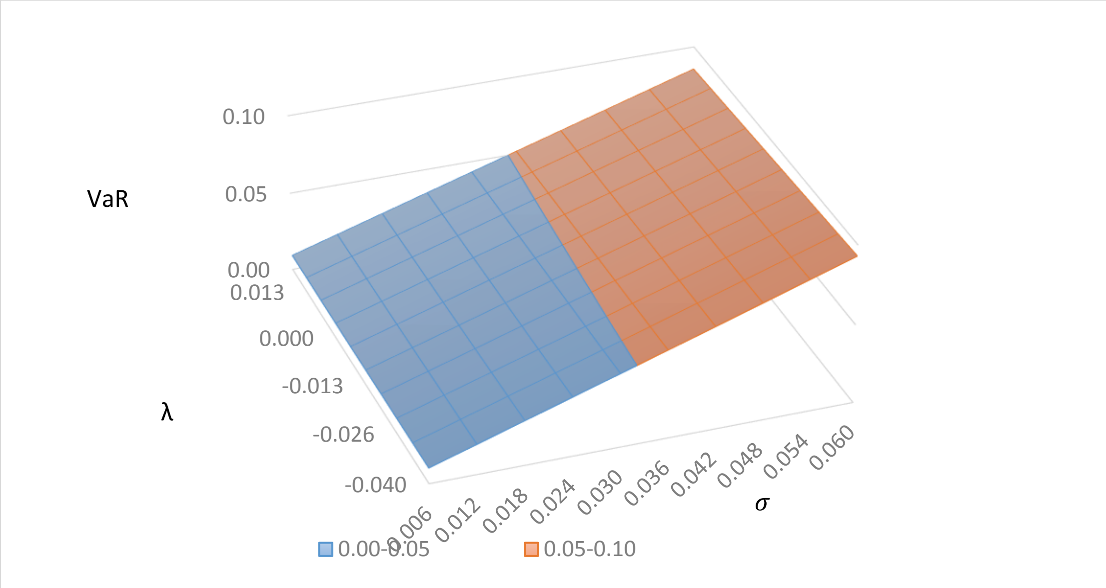


Figure 61. Skewed T Distribution VaR/ES Surface

Panel F. ES Surface with respect to σ and λ

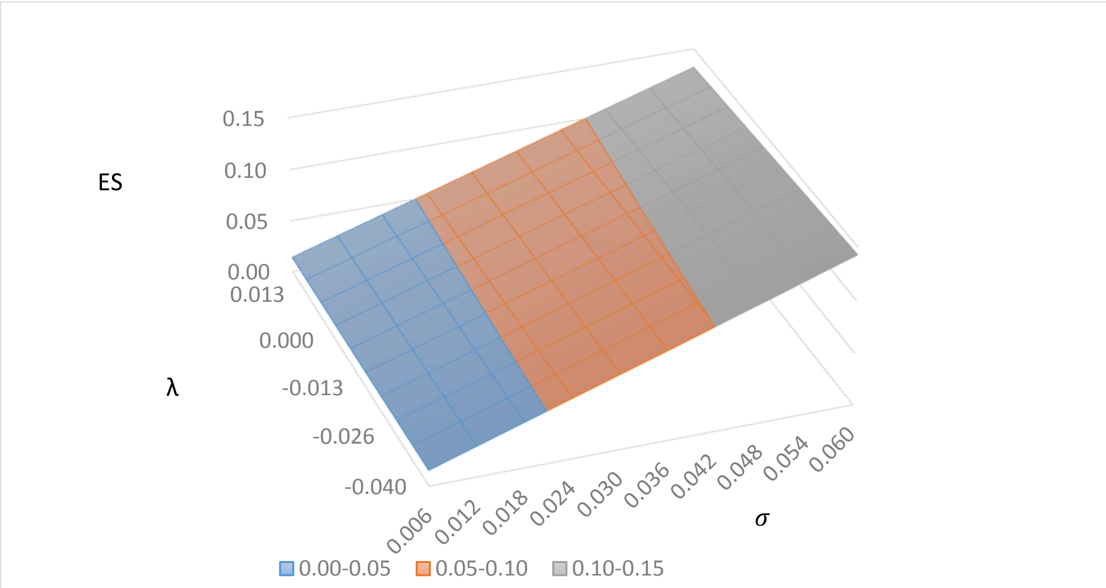


Table 28. Skewed Student's T Distribution VaR/ES Surface Data

Panel A. VaR with respect to ν and σ

		ν									
		2.08	2.81	3.55	4.29	5.02	5.76	6.50	7.24	7.97	8.71
σ	0.006	0.004	0.008	0.009	0.010	0.010	0.010	0.010	0.010	0.010	0.010
	0.012	0.007	0.016	0.018	0.019	0.019	0.019	0.019	0.020	0.020	0.020
	0.018	0.010	0.023	0.026	0.028	0.028	0.029	0.029	0.029	0.029	0.029
	0.024	0.013	0.031	0.035	0.037	0.037	0.038	0.038	0.038	0.039	0.039
	0.030	0.016	0.039	0.043	0.045	0.046	0.047	0.047	0.048	0.048	0.048
	0.036	0.020	0.046	0.052	0.054	0.056	0.056	0.057	0.057	0.057	0.058
	0.042	0.023	0.054	0.061	0.063	0.065	0.066	0.066	0.067	0.067	0.067
	0.048	0.026	0.062	0.069	0.072	0.074	0.075	0.076	0.076	0.076	0.076
	0.054	0.029	0.069	0.078	0.081	0.083	0.084	0.085	0.085	0.086	0.086
	0.060	0.032	0.077	0.086	0.090	0.092	0.093	0.094	0.095	0.095	0.095

Panel B. ES with respect to ν and σ

		ν									
		2.076	2.813	3.550	4.287	5.024	5.761	6.498	7.235	7.972	8.709
σ	0.006	0.007	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
	0.012	0.014	0.027	0.028	0.027	0.027	0.027	0.027	0.027	0.026	0.026
	0.018	0.020	0.040	0.041	0.041	0.040	0.040	0.040	0.039	0.039	0.039
	0.024	0.027	0.052	0.054	0.054	0.053	0.053	0.053	0.052	0.052	0.052
	0.030	0.033	0.065	0.067	0.067	0.066	0.066	0.065	0.065	0.065	0.064
	0.036	0.039	0.078	0.081	0.080	0.080	0.079	0.078	0.078	0.077	0.077
	0.042	0.046	0.091	0.094	0.093	0.093	0.092	0.091	0.091	0.090	0.090
	0.048	0.052	0.104	0.107	0.107	0.106	0.105	0.104	0.104	0.103	0.103
	0.054	0.059	0.117	0.120	0.120	0.119	0.118	0.117	0.116	0.116	0.115
	0.060	0.065	0.129	0.134	0.133	0.132	0.131	0.130	0.129	0.129	0.128

Table 28. Skewed Student's T Distribution VaR/ES Surface Data

Panel C. VaR with respect to ν and λ

		ν									
		2.076	2.813	3.550	4.287	5.024	5.761	6.498	7.235	7.972	8.709
λ	-0.040	0.035	0.082	0.093	0.097	0.099	0.100	0.101	0.101	0.102	0.102
	-0.033	0.035	0.082	0.092	0.096	0.098	0.099	0.100	0.100	0.101	0.101
	-0.026	0.034	0.081	0.091	0.095	0.097	0.098	0.099	0.100	0.100	0.100
	-0.020	0.034	0.080	0.090	0.094	0.096	0.097	0.098	0.099	0.099	0.099
	-0.013	0.034	0.079	0.089	0.093	0.095	0.097	0.097	0.098	0.098	0.099
	-0.007	0.033	0.079	0.088	0.092	0.094	0.096	0.096	0.097	0.097	0.098
	0.000	0.033	0.078	0.088	0.092	0.094	0.095	0.096	0.096	0.097	0.097
	0.006	0.033	0.077	0.087	0.091	0.093	0.094	0.095	0.095	0.096	0.096
	0.013	0.032	0.076	0.086	0.090	0.092	0.093	0.094	0.094	0.095	0.095
	0.020	0.032	0.076	0.085	0.089	0.091	0.092	0.093	0.094	0.094	0.094

Panel D. ES with respect to ν and λ

		ν									
		2.076	2.813	3.550	4.287	5.024	5.761	6.498	7.235	7.972	8.709
λ	-0.040	0.070	0.139	0.143	0.142	0.141	0.139	0.138	0.137	0.137	0.136
	-0.033	0.070	0.137	0.142	0.141	0.139	0.138	0.137	0.136	0.136	0.135
	-0.026	0.069	0.136	0.140	0.140	0.138	0.137	0.136	0.135	0.135	0.134
	-0.020	0.068	0.135	0.139	0.139	0.137	0.136	0.135	0.134	0.133	0.133
	-0.013	0.068	0.134	0.138	0.137	0.136	0.135	0.134	0.133	0.132	0.132
	-0.007	0.067	0.133	0.137	0.136	0.135	0.134	0.133	0.132	0.131	0.131
	0.000	0.067	0.131	0.136	0.135	0.134	0.133	0.132	0.131	0.130	0.130
	0.006	0.066	0.130	0.134	0.134	0.133	0.132	0.131	0.130	0.129	0.129
	0.013	0.065	0.129	0.133	0.133	0.132	0.130	0.130	0.129	0.128	0.128
	0.020	0.065	0.128	0.132	0.131	0.130	0.129	0.128	0.128	0.127	0.126

Table 28. Skewed Student's T Distribution VaR/ES Surface Data

Panel E. VaR with respect to σ and λ

		σ									
		0.006	0.012	0.018	0.024	0.030	0.036	0.042	0.048	0.054	0.060
λ	-0.040	0.0130	0.0252	0.0373	0.0494	0.0615	0.0736	0.0858	0.0979	0.1100	0.1221
	-0.033	0.0129	0.0250	0.0370	0.0490	0.0610	0.0730	0.0850	0.0971	0.1091	0.1211
	-0.026	0.0128	0.0247	0.0367	0.0486	0.0605	0.0724	0.0843	0.0962	0.1082	0.1201
	-0.020	0.0127	0.0245	0.0363	0.0482	0.0600	0.0718	0.0836	0.0954	0.1072	0.1190
	-0.013	0.0126	0.0243	0.0360	0.0477	0.0595	0.0712	0.0829	0.0946	0.1063	0.1180
	-0.007	0.0125	0.0241	0.0357	0.0473	0.0589	0.0705	0.0822	0.0938	0.1054	0.1170
	0.000	0.0124	0.0239	0.0354	0.0469	0.0584	0.0699	0.0814	0.0929	0.1044	0.1159
	0.006	0.0123	0.0237	0.0351	0.0465	0.0579	0.0693	0.0807	0.0921	0.1035	0.1149
	0.013	0.0122	0.0235	0.0348	0.0461	0.0574	0.0687	0.0800	0.0913	0.1026	0.1139
	0.020	0.0121	0.0233	0.0345	0.0456	0.0568	0.0680	0.0792	0.0904	0.1016	0.1128

		σ									
		0.006	0.012	0.018	0.024	0.030	0.036	0.042	0.048	0.054	0.060
λ	-0.040	0.0100	0.0192	0.0284	0.0376	0.0468	0.0560	0.0653	0.0745	0.0837	0.0929
	-0.033	0.0099	0.0190	0.0282	0.0373	0.0464	0.0556	0.0647	0.0738	0.0830	0.0921
	-0.026	0.0098	0.0188	0.0279	0.0370	0.0460	0.0551	0.0641	0.0732	0.0822	0.0913
	-0.020	0.0097	0.0187	0.0277	0.0366	0.0456	0.0546	0.0635	0.0725	0.0815	0.0905
	-0.013	0.0096	0.0185	0.0274	0.0363	0.0452	0.0541	0.0630	0.0719	0.0808	0.0896
	-0.007	0.0095	0.0183	0.0272	0.0360	0.0448	0.0536	0.0624	0.0712	0.0800	0.0888
	0.000	0.0095	0.0182	0.0269	0.0356	0.0444	0.0531	0.0618	0.0705	0.0793	0.0880
	0.006	0.0094	0.0180	0.0267	0.0353	0.0439	0.0526	0.0612	0.0699	0.0785	0.0872
	0.013	0.0093	0.0178	0.0264	0.0350	0.0435	0.0521	0.0607	0.0692	0.0778	0.0863
	0.020	0.0092	0.0177	0.0261	0.0346	0.0431	0.0516	0.0601	0.0686	0.0770	0.0855

Panel F. ES with respect to σ and λ

		σ									
		0.006	0.012	0.018	0.024	0.030	0.036	0.042	0.048	0.054	0.060
λ	-0.040	0.0152	0.0294	0.0436	0.0577	0.0719	0.0861	0.1002	0.1144	0.1286	0.1427
	-0.033	0.0151	0.0291	0.0432	0.0572	0.0713	0.0854	0.0994	0.1135	0.1275	0.1416
	-0.026	0.0150	0.0289	0.0428	0.0568	0.0707	0.0846	0.0986	0.1125	0.1264	0.1404
	-0.020	0.0148	0.0287	0.0425	0.0563	0.0701	0.0839	0.0977	0.1116	0.1254	0.1392
	-0.013	0.0147	0.0284	0.0421	0.0558	0.0695	0.0832	0.0969	0.1106	0.1243	0.1380
	-0.007	0.0146	0.0282	0.0417	0.0553	0.0689	0.0825	0.0961	0.1096	0.1232	0.1368
	0.000	0.0145	0.0279	0.0414	0.0548	0.0683	0.0818	0.0952	0.1087	0.1221	0.1356
	0.006	0.0143	0.0277	0.0410	0.0544	0.0677	0.0810	0.0944	0.1077	0.1211	0.1344
	0.013	0.0142	0.0274	0.0406	0.0539	0.0671	0.0803	0.0935	0.1067	0.1200	0.1332
	0.020	0.0141	0.0272	0.0403	0.0534	0.0665	0.0796	0.0927	0.1058	0.1189	0.1320

8.3.2.3 Skewed Generalized t distribution

Figure 62. Skewed Generalized T Distirbution VaR/ES Surface

Panel A. VaR Surface with respect to ν and σ

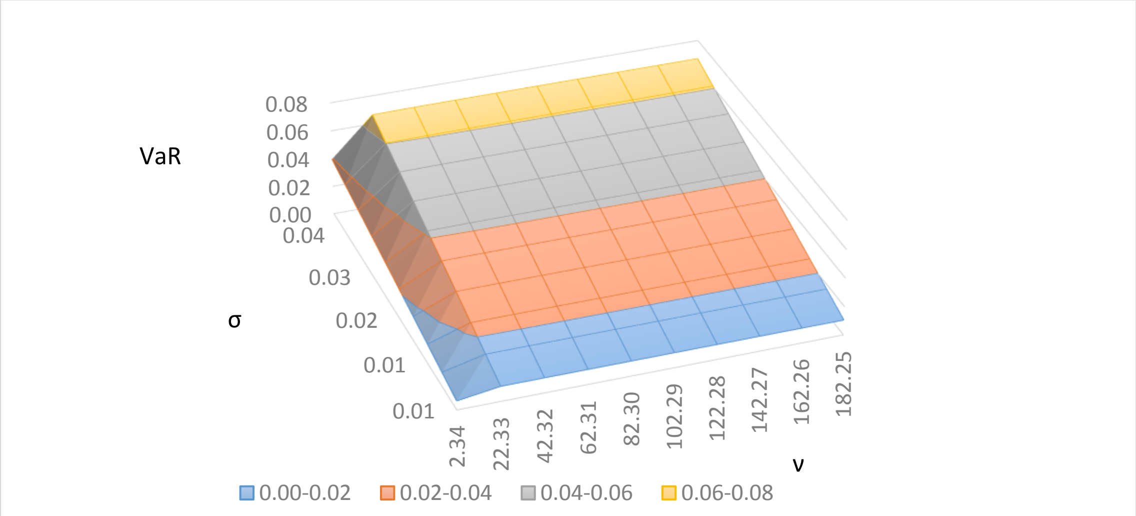


Figure 62. Skewed Generalized T Distirbution VaR/ES Surface

Panel B. ES Surface with respect to ν and σ

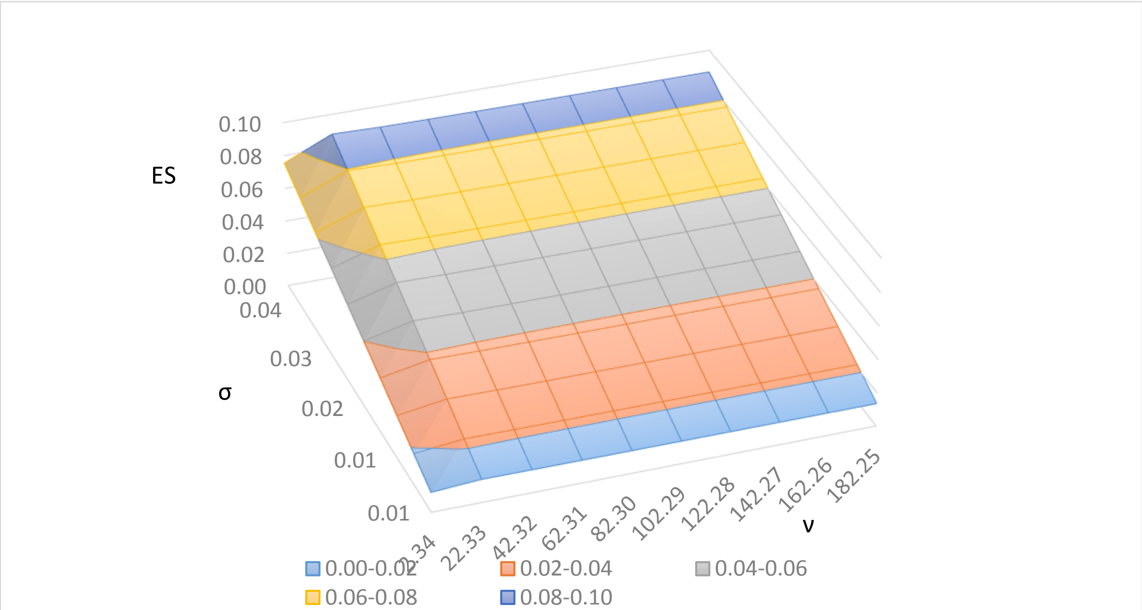


Figure 62. Skewed Generalized T Distirbution VaR/ES Surface

Panel C. VaR Surface with respect to λ and ν

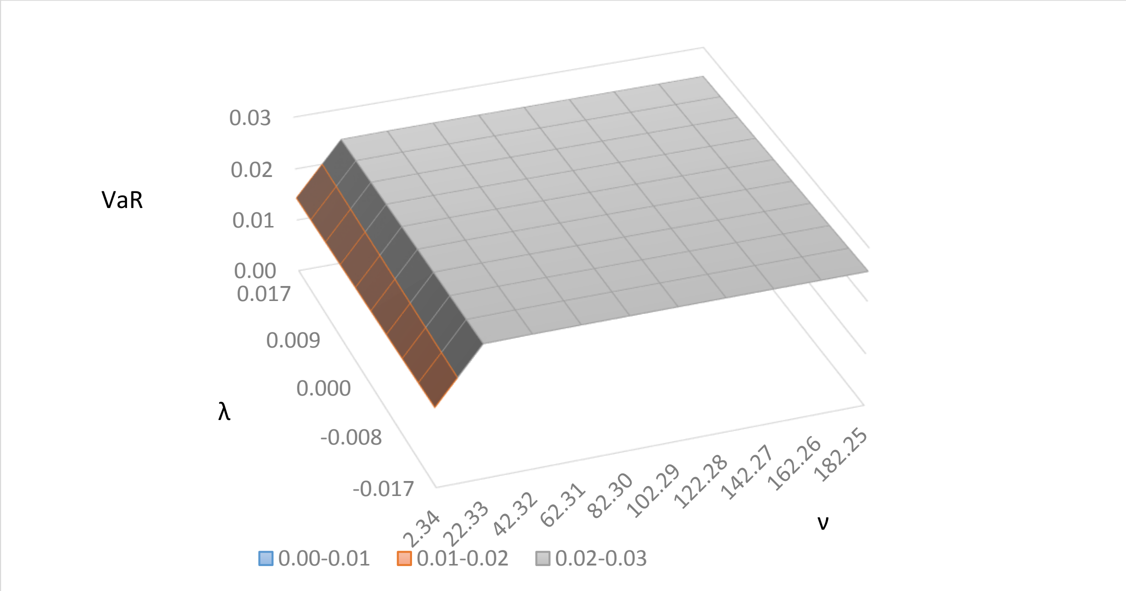


Figure 62. Skewed Generalized T Distirbution VaR/ES Surface

Panel D. ES Surface with respect to λ and ν

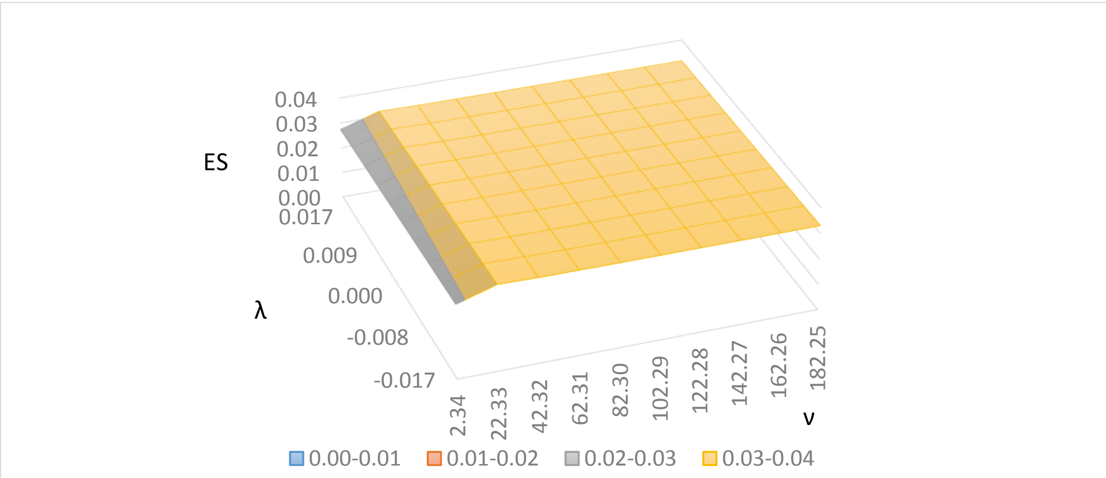


Figure 62. Skewed Generalized T Distirbution VaR/ES Surface

Panel E. VaR Surface with respect to k and ν

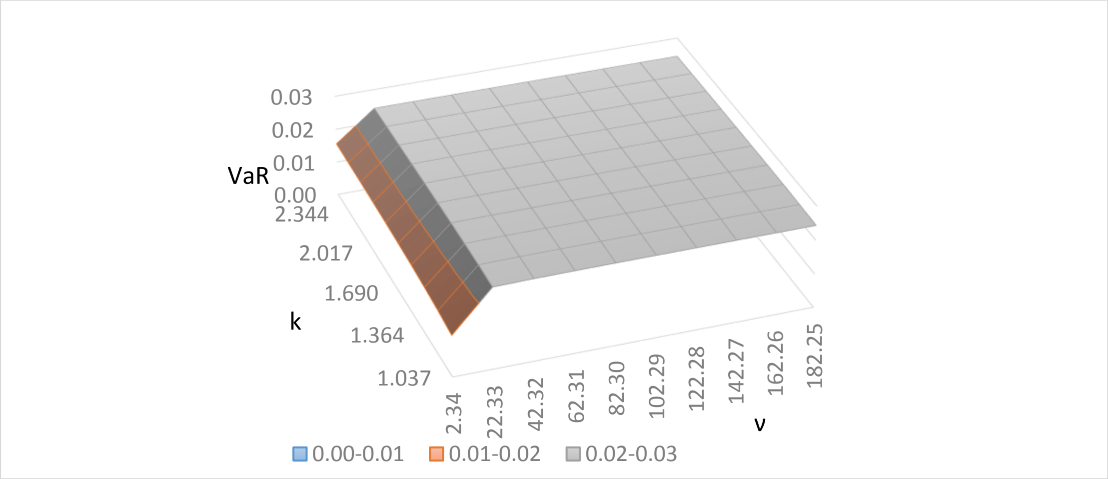


Figure 62. Skewed Generalized T Distirbution VaR/ES Surface

Panel F. ES Surface with respect to k and ν

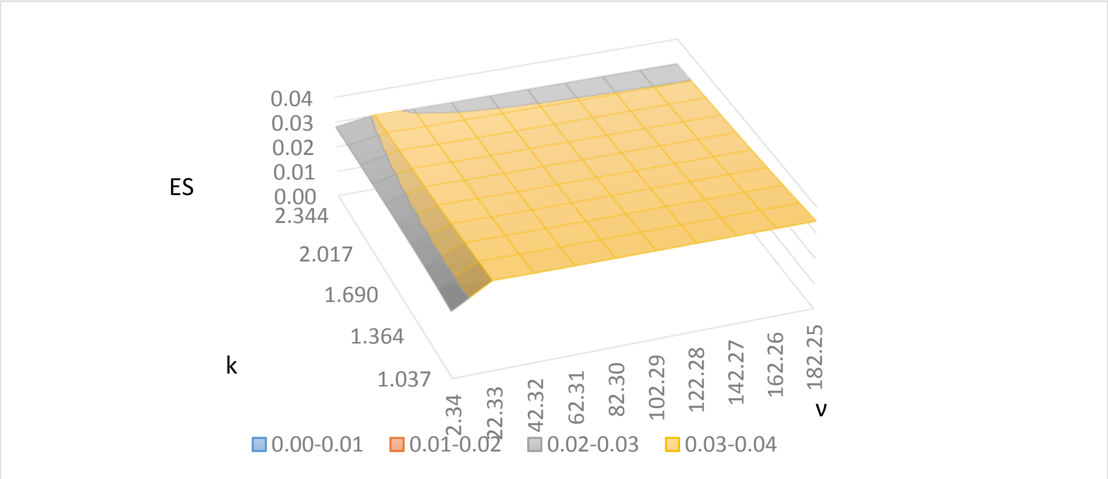


Figure 62. Skewed Generalized T Distirbution VaR/ES Surface

Panel G. VaR Surface with respect to λ and σ

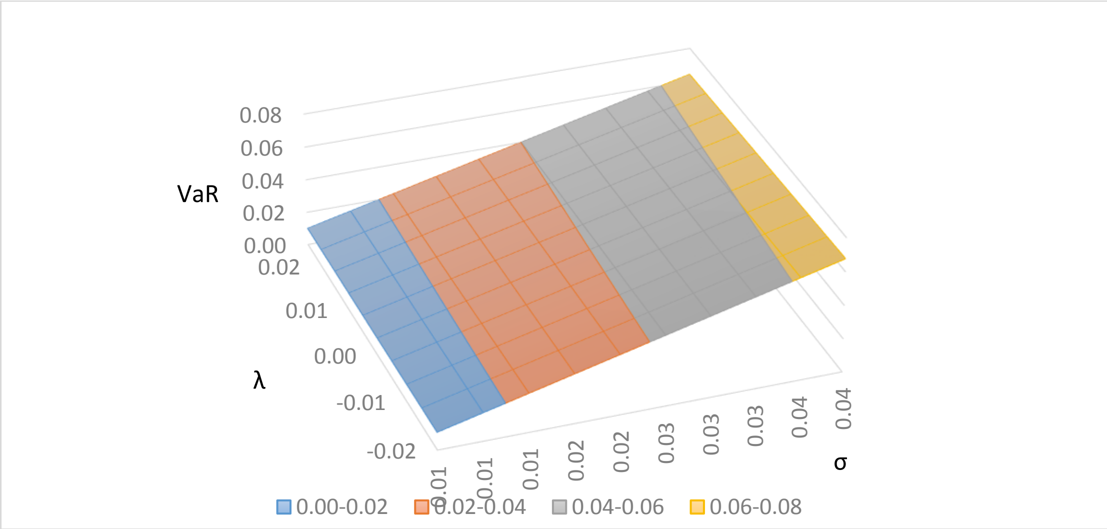


Figure 62. Skewed Generalized T Distirbution VaR/ES Surface

Panel H. ES Surface with respect to λ and σ

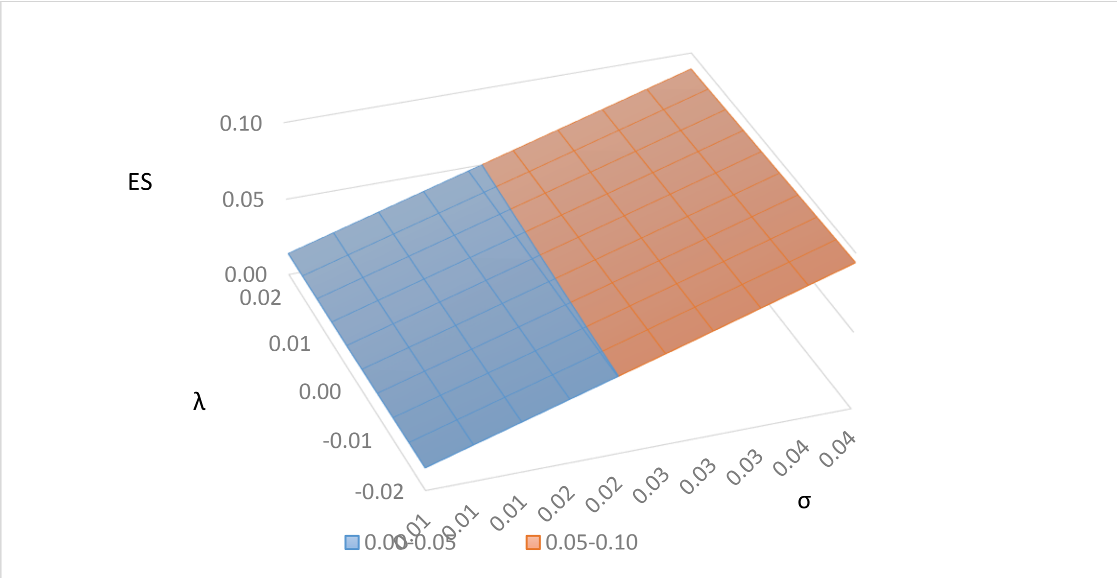


Figure 62. Skewed Generalized T Distirbution VaR/ES Surface

Panel I. VaR Surface with respect to σ and k

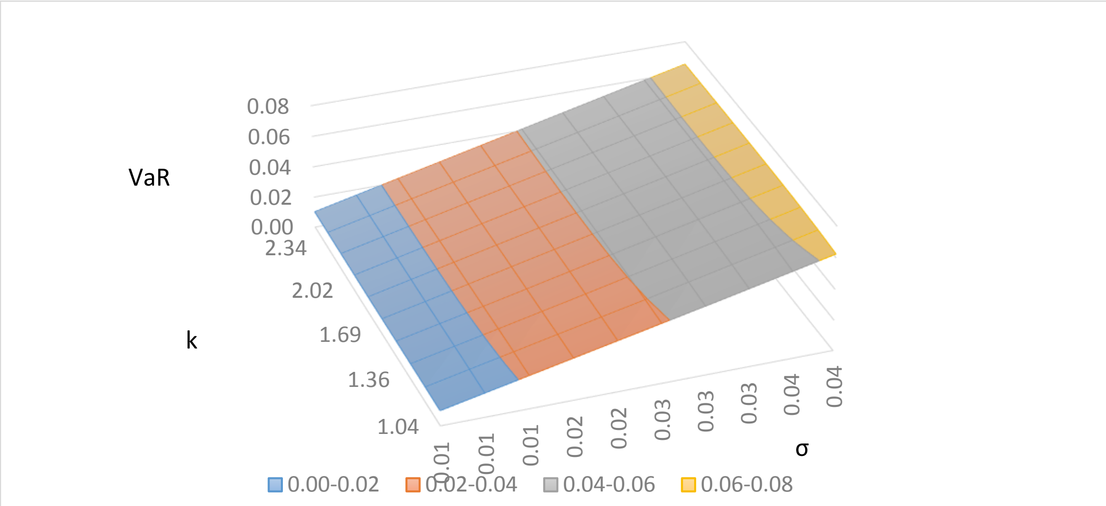


Figure 62. Skewed Generalized T Distirbution VaR/ES Surface

Panel J. ES Surface with respect to σ and k

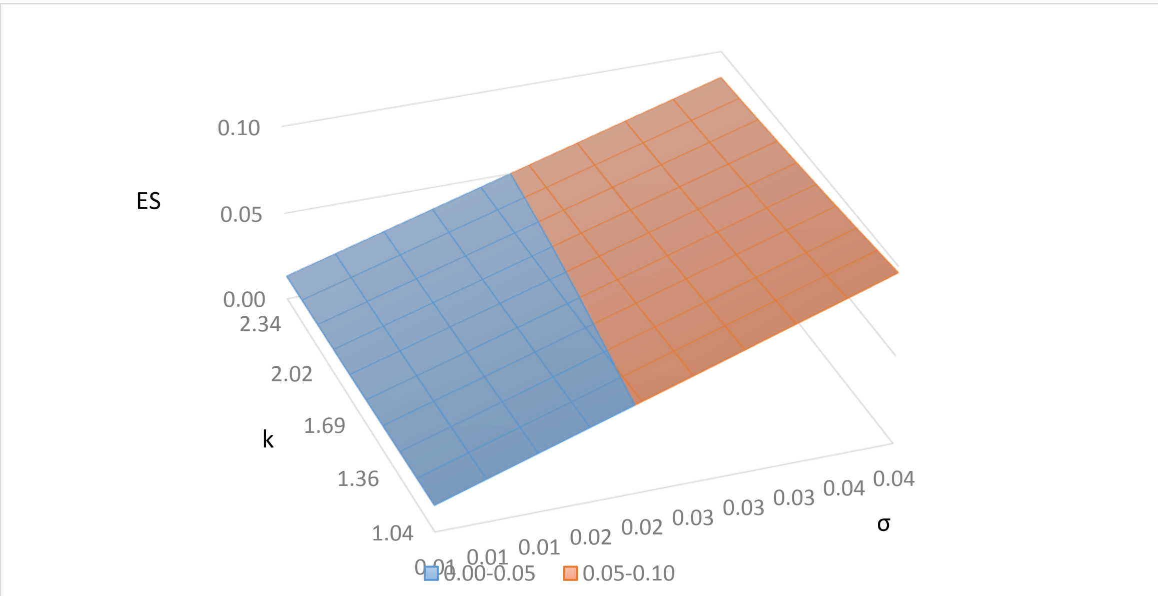


Figure 62. Skewed Generalized T Distirbution VaR/ES Surface

Panel K. VaR Surface with respect to λ and k

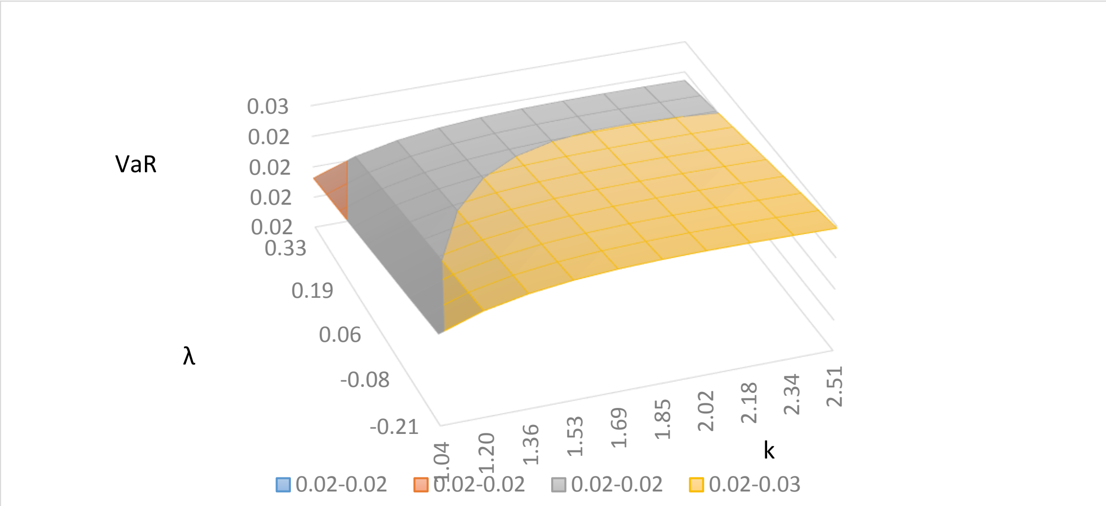


Figure 62. Skewed Generalized T Distirbution VaR/ES Surface

Panel L. ES Surface with respect to λ and k

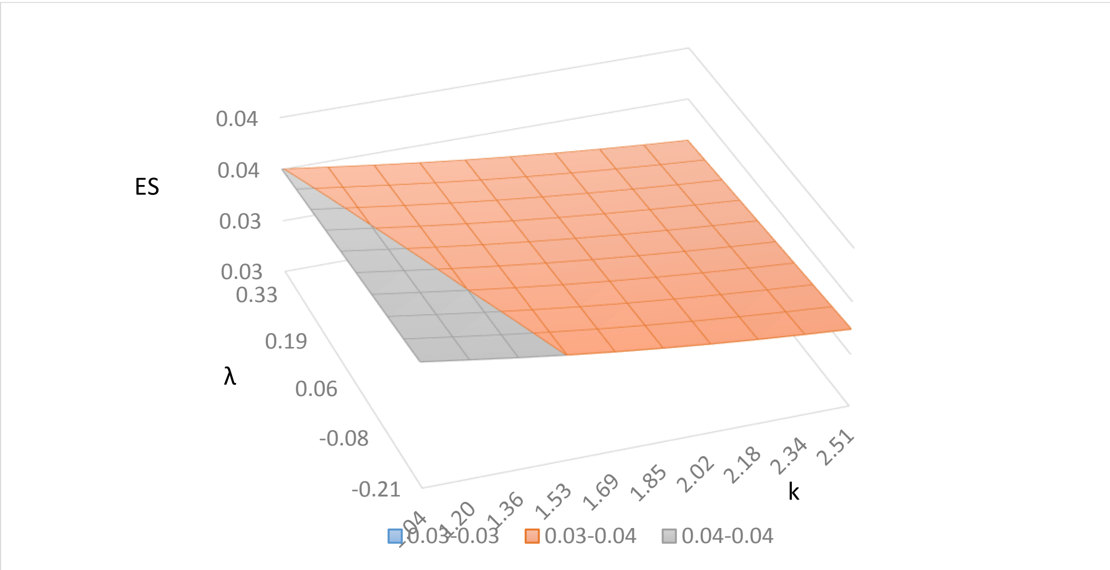


Table 29. Skewed Generalized Student's T Distribution

Panel A. VaR with respect to ν and σ

		ν									
		2.34	22.33	42.32	62.31	82.30	102.29	122.28	142.27	162.26	182.25
σ	0.01	0.0062	0.0104	0.0104	0.0105	0.0105	0.0105	0.0105	0.0105	0.0105	0.0105
	0.01	0.0099	0.0166	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167
	0.01	0.0136	0.0228	0.0229	0.0230	0.0230	0.0230	0.0230	0.0230	0.0230	0.0230
	0.02	0.0173	0.0291	0.0292	0.0292	0.0292	0.0292	0.0292	0.0292	0.0292	0.0293
	0.02	0.0209	0.0353	0.0354	0.0355	0.0355	0.0355	0.0355	0.0355	0.0355	0.0355
	0.03	0.0246	0.0415	0.0417	0.0417	0.0417	0.0418	0.0418	0.0418	0.0418	0.0418
	0.03	0.0283	0.0477	0.0479	0.0480	0.0480	0.0480	0.0480	0.0480	0.0480	0.0480
	0.03	0.0320	0.0540	0.0542	0.0542	0.0542	0.0543	0.0543	0.0543	0.0543	0.0543
	0.04	0.0356	0.0602	0.0604	0.0605	0.0605	0.0605	0.0605	0.0605	0.0606	0.0606
	0.04	0.0393	0.0664	0.0666	0.0667	0.0668	0.0668	0.0668	0.0668	0.0668	0.0668

Panel B. ES with respect to ν and σ

		ν									
		2.34	22.33	42.32	62.31	82.30	102.29	122.28	142.27	162.26	182.25
σ	0.01	0.012	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
	0.01	0.019	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022
	0.01	0.026	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
	0.02	0.033	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038
	0.02	0.040	0.047	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046
	0.03	0.047	0.055	0.055	0.054	0.054	0.054	0.054	0.054	0.054	0.054
	0.03	0.054	0.063	0.063	0.063	0.062	0.062	0.062	0.062	0.062	0.062
	0.03	0.061	0.071	0.071	0.071	0.071	0.070	0.070	0.070	0.070	0.070
	0.04	0.068	0.080	0.079	0.079	0.079	0.079	0.079	0.079	0.079	0.078
	0.04	0.075	0.088	0.087	0.087	0.087	0.087	0.087	0.087	0.087	0.087

Table 29. Skewed Generalized Student's T Distribution VaR/ES Surface Data

Panel C. VaR with respect to λ and ν

		ν									
		2.34	22.33	42.32	62.31	82.30	102.29	122.28	142.27	162.26	182.25
λ	-0.017	0.0152	0.0254	0.0255	0.0255	0.0255	0.0256	0.0256	0.0256	0.0256	0.0256
	-0.013	0.0151	0.0253	0.0254	0.0254	0.0254	0.0254	0.0254	0.0254	0.0254	0.0254
	-0.008	0.0150	0.0251	0.0252	0.0253	0.0253	0.0253	0.0253	0.0253	0.0253	0.0253
	-0.004	0.0149	0.0250	0.0251	0.0251	0.0251	0.0251	0.0251	0.0251	0.0252	0.0252
	0.000	0.0148	0.0249	0.0249	0.0250	0.0250	0.0250	0.0250	0.0250	0.0250	0.0250
	0.004	0.0147	0.0247	0.0248	0.0248	0.0249	0.0249	0.0249	0.0249	0.0249	0.0249
	0.009	0.0146	0.0246	0.0247	0.0247	0.0247	0.0247	0.0247	0.0247	0.0247	0.0247
	0.013	0.0145	0.0244	0.0245	0.0246	0.0246	0.0246	0.0246	0.0246	0.0246	0.0246
	0.017	0.0144	0.0243	0.0244	0.0244	0.0244	0.0244	0.0244	0.0244	0.0244	0.0245
	0.021	0.0143	0.0241	0.0242	0.0243	0.0243	0.0243	0.0243	0.0243	0.0243	0.0243

Panel D. ES with respect to λ and ν

		ν									
		2.34	22.33	42.32	62.31	82.30	102.29	122.28	142.27	162.26	182.25
λ	-0.017	0.0290	0.0335	0.0333	0.0332	0.0331	0.0331	0.0330	0.0330	0.0330	0.0330
	-0.013	0.0288	0.0334	0.0331	0.0330	0.0329	0.0329	0.0329	0.0329	0.0329	0.0328
	-0.008	0.0286	0.0332	0.0329	0.0328	0.0328	0.0327	0.0327	0.0327	0.0327	0.0327
	-0.004	0.0284	0.0330	0.0328	0.0326	0.0326	0.0326	0.0325	0.0325	0.0325	0.0325
	0.000	0.0283	0.0329	0.0326	0.0325	0.0324	0.0324	0.0324	0.0324	0.0324	0.0323
	0.004	0.0281	0.0327	0.0324	0.0323	0.0323	0.0322	0.0322	0.0322	0.0322	0.0322
	0.009	0.0279	0.0325	0.0322	0.0321	0.0321	0.0321	0.0320	0.0320	0.0320	0.0320
	0.013	0.0277	0.0323	0.0321	0.0320	0.0319	0.0319	0.0319	0.0319	0.0318	0.0318
	0.017	0.0276	0.0322	0.0319	0.0318	0.0318	0.0317	0.0317	0.0317	0.0317	0.0317
	0.021	0.0274	0.0320	0.0317	0.0316	0.0316	0.0316	0.0315	0.0315	0.0315	0.0315

Table 29. Skewed Generalized Student's T Distribution VaR/ES Surface Data

Panel E. VaR with respect to ν and k

		ν									
		2.34	22.33	42.32	62.31	82.30	102.29	122.28	142.27	162.26	182.25
k	1.037	0.0122	0.0239	0.0241	0.0242	0.0243	0.0243	0.0243	0.0243	0.0243	0.0243
	1.201	0.0131	0.0242	0.0244	0.0245	0.0245	0.0245	0.0245	0.0245	0.0245	0.0245
	1.364	0.0138	0.0244	0.0245	0.0246	0.0246	0.0246	0.0246	0.0246	0.0246	0.0246
	1.527	0.0143	0.0245	0.0246	0.0246	0.0246	0.0246	0.0246	0.0246	0.0246	0.0246
	1.690	0.0146	0.0245	0.0246	0.0246	0.0246	0.0246	0.0246	0.0246	0.0246	0.0246
	1.854	0.0149	0.0245	0.0245	0.0246	0.0246	0.0246	0.0246	0.0246	0.0246	0.0246
	2.017	0.0151	0.0244	0.0245	0.0245	0.0245	0.0245	0.0245	0.0245	0.0245	0.0245
	2.180	0.0153	0.0244	0.0245	0.0245	0.0245	0.0245	0.0245	0.0245	0.0245	0.0245
	2.344	0.0154	0.0244	0.0244	0.0244	0.0244	0.0244	0.0244	0.0244	0.0244	0.0244
	2.507	0.0155	0.0243	0.0244	0.0244	0.0244	0.0244	0.0244	0.0244	0.0244	0.0244

Panel F. ES with respect to ν and k

		ν									
		2.34	22.33	42.32	62.31	82.30	102.29	122.28	142.27	162.26	182.25
k	1.037	0.0262	0.0350	0.0348	0.0347	0.0346	0.0346	0.0346	0.0346	0.0346	0.0346
	1.201	0.0269	0.0342	0.0339	0.0339	0.0338	0.0338	0.0338	0.0338	0.0337	0.0337
	1.364	0.0274	0.0335	0.0332	0.0331	0.0331	0.0330	0.0330	0.0330	0.0330	0.0330
	1.527	0.0277	0.0328	0.0326	0.0325	0.0324	0.0324	0.0324	0.0324	0.0323	0.0323
	1.690	0.0278	0.0323	0.0320	0.0319	0.0318	0.0318	0.0318	0.0318	0.0318	0.0318
	1.854	0.0279	0.0318	0.0315	0.0314	0.0313	0.0313	0.0313	0.0313	0.0312	0.0312
	2.017	0.0280	0.0313	0.0310	0.0309	0.0309	0.0308	0.0308	0.0308	0.0308	0.0308
	2.180	0.0280	0.0309	0.0306	0.0305	0.0305	0.0304	0.0304	0.0304	0.0304	0.0304
	2.344	0.0280	0.0305	0.0302	0.0301	0.0301	0.0301	0.0300	0.0300	0.0300	0.0300
	2.507	0.0280	0.0302	0.0299	0.0298	0.0298	0.0297	0.0297	0.0297	0.0297	0.0297

Table 29. Skewed Generalized Student's T Distribution VaR/ES Surface Data

Panel G. VaR with respect to λ and σ

		σ									
		0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.04	0.04
λ	-0.02	0.011	0.017	0.023	0.030	0.036	0.042	0.049	0.055	0.061	0.068
	-0.01	0.011	0.017	0.023	0.029	0.036	0.042	0.048	0.055	0.061	0.067
	-0.01	0.010	0.017	0.023	0.029	0.035	0.042	0.048	0.054	0.061	0.067
	0.00	0.010	0.017	0.023	0.029	0.035	0.042	0.048	0.054	0.060	0.066
	0.00	0.010	0.017	0.023	0.029	0.035	0.041	0.047	0.054	0.060	0.066
	0.00	0.010	0.016	0.023	0.029	0.035	0.041	0.047	0.053	0.059	0.066
	0.01	0.010	0.016	0.022	0.029	0.035	0.041	0.047	0.053	0.059	0.065
	0.01	0.010	0.016	0.022	0.028	0.034	0.041	0.047	0.053	0.059	0.065
	0.02	0.010	0.016	0.022	0.028	0.034	0.040	0.046	0.052	0.058	0.064
	0.02	0.010	0.016	0.022	0.028	0.034	0.040	0.046	0.052	0.058	0.064

Panel H. ES with respect to λ and σ

		σ									
		0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.04	0.04
λ	-0.02	0.015	0.023	0.032	0.041	0.050	0.059	0.067	0.076	0.085	0.094
	-0.01	0.015	0.023	0.032	0.041	0.050	0.058	0.067	0.076	0.085	0.093
	-0.01	0.014	0.023	0.032	0.041	0.049	0.058	0.067	0.075	0.084	0.093
	0.00	0.014	0.023	0.032	0.040	0.049	0.058	0.066	0.075	0.084	0.092
	0.00	0.014	0.023	0.032	0.040	0.049	0.057	0.066	0.075	0.083	0.092
	0.00	0.014	0.023	0.031	0.040	0.049	0.057	0.066	0.074	0.083	0.091
	0.01	0.014	0.023	0.031	0.040	0.048	0.057	0.065	0.074	0.082	0.091
	0.01	0.014	0.023	0.031	0.040	0.048	0.057	0.065	0.073	0.082	0.090
	0.02	0.014	0.022	0.031	0.039	0.048	0.056	0.065	0.073	0.081	0.090
	0.02	0.014	0.022	0.031	0.039	0.047	0.056	0.064	0.073	0.081	0.089

Table 29. Skewed Generalized Student's T Distribution VaR/ES Surface Data

Panel H. VaR with respect to σ and k

		σ									
		0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.04	0.04
k	1.04	0.010	0.016	0.021	0.027	0.033	0.039	0.045	0.051	0.056	0.062
	1.20	0.010	0.016	0.022	0.028	0.034	0.040	0.046	0.052	0.058	0.064
	1.36	0.010	0.016	0.022	0.028	0.034	0.040	0.046	0.052	0.058	0.064
	1.53	0.010	0.016	0.022	0.028	0.034	0.040	0.047	0.053	0.059	0.065
	1.69	0.010	0.016	0.022	0.028	0.035	0.041	0.047	0.053	0.059	0.065
	1.85	0.010	0.016	0.022	0.029	0.035	0.041	0.047	0.053	0.059	0.065
	2.02	0.010	0.016	0.022	0.029	0.035	0.041	0.047	0.053	0.059	0.065
	2.18	0.010	0.016	0.022	0.029	0.035	0.041	0.047	0.053	0.059	0.065
	2.34	0.010	0.016	0.022	0.029	0.035	0.041	0.047	0.053	0.059	0.065
	2.51	0.010	0.016	0.022	0.029	0.035	0.041	0.047	0.053	0.059	0.065

Panel I. ES with respect to σ and k

		σ									
		0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.04	0.04
k	1.04	0.015	0.024	0.033	0.042	0.051	0.060	0.069	0.078	0.087	0.096
	1.20	0.015	0.024	0.033	0.041	0.050	0.059	0.068	0.077	0.086	0.095
	1.36	0.015	0.023	0.032	0.041	0.049	0.058	0.067	0.076	0.084	0.093
	1.53	0.014	0.023	0.031	0.040	0.049	0.057	0.066	0.074	0.083	0.092
	1.69	0.014	0.023	0.031	0.039	0.048	0.056	0.065	0.073	0.082	0.090
	1.85	0.014	0.022	0.031	0.039	0.047	0.056	0.064	0.072	0.081	0.089
	2.02	0.014	0.022	0.030	0.038	0.047	0.055	0.063	0.071	0.080	0.088
	2.18	0.014	0.022	0.030	0.038	0.046	0.054	0.062	0.070	0.079	0.087
	2.34	0.013	0.021	0.029	0.038	0.046	0.054	0.062	0.070	0.078	0.086
	2.51	0.013	0.021	0.029	0.037	0.045	0.053	0.061	0.069	0.077	0.085

Table 29. Skewed Generalized Student's T Distribution VaR/ES Surface Data

Panel J. VaR with respect to λ and k

		λ									
		-0.21	-0.14	-0.08	-0.01	0.06	0.13	0.19	0.26	0.33	0.40
k	1.04	0.024	0.024	0.024	0.024	0.023	0.023	0.023	0.023	0.023	0.023
	1.20	0.024	0.024	0.024	0.024	0.024	0.024	0.024	0.023	0.023	0.023
	1.36	0.025	0.025	0.024	0.024	0.024	0.024	0.024	0.024	0.024	0.023
	1.53	0.025	0.025	0.025	0.024	0.024	0.024	0.024	0.024	0.024	0.024
	1.69	0.025	0.025	0.025	0.025	0.024	0.024	0.024	0.024	0.024	0.024
	1.85	0.025	0.025	0.025	0.025	0.024	0.024	0.024	0.024	0.024	0.024
	2.02	0.025	0.025	0.025	0.025	0.024	0.024	0.024	0.024	0.024	0.024
	2.18	0.025	0.025	0.025	0.025	0.024	0.024	0.024	0.024	0.024	0.024
	2.34	0.025	0.025	0.025	0.025	0.024	0.024	0.024	0.024	0.024	0.024
	2.51	0.025	0.025	0.025	0.025	0.024	0.024	0.024	0.024	0.024	0.024

Panel K. ES with respect to to λ and k

		λ									
		-0.21	-0.14	-0.08	-0.01	0.06	0.13	0.19	0.26	0.33	0.40
k	1.04	0.037	0.037	0.036	0.036	0.036	0.036	0.036	0.035	0.035	0.035
	1.20	0.036	0.036	0.036	0.036	0.035	0.035	0.035	0.035	0.035	0.034
	1.36	0.036	0.035	0.035	0.035	0.035	0.035	0.034	0.034	0.034	0.034
	1.53	0.035	0.035	0.035	0.034	0.034	0.034	0.034	0.034	0.033	0.033
	1.69	0.034	0.034	0.034	0.034	0.034	0.034	0.033	0.033	0.033	0.033
	1.85	0.034	0.034	0.034	0.033	0.033	0.033	0.033	0.033	0.033	0.032
	2.02	0.033	0.033	0.033	0.033	0.033	0.033	0.032	0.032	0.032	0.032
	2.18	0.033	0.033	0.033	0.033	0.032	0.032	0.032	0.032	0.032	0.032
	2.34	0.033	0.033	0.032	0.032	0.032	0.032	0.032	0.032	0.031	0.031
	2.51	0.032	0.032	0.032	0.032	0.032	0.032	0.031	0.031	0.031	0.031

8.4 Robustness Discussion Results

Table 32. Normality Test Results of the Developed Stock Exchanges

Panel A. High Quarterly Volatily Regime											
		Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
Jaque Bera Test	Test Statistic	4187.88	3345.66	1367.32	1860.96	2369.49	2642.54	3568.44	470.89	1878.76	1586.79
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4793	0.4764	0.4831	0.4780	0.4807	0.4870	0.4746	0.4843	0.4681	0.4754
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		Germany	Greece	Italy	Ireland	NL	Portugal	Switzerland	Sweden	UK	
Jaque Bera Test	Test Statistic	963.63	1821.21	857.47	2935.30	2069.88	3302.44	2155.51	943.80	1972.99	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Kolmogorov–Smirnov Normality test	Test Statistic	0.4721	0.4735	0.4752	0.4754	0.4734	0.4836	0.4747	0.4799	0.4785	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Panel B. Low Quarterly Volatily Regime											
		Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
Jaque Bera Test	Test Statistic	234.79	248.32	3206.33	643.01	347.81	1912.93	1958.84	2189.90	11669.28	440.94
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4886	0.4894	0.4742	0.4891	0.4895	0.4905	0.4843	0.4784	0.4820	0.4841
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK	
Jaque Bera Test	Test Statistic	174.85	5763.10	8325.62	11640.48	462.13	4533.84	379.15	1322.03	166.44	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Kolmogorov–Smirnov Normality test	Test Statistic	0.4854	0.4697	0.4802	0.4864	0.4855	0.4810	0.4875	0.4750	0.4897	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	

Note: Tables 32 demonstrates the normality of the distributions of daily returns of the bull and bear subsamples (Panel A for bull market and Panel B for bear market). The test statistics values and the associated p values are presented of Jaque Bera Test and Kolmogorov–Smirnov Normality Test are presented. The results of Table 13 indicate that the normality of the distributions of daily returns is rejected for every DSE for both high quarterly volatility regime and low quarterly volatility regime. The data source is DataStream.

Table 33. Normality Test Results of the Emerging Stock Exchanges

Panel A. High Quarterly Volatily Regime

		South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
Jaque Bera Test	Test Statistic	801.77	8268.17	1589.65	4825.19	2289.00	9290.34	30882.24	12999.04	558.61	2738.15
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4784	0.4877	0.4739	0.4749	0.4766	0.4844	0.4786	0.4756	0.4762	0.4769
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
Jaque Bera Test	Test Statistic	3903.76	27228.19	5875.07	5212.68	1373.37	9334.35	3807.12	2224.83	10977.50
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4738	0.4667	0.4718	0.4652	0.4663	0.4848	0.4822	0.4751	0.4747
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Panel B. Low Quarterly Volatily Regime

		South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
Jaque Bera Test	Test Statistic	795.12	1579.86	2124.44	5650.88	579.64	1762.50	1639.92	12162.40	1221.76	24551.22
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4852	0.4843	0.4777	0.4810	0.4812	0.4890	0.4827	0.4753	0.4840	0.4805
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
Jaque Bera Test	Test Statistic	94.91	2379.28	9747.40	737.28	974.65	580.94	9896.28	726.60	10412.22
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4827	0.4756	0.4770	0.4762	0.4737	0.4899	0.4763	0.4845	0.4792
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: Tables 33 demonstrates the normality of the distributions of daily returns of the bull and bear subsamples (Panel A for bull market and Panel B for bear market). The test statistics values and the associated p values are presented of Jaque Bera Test and Kolmogorov–Smirnov Normality Test are presented. The results of Table 13 indicate that the normality of the distributions of daily returns is rejected for every ESE for both high quarterly volatility regime and low quarterly volatility regime. The data source is DataStream.

Table 34. Probability Density Models and Parameters of the Developed Stock Exchanges

Panel A. High Quarterly Volatily Regime

		Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
N	σ	0.0140	0.0151	0.0128	0.0135	0.0116	0.0075	0.0166	0.0097	0.0215	0.0165
ST	ν	3.0392	3.0634	6.9681	3.3466	3.7989	4.0688	2.9660	4.4705	3.6843	3.9880
	σ	0.0151	0.0165	0.0127	0.0143	0.0119	0.0076	0.0182	0.0099	0.0224	0.0169
HST	ν	3.0363	3.0636	6.9756	3.3491	3.7964	4.0645	2.9567	4.4692	3.6848	3.9940
	λ	0.0044	-0.0026	-0.0016	0.0009	0.0018	0.0010	0.0071	-0.0002	-0.0056	-0.0037
	σ	0.0151	0.0165	0.0127	0.0143	0.0119	0.0076	0.0183	0.0099	0.0224	0.0168
SGT	ν	3.9595	7.1219	9.9284	6.9022	4.3838	3.7595	4.1040	7.1733	8.3808	4.4019
	λ	0.0048	0.0005	-0.0024	0.0011	0.0016	0.0015	0.0055	-0.0010	-0.0022	-0.0038
	k	1.6061	1.2385	1.7247	1.3354	1.7924	2.1351	1.5509	1.5978	1.3493	1.8642
	σ	0.0143	0.0151	0.0127	0.0135	0.0117	0.0077	0.0169	0.0097	0.0215	0.0167

		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK
N	σ	0.0182	0.0191	0.0182	0.0169	0.0164	0.0115	0.0148	0.0130	0.0137
ST	ν	3.9704	3.5101	4.7363	3.4123	3.0567	4.2355	3.5092	4.1184	3.7758
	σ	0.0188	0.0202	0.0183	0.0177	0.0180	0.0117	0.0153	0.0134	0.0141
HST	ν	3.9789	3.5077	4.7465	3.4108	3.0585	4.2408	3.5137	4.1238	3.7757
	λ	-0.0050	0.0033	-0.0029	0.0003	0.0015	-0.0011	-0.0013	-0.0020	-0.0004
	σ	0.0188	0.0202	0.0183	0.0177	0.0179	0.0117	0.0153	0.0134	0.0141
SGT	ν	6.1475	9.0479	5.6437	3.9485	4.5739	7.2844	3.7166	6.0805	4.9525
	λ	-0.0042	0.0013	-0.0032	0.0003	0.0013	-0.0022	-0.0015	-0.0013	-0.0005
	k	1.5639	1.2823	1.8054	1.7896	1.4946	1.5184	1.9047	1.6111	1.6723
	σ	0.0183	0.0191	0.0182	0.0173	0.0167	0.0115	0.0152	0.0131	0.0138

Note: Tables 34 demonstrates the estimated values of the parameters for different probability density models for each DSE. The estimated values of parameters of the same probability density models are heterogenous for different stock exchanges and for different market regimes. The data source is DataStream.

Table 34 (Cont.). Probability Density Models and Parameters of the Developed Stock Exchanges

Panel B. Low Volatily Periods

		Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
N	σ	0.0075	0.0076	0.0176	0.0078	0.0074	0.0063	0.0111	0.0136	0.0118	0.0107
ST	ν	6.3052	5.4780	3.4306	5.3105	4.9497	5.8829	4.8108	3.3186	3.9096	4.0078
	σ	0.0076	0.0077	0.0183	0.0078	0.0075	0.0062	0.0110	0.0144	0.0117	0.0111
HST	ν	6.4122	5.5044	3.4285	5.3278	4.9599	5.9130	4.8060	3.3202	3.9116	4.0127
	λ	-0.0098	-0.0057	0.0025	-0.0026	-0.0007	-0.0079	0.0003	0.0002	0.0066	-0.0013
	σ	0.0075	0.0077	0.0183	0.0078	0.0075	0.0062	0.0110	0.0144	0.0117	0.0111
SGT	ν	11.7855	319.7582	5.3031	5.4828	14.5418	6.4380	3.9642	4.3485	3.4817	11.4659
	λ	-0.0112	-0.0066	0.0024	-0.0032	-0.0051	-0.0080	0.0021	0.0005	0.0073	-0.0022
	k	1.6410	1.2554	1.4720	1.9672	1.4270	1.9116	2.3376	1.6368	2.2280	1.3440
	σ	0.0075	0.0076	0.0176	0.0078	0.0074	0.0062	0.0112	0.0138	0.0119	0.0107

		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK
N	σ	0.0108	0.0193	0.0121	0.0097	0.0092	0.0127	0.0082	0.0162	0.0071
ST	ν	4.7112	2.9029	3.1667	4.8086	4.0158	2.9686	4.9304	2.9604	5.6948
	σ	0.0111	0.0211	0.0129	0.0094	0.0096	0.0139	0.0083	0.0181	0.0071
HST	ν	4.7199	2.9043	3.1624	4.7862	4.0205	2.9548	4.9221	2.9650	5.7083
	λ	-0.0024	-0.0030	0.0027	0.0115	-0.0020	0.0070	0.0004	-0.0044	-0.0027
	σ	0.0111	0.0211	0.0130	0.0095	0.0096	0.0140	0.0083	0.0181	0.0071
SGT	ν	4869.9669	3.7503	4.9452	4.1187	6.1763	6.6642	7.9490	4.8137	7.1958
	λ	-0.0051	-0.0006	0.0025	0.0134	-0.0027	0.0056	-0.0017	-0.0029	-0.0036
	k	1.1930	1.6097	1.4829	2.2599	1.5993	1.2438	1.6165	1.4465	1.8098
	σ	0.0108	0.0197	0.0121	0.0095	0.0093	0.0126	0.0082	0.0165	0.0071

Note: Tables 34 demonstrates the estimated values of the parameters for different probability density models for each DSE. The estimated values of parameters of the same probability density models are heterogenous for different stock exchanges and for different market regimes. The data source is DataStream.

Table 35. Emerging Stock Exchanges Probability Density Models and Parameters

		Panel A. High Quarterly Volatily Regime									
		South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
N	σ	0.0138	0.0063	0.0170	0.0162	0.0145	0.0095	0.0143	0.0137	0.0160	0.0146
ST	ν	4.6827	3.1344	2.7717	3.0402	2.4106	3.1922	3.7767	2.0121	3.4308	3.7476
	σ	0.0140	0.0067	0.0199	0.0178	0.0199	0.0100	0.0140	0.0760	0.0173	0.0149
HST	ν	4.6850	3.1313	2.7645	3.0319	2.4007	3.1923	3.7738	2.0162	3.4319	3.7427
	λ	-0.0020	-0.0005	0.0048	0.0040	0.0155	0.0047	0.0005	0.0305	-0.0016	0.0045
	σ	0.0140	0.0067	0.0200	0.0178	0.0201	0.0100	0.0140	0.0656	0.0173	0.0149
SGT	ν	5.5730	3.9700	7.9286	5.3528	7.5871	4.3434	3.3262	2.8830	1377.9630	5.0588
	λ	-0.0012	0.0001	0.0014	0.0035	0.0068	0.0047	0.0012	0.0242	-0.0006	0.0037
	k	1.8074	1.6510	1.1541	1.3878	1.0618	1.5811	2.2651	1.2099	1.0411	1.6250
	σ	0.0139	0.0064	0.0171	0.0163	0.0147	0.0095	0.0143	0.0155	0.0160	0.0146
		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru	
N	σ	0.0172	0.0230	0.0174	0.0244	0.0239	0.0088	0.0108	0.0149	0.0152	
ST	ν	3.6474	2.8918	2.4186	3.1449	3.1151	2.9054	3.2908	3.0107	2.3983	
	σ	0.0176	0.0243	0.0232	0.0260	0.0263	0.0095	0.0114	0.0164	0.0196	
HST	ν	3.6500	2.8884	2.4202	3.1419	3.1143	2.8999	3.2876	3.0150	2.3969	
	λ	0.0003	0.0037	0.0047	-0.0017	0.0019	0.0071	0.0030	-0.0036	0.0100	
	σ	0.0176	0.0243	0.0232	0.0260	0.0263	0.0096	0.0114	0.0164	0.0196	
SGT	ν	4.3258	3.4434	4.8205	4.2101	10.2988	3.1828	5.6680	5.0257	2.5625	
	λ	0.0004	0.0037	0.0028	-0.0009	0.0006	0.0066	0.0008	-0.0019	0.0095	
	k	1.7543	1.6778	1.2176	1.6003	1.1767	1.8223	1.4275	1.4221	1.8435	
	σ	0.0173	0.0230	0.0177	0.0247	0.0240	0.0092	0.0108	0.0151	0.0180	

Note: Tables 35 demonstrates the estimated values of the parameters for different probability density models for each ESE. The estimated values of parameters of the same probability density models are heterogenous for different stock exchanges and for different market regimes. The data source is DataStream.

Table 35.(Cont.). Emerging Stock Exchanges Probability Density Models and Parameters .

Panel B. Low Quarterly Volatily Regime

		South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
N	σ	0.0095	0.0090	0.0156	0.0136	0.0126	0.0065	0.0118	0.0165	0.0110	0.0126
ST	ν	6.2754	2.6915	3.1298	3.8678	2.7386	3.6014	4.3218	2.0041	3.4128	4.0904
	σ	0.0095	0.0107	0.0168	0.0136	0.0152	0.0067	0.0118	0.1660	0.0117	0.0124
HST	ν	6.3182	2.6933	3.1252	3.8491	2.7098	3.5977	4.3075	2.0045	3.3964	4.0870
	λ	-0.0063	0.0072	0.0115	0.0051	0.0168	0.0028	0.0067	0.0370	0.0074	0.0018
	σ	0.0095	0.0107	0.0168	0.0136	0.0153	0.0067	0.0118	0.1578	0.0117	0.0124
SGT	ν	4.2747	5.7749	7.4785	3.4987	47.6139	4.4274	3.9270	3.4032	6.5824	4.7782
	λ	-0.0053	0.0049	0.0074	0.0055	0.0028	0.0028	0.0076	0.0365	-0.0028	0.0016
	k	2.6897	1.2341	1.2250	2.1851	0.9732	1.7187	2.1561	1.1188	1.3809	1.7878
	σ	0.0096	0.0091	0.0156	0.0138	0.0126	0.0066	0.0119	0.0181	0.0111	0.0123

		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
N	σ	0.0124	0.0179	0.0134	0.0173	0.0179	0.0063	0.0153	0.0104	0.0126
ST	ν	7.9463	3.0142	2.8507	5.3906	4.3861	5.7874	3.0736	5.0238	2.8074
	σ	0.0125	0.0195	0.0144	0.0173	0.0182	0.0063	0.0158	0.0104	0.0140
HST	ν	7.9484	2.9824	2.8503	5.4084	4.3839	5.7963	3.0684	5.0399	2.8051
	λ	-0.0010	0.0247	0.0120	-0.0055	-0.0003	-0.0009	0.0082	-0.0052	0.0069
	σ	0.0125	0.0196	0.0144	0.0173	0.0182	0.0063	0.0158	0.0104	0.0141
SGT	ν	10.9618	6.1094	2.9781	6.0413	5.8846	6.0927	2.7815	5.4738	4.0784
	λ	-0.0016	0.0130	0.0117	-0.0056	-0.0003	-0.0011	0.0088	-0.0050	0.0053
	k	1.8119	1.2688	1.9059	1.8790	1.6856	1.9483	2.2606	1.9038	1.4794
	σ	0.0124	0.0179	0.0141	0.0172	0.0180	0.0063	0.0165	0.0104	0.0127

Note: Tables 35 demonstrates the estimated values of the parameters for different probability density models for each ESE. The estimated values of parameters of the same probability density models are heterogenous for different stock exchanges and for different market regimes. The data source is DataStream.

Table 36. Goodness of Fit of Probability Density Models of the Developed Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel A. High Quarterly Volatily Regime											
-	-	Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
-Log Likelihood	N	-6234.03	-6715.02	-5407.07	-6749.54	-7455.35	-8171.96	-6628.63	-6498.06	-6111.48	-6550.01
	ST	-6480.55	-6949.59	-5459.89	-6933.21	-7637.39	-8339.45	-6892.32	-6580.25	-6271.64	-6706.78
	HST	-6480.59	-6949.60	-5459.89	-6933.22	-7637.40	-8339.45	-6892.44	-6580.25	-6271.72	-6706.82
	SGT	**-6482.54**	**-6960.97**	**-5460.86**	**-6941.26**	**-7637.91**	**-8339.65**	**-6895.42**	**-6582.18**	**-6279.60**	**-6707.05**
Akaike Information Criterion	N	-12464.05	-13426.04	-10810.14	-13495.09	-14906.70	-16339.92	-13253.25	-12992.12	-12218.96	-13096.02
	ST	-12955.09	-13893.17	-10913.78	-13860.43	-15268.78	-16672.90	-13778.63	-13154.49	-12537.28	-13407.56
	HST	**-12955.18**	-13893.21	**-10913.79**	-13860.43	**-15268.80**	**-16672.91**	-13778.88	**-13154.49**	-12537.45	**-13407.63**
	SGT	-12955.08	**-13911.94**	-10911.71	**-13872.51**	-15265.83	-16669.29	**-13780.84**	-13154.36	**-12549.20**	-13404.11
Schwartz Bayesian Criterion	N	6226.33	6707.23	5399.55	6741.79	7447.55	8164.19	6620.81	6490.45	6103.65	6542.21
	ST	6469.01	6937.90	5448.62	6921.58	7625.68	8327.80	6880.60	6568.83	6259.89	6695.08
	HST	**6469.05**	6937.91	**5448.62**	6921.58	**7625.69**	**8327.81**	**6880.72**	**6568.83**	6259.97	**6695.12**
	SGT	6463.31	**6941.49**	5442.06	**6921.86**	7618.40	8320.23	6875.89	6563.15	**6260.02**	6687.55
Normal Distribution	LR Statistic	497.0	491.9	107.6	383.4	365.1	335.4	533.6	168.2	336.2	314.1
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	4.0	22.8	1.9	16.1	1.0	0.4	6.2	3.9	15.9	0.5
	P value	0.1360	0.0000	0.3803	0.0003	0.5921	0.8233	0.0449	0.1444	0.0003	0.7607
Skewed T Distribution	LR Statistic	3.9	22.7	1.9	16.1	1.0	0.4	6.0	3.9	15.8	0.5
	P value	0.0482	0.0000	0.1653	0.0001	0.3102	0.5360	0.0146	0.0492	0.0001	0.4912

Note: Table 36 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each DSE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 36 (Cont.). Goodness of Fit of Probability Density Models of the Developed Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK
Panel A. High Quarterly Volatily Regime										
-Log Likelihood	N	-6174.994	-5288.619	-5959.297	-6287.075	-6529.875	-5619.800	-6116.166	-5940.419	-7563.963
	ST	-6308.662	-5433.143	-6062.351	-6483.513	-6760.395	-5728.736	-6301.781	-6048.454	-7743.370
	HST	-6308.727	-5433.167	-6062.372	-6483.513	-6760.400	-5728.738	-6301.785	-6048.463	-7743.370
	SGT	**-6311.472**	**-5441.577**	**-6062.837**	**-6484.070**	**-6764.312**	**-5731.762**	**-6301.875**	**-6050.387**	**-7745.151**
Akaike Information Criterion	N	-12345.989	-10573.238	-11914.595	-12570.151	-13055.751	-11235.600	-12228.332	-11876.838	-15123.925
	ST	-12611.324	-10860.286	-12118.702	-12961.026	-13514.789	-11451.472	-12597.562	-12090.908	-15480.740
	HST	-12611.454	-10860.334	**-12118.743**	**-12961.026**	-13514.799	-11451.477	**-12597.571**	**-12090.926**	**-15480.741**
	SGT	**-12612.943**	**-10873.153**	-12115.674	-12958.139	**-13518.624**	**-11453.523**	-12593.749	-12090.775	-15480.302
Schwartz Bayesian Criterion	N	6167.216	5280.977	5951.556	6279.309	6522.080	5612.279	6108.476	5932.801	7556.087
	ST	6296.994	5421.679	6050.739	6471.862	6748.702	5717.454	6290.245	6037.027	7731.557
	HST	**6297.060**	5421.703	**6050.759**	**6471.863**	**6748.707**	**5717.456**	**6290.250**	**6037.037**	**7731.557**
	SGT	6292.026	**5422.470**	6043.483	6464.652	6744.825	5712.958	6282.649	6031.343	7725.462
Normal Distribution	LR Statistic	272.95	305.92	207.08	393.99	468.87	223.92	371.42	219.94	362.38
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	5.62	16.87	0.97	1.11	7.84	6.05	0.19	3.87	3.56
	P value	0.0602	0.0002	0.6153	0.5730	0.0199	0.0485	0.9106	0.1447	0.1685
Skewed T Distribution	LR Statistic	5.49	16.82	0.93	1.11	7.82	6.05	0.18	3.85	3.56
	P value	0.0191	0.0000	0.3348	0.2914	0.0052	0.0139	0.6727	0.0498	0.0591

Note: Table 36 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each DSE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 36 (Cont.). Goodness of Fit of Probability Density Models of the Developed Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel B. Low Quarterly Volatily Regime											
-	-	Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
-Log Likelihood	N	-7223.096	-6416.074	-4815.542	-6616.958	-6479.359	-6079.703	-5365.943	-4981.379	-5264.527	-5938.000
	ST	-7266.269	-6462.412	-4989.796	-6686.890	-6536.287	-6145.517	-5465.518	-5134.718	-5440.271	-6025.370
	HST	-7266.498	-6462.479	-4989.808	-6686.908	-6536.288	-6145.641	-5465.518	-5134.718	-5440.353	-6025.374
	SGT	**-7267.728**	**-6471.087**	**-4993.328**	**-6686.920**	**-6540.548**	**-6145.722**	**-5466.305**	**-5136.120**	**-5440.766**	**-6030.456**
Akaike Information Criterion	N	-14442.192	-12828.148	-9627.085	-13229.916	-12954.718	-12155.406	-10727.885	-9958.758	-10525.054	-11872.000
	ST	-14526.538	-12918.823	-9973.591	-13367.780	-13066.575	-12285.035	-10925.035	-10263.435	-10874.542	-12044.739
	HST	**-14526.995**	-12918.959	-9973.616	**-13367.817**	-13066.576	**-12285.281**	**-10925.036**	**-10263.435**	**-10874.707**	-12044.748
	SGT	-14525.455	**-12932.174**	**-9976.656**	-13363.840	**-13071.096**	-12281.444	-10922.610	-10262.240	-10871.533	**-12050.912**
Schwartz Bayesian Criterion	N	7215.456	6408.550	4808.025	6609.394	6471.833	6072.286	5358.481	4973.922	5257.064	5930.448
	ST	7254.809	6451.125	4978.520	6675.544	6524.999	6134.391	5454.325	5123.533	5429.076	6014.041
	HST	**7255.037**	6451.193	**4978.532**	**6675.563**	**6525.000**	**6134.514**	**5454.325**	**5123.533**	**5429.158**	**6014.045**
	SGT	7248.627	**6452.276**	4974.536	6668.011	6521.734	6127.178	5447.651	5117.479	5422.108	6011.575
Normal Distribution	LR Statistic	89.26	110.03	355.57	139.92	122.38	132.04	200.72	309.48	352.48	184.91
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	2.92	17.35	7.07	0.06	8.52	0.41	1.57	2.80	0.99	10.17
	P value	0.2326	0.0002	0.0292	0.9703	0.0141	0.8149	0.4551	0.2461	0.6095	0.0062
Skewed T Distribution	LR Statistic	2.46	17.22	7.04	0.02	8.52	0.16	1.57	2.80	0.83	10.16
	P value	0.1168	0.0000	0.0080	0.8784	0.0035	0.6866	0.2096	0.0940	0.3634	0.0014

Note: Table 36 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each DSE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 36 (Cont.). Goodness of fit of Probability Density Models of the Developed Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel B. Low Quarterly Volatily Regime										
		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK
-Log Likelihood	N	-6015.542	-4578.022	-6023.829	-6231.303	-6246.063	-6029.343	-7070.638	-4684.337	-5877.434
	ST	-6066.240	-4804.325	-6221.086	-6382.805	-6336.980	-6245.428	-7142.385	-4843.170	-5917.792
	HST	-6066.252	-4804.341	-6221.101	-6383.088	-6336.989	-6245.525	-7142.385	-4843.202	-5917.805
	SGT	**-6081.750**	**-4806.041**	**-6224.864**	**-6383.785**	**-6338.447**	**-6255.723**	**-7143.957**	**-4846.351**	**-5918.043**
Akaike Information Criterion	N	-12027.084	-9152.045	-12043.657	-12458.606	-12488.126	-12054.686	-14137.276	-9364.674	-11750.868
	ST	-12126.480	-9602.650	-12436.173	-12759.609	-12667.960	-12484.855	-14278.769	-9680.340	-11829.584
	HST	-12126.504	**-9602.682**	-12436.202	**-12760.176**	**-12667.977**	-12485.051	**-14278.770**	-9680.403	**-11829.611**
	SGT	**-12153.501**	-9602.082	**-12439.727**	-12757.571	-12666.894	**-12501.446**	-14277.914	**-9682.703**	-11826.085
Schwartz Bayesian Criterion	N	6007.975	4570.521	6016.222	6223.734	6238.507	6021.720	7062.993	4676.880	5870.018
	ST	6054.890	4793.073	6209.676	6371.451	6325.646	6233.994	7130.918	4831.985	5906.667
	HST	6054.902	**4793.089**	**6209.691**	**6371.735**	**6325.655**	6234.091	**7130.919**	**4832.016**	**5906.681**
	SGT	**6062.833**	4787.288	6205.846	6364.863	6319.557	**6236.666**	7124.846	4827.709	5899.502
Normal Distribution	LR Statistic	132.42	456.04	402.07	304.96	184.77	452.76	146.64	324.03	81.22
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	31.02	3.43	7.55	1.96	2.93	20.59	3.15	6.36	0.50
	P value	0.0000	0.1798	0.0229	0.3750	0.2306	0.0000	0.2075	0.0415	0.7781
Skewed T Distribution	LR Statistic	31.00	3.40	7.52	1.39	2.92	20.40	3.14	6.30	0.47
	P value	0.0000	0.0652	0.0061	0.2376	0.0876	0.0000	0.0762	0.0121	0.4908

Note: Table 36 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each DSE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 37. Goodness of Fit of Probability Density Models of the Emerging Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel A. High Quarterly Volatily Regime											
-	-	South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
-Log Likelihood	N	-7168.18	-7235.51	-5810.99	-6807.15	-6795.23	-7804.50	-6403.89	-5295.90	-6425.43	-6247.70
	ST	-7277.19	-7454.07	-6024.13	-7052.80	-7091.51	-8064.75	-6680.86	-5815.22	-6549.27	-6418.36
	HST	-7277.20	-7454.07	-6024.17	-7052.84	-7092.03	-8064.81	-6680.87	-5816.39	-6549.28	-6418.41
	SGT	**-7277.71**	**-7455.56**	**-6037.81**	**-7060.11**	**-7109.17**	**-8067.62**	**-6681.60**	**-5826.44**	**-6571.45**	**-6420.35**
Akaike Information Criterion	N	-14332.36	-14467.03	-11617.98	-13610.31	-13586.46	-15605.00	-12803.77	-10587.81	-12846.85	-12491.41
	ST	-14548.38	-14902.14	-12042.25	-14099.61	-14177.01	-16123.50	-13355.73	-11624.43	-13092.54	-12830.72
	HST	**-14548.40**	**-14902.14**	-12042.35	-14099.68	-14178.06	-16123.61	**-13355.73**	-11626.77	-13092.56	**-12830.82**
	SGT	-14545.42	-14901.12	**-12065.62**	**-14110.22**	**-14208.33**	**-16125.23**	-13353.20	**-11642.87**	**-13132.90**	-12830.69
Schwartz Bayesian Criterion	N	7160.36	7227.92	5803.30	6799.32	6787.44	7796.71	6396.16	5288.39	6417.66	6240.00
	ST	7265.45	7442.68	6012.59	7041.06	7079.82	8053.07	6669.28	5803.94	6537.62	6406.80
	HST	**7265.46**	**7442.68**	6012.64	**7041.09**	7080.35	**8053.13**	**6669.28**	5805.11	6537.62	**6406.85**
	SGT	7258.15	7436.57	**6018.58**	7040.53	**7089.69**	8048.15	6662.29	**5807.64**	**6552.02**	6401.08
Normal Distribution	LR Statistic	219.06	440.09	453.64	505.92	627.87	526.23	555.43	1061.06	292.04	345.29
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	1.04	2.98	27.37	14.62	35.32	5.73	1.47	22.44	44.35	3.97
	P value	0.5937	0.2255	0.0000	0.0007	0.0000	0.0570	0.4802	0.0000	0.0000	0.1375
Skewed T Distribution	LR Statistic	1.02	2.98	27.27	14.54	34.27	5.62	1.47	20.10	44.34	3.87
	P value	0.3125	0.0844	0.0000	0.0001	0.0000	0.0178	0.2260	0.0000	0.0000	0.0491

Note: Table 37 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each ESE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 37 (Cont.). Goodness of Fit of Probability Density Models of the Emerging Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel A. High Quarterly Volatily Regime										
		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
-Log Likelihood	N	-6619.69	-6137.58	-6603.87	-5779.08	-5683.89	-6388.01	-6397.03	-7087.46	-5825.17
	ST	-6833.50	-6573.55	-6971.36	-6042.37	-5871.76	-6654.84	-6581.40	-7323.07	-6240.77
	HST	-6833.50	-6573.59	-6971.41	-6042.37	-5871.77	-6654.93	-6581.42	-7323.11	-6240.97
	SGT	**-6834.40**	**-6574.96**	**-6984.10**	**-6044.87**	**-5885.37**	**-6655.22**	**-6586.66**	**-7328.47**	**-6241.20**
Akaike Information Criterion	N	-13235.38	-12271.16	-13203.74	-11554.15	-11363.79	-12772.03	-12790.06	-14170.92	-11646.33
	ST	-13661.00	-13141.11	-13936.72	-12078.73	-11737.51	-13303.67	-13156.80	-14640.14	-12475.54
	HST	**-13661.00**	**-13141.18**	-13936.83	-12078.75	-11737.53	**-13303.86**	-13156.84	-14640.21	**-12475.94**
	SGT	-13658.80	-13139.91	**-13958.19**	**-12079.74**	**-11760.73**	-13300.43	**-13163.33**	**-14646.94**	-12472.39
Schwartz Bayesian Criterion	N	6611.87	6129.71	6596.04	5771.24	5676.09	6380.45	6389.40	7079.62	5817.51
	ST	6821.76	6561.75	6959.62	6030.62	5860.05	6643.49	6569.96	7311.31	6229.29
	HST	**6821.76**	**6561.79**	6959.67	**6030.63**	5860.06	**6643.58**	**6569.98**	**7311.34**	**6229.49**
	SGT	6814.83	6555.29	**6964.52**	6025.29	**5865.85**	6636.31	6567.59	7308.87	6222.06
Normal Distribution	LR Statistic	429.4103	874.7548	760.4496	531.5850	402.9480	534.4069	379.2669	482.0243	832.0598
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	1.7924	2.8076	25.4701	5.0052	27.2194	0.7642	10.5312	10.7995	0.8493
	P value	0.4081	0.2457	0.0000	0.0819	0.0000	0.6824	0.0052	0.0045	0.6540
Skewed T Distribution	LR Statistic	1.7919	2.7369	25.3644	4.9920	27.2020	0.5710	10.4898	10.7330	0.4487
	P value	0.1807	0.0981	0.0000	0.0255	0.0000	0.4499	0.0012	0.0011	0.5030

Note: Table 37 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each ESE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 37 (Cont.) Goodness of Fit of Probability Density Models of the Emerging Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel B. Low Quarterly Volatily Regime											
-	-	South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
-Log Likelihood	N	-5629.479	-5749.175	-5274.696	-4875.830	-5260.467	-6439.219	-5761.929	-6309.626	-5658.255	-5723.802
	ST	-5689.334	-5941.772	-5452.862	-5030.007	-5404.821	-6575.713	-5878.113	-6864.622	-5794.798	-5905.182
	HST	-5689.417	-5941.858	-5453.121	-5030.048	-5405.288	-6575.728	-5878.203	-6867.496	-5794.899	-5905.189
	SGT	**-5692.288**	**-5949.235**	**-5462.962**	**-5030.300**	**-5419.769**	**-6576.477**	**-5878.370**	**-6883.680**	**-5799.193**	**-5905.704**
Akaike Information Criterion	N	-11254.957	-11494.351	-10545.392	-9747.660	-10516.934	-12874.438	-11519.857	-12615.251	-11312.510	-11443.604
	ST	-11372.668	-11877.544	-10899.725	-10054.014	-10803.642	-13145.427	-11750.225	-13723.244	-11583.597	-11804.364
	HST	-11372.833	-11877.715	-10900.242	**-10054.097**	-10804.576	**-13145.457**	**-11750.407**	-13728.991	-11583.798	**-11804.378**
	SGT	**-11374.576**	**-11888.470**	**-10915.925**	-10050.600	**-10829.539**	-13142.953	-11746.741	**-13757.359**	**-11588.387**	-11801.408
Schwartz Bayesian Criterion	N	5622.016	5741.710	5267.135	4868.395	5252.982	6431.736	5754.376	6301.863	5650.741	5716.233
	ST	5678.141	5930.574	5441.521	5018.855	5393.593	6564.488	5866.784	6852.977	5783.528	5893.829
	HST	**5678.223**	**5930.659**	5441.779	**5018.896**	5394.061	**6564.504**	**5866.875**	6855.851	**5783.629**	**5893.836**
	SGT	5673.63	5930.57	**5444.06**	5011.71	**5401.06**	6557.77	5859.49	**6864.27**	5780.41	5886.78
Normal Distribution	LR Statistic	125.6187	400.1192	376.5330	308.9396	318.6048	274.5157	232.8832	1148.1080	281.8769	363.8040
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	5.9082	14.9255	20.2001	0.5852	29.8974	1.5268	0.5152	38.1157	8.7901	1.0439
	P value	0.0521	0.0006	0.0000	0.7463	0.0000	0.4661	0.7729	0.0000	0.0123	0.5933
Skewed T Distribution	LR Statistic	5.7430	14.7547	19.6829	0.5032	28.9625	1.4965	0.3340	32.3682	8.5886	1.0297
	P value	0.0166	0.0001	0.0000	0.4781	0.0000	0.2212	0.5633	0.0000	0.0034	0.3102

Note: Table 37 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each ESE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 37 (Cont.). Goodness of fit of Probability Density Models of the Emerging Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel B. Low Quarterly Volatily Regime										
		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
-Log Likelihood	N	-5180.28	-4456.36	-5046.21	-4596.12	-4471.90	-8446.58	-4760.60	-5470.31	-6332.61
	ST	-5203.49	-4633.88	-5325.96	-4663.57	-4561.76	-8517.41	-5016.89	-5544.22	-6617.62
	HST	-5203.49	-4634.90	-5326.21	-4663.63	-4561.76	-8517.41	-5017.01	-5544.27	-6617.72
	SGT	**-5203.80**	**-4641.52**	**-5326.28**	**-4663.76**	**-4562.79**	**-8517.44**	**-5017.43**	**-5544.35**	**-6621.65**
Akaike Information Criterion	N	-10356.57	-8908.73	-10088.42	-9188.24	-8939.81	-16889.15	-9517.19	-10936.62	-12661.21
	ST	-10400.97	-9261.76	-10645.92	-9321.14	-9117.52	-17028.82	-10027.78	-11082.45	-13229.24
	HST	**-10400.98**	-9263.81	**-10646.41**	**-9321.26**	**-9117.52**	**-17028.82**	**-10028.02**	**-11082.55**	-13229.44
	SGT	-10397.59	**-9273.04**	-10642.57	-9317.52	-9115.58	-17024.88	-10024.86	-11078.71	**-13233.30**
Schwartz Bayesian Criterion	N	5172.82	4448.92	5038.75	4588.66	4464.45	8438.83	4753.14	5462.85	6324.94
	ST	5192.29	4622.71	5314.76	4652.37	4550.59	8505.79	5005.71	5533.03	6606.12
	HST	**5192.29**	**4623.74**	**5315.01**	**4652.43**	**4550.59**	**8505.79**	**5005.83**	**5533.08**	**6606.22**
	SGT	5185.14	4622.91	5307.62	4645.10	4544.17	8498.08	4998.80	5525.70	6602.48
Normal Distribution	LR Statistic	47.0242	370.3178	560.1484	135.2765	181.7756	141.7317	513.6673	148.0924	578.0884
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	0.6230	15.2850	0.6476	0.3806	2.0624	0.0641	1.0782	0.2586	8.0546
	P value	0.7324	0.0005	0.7234	0.8267	0.3566	0.9685	0.5833	0.8787	0.0178
Skewed T Distribution	LR Statistic	0.6192	13.2347	0.1526	0.2608	2.0619	0.0601	0.8411	0.1594	7.8597
	P value	0.4314	0.0003	0.6960	0.6096	0.1510	0.8063	0.3591	0.6897	0.0051

Note: Table 37 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each ESE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 40. Normality Test Results of the Developed Stock Exchanges

Panel A. High Quarterly Skewness Regime											
		Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
Jaque Bera Test	Test Statistic	8388.26	7313.30	6143.00	3495.24	1600.91	538.69	8031.88	482.66	5139.15	801.95
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4788	0.4763	0.4751	0.4802	0.4846	0.4896	0.4770	0.4837	0.4712	0.4775
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		Germany	Greece	Italy	Ireland	NL	Portugal	Switzerland	Sweden	UK	
Jaque Bera Test	Test Statistic	594.88	2455.00	692.22	3093.42	1588.31	5050.91	3638.02	1359.61	3281.05	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Kolmogorov–Smirnov Normality test	Test Statistic	0.4746	0.4749	0.4779	0.4774	0.4764	0.4842	0.4747	0.4817	0.4783	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Panel B. Low Quarterly Skewness Regime											
		Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
Jaque Bera Test	Test Statistic	1541.58	2179.43	1247.27	2447.25	3934.02	3179.85	1210.14	3251.23	2341.74	3842.71
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4841	0.4817	0.4785	0.4814	0.4821	0.4871	0.4780	0.4799	0.4732	0.4794
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK	
Jaque Bera Test	Test Statistic	3102.84	4145.11	4243.26	9304.75	6228.37	3777.71	1463.18	1315.48	1356.98	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Kolmogorov–Smirnov Normality test	Test Statistic	0.4782	0.4716	0.4766	0.4784	0.4783	0.4812	0.4838	0.4757	0.4847	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	

Note: Table 40 demonstrates the normality of the distributions of daily returns of the bull and bear subsamples (Panel A for bull market and Panel B for bear market). The test statistics values and the associated p values are presented of Jaque Bera Test and Kolmogorov–Smirnov Normality Test are presented. The results of Table 13 indicate that the normality of the distributions of daily returns is rejected for every DSE for both high quarterly skewness regime and low quarterly skewness regime. The data source is DataStream.

Table 41. Normality Test Results of the Emerging Stock Exchanges

Panel A. High Quarterly Skewness Regime											
		South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
Jaque Bera Test	Test Statistic	1345.76	6622.20	1645.49	8666.08	2035.27	2950.82	49227.19	7345.66	1938.35	24236.24
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4798	0.4861	0.4766	0.4776	0.4801	0.4873	0.4801	0.4729	0.4772	0.4817
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru	
Jaque Bera Test	Test Statistic	5423.66	47279.27	6885.78	8399.68	669.73	24921.46	19414.16	4181.72	15640.76	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Kolmogorov–Smirnov Normality test	Test Statistic	0.4742	0.4721	0.4771	0.4655	0.4709	0.4878	0.4771	0.4770	0.4750	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Panel B. Low Quarterly Skewness Regime											
		South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
Jaque Bera Test	Test Statistic	741.20	2525.62	1683.72	2936.14	1293.14	12324.88	1693.25	18680.30	340.72	3013.15
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4810	0.4860	0.4753	0.4754	0.4773	0.4847	0.4806	0.4770	0.4786	0.4774
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru	
Jaque Bera Test	Test Statistic	446.43	1254.24	6493.40	619.30	2528.14	3690.54	3571.16	1007.51	8046.90	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Kolmogorov–Smirnov Normality test	Test Statistic	0.4796	0.4682	0.4733	0.4706	0.4673	0.4869	0.4800	0.4786	0.4780	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	

Note: Table 41 demonstrates the normality of the distributions of daily returns of the bull and bear subsamples (Panel A for bull market and Panel B for bear market). The test statistics values and the associated p values are presented of Jaque Bera Test and Kolmogorov–Smirnov Normality Test are presented. The results of Table 13 indicate that the normality of the distributions of daily returns is rejected for every DSE for both high quarterly skewness regime and low quarterly skewness regime. The data source is DataStream.

Table 42. Probability Density Models and Parameters of the Developed Stock Exchanges

Panel A. High Quarterly Skewness Regime

		Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
N	σ	0.0130	0.0137	0.0162	0.0116	0.0094	0.0062	0.0148	0.0100	0.0186	0.0143
ST	ν	2.3010	2.1849	3.6172	2.8248	3.9565	5.5692	2.8169	4.6657	2.6897	3.6222
	σ	0.0185	0.0240	0.0161	0.0131	0.0096	0.0062	0.0162	0.0102	0.0220	0.0150
HST	ν	2.2894	2.1837	3.6101	2.8220	3.9607	5.6148	2.8069	4.6827	2.6942	3.6260
	λ	0.0135	0.0010	0.0037	0.0042	-0.0024	-0.0068	0.0112	-0.0057	-0.0029	-0.0044
	σ	0.0188	0.0240	0.0161	0.0131	0.0096	0.0062	0.0163	0.0102	0.0220	0.0150
SGT	ν	3.1270	5.0261	3.7152	4.1418	5.2238	6.0285	3.2107	6.1907	6.3873	7.7024
	λ	0.0141	0.0034	0.0035	0.0041	-0.0020	-0.0073	0.0097	-0.0053	0.0003	-0.0022
	k	1.4495	1.0864	1.9435	1.4890	1.6709	1.9209	1.7433	1.7232	1.1929	1.3887
	σ	0.0139	0.0138	0.0160	0.0119	0.0095	0.0062	0.0154	0.0101	0.0187	0.0143

		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK
N	σ	0.0162	0.0174	0.0157	0.0144	0.0140	0.0112	0.0139	0.0127	0.0128
ST	ν	3.1318	3.7076	3.8958	2.9253	2.7787	3.4749	2.5866	4.0262	2.6629
	σ	0.0178	0.0178	0.0164	0.0159	0.0163	0.0117	0.0167	0.0130	0.0153
HST	ν	3.1366	3.7143	3.9021	2.9184	2.7789	3.4711	2.5838	4.0307	2.6590
	λ	-0.0032	-0.0045	-0.0016	0.0076	0.0009	0.0035	0.0028	-0.0066	0.0039
	σ	0.0178	0.0178	0.0164	0.0159	0.0163	0.0117	0.0167	0.0130	0.0153
SGT	ν	11.5783	5.2604	9.5002	3.1481	4.6805	5.4392	3.1243	6.5249	4.3404
	λ	-0.0007	-0.0026	-0.0018	0.0073	0.0014	0.0013	0.0028	-0.0044	0.0036
	k	1.1610	1.5904	1.3718	1.8558	1.3991	1.5153	1.6567	1.5304	1.3877
	σ	0.0162	0.0173	0.0158	0.0154	0.0144	0.0112	0.0150	0.0127	0.0131

Note: Tables 42 demonstrates the estimated values of the parameters for different probability density models for each DSE. The estimated values of parameters of the same probability density models are heterogenous for different stock exchanges and for different market regimes. The data source is DataStream.

Table 42 (Cont.). Probability Density Models and Parameters of the Developed Stock Exchanges

		Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
Panel B. Low Quarterly Skewness Regime											
N	σ	0.0100	0.0113	0.0148	0.0110	0.0105	0.0077	0.0143	0.0127	0.0177	0.0143
ST	ν	4.3443	3.7300	4.6057	3.5598	3.4768	4.0759	3.6854	3.1575	3.0256	3.5094
	σ	0.0102	0.0117	0.0150	0.0114	0.0108	0.0078	0.0148	0.0137	0.0195	0.0146
HST	ν	4.3625	3.7299	4.6052	3.5576	3.4696	4.0786	3.6821	3.1467	3.0278	3.5045
	λ	-0.0037	-0.0014	0.0006	0.0003	0.0051	0.0006	0.0026	0.0057	-0.0002	0.0018
	σ	0.0101	0.0117	0.0150	0.0114	0.0108	0.0078	0.0148	0.0137	0.0195	0.0147
SGT	ν	4.7383	7.5291	10.2716	4.4131	4.7438	3.8660	3.7062	4.5463	4.2897	4.1121
	λ	-0.0039	-0.0008	-0.0017	0.0002	0.0041	0.0007	0.0033	0.0044	0.0011	0.0009
	k	1.8915	1.3905	1.4187	1.7058	1.5905	2.0878	1.9791	1.5390	1.5511	1.7562
	σ	0.0101	0.0112	0.0148	0.0111	0.0105	0.0078	0.0148	0.0129	0.0181	0.0144
		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK	
N	σ	0.0148	0.0202	0.0156	0.0139	0.0135	0.0127	0.0105	0.0158	0.0102	
ST	ν	3.8023	3.0178	3.2550	3.2405	2.9104	3.4937	4.3557	3.1739	4.4291	
	σ	0.0151	0.0221	0.0165	0.0144	0.0146	0.0132	0.0107	0.0172	0.0103	
HST	ν	3.8054	3.0181	3.2512	3.2501	2.9124	3.4937	4.3612	3.1760	4.4401	
	λ	-0.0030	0.0019	0.0015	0.0094	0.0062	0.0021	-0.0011	-0.0009	-0.0037	
	σ	0.0151	0.0221	0.0165	0.0144	0.0146	0.0132	0.0107	0.0172	0.0103	
SGT	ν	6.5740	5.5536	5.4742	3.4468	3.4818	7.3692	6.2833	4.6818	5.7257	
	λ	-0.0026	0.0023	0.0017	0.0086	0.0065	0.0015	-0.0017	-0.0011	-0.0041	
	k	1.4536	1.3597	1.4212	1.8828	1.6889	1.3249	1.6269	1.5442	1.7347	
	σ	0.0147	0.0203	0.0156	0.0142	0.0138	0.0126	0.0105	0.0161	0.0102	

Note: Tables 42 demonstrates the estimated values of the parameters for different probability density models for each DSE. The estimated values of parameters of the same probability density models are heterogenous for different stock exchanges and for different market regimes. The data source is DataStream.

Table 43. Emerging Stock Exchanges Probability Density Models and Parameters

Panel A. Bull Market Regime

		South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
N	σ	0.0126	0.0072	0.0149	0.0144	0.0123	0.0075	0.0137	0.0154	0.0137	0.0127
ST	ν	3.9321	2.6012	2.9116	3.3813	2.9459	3.7792	3.7423	2.0022	2.6699	4.4545
	σ	0.0129	0.0085	0.0168	0.0149	0.0137	0.0077	0.0130	0.1892	0.0165	0.0124
HST	ν	3.9350	2.6031	2.9084	3.3819	2.9397	3.7806	3.7390	2.0049	2.6676	4.4585
	λ	-0.0025	0.0022	0.0030	0.0001	0.0039	-0.0002	-0.0003	0.0365	0.0015	-0.0025
	σ	0.0129	0.0085	0.0168	0.0149	0.0138	0.0077	0.0130	0.1269	0.0165	0.0124
SGT	ν	4.4026	3.2184	8.1298	3.8333	6.9289	4.5661	3.2071	2.5113	5.5325	6.2249
	λ	-0.0024	0.0021	0.0007	0.0001	-0.0032	0.0002	0.0003	0.0391	0.0020	-0.0014
	k	1.8427	1.6158	1.1718	1.8049	1.2349	1.7545	2.3579	1.1987	1.2659	1.6288
	σ	0.0128	0.0076	0.0149	0.0146	0.0123	0.0075	0.0134	0.0204	0.0139	0.0123

		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
N	σ	0.0164	0.0218	0.0139	0.0234	0.0217	0.0075	0.0136	0.0132	0.0145
ST	ν	3.7125	2.7696	2.4218	2.8081	3.7859	3.3049	3.0404	2.7727	2.3507
	σ	0.0165	0.0226	0.0180	0.0257	0.0226	0.0073	0.0139	0.0150	0.0187
HST	ν	3.7168	2.7559	2.4242	2.8093	3.7843	3.3058	3.0292	2.7704	2.3494
	λ	0.0013	0.0163	0.0038	-0.0026	0.0016	0.0035	0.0092	-0.0013	-0.0001
	σ	0.0165	0.0227	0.0179	0.0257	0.0227	0.0073	0.0139	0.0150	0.0188
SGT	ν	3.6030	2.8956	2.9887	3.3423	12.0800	2.7048	3.0395	3.3389	2.3136
	λ	0.0014	0.0155	0.0028	-0.0019	0.0005	0.0038	0.0091	-0.0008	0.0001
	k	2.0566	1.8824	1.6163	1.6866	1.2779	2.6504	1.9930	1.6777	2.0462
	σ	0.0166	0.0221	0.0151	0.0241	0.0217	0.0079	0.0139	0.0140	0.0194

Note: Tables 43 demonstrates the estimated values of the parameters for different probability density models for each ESE. The estimated values of parameters of the same probability density models are heterogenous for different stock exchanges and for different market regimes. The data source is DataStream.

Table 43 (Cont.).. Emerging Stock Exchanges Probability Density Models and Parameters

Panel B. Bear Market Regime

		South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
N	σ	0.0119	0.0080	0.0175	0.0161	0.0148	0.0090	0.0128	0.0153	0.0145	0.0144
ST	ν	5.1766	2.8245	3.0035	3.1870	2.3407	2.7122	4.1207	2.0108	3.6830	3.5204
	σ	0.0120	0.0092	0.0194	0.0173	0.0221	0.0104	0.0130	0.0956	0.0154	0.0149
HST	ν	5.1948	2.8204	2.9906	3.1683	2.3077	2.7078	4.1140	2.0076	3.6892	3.5142
	λ	-0.0054	0.0032	0.0099	0.0099	0.0253	0.0077	0.0053	0.0370	-0.0017	0.0078
	σ	0.0120	0.0092	0.0195	0.0173	0.0229	0.0104	0.0130	0.1132	0.0154	0.0149
SGT	ν	4.3840	4.9748	7.8280	4.9129	20.4545	4.2626	3.8717	3.5307	627.0090	4.4301
	λ	-0.0054	0.0034	0.0055	0.0072	0.0092	0.0081	0.0058	0.0312	-0.0046	0.0064
	k	2.2469	1.3552	1.1949	1.4805	0.9236	1.4038	2.0982	1.1324	1.0689	1.6839
	σ	0.0121	0.0081	0.0176	0.0163	0.0149	0.0091	0.0131	0.0163	0.0145	0.0145

		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
N	σ	0.0142	0.0204	0.0173	0.0202	0.0216	0.0076	0.0124	0.0132	0.0136
ST	ν	5.1729	3.1195	2.6323	4.6249	2.9992	3.8806	3.1043	4.1091	2.7782
	σ	0.0144	0.0224	0.0204	0.0205	0.0237	0.0077	0.0134	0.0135	0.0154
HST	ν	5.1680	3.1116	2.6308	4.6226	2.9943	3.8754	3.1045	4.1172	2.7701
	λ	0.0002	0.0057	0.0093	-0.0022	0.0032	0.0036	0.0033	-0.0036	0.0101
	σ	0.0144	0.0224	0.0204	0.0205	0.0238	0.0077	0.0133	0.0135	0.0154
SGT	ν	8.4668	17.8536	3.9223	6.0668	4.4284	4.2105	5.0441	5.1787	3.9747
	λ	0.0002	0.0017	0.0070	-0.0022	0.0029	0.0033	0.0020	-0.0030	0.0080
	k	1.6191	1.0575	1.4267	1.7308	1.4950	1.8763	1.4281	1.7284	1.4871
	σ	0.0142	0.0204	0.0177	0.0203	0.0220	0.0076	0.0125	0.0133	0.0139

Note: Tables 43 demonstrates the estimated values of the parameters for different probability density models for each ESE. The estimated values of parameters of the same probability density models are heterogenous for different stock exchanges and for different market regimes. The data source is DataStream.

Table 44. Goodness of Fit of Probability Density Models of the Developed Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel A. High Quarterly Skewness Regime											
-	-	Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
-Log Likelihood	N	-5102.23	-5693.50	-4146.34	-5935.46	-6108.56	-6980.06	-6187.16	-4994.86	-5357.51	-6026.39
	ST	-5447.62	-6052.60	-4327.63	-6160.99	-6230.94	**-7043.81**	-6514.55	-5061.10	-5601.14	-6152.07
	HST	-5447.91	-6052.60	-4327.65	-6161.03	-6230.95	-7043.91	-6514.81	-5061.15	**-5601.16**	-6152.12
	SGT	**-5451.12**	**-6066.91**	**-4327.68**	**-6164.76**	**-6232.13**	-7043.97	**-6515.55**	**-5061.84**	-5612.10	**-6157.41**
Akaike Information Criterion	N	-10200.46	-11383.00	-8288.68	-11866.93	-12213.13	-13956.12	-12370.32	-9985.73	-10711.02	-12048.78
	ST	-10889.24	-12099.20	-8649.27	-12315.99	-12455.89	-14081.62	-13023.10	-10116.19	-11196.29	-12298.15
	HST	-10889.82	-12099.21	**-8649.31**	-12316.05	**-12455.91**	**-14081.82**	**-13023.63**	**-10116.30**	-11196.32	-12298.23
	SGT	**-10892.24**	**-12123.83**	-8645.36	**-12319.52**	-12454.26	-14077.95	-13021.10	-10113.68	**-11214.20**	**-12304.83**
Schwartz Bayesian Criterion	N	5094.77	5685.91	4139.01	5927.89	6101.02	6972.51	6179.46	4987.51	5349.86	6018.73
	ST	5436.42	6041.21	4316.63	6149.63	6219.63	7032.48	6502.99	5050.06	5589.68	6140.58
	HST	**5436.71**	6041.22	**4316.65**	**6149.66**	**6219.64**	**7032.58**	**6503.26**	**5050.11**	5589.69	**6140.62**
	SGT	5432.46	**6047.93**	4309.34	6145.82	6213.28	7025.09	6496.29	5043.44	**5592.99**	6138.25
Normal Distribution	LR Statistic	697.8	746.8	362.7	458.6	247.1	127.8	656.8	134.0	509.2	262.0
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	7.0	28.6	0.1	7.5	2.4	0.3	2.0	1.5	21.9	10.7
	P value	0.0302	0.0000	0.9549	0.0231	0.3047	0.8489	0.3670	0.4749	0.0000	0.0048
Skewed T Distribution	LR Statistic	6.4	28.6	0.1	7.5	2.4	0.1	1.5	1.4	21.9	10.6
	P value	0.0113	0.0000	0.8189	0.0063	0.1249	0.7182	0.2251	0.2397	0.0000	0.0011

Note: Table 44 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each DSE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 44 (Cont.). Goodness of Fit of Probability Density Models of the Developed Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel A. High Quarterly Skewness Regime										
		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK
-Log Likelihood	N	-4782.098	-3695.223	-4757.723	-5233.548	-6048.837	-4721.417	-4981.097	-4668.877	-6266.927
	ST	-4909.154	-3805.555	-4846.399	-5451.453	-6261.537	-4853.140	-5232.568	-4766.271	-6525.539
	HST	-4909.171	-3805.585	-4846.403	-5451.557	-6261.539	-4853.160	-5232.580	-4766.342	-6525.572
	SGT	**-4918.760**	**-3807.180**	**-4852.019**	**-5451.727**	**-6266.625**	**-4855.647**	**-5233.683**	**-4768.859**	**-6531.245**
Akaike Information Criterion	N	-9560.196	-7386.445	-9511.446	-10463.095	-12093.673	-9438.834	-9958.194	-9333.754	-12529.853
	ST	-9812.307	-7605.110	-9686.797	-10896.906	-12517.075	-9700.280	-10459.136	-9526.541	-13045.078
	HST	-9812.341	**-7605.170**	-9686.806	**-10897.114**	-12517.078	-9700.319	**-10459.161**	-9526.684	-13045.144
	SGT	**-9827.521**	-7604.359	**-9694.038**	-10893.454	**-12523.250**	**-9701.294**	-10457.366	**-9527.718**	**-13052.490**
Schwartz Bayesian Criterion	N	4774.621	3687.976	4750.261	5226.021	6041.176	4714.079	4973.633	4661.509	6259.261
	ST	4897.938	3794.685	4835.205	5440.163	6250.046	4842.133	5221.372	4755.218	6514.041
	HST	4897.955	**3794.715**	**4835.210**	**5440.267**	**6250.047**	**4842.152**	**5221.384**	**4755.290**	**6514.073**
	SGT	**4900.068**	3789.064	4833.363	5432.910	6247.473	4837.301	5215.023	4750.438	6512.081
Normal Distribution	LR Statistic	273.32	223.91	188.59	436.36	435.58	268.46	505.17	199.96	528.64
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	19.21	3.25	11.24	0.55	10.18	5.01	2.23	5.18	11.41
	P value	0.0001	0.1970	0.0036	0.7605	0.0062	0.0815	0.3280	0.0751	0.0033
Skewed T Distribution	LR Statistic	19.18	3.19	11.23	0.34	10.17	4.97	2.20	5.03	11.35
	P value	0.0000	0.0741	0.0008	0.5600	0.0014	0.0257	0.1376	0.0249	0.0008

Note: Table 44 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each DSE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 44 (Cont.). Goodness of Fit of Probability Density Models of the Developed Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel B. Low Quarterly Skewness Regime											
-	-	Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
-Log Likelihood	N	-8037.042	-7034.721	-5989.623	-7142.709	-7628.541	-7288.700	-5653.642	-6425.347	-5690.959	-6272.217
	ST	-8172.090	-7187.366	-6089.269	-7327.751	-7846.709	-7448.085	-5789.251	-6631.286	-5900.447	-6479.865
	HST	-8172.128	-7187.371	-6089.270	-7327.751	-7846.776	-7448.086	**-5789.263**	-6631.359	-5900.447	-6479.872
	SGT	**-8172.258**	**-7193.784**	**-6094.570**	**-7328.871**	**-7849.380**	**-7448.167**	-5789.262	**-6634.319**	**-5903.288**	**-6480.634**
Akaike Information Criterion	N	-16070.083	-14065.443	-11975.246	-14281.418	-15253.083	-14573.400	-11303.284	-12846.694	-11377.918	-12540.434
	ST	-16338.180	-14368.731	-12172.538	-14649.502	-15687.419	-14890.170	-11572.501	-13256.572	-11794.894	-12953.729
	HST	**-16338.257**	-14368.741	-12172.540	**-14649.502**	-15687.551	**-14890.172**	**-11572.527**	-13256.718	-11794.894	**-12953.744**
	SGT	-16334.517	**-14377.569**	**-12179.140**	-14647.742	**-15688.760**	-14886.335	-11568.524	**-13258.638**	**-11796.576**	-12951.269
Schwartz Bayesian Criterion	N	8029.208	7026.983	5981.952	7134.964	7620.746	7281.043	5646.042	6417.659	5683.273	6264.514
	ST	8160.339	7175.759	6077.763	7316.134	7835.016	7436.599	5777.851	6619.754	5888.918	6468.310
	HST	**8160.378**	**7175.764**	**6077.764**	**7316.134**	**7835.083**	**7436.600**	**5777.863**	**6619.828**	**5888.918**	**6468.317**
	SGT	8152.674	7174.439	6075.393	7309.508	7829.892	7429.024	5770.262	6615.100	5884.073	6461.377
Normal Distribution	LR Statistic	270.43	318.13	209.89	372.32	441.68	318.93	271.24	417.94	424.66	416.83
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	0.34	12.84	10.60	2.24	5.34	0.17	0.02	6.07	5.68	1.54
	P value	0.8448	0.0016	0.0050	0.3264	0.0692	0.9206	0.9887	0.0482	0.0584	0.4632
Skewed T Distribution	LR Statistic	0.26	12.83	10.60	2.24	5.21	0.16	0.00	5.92	5.68	1.52
	P value	0.6100	0.0003	0.0011	0.1345	0.0225	0.6864	1.0000	0.0150	0.0171	0.2169

Note: Table 44 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each DSE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 44 (Cont.). Goodness of fit of Probability Density Models of the Developed Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK
Panel B. Low Quarterly Skewness Regime										
-Log Likelihood	N	-7141.862	-6192.581	-7054.334	-6981.522	-6402.510	-6933.219	-7940.161	-5953.065	-6848.941
	ST	-7328.821	-6436.202	-7294.612	-7254.634	-6697.946	-7125.648	-8074.491	-6127.387	-6955.945
	HST	-7328.848	-6436.210	-7294.617	-7254.837	-6698.033	-7125.659	-8074.494	-6127.389	-6955.981
	SGT	**-7335.116**	**-6444.077**	**-7301.053**	**-7255.015**	**-6699.310**	**-7134.920**	**-8076.655**	**-6129.869**	**-6956.901**
Akaike Information Criterion	N	-14279.723	-12381.162	-14104.669	-13959.044	-12801.021	-13862.439	-15876.323	-11902.130	-13693.881
	ST	-14651.643	-12866.403	-14583.223	-14503.268	-13389.893	-14245.296	-16142.981	-12248.774	-13905.889
	HST	-14651.696	-12866.420	-14583.235	**-14503.673**	**-13390.066**	-14245.318	-16142.988	-12248.778	**-13905.963**
	SGT	**-14660.231**	**-12878.154**	**-14592.106**	-14500.029	-13388.619	**-14259.840**	**-16143.310**	**-12249.738**	-13903.801
Schwartz Bayesian Criterion	N	7134.016	6184.760	7046.482	6973.722	6394.807	6925.456	7932.324	5945.377	6841.262
	ST	7317.053	6424.470	7282.832	7242.934	6686.391	7114.003	8062.735	6115.856	6944.427
	HST	**7317.080**	6424.479	**7282.838**	**7243.136**	**6686.478**	7114.014	**8062.739**	**6115.857**	**6944.464**
	SGT	7315.502	**6424.525**	7281.421	7235.514	6680.051	**7115.512**	8057.063	6110.650	6937.705
Normal Distribution	LR Statistic	386.51	502.99	493.44	546.98	593.60	403.40	272.99	353.61	215.92
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	12.59	15.75	12.88	0.76	2.73	18.54	4.33	4.96	1.91
	P value	0.0018	0.0004	0.0016	0.6833	0.2558	0.0001	0.1148	0.0836	0.3844
Skewed T Distribution	LR Statistic	12.53	15.73	12.87	0.36	2.55	18.52	4.32	4.96	1.84
	P value	0.0004	0.0001	0.0003	0.5507	0.1101	0.0000	0.0376	0.0259	0.1751

Note: Table 44 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each DSE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 45. Goodness of Fit of Probability Density Models of the Emerging Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel A. High Quarterly Skewness Regime											
-	-	South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
-Log Likelihood	N	-6109.63	-5253.28	-5299.75	-6224.51	-5767.80	-7099.31	-5085.02	-4250.34	-6462.45	-5262.71
	ST	-6245.35	-5489.47	-5479.79	-6448.85	-5954.24	-7251.09	-5355.19	-4721.76	-6699.97	-5415.98
	HST	-6245.37	-5489.48	-5479.81	-6448.85	-5954.27	-7251.09	-5355.19	-4723.29	-6699.98	-5416.00
	SGT	**-6245.62**	**-5490.78**	**-5490.62**	**-6449.37**	**-5962.45**	**-7251.77**	**-5356.22**	**-4735.80**	**-6708.47**	**-5417.98**
Akaike Information Criterion	N	-12215.25	-10502.55	-10595.50	-12445.02	-11531.61	-14194.63	-10166.05	-8496.68	-12920.90	-10521.42
	ST	-12484.70	-10972.95	-10953.58	-12891.71	-11902.48	-14496.18	-10704.38	-9437.52	-13393.95	-10825.97
	HST	**-12484.73**	**-10972.96**	-10953.61	**-12891.71**	-11902.54	**-14496.18**	**-10704.38**	-9440.58	-13393.96	**-10825.99**
	SGT	-12481.23	-10971.57	**-10971.23**	-12888.74	**-11914.90**	-14493.54	-10702.44	**-9461.61**	**-13406.95**	-10825.96
Schwartz Bayesian Criterion	N	6101.99	5245.97	5292.20	6216.81	5760.24	7091.69	5077.54	4243.00	6454.73	5255.22
	ST	6233.90	5478.51	5468.47	6437.31	5942.88	7239.66	5343.97	4710.75	6688.40	5404.75
	HST	**6233.91**	**5478.52**	5468.48	**6437.31**	5942.92	**7239.66**	**5343.97**	4712.28	6688.40	**5404.76**
	SGT	6226.53	5472.51	**5471.74**	6430.12	**5943.53**	7232.71	5337.52	**4717.45**	**6689.18**	5399.26
Normal Distribution	LR Statistic	271.98	475.01	381.74	449.71	389.29	304.91	542.39	970.93	492.04	310.54
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	0.53	2.62	21.65	1.03	16.43	1.36	2.06	28.08	17.00	4.00
	P value	0.7683	0.2698	0.0000	0.5975	0.0003	0.5064	0.3569	0.0000	0.0002	0.1355
Skewed T Distribution	LR Statistic	0.50	2.61	21.62	1.03	16.37	1.36	2.06	25.03	16.99	3.97
	P value	0.4804	0.1064	0.0000	0.3102	0.0001	0.2435	0.1512	0.0000	0.0000	0.0462

Note: Table 45 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each ESE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 45 (Cont.). Goodness of Fit of Probability Density Models of the Emerging Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel A. High Quarterly Skewness Regime										
		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
-Log Likelihood	N	-6055.39	-5388.39	-5358.22	-4694.23	-4747.09	-4335.41	-5364.08	-6303.11	-4500.04
	ST	-6272.57	-5878.05	-5677.90	-4992.03	-4851.06	-4542.82	-5674.55	-6581.65	-4882.81
	HST	-6272.57	-5878.63	-5677.93	-4992.04	-4851.06	-4542.84	-5674.71	-6581.65	-4882.81
	SGT	**-6272.61**	**-5878.77**	**-5679.50**	**-4993.21**	**-4858.87**	**-4544.39**	**-5674.71**	**-6582.80**	**-4882.82**
Akaike Information Criterion	N	-12106.78	-10772.77	-10712.44	-9384.45	-9490.18	-8666.83	-10724.15	-12602.23	-8996.09
	ST	-12539.14	-11750.10	-11349.80	-9978.05	-9696.12	-9079.65	-11343.10	-13157.29	-9759.61
	HST	**-12539.14**	**-11751.25**	**-11349.85**	**-9978.08**	-9696.13	**-9079.68**	**-11343.42**	**-13157.30**	**-9759.61**
	SGT	-12535.21	-11747.54	-11348.99	-9976.41	**-9707.74**	-9078.78	-11339.42	-13155.59	-9755.65
Schwartz Bayesian Criterion	N	6047.67	5380.67	5350.69	4686.62	4739.51	4328.28	5356.54	6295.43	4492.67
	ST	6260.99	5866.48	5666.60	4980.62	4839.68	4532.13	5663.26	6570.12	4871.74
	HST	**6260.99**	**5867.06**	**5666.62**	**4980.63**	4839.69	**4532.15**	**5663.41**	**6570.13**	**4871.74**
	SGT	6253.31	5859.49	5660.66	4974.19	**4839.91**	4526.57	5655.88	6563.59	4864.38
Normal Distribution	LR Statistic	434.4363	980.7708	642.5461	597.9567	223.5564	417.9537	621.2669	559.3658	765.5582
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	0.0765	1.4452	3.1915	2.3602	15.6213	3.1287	0.3142	2.2996	0.0361
	P value	0.9625	0.4855	0.2028	0.3073	0.0004	0.2092	0.8546	0.3167	0.9821
Skewed T Distribution	LR Statistic	0.0687	0.2910	3.1402	2.3334	15.6099	3.0975	0.0008	2.2908	0.0360
	P value	0.7932	0.5896	0.0764	0.1266	0.0001	0.0784	0.9774	0.1301	0.8494

Note: Table 45 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each ESE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 45 (Cont.) Goodness of Fit of Probability Density Models of the Emerging Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel B. Low Quarterly Skewness Regime											
-	-	South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
-Log Likelihood	N	-6554.602	-7628.338	-5804.984	-5439.674	-6304.649	-7040.329	-7045.416	-7319.150	-5490.459	-6703.948
	ST	-6640.033	-7868.669	-6006.543	-5625.065	-6549.159	-7336.187	-7192.999	-7944.024	-5578.668	-6902.219
	HST	-6640.104	-7868.693	-6006.756	-5625.263	-6550.456	-7336.313	-7193.072	-7947.128	-5578.674	-6902.372
	SGT	**-6640.600**	**-7875.331**	**-6018.465**	**-5628.657**	**-6574.031**	**-7341.676**	**-7193.156**	**-7963.620**	**-5596.946**	**-6903.636**
Akaike Information Criterion	N	-13105.204	-15252.675	-11605.968	-10875.347	-12605.298	-14076.657	-14086.832	-14634.300	-10976.917	-13403.896
	ST	-13274.066	-15731.339	-12007.087	-11244.129	-13092.318	-14666.373	-14379.998	-15882.048	-11151.335	-13798.439
	HST	**-13274.208**	-15731.385	-12007.512	-11244.526	-13094.912	-14666.627	**-14380.145**	-15888.256	-11151.347	**-13798.744**
	SGT	-13271.201	**-15740.661**	**-12026.929**	**-11247.315**	**-13138.062**	**-14673.352**	-14376.312	**-15917.241**	**-11183.893**	-13797.272
Schwartz Bayesian Criterion	N	6546.916	7620.624	5797.282	5432.069	6296.926	7032.659	7037.634	7311.267	5482.883	6696.175
	ST	6628.504	7857.098	5994.991	5613.657	6537.575	7324.682	7181.325	7932.199	5567.304	6890.560
	HST	**6628.575**	**7857.121**	5995.203	**5613.856**	6538.872	**7324.809**	**7181.399**	7935.303	5567.310	**6890.713**
	SGT	6621.38	7856.05	**5999.21**	5609.65	**6554.72**	7322.50	7173.70	**7943.91**	**5578.01**	6884.20
Normal Distribution	LR Statistic	171.9964	493.9857	426.9611	377.9675	538.7638	602.6951	295.4795	1288.9401	212.9751	399.3759
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	1.1348	13.3227	23.8425	7.1851	49.7431	10.9791	0.3137	39.1924	36.5575	2.8332
	P value	0.5670	0.0013	0.0000	0.0275	0.0000	0.0041	0.8548	0.0000	0.0000	0.2425
Skewed T Distribution	LR Statistic	0.9929	13.2757	23.4175	6.7885	47.1491	10.7254	0.1667	32.9849	36.5452	2.5281
	P value	0.3190	0.0003	0.0000	0.0092	0.0000	0.0011	0.6831	0.0000	0.0000	0.1118

Note: Table 45 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each ESE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 45 (Cont.). Goodness of fit of Probability Density Models of the Emerging Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel B. Low Quarterly Skewness Regime										
		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
-Log Likelihood	N	-5663.87	-5145.71	-6273.05	-5586.68	-5329.37	-10377.45	-5688.21	-6127.30	-7626.62
	ST	-5730.29	-5315.27	-6616.45	-5680.12	-5554.13	-10603.42	-5885.93	-6246.95	-7969.72
	HST	-5730.29	-5315.33	-6616.64	-5680.13	-5554.15	-10603.47	-5885.95	-6246.98	-7969.99
	SGT	**-5732.09**	**-5329.41**	**-6621.65**	**-5680.97**	**-5557.67**	**-10603.69**	**-5890.25**	**-6247.83**	**-7974.07**
Akaike Information Criterion	N	-11323.74	-10287.41	-12542.10	-11169.36	-10654.75	-20750.91	-11372.42	-12250.61	-15249.23
	ST	-11454.59	-10624.54	-13226.90	-11354.24	-11102.26	-21200.85	-11765.86	-12487.90	-15933.44
	HST	**-11454.59**	-10624.67	-13227.29	**-11354.26**	-11102.31	**-21200.93**	-11765.90	**-12487.95**	-15933.97
	SGT	-11454.17	**-10648.83**	**-13233.30**	-11351.95	**-11105.34**	-21197.39	**-11770.50**	-12485.67	**-15938.13**
Schwartz Bayesian Criterion	N	5656.27	5138.07	6265.27	5578.96	5321.68	10369.45	5680.65	6119.65	7618.73
	ST	5718.89	5303.81	6604.79	5668.54	5542.58	10591.42	5874.59	6235.47	7957.90
	HST	**5718.89**	5303.87	**6604.98**	**5668.55**	**5542.61**	**10591.46**	**5874.61**	**6235.50**	**7958.16**
	SGT	5713.09	**5310.31**	6602.21	5661.68	5538.42	10583.68	5871.36	6228.70	7954.36
Normal Distribution	LR Statistic	136.4335	367.4107	697.1976	188.5881	456.5890	452.4792	404.0823	241.0632	694.9048
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	3.5867	28.2877	10.3960	1.7113	7.0736	0.5420	8.6468	1.7728	8.6914
	P value	0.1664	0.0000	0.0055	0.4250	0.0291	0.7626	0.0133	0.4121	0.0130
Skewed T Distribution	LR Statistic	3.5865	28.1569	10.0080	1.6864	7.0288	0.4580	8.6030	1.7136	8.1648
	P value	0.0583	0.0000	0.0016	0.1941	0.0080	0.4986	0.0034	0.1905	0.0043

Note: Table 45 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each ESE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 48. Probability Density Models and Parameters of the Developed Stock Exchanges (Weekly Data)

-	-	Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
N	σ	0.0113	0.0124	0.0154	0.0113	0.0100	0.0071	0.0145	0.0117	0.0182	0.0143
ST	ν	3.0928	2.7661	4.0824	3.1858	3.6436	4.4730	3.1655	3.4987	2.8587	3.5486
	σ	0.0119	0.0142	0.0154	0.0120	0.0103	0.0070	0.0154	0.0122	0.0206	0.0149
HST	ν	3.0639	2.7662	4.0373	3.1627	3.6177	4.4206	3.1335	3.4683	2.8370	3.5525
	λ	0.0152	0.0010	0.0150	0.0150	0.0152	0.0152	0.0149	0.0147	0.0134	-0.0016
	σ	0.0120	0.0142	0.0155	0.0121	0.0103	0.0071	0.0155	0.0122	0.0207	0.0149
SGT	ν	3.4319	5.1957	5.2731	4.2832	4.8042	4.2519	3.3263	4.4471	4.9633	5.0526
	λ	0.0150	0.0152	0.0170	0.0171	0.0141	0.0150	0.0129	0.0147	0.0008	0.0151
	k	1.7936	1.2840	1.6555	1.5893	1.6309	2.0626	1.8912	1.6724	1.3774	1.5767
	σ	0.0117	0.0125	0.0153	0.0115	0.0101	0.0071	0.0152	0.0118	0.0184	0.0144

		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK
N	σ	0.0153	0.0192	0.0156	0.0141	0.0137	0.0121	0.0120	0.0146	0.0116
ST	ν	3.4601	3.1867	3.4697	3.0921	2.8391	3.4430	3.2328	3.3560	3.2152
	σ	0.0162	0.0205	0.0164	0.0150	0.0154	0.0127	0.0126	0.0155	0.0123
HST	ν	3.4785	3.1626	3.4385	3.0678	2.8177	3.4378	3.2086	3.3304	3.1889
	λ	-0.0028	0.0130	0.0149	0.0153	0.0145	0.0026	0.0146	0.0148	0.0150
	σ	0.0161	0.0206	0.0165	0.0151	0.0156	0.0127	0.0127	0.0155	0.0124
SGT	ν	7.3091	5.2383	6.4159	3.2696	3.8386	6.3787	3.7648	4.7952	4.1988
	λ	-0.0015	0.0008	-0.0002	0.0140	0.0127	0.0162	0.0175	0.0116	0.0171
	k	1.3390	1.4439	1.4096	1.8838	1.5516	1.3844	1.7410	1.5676	1.6265
	σ	0.0154	0.0193	0.0157	0.0148	0.0142	0.0121	0.0123	0.0148	0.0118

Note: Tables 48 demonstrates the estimated values of the parameters for different probability density models for each DSE. The estimated values of parameters of the same probability density models are heterogenous for different stock exchanges and for different market regimes. The data source is DataStream.

Table 49. Probability Density Models and Parameters of the Emerging Stock Exchanges (Weekly Data)

-	-	South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
N	σ	0.0123	0.0077	0.0164	0.0152	0.0137	0.0083	0.0132	0.0154	0.0141	0.0137
ST	ν	4.4779	2.6903	2.9103	3.2509	2.5277	3.0873	3.9364	2.0178	2.9987	3.7954
	σ	0.0124	0.0090	0.0184	0.0161	0.0176	0.0089	0.0130	0.0719	0.0159	0.0138
HST	ν	4.4375	2.6804	2.8933	3.2260	2.5162	3.0804	3.9185	2.0763	2.9771	3.7697
	λ	0.0152	0.0146	0.0129	0.0054	0.0134	0.0150	0.0156	0.0005	0.0136	0.0149
	σ	0.0124	0.0090	0.0185	0.0161	0.0178	0.0089	0.0131	0.0356	0.0159	0.0139
SGT	ν	4.3114	4.0831	7.4056	4.1477	10.3225	4.1026	3.4671	3.3268	16.5682	4.7351
	λ	0.0149	0.0150	0.0146	0.0047	0.0152	0.0157	0.0147	0.0144	0.0010	0.0151
	k	2.0410	1.4288	1.1886	1.6507	1.0374	1.5954	2.2407	1.1105	1.0829	1.6954
	σ	0.0125	0.0079	0.0165	0.0154	0.0138	0.0084	0.0133	0.0166	0.0141	0.0136

		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
N	σ	0.0154	0.0212	0.0159	0.0218	0.0216	0.0075	0.0130	0.0132	0.0140
ST	ν	4.1776	2.8937	2.4700	3.4814	3.3019	3.6457	3.0714	3.2824	2.5596
	σ	0.0155	0.0226	0.0201	0.0224	0.0231	0.0076	0.0136	0.0140	0.0165
HST	ν	4.1640	2.8812	2.4618	3.4792	3.3001	3.6264	3.0565	3.2840	2.5556
	λ	0.0145	0.0124	0.0148	-0.0019	0.0017	0.0150	0.0135	-0.0026	0.0127
	σ	0.0155	0.0227	0.0203	0.0224	0.0231	0.0076	0.0137	0.0140	0.0166
SGT	ν	4.4395	4.1043	3.5889	4.0457	6.2329	3.5175	3.6180	4.1257	3.0313
	λ	0.0159	0.0085	0.0163	0.0162	0.0013	0.0150	0.0154	0.0139	0.0147
	k	1.9080	1.4734	1.4279	1.7664	1.3844	2.0572	1.7077	1.6652	1.6737
	σ	0.0154	0.0209	0.0165	0.0220	0.0218	0.0077	0.0131	0.0135	0.0149

Note: Tables 49 demonstrates the estimated values of the parameters for different probability density models for each ESE. The estimated values of parameters of the same probability density models are heterogenous for different stock exchanges and for different market regimes. The data source is DataStream.

Table 50. Goodness of Fit of Probability Density Models of the Developed Stock Exchanges (The optimal value for Loglikelihood, AIC and SBC are in bold)

		Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
-Log Likelihood	N	-2078.93	-2031.88	-1557.40	-1969.72	-2139.56	-2252.03	-1776.51	-1710.87	-1604.77	-1852.84
	ST	-2138.07	-2094.67	-1603.11	-2042.33	-2205.23	-2290.95	-1860.02	-1793.98	-1660.40	-1899.69
	HST	-2138.08	-2094.77	-1603.23	-2042.33	-2205.24	-2291.00	-1860.02	-1794.00	-1660.40	-1899.79
	SGT	**-2138.08**	**-2094.79**	**-1605.12**	**-2042.38**	**-2205.31**	**-2291.13**	**-1860.03**	**-1794.39**	**-1662.15**	**-1899.80**
Akaike Information Criterion	N	-4153.85	-4059.75	-3110.81	-3935.44	-4275.11	-4500.05	-3549.03	-3417.74	-3205.53	-3701.69
	ST	-4270.14	-4183.33	-3200.22	-4078.66	-4404.46	-4575.89	-3714.03	-3581.96	-3314.80	-3793.38
	HST	**-4270.15**	**-4183.53**	**-3200.46**	**-4078.67**	**-4404.49**	**-4576.01**	**-3714.05**	**-3582.00**	**-3314.80**	**-3793.59**
	SGT	-4266.16	-4179.58	-3200.24	-4074.77	-4400.62	-4572.26	-3710.06	-3578.78	-3314.30	-3789.59
Schwartz Bayesian Criterion	N	2072.14	2025.09	1550.74	1962.93	2132.77	2245.30	1769.73	1704.21	1597.98	1846.06
	ST	2127.89	2084.49	1593.12	2032.15	2195.05	2280.86	1849.84	1783.98	1650.22	1889.51
	HST	**2127.90**	**2084.59**	**1593.24**	**2032.15**	**2195.06**	**2280.92**	**1849.84**	**1784.00**	**1650.22**	**1889.61**
	SGT	2121.11	2077.83	1588.47	2025.42	2188.34	2274.32	1843.06	1777.73	1645.19	1882.83
N vs SGT	LR Statistic	118.31	125.83	95.43	145.33	131.51	78.21	167.03	167.03	114.77	93.91
	P value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST vs SGT	LR Statistic	0.02	0.25	4.02	0.11	0.17	0.37	0.03	0.82	3.51	0.21
	P value	0.99	0.88	0.13	0.95	0.92	0.83	0.99	0.67	0.17	0.90
HST vs SGT	LR Statistic	0.01	0.05	3.79	0.10	0.14	0.25	0.01	0.78	3.50	0.00
	P value	0.93	0.82	0.05	0.75	0.71	0.61	0.92	0.38	0.06	0.96

Note: Table 50 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each DSE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 50 (Cont.). Goodness of Fit of Probability Density Models of the Developed Stock Exchanges (The optimal value for Loglikelihood, AIC and SBC are in bold)

		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK
-Log Likelihood	N	-1762.83	-1426.47	-1745.92	-1814.62	-1858.90	-1683.13	-1974.85	-1629.07	-2043.67
	ST	-1806.15	-1465.12	-1802.15	-1892.83	-1933.81	-1737.57	-2060.10	-1678.68	-2107.79
	HST	-1806.21	-1465.24	-1802.21	-1892.88	-1933.81	-1737.57	-2060.12	-1678.73	-2107.79
	SGT	**-1806.29**	**-1465.39**	**-1803.20**	**-1892.88**	**-1934.35**	**-1738.14**	**-2060.69**	**-1680.14**	**-2109.00**
Akaike Information Criterion	N	-3521.67	-2848.93	-3487.85	-3625.23	-3713.79	-3362.26	-3945.70	-3254.15	-4083.35
	ST	-3606.29	-2924.24	-3598.29	-3779.65	-3861.61	-3469.14	-4114.20	-3351.36	-4209.59
	HST	**-3606.43**	**-2924.47**	**-3598.42**	**-3779.75**	**-3861.62**	**-3469.15**	**-4114.24**	**-3351.47**	**-4209.59**
	SGT	-3602.58	-2920.79	-3596.41	-3775.75	-3858.70	-3466.27	-4111.38	-3350.28	-4208.01
Schwartz Bayesian Criterion	N	1756.05	1419.75	1739.14	1807.83	1852.11	1676.45	1968.07	1622.41	2036.89
	ST	1795.97	1455.05	1791.97	1882.65	1923.63	1727.55	2049.92	1668.69	2097.61
	HST	**1796.03**	**1455.16**	**1792.03**	**1882.70**	**1923.63**	**1727.55**	**2049.94**	**1668.74**	**2097.61**
	SGT	1789.32	1448.60	1786.24	1875.91	1917.38	1721.44	2043.72	1663.49	2092.04
N vs SGT	LR Statistic	86.91	77.85	114.56	156.52	150.91	110.01	171.67	102.14	130.66
	P value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST vs SGT	LR Statistic	0.29	0.55	2.11	0.10	1.09	1.13	1.18	2.93	2.42
	P value	0.87	0.76	0.35	0.95	0.58	0.57	0.55	0.23	0.30
HST vs SGT	LR Statistic	0.15	0.32	1.99	0.00	1.08	1.13	1.14	2.81	2.42
	P value	0.70	0.57	0.16	0.98	0.30	0.29	0.29	0.09	0.12

Note: Table 50 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each DSE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 51. Goodness of Fit of Probability Density Models of the Emerging Stock Exchanges (The optimal value for Loglikelihood, AIC and SBC are in bold)

		South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
-Log Likelihood	N	-1950.04	-1884.22	-1676.16	-1643.18	-1771.17	-2163.71	-1807.27	-1682.44	-1809.37	-1797.40
	ST	-1980.58	-1995.70	-1713.68	-1713.01	-1848.73	-2254.37	-1872.24	-1807.57	-1846.37	-1850.32
	HST	-1980.63	-1995.77	-1713.68	-1713.07	-1848.89	-2254.48	-1872.24	-1808.12	-1846.38	-1850.32
	SGT	**-1980.65**	**-1997.84**	**-1714.14**	**-1713.11**	**-1848.90**	**-2255.13**	**-1872.78**	**-1812.19**	**-1851.33**	**-1850.46**
Akaike Information Criterion	N	-3896.08	-3764.43	-3348.33	-3282.35	-3538.34	-4323.43	-3610.54	-3360.88	-3614.74	-3590.79
	ST	-3955.15	-3985.40	-3421.36	-3420.03	-3691.46	-4502.75	-3738.48	-3609.15	-3686.74	-3694.63
	HST	**-3955.26**	-3985.54	**-3421.37**	**-3420.13**	**-3691.78**	**-4502.96**	**-3738.48**	-3610.23	-3686.76	**-3694.64**
	SGT	-3951.29	**-3985.67**	-3418.27	-3416.22	-3687.81	-4500.27	-3735.56	**-3614.38**	**-3692.67**	-3690.92
Schwartz Bayesian Criterion	N	1943.25	1877.56	1669.38	1636.39	1764.38	2156.93	1800.48	1675.66	1802.58	1790.61
	ST	1970.40	1985.71	1703.50	1702.83	1838.55	2244.19	1862.06	1797.39	1836.19	1840.14
	HST	**1970.45**	**1985.78**	**1703.50**	**1702.89**	**1838.71**	**2244.30**	**1862.06**	**1797.94**	**1836.20**	**1840.14**
	SGT	1963.68	1981.19	1697.17	1696.14	1831.94	2238.17	1855.81	1795.22	1834.37	1833.49
N vs SGT	LR Statistic	61.21	227.24	75.94	139.87	155.47	182.84	131.01	259.49	83.93	106.13
	P value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST vs SGT	LR Statistic	0.14	4.28	0.91	0.19	0.35	1.52	1.08	9.23	9.93	0.29
	P value	0.93	0.12	0.63	0.91	0.84	0.47	0.58	0.01	0.01	0.87
HST vs SGT	LR Statistic	0.03	4.13	0.91	0.09	0.03	1.30	1.08	8.14	9.90	0.28
	P value	0.86	0.04	0.34	0.77	0.86	0.25	0.30	0.00	0.00	0.60

Note: Table 51 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each ESE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 51 (Cont.). Goodness of Fit of Probability Density Models of the Emerging Stock Exchanges (The optimal value for Loglikelihood, AIC and SBC are in bold)

		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
-Log Likelihood	N	-1754.23	-1437.97	-1630.57	-1451.55	-1394.15	-2249.79	-1595.32	-1859.83	-1690.96
	ST	-1824.42	-1546.62	-1759.71	-1490.02	-1426.23	-2290.65	-1707.25	-1922.15	-1809.76
	HST	-1824.43	-1546.64	-1759.88	-1490.08	-1426.30	-2290.68	-1707.47	-1922.15	-1809.87
	SGT	**-1825.25**	**-1547.06**	**-1762.89**	**-1490.18**	**-1426.70**	**-2291.77**	**-1707.83**	**-1922.19**	**-1810.01**
Akaike Information Criterion	N	-3504.45	-2871.93	-3257.13	-2899.09	-2784.31	-4495.59	-3186.63	-3715.67	-3377.93
	ST	-3642.84	-3087.25	-3513.41	-2974.05	-2846.47	-4575.29	-3408.50	-3838.29	-3613.53
	HST	**-3642.85**	**-3087.27**	-3513.76	**-2974.16**	**-2846.59**	**-4575.35**	**-3408.94**	**-3838.30**	**-3613.75**
	SGT	-3640.50	-3084.12	**-3515.77**	-2970.37	-2843.40	-4573.55	-3405.66	-3834.39	-3610.01
Schwartz Bayesian Criterion	N	1747.44	1431.18	1623.78	1444.76	1387.37	2243.01	1588.62	1853.05	1684.18
	ST	1814.24	1536.44	1749.53	1479.84	1416.05	2280.47	1697.21	1911.97	1799.58
	HST	**1814.25**	**1536.46**	**1749.70**	**1479.90**	**1416.11**	**2280.50**	**1697.43**	**1911.97**	**1799.69**
	SGT	1808.28	1530.09	1745.92	1473.22	1409.73	2274.81	1691.09	1905.23	1793.04
N vs SGT	LR Statistic	142.05	218.19	264.64	77.27	65.09	83.96	225.02	124.72	238.09
	P value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST vs SGT	LR Statistic	1.66	0.87	6.36	0.32	0.93	2.25	1.15	0.09	0.49
	P value	0.44	0.65	0.04	0.85	0.63	0.32	0.56	0.95	0.78
HST vs SGT	LR Statistic	1.65	0.85	6.02	0.21	0.81	2.19	0.71	0.09	0.26
	P value	0.20	0.36	0.01	0.65	0.37	0.14	0.40	0.76	0.61

Note: Table 51 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each ESE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 54. Normality Test Results of the Developed Stock Exchanges

Panel A. Bull Markets											
		Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
Jaque Bera Test	Test Statistic	137.14	362.02	50.29	504.83	101.34	19.17	4323.07	4815.38	599.72	67.48
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4760	0.4742	0.4709	0.4749	0.4777	0.4845	0.4748	0.4767	0.4690	0.4697
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		Germany	Greece	Italy	Ireland	NL	Portugal	Switzerland	Sweden	UK	
Jaque Bera Test	Test Statistic	214.60	602.65	916.59	1773.85	1856.11	61.52	209.08	1968.85	52.45	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Kolmogorov–Smirnov Normality test	Test Statistic	0.4682	0.4676	0.4669	0.4743	0.4745	0.4748	0.4796	0.4735	0.4758	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Panel B. Bear Markets											
		Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
Jaque Bera Test	Test Statistic	180.93	89.42	254.67	264.05	169.07	47.45	107.72	138.22	24.09	87.63
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4678	0.4734	0.4645	0.4675	0.4685	0.4785	0.4694	0.4738	0.4527	0.4587
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK	
Jaque Bera Test	Test Statistic	72.75	57.73	65.95	74.51	56.38	179.14	262.83	2.98	152.70	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2256	0.0000	
Kolmogorov–Smirnov Normality test	Test Statistic	0.4637	0.4618	0.4676	0.4618	0.4623	0.4635	0.4684	0.4706	0.4651	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	

Note: Tables 54 demonstrates the normality of the distributions of daily returns of the bull and bear subsamples (Panel A for bull market and Panel B for bear market). The test statistics values and the associated p values are presented of Jaque Bera Test and Kolmogorov–Smirnov Normality Test are presented. The results of Table 13 indicate that the normality of the distributions of weekly log-returns is rejected for every DSE for both bull market and bear market. The data source is DataStream.

Table 55. Normality Test Results of the Emerging Stock Exchanges

Panel A. Bull Markets

		South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
Jaque Bera Test	Test Statistic	283.56	111.71	3.54	149.39	60.20	447.58	469.30	641.58	180.57	29.56
	P Value	0.0000	0.0000	0.1703	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4719	0.4782	0.4667	0.4693	0.4761	0.4806	0.4729	0.4707	0.4767	0.4737
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
Jaque Bera Test	Test Statistic	964.61	5329.53	368.16	114.12	368.25	94.84	383.73	304.92	11225.92
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4730	0.4688	0.4723	0.4675	0.4622	0.4788	0.4732	0.4688	0.4768
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Panel B. Bear Markets

		South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
Jaque Bera Test	Test Statistic	35.75	1149.22	396.32	175.37	171.49	328.38	338.06	322.27	2.11	219.86
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3489	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4726	0.4734	0.4606	0.4566	0.4635	0.4778	0.4726	0.4606	0.4635	0.4584
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
Jaque Bera Test	Test Statistic	2022.93	258.63	469.17	54.62	55.93	251.35	7273.22	97.25	1392.55
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4680	0.4661	0.4539	0.4582	0.4554	0.4715	0.4687	0.4701	0.4695
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: Tables 55 demonstrates the normality of the distributions of daily returns of the bull and bear subsamples (Panel A for bull market and Panel B for bear market). The test statistics values and the associated p values are presented of Jaque Bera Test and Kolmogorov–Smirnov Normality Test are presented. The results of Table 13 indicate that the normality of the distributions of weekly log-returns is rejected for every ESE for both bull market and bear market. The data source is DataStream.

Table 56. Probability Density Models and Parameters of the Developed Stock Exchanges

		Panel A. Bull Markets									
		Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
N	σ	0.0182	0.0204	0.0253	0.0211	0.0172	0.0135	0.0253	0.0214	0.0306	0.0240
ST	ν	4.9574	3.9180	6.4966	3.6311	4.9923	8.2893	3.9571	5.0281	4.0791	4.8213
	σ	0.0184	0.0211	0.0254	0.0218	0.0174	0.0135	0.0249	0.0206	0.0309	0.0245
HST	ν	4.9830	3.9678	6.4836	3.6024	5.0093	8.2954	3.9440	5.0260	4.0613	4.8193
	λ	-0.0060	-0.0197	-0.0104	-0.0110	-0.0073	-0.0109	-0.0135	-0.0083	-0.0055	-0.0035
	σ	0.0184	0.0210	0.0254	0.0219	0.0174	0.0135	0.0250	0.0206	0.0309	0.0245
SGT	ν	4.7283	6.5107	7.7239	3.5093	6.9583	17343.5895	3.6732	4.0584	4.5754	68.2825
	λ	-0.0058	-0.0128	-0.0085	-0.0115	-0.0070	-0.0051	-0.0143	-0.0093	-0.0047	0.0003
	k	2.0646	1.5201	1.8509	2.0437	1.7249	1.4475	2.1236	2.3867	1.8273	1.2444
	σ	0.0185	0.0205	0.0254	0.0220	0.0172	0.0135	0.0252	0.0208	0.0307	0.0240
		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK	
N	σ	0.0267	0.0338	0.0293	0.0234	0.0232	0.0198	0.0187	0.0252	0.0186	
ST	ν	4.5672	3.4683	2.9200	5.6064	4.8008	5.6975	5.4160	3.6831	5.1825	
	σ	0.0271	0.0353	0.0329	0.0227	0.0229	0.0199	0.0187	0.0254	0.0190	
HST	ν	4.5616	3.4234	2.9100	5.6455	4.8000	5.7642	5.4143	3.6679	5.1769	
	λ	-0.0053	-0.0134	-0.0096	-0.0144	-0.0131	0.0165	-0.0021	-0.0129	-0.0025	
	σ	0.0271	0.0355	0.0330	0.0227	0.0229	0.0199	0.0187	0.0254	0.0190	
SGT	ν	7.5001	4.8059	9.0005	5.0303	5.0227	11.5682	5.5538	4.1674	159.5131	
	λ	-0.0028	-0.0101	-0.0066	-0.0153	-0.0124	0.0108	-0.0020	-0.0119	-0.0009	
	k	1.5553	1.5906	1.1342	2.1833	1.9386	1.5439	1.9685	1.8049	1.2328	
	σ	0.0267	0.0340	0.0293	0.0228	0.0228	0.0198	0.0187	0.0251	0.0186	

Note: Tables 56 demonstrates the estimated values of the parameters for different probability density models for each DSE. The estimated values of parameters of the same probability density models are heterogenous for different stock exchanges and for different market regimes. The data source is DataStream.

Table 56 (Cont.). Probability Density Models and Parameters of the Developed Stock Exchanges

Panel B. Bear Markets											
		Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	Fran
N	σ	0.0302	0.0323	0.0397	0.0294	0.0292	0.0225	0.0388	0.0348	0.0466	0.03
ST	ν	5.2300	4.8197	5.0665	4.0879	4.3164	5.3745	5.6847	5.6398	6.0313	5.10
	σ	0.0302	0.0326	0.0390	0.0297	0.0291	0.0226	0.0389	0.0345	0.0470	0.03
HST	ν	5.3222	4.7514	5.0861	4.0917	4.3053	5.4229	6.0020	5.9959	6.0978	5.12
	λ	-0.0128	0.0116	-0.0045	0.0016	0.0049	-0.0064	-0.0184	-0.0243	-0.0136	-0.00
	σ	0.0301	0.0327	0.0390	0.0297	0.0292	0.0225	0.0387	0.0343	0.0470	0.03
SGT	ν	4.9392	4.7550	3.3992	2.9184	2.0736	6.5500	5.6465	2.9715	1132.5027	2.84
	λ	-0.0133	0.0117	-0.0091	0.0039	0.0199	-0.0076	-0.0173	-0.0235	-0.0096	-0.00
	k	2.1010	1.9980	3.3883	2.8990	23.0240	1.8014	2.0605	5.0605	1.3102	4.25
	σ	0.0302	0.0327	0.0399	0.0319	0.0758	0.0225	0.0388	0.0368	0.0466	0.04
		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK	
N	σ	0.0386	0.0448	0.0359	0.0384	0.0380	0.0352	0.0319	0.0362	0.0320	
ST	ν	7.3112	6.2562	6.7132	4.0448	4.6833	4.9683	3.7734	49.0531	4.3461	
	σ	0.0385	0.0450	0.0359	0.0399	0.0387	0.0351	0.0325	0.0362	0.0324	
HST	ν	7.6617	6.2732	7.0104	4.2275	4.7214	4.9748	3.7583	82.1389	4.3961	
	λ	-0.0163	-0.0027	-0.0173	-0.0215	-0.0041	-0.0093	0.0041	-0.0238	-0.0113	
	σ	0.0384	0.0450	0.0358	0.0396	0.0386	0.0352	0.0325	0.0362	0.0323	
SGT	ν	5.0099	6.5739	5.9073	21.5328	5.9276	3.1814	2.6599	14484.7955	7.2538	
	λ	-0.0131	-0.0031	-0.0164	-0.0148	-0.0062	-0.0089	0.0097	-0.0225	-0.0088	
	k	2.5627	1.9567	2.1839	1.2559	1.7768	3.0150	3.0575	1.8626	1.5174	
	σ	0.0387	0.0449	0.0359	0.0383	0.0383	0.0371	0.0366	0.0362	0.0319	

Note: Tables 56 demonstrates the estimated values of the parameters for different probability density models for each DSE. The estimated values of parameters of the same probability density models are heterogenous for different stock exchanges and for different market regimes. The data source is DataStream.

Table 57. Emerging Stock Exchanges Probability Density Models and Parameters

Panel A. Bull Market Regime

		South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
N	σ	0.0233	0.0190	0.0309	0.0267	0.0254	0.0172	0.0269	0.0260	0.0225	0.0242
ST	ν	5.5759	3.7128	11.7517	4.6353	5.2241	4.2659	3.6291	2.8999	5.4456	6.3531
	σ	0.0233	0.0201	0.0309	0.0271	0.0259	0.0175	0.0280	0.0293	0.0226	0.0244
HST	ν	5.5766	3.7465	11.6890	4.6340	5.2249	4.2635	3.6140	2.8974	5.4866	6.3735
	λ	-0.0036	0.0065	0.0063	-0.0020	-0.0010	0.0001	-0.0057	-0.0045	0.0060	0.0032
	σ	0.0233	0.0200	0.0309	0.0271	0.0259	0.0175	0.0280	0.0293	0.0226	0.0244
SGT	ν	7.6200	5.1525	499.5832	6.7944	13.3940	7.1455	4.8018	4.0888	9.5525	25491.4251
	λ	-0.0024	0.0078	0.0028	-0.0008	0.0030	0.0018	-0.0042	-0.0060	-0.0011	0.0069
	k	1.7122	1.6735	1.5523	1.6535	1.5023	1.5341	1.6678	1.5518	1.5675	1.3412
	σ	0.0232	0.0194	0.0309	0.0267	0.0255	0.0171	0.0272	0.0268	0.0225	0.0242

		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
N	σ	0.0288	0.0387	0.0307	0.0382	0.0429	0.0167	0.0271	0.0258	0.0317
ST	ν	5.6943	4.1849	3.6685	3.8538	4.9213	6.0298	4.2853	3.7435	3.9818
	σ	0.0283	0.0372	0.0319	0.0402	0.0428	0.0167	0.0274	0.0268	0.0297
HST	ν	5.6736	4.1211	3.6934	3.8109	4.9085	6.0751	4.2575	3.7373	3.9131
	λ	-0.0050	-0.0158	0.0037	-0.0103	-0.0053	-0.0082	-0.0118	-0.0100	-0.0115
	σ	0.0283	0.0373	0.0319	0.0403	0.0429	0.0167	0.0275	0.0268	0.0299
SGT	ν	4.5769	3.1628	4.3445	49.4074	5.1427	4.0791	6.2263	4.4873	2.7322
	λ	-0.0072	-0.0203	0.0035	0.0047	-0.0049	-0.0085	-0.0077	-0.0083	-0.0149
	k	2.3311	2.6887	1.7752	1.1592	1.9388	2.5831	1.6015	1.7663	3.1742
	σ	0.0285	0.0388	0.0313	0.0382	0.0428	0.0170	0.0271	0.0263	0.0330

Note: Tables 57 demonstrates the estimated values of the parameters for different probability density models for each DSE. The estimated values of parameters of the same probability density models are heterogenous for different stock exchanges and for different market regimes. The data source is DataStream.

Table 57 (Cont.). Emerging Stock Exchanges Probability Density Models and Parameters

Panel B. Bear Market Regime

		South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
N	σ	0.0298	0.0232	0.0375	0.0449	0.0403	0.0252	0.0342	0.0441	0.0390	0.0380
ST	ν	7.2747	2.2698	3.7624	3.7399	2.7715	3.1298	4.8920	3.1262	21.0489	3.9121
	σ	0.0298	0.0333	0.0386	0.0469	0.0472	0.0271	0.0341	0.0477	0.0391	0.0386
HST	ν	7.4156	2.1860	3.7401	3.7317	2.6723	3.0783	4.8589	3.0360	21.2852	3.9054
	λ	-0.0083	0.0559	0.0040	0.0013	0.0315	0.0156	0.0042	0.0209	-0.0187	0.0076
	σ	0.0298	0.0387	0.0387	0.0469	0.0490	0.0273	0.0341	0.0485	0.0391	0.0386
SGT	ν	6938.7718	2.1000	4.4074	5.7320	2.7075	3.5247	4.2796	2.8787	62.0896	3.3352
	λ	-0.0145	0.0493	0.0031	-0.0012	0.0311	0.0145	0.0062	0.0218	-0.0173	0.0094
	k	1.3263	2.4333	1.7778	1.5649	1.9756	1.7798	2.1971	2.1076	1.8598	2.3401
	σ	0.0298	0.0468	0.0380	0.0454	0.0485	0.0264	0.0343	0.0497	0.0391	0.0396

		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
N	σ	0.0354	0.0555	0.0453	0.0473	0.0496	0.0219	0.0376	0.0343	0.0350
ST	ν	4.0485	4.2179	2.6837	4.9090	5.4456	4.0417	2.5471	3.8420	2.9432
	σ	0.0348	0.0558	0.0522	0.0483	0.0502	0.0221	0.0439	0.0357	0.0384
HST	ν	4.0014	4.1761	2.6300	5.0829	5.4668	4.0410	2.4352	3.8105	2.8794
	λ	0.0122	0.0059	0.0217	-0.0171	-0.0028	-0.0006	0.0501	0.0067	0.0233
	σ	0.0349	0.0560	0.0534	0.0481	0.0502	0.0221	0.0472	0.0358	0.0390
SGT	ν	4.1767	3.5304	2.1169	59.6713	15.9004	3.2675	2.9108	17.5145	5.0442
	λ	0.0116	0.0096	0.0233	-0.0163	-0.0070	-0.0010	0.0453	-0.0030	0.0185
	k	1.9283	2.2066	2.7506	1.2896	1.4585	2.4656	1.6717	1.2186	1.3492
	σ	0.0348	0.0578	0.0922	0.0472	0.0496	0.0228	0.0403	0.0343	0.0351

Note: Tables 57 demonstrates the estimated values of the parameters for different probability density models for each DSE. The estimated values of parameters of the same probability density models are heterogenous for different stock exchanges and for different market regimes. The data source is DataStream.

Table 58. Goodness of Fit of Probability Density Models of the Developed Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel A. Bull Markets											
-	-	Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
-Log Likelihood	N	-1610.46	-1663.64	-1114.56	-1217.93	-1707.26	-1940.19	-1294.71	-1342.15	-1185.28	-1411.72
	ST	-1633.43	-1702.54	-1125.10	-1255.32	-1727.74	**-1947.17**	-1351.29	-1388.88	-1225.21	-1430.08
	HST	-1633.46	-1702.82	-1125.17	-1255.38	-1727.78	-1947.27	-1351.40	-1388.93	**-1225.23**	-1430.08
	SGT	**-1633.47**	**-1704.07**	**-1125.21**	**-1255.38**	**-1728.08**	-1948.55	**-1351.43**	**-1389.36**	-1225.32	**-1432.70**
Akaike Information Criterion	N	-3216.92	-3323.29	-2225.11	-2431.86	-3410.51	-3876.38	-2585.42	-2680.30	-2366.55	-2819.43
	ST	-3260.86	-3399.08	-2244.21	-2504.64	-3449.49	-3888.35	-2696.57	-2771.77	-2444.43	-2854.15
	HST	**-3260.91**	**-3399.63**	**-2244.34**	**-2504.76**	**-3449.56**	**-3888.54**	**-2696.79**	**-2771.85**	**-2444.46**	-2854.17
	SGT	-3256.94	-3398.13	-2240.42	-2500.77	-3446.15	-3887.10	-2692.87	-2768.73	-2440.65	**-2855.40**
Schwartz Bayesian Criterion	N	1604.02	1657.13	1108.35	1211.72	1700.79	1933.68	1288.36	1335.83	1178.92	1405.30
	ST	1623.78	1692.77	1115.80	1246.00	1718.04	1937.41	1341.76	1379.41	1215.69	1420.45
	HST	**1623.80**	**1693.05**	**1115.86**	**1246.06**	**1718.08**	**1937.51**	**1341.87**	**1379.45**	**1215.70**	**1420.46**
	SGT	1617.38	1687.79	1109.71	1239.85	1711.90	1932.27	1335.56	1373.57	1209.45	1416.66
Normal Distribution	LR Statistic	46.0	80.8	21.3	74.9	41.6	16.7	113.4	94.4	80.1	42.0
	P value	0.0000	0.0000	0.0001	0.0000	0.0000	0.0008	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	0.1	3.1	0.2	0.1	0.7	2.8	0.3	1.0	0.2	5.3
	P value	0.9641	0.2173	0.8978	0.9362	0.7156	0.2527	0.8624	0.6187	0.8958	0.0724
Skewed T Distribution	LR Statistic	0.0	2.5	0.1	0.0	0.6	2.6	0.1	0.9	0.2	5.2
	P value	0.8799	0.1139	0.7661	0.9301	0.4421	0.1099	0.7848	0.3504	0.6685	0.0221

Note: Table 58 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each DSE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 58 (Cont.). Goodness of Fit of Probability Density Models of the Developed Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel A. Bull Market Regime										
		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK
-Log Likelihood	N	-1226.806	-816.357	-1077.917	-1313.876	-1441.196	-1028.693	-1234.841	-1269.508	-1569.798
	ST	-1252.333	-850.836	-1128.718	-1348.709	-1482.419	-1040.013	-1253.355	-1323.365	-1584.657
	HST	-1252.349	-850.910	-1128.763	-1348.843	-1482.535	-1040.143	-1253.358	-1323.463	-1584.662
	SGT	**-1253.150**	**-851.521**	**-1132.488**	**-1348.942**	**-1482.548**	**-1040.688**	**-1253.361**	**-1323.590**	**-1588.749**
Akaike Information Criterion	N	-2449.613	-1628.715	-2151.834	-2623.752	-2878.392	-2053.386	-2465.682	-2535.016	-3135.597
	ST	-2498.666	-1695.672	-2251.436	-2691.417	-2958.838	-2074.027	-2500.711	-2640.731	-3163.314
	HST	**-2498.699**	**-1695.819**	-2251.527	**-2691.686**	**-2959.069**	**-2074.286**	**-2500.716**	**-2640.926**	-3163.324
	SGT	-2496.299	-1693.043	**-2254.977**	-2687.884	-2955.097	-2071.376	-2496.721	-2637.179	**-3167.498**
Schwartz Bayesian Criterion	N	1220.484	810.329	1071.681	1307.545	1434.775	1022.674	1228.663	1263.178	1563.382
	ST	1242.849	841.794	1119.363	1339.211	1472.786	1030.986	1244.088	1313.871	1575.032
	HST	**1242.866**	**841.867**	**1119.409**	**1339.346**	**1472.902**	**1031.115**	**1244.091**	**1313.968**	**1575.037**
	SGT	1237.343	836.451	1116.898	1333.113	1466.494	1025.641	1237.916	1307.765	1572.707
Normal Distribution	LR Statistic	52.69	70.33	109.14	70.13	82.70	23.99	37.04	108.16	37.90
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	1.63	1.37	7.54	0.47	0.26	1.35	0.01	0.45	8.18
	P value	0.4419	0.5041	0.0230	0.7917	0.8785	0.5095	0.9948	0.7990	0.0167
Skewed T Distribution	LR Statistic	1.60	1.22	7.45	0.20	0.03	1.09	0.01	0.25	8.17
	P value	0.2059	0.2687	0.0063	0.6558	0.8683	0.2965	0.9401	0.6145	0.0042

Note: Table 58 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each DSE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 58 (Cont.). Goodness of Fit of Probability Density Models of the Developed Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel B. Bear Markets											
-	-	Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
-Log Likelihood	N	-546.912	-428.516	-518.820	-816.087	-509.262	-384.970	-573.306	-447.978	-515.671	-512.986
	ST	-558.723	-437.691	-536.807	-841.794	-526.600	-390.764	-583.003	-457.858	-521.967	-525.065
	HST	-558.771	-437.722	-536.814	-841.796	-526.606	-390.771	-583.112	-458.001	-522.034	-525.075
	SGT	**-558.785**	**-437.722**	**-537.905**	**-842.426**	**-529.419**	**-390.786**	**-583.116**	**-460.002**	**-523.022**	**-526.390**
Akaike Information Criterion	N	-1089.823	-853.032	-1033.640	-1628.175	-1014.525	-765.939	-1142.613	-891.956	-1027.343	-1021.972
	ST	-1111.445	-869.383	-1067.614	-1677.589	-1047.199	-775.527	-1160.005	-909.717	-1037.934	-1044.131
	HST	**-1111.541**	**-869.445**	**-1067.627**	**-1677.591**	-1047.212	**-775.542**	**-1160.224**	-910.002	**-1038.067**	**-1044.151**
	SGT	-1107.569	-865.445	-1065.809	-1674.852	**-1048.838**	-771.572	-1156.232	**-910.004**	-1036.045	-1042.781
Schwartz Bayesian Criterion	N	541.340	423.155	513.161	810.129	503.778	379.882	567.560	442.535	509.925	507.369
	ST	550.364	429.649	528.318	832.857	518.372	383.132	574.383	449.695	513.348	516.640
	HST	**550.412**	**429.680**	**528.324**	**832.858**	**518.379**	**383.139**	**574.493**	**449.837**	**513.414**	**516.650**
	SGT	544.854	424.319	523.756	827.530	515.707	378.067	568.751	446.396	508.657	512.348
Normal Distribution	LR Statistic	23.75	18.41	38.17	52.68	40.31	11.63	19.62	24.05	14.70	26.81
	P value	0.0000	0.0004	0.0000	0.0000	0.0000	0.0088	0.0002	0.0000	0.0021	0.0000
Student's T Distribution	LR Statistic	0.12	0.06	2.20	1.26	5.64	0.04	0.23	4.29	2.11	2.65
	P value	0.9397	0.9693	0.3336	0.5318	0.0596	0.9778	0.8926	0.1173	0.3480	0.2658
Skewed T Distribution	LR Statistic	0.03	0.00	2.18	1.26	5.63	0.03	0.01	4.00	1.98	2.63
	P value	0.8664	0.9965	0.1396	0.2616	0.0177	0.8611	0.9278	0.0455	0.1597	0.1049

Note: Table 58 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each DSE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 58 (Cont.). Goodness of fit of Probability Density Models of the Developed Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel B. Bear Markets										
		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK
-Log Likelihood	N	-603.908	-691.550	-715.672	-596.389	-501.992	-742.158	-819.050	-417.663	-554.115
	ST	-610.792	-701.020	-723.934	-609.987	-511.959	-760.870	-850.697	-417.730	-569.355
	HST	-610.891	-701.023	-724.057	-610.133	-511.964	-760.908	-850.704	-417.901	-569.393
	SGT	**-611.155**	**-701.027**	**-724.107**	**-611.485**	**-512.029**	**-762.002**	**-851.809**	**-417.983**	**-569.778**
Akaike Information Criterion	N	-1203.817	-1379.100	-1427.344	-1188.778	-999.984	-1480.315	-1634.101	**-831.327**	-1104.231
	ST	-1215.584	-1396.039	-1441.867	-1213.974	-1017.918	-1515.741	-1695.395	-829.459	-1132.711
	HST	**-1215.782**	**-1396.046**	**-1442.114**	**-1214.266**	**-1017.928**	**-1515.816**	**-1695.408**	-829.802	**-1132.786**
	SGT	-1212.311	-1392.053	-1438.214	-1212.970	-1014.057	-1514.004	-1693.618	-825.967	-1129.555
Schwartz Bayesian Criterion	N	598.112	685.534	709.745	590.608	496.390	736.204	813.049	**412.270**	548.502
	ST	602.098	691.995	715.043	601.316	503.556	751.941	841.695	409.639	560.936
	HST	**602.197**	**691.999**	**715.167**	**601.462**	**503.561**	**751.978**	**841.702**	409.811	**560.973**
	SGT	596.665	685.986	709.290	597.033	498.023	747.119	836.806	404.499	555.745
Normal Distribution	LR Statistic	14.49	18.95	16.87	30.19	20.07	39.69	65.52	0.64	31.32
	P value	0.0023	0.0003	0.0008	0.0000	0.0002	0.0000	0.0000	0.8872	0.0000
Student's T Distribution	LR Statistic	0.73	0.01	0.35	3.00	0.14	2.26	2.22	0.51	0.84
	P value	0.6952	0.9930	0.8407	0.2236	0.9330	0.3225	0.3290	0.7759	0.6555
Skewed T Distribution	LR Statistic	0.53	0.01	0.10	2.70	0.13	2.19	2.21	0.16	0.77
	P value	0.4670	0.9329	0.7519	0.1001	0.7191	0.1391	0.1371	0.6852	0.3803

Note: Table 58 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each DSE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 59. Goodness of Fit of Probability Density Models of the Emerging Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel A. Bull Markets											
-	-	South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
-Log Likelihood	N	-1410.35	-1213.07	-903.96	-1122.64	-1433.00	-1557.94	-1246.24	-1222.11	-1346.61	-1280.34
	ST	-1432.63	-1236.46	-905.78	-1143.60	-1448.87	-1589.72	-1285.27	-1276.79	-1365.47	-1289.11
	HST	-1432.64	-1236.48	-905.80	-1143.60	-1448.87	-1589.72	-1285.29	-1276.80	-1365.49	-1289.11
	SGT	**-1432.96**	**-1236.69**	**-907.07**	**-1143.96**	**-1449.79**	**-1590.60**	**-1285.67**	**-1277.53**	**-1366.07**	**-1291.31**
Akaike Information Criterion	N	-2816.69	-2422.14	-1803.93	-2241.29	-2862.00	-3111.88	-2488.48	-2440.21	-2689.21	-2556.68
	ST	-2859.27	-2466.92	-1805.56	-2281.19	-2891.74	**-3173.45**	-2564.53	-2547.59	-2724.94	-2572.21
	HST	**-2859.29**	**-2466.96**	**-1805.60**	**-2281.20**	**-2891.74**	-3173.45	**-2564.57**	**-2547.61**	**-2724.98**	-2572.23
	SGT	-2855.93	-2463.38	-1804.15	-2277.92	-2889.57	-3171.20	-2561.33	-2545.05	-2722.14	**-2572.62**
Schwartz Bayesian Criterion	N	1403.95	1206.90	**897.88**	1116.41	1426.55	1551.56	1239.90	1215.80	1340.27	1274.02
	ST	1423.03	1227.21	896.65	1134.25	1439.18	**1580.16**	1275.76	1267.33	1355.96	1279.63
	HST	**1423.04**	**1227.23**	896.67	**1134.25**	**1439.19**	1580.16	**1275.78**	**1267.34**	**1355.98**	**1279.63**
	SGT	1416.96	1221.27	891.86	1128.38	1433.65	1574.65	1269.81	1261.76	1350.22	1275.51
Normal Distribution	LR Statistic	45.23	47.23	6.22	42.63	33.57	65.32	78.86	110.84	38.93	21.94
	P value	0.0000	0.0000	0.1014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001
Student's T Distribution	LR Statistic	0.66	0.46	2.59	0.73	1.84	1.75	0.80	1.47	1.21	4.41
	P value	0.7183	0.7963	0.2741	0.6928	0.3990	0.4161	0.6713	0.4803	0.5470	0.1104
Skewed T Distribution	LR Statistic	0.64	0.42	2.54	0.73	1.84	1.75	0.76	1.44	1.16	4.39
	P value	0.4223	0.5192	0.1106	0.3931	0.1754	0.1854	0.3835	0.2295	0.2809	0.0361

Note: Table 59 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each ESE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 59 (Cont.). Goodness of Fit of Probability Density Models of the Emerging Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel A. Bull Markets										
		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
-Log Likelihood	N	-1041.60	-1184.91	-1217.25	-841.37	-905.13	-1618.94	-986.82	-1452.33	-828.92
	ST	-1066.80	-1257.62	-1257.76	-861.46	-930.91	-1634.71	-1013.20	-1492.39	-889.81
	HST	-1066.82	-1257.79	-1257.76	-861.51	-930.93	-1634.75	-1013.26	-1492.46	-889.86
	SGT	**-1067.03**	**-1259.06**	**-1257.89**	**-863.96**	**-930.94**	**-1635.45**	**-1013.66**	**-1492.66**	**-890.90**
Akaike Information Criterion	N	-2079.20	-2365.82	-2430.50	-1678.73	-1806.26	-3233.89	-1969.65	-2900.65	-1653.85
	ST	-2127.60	-2509.24	-2509.51	-1716.91	-1855.83	-3263.41	-2020.40	-2978.78	-1773.62
	HST	**-2127.63**	**-2509.59**	**-2509.53**	-1717.01	**-1855.86**	**-3263.51**	**-2020.53**	**-2978.92**	**-1773.72**
	SGT	-2124.06	-2508.13	-2505.78	**-1717.91**	-1851.89	-3260.90	-2017.32	-2975.32	-1771.79
Schwartz Bayesian Criterion	N	1035.41	1178.44	1210.87	835.24	898.87	1612.54	980.71	1445.85	822.91
	ST	1057.51	1247.92	1248.19	852.27	921.52	1625.10	1004.03	1482.68	880.79
	HST	**1057.53**	**1248.09**	**1248.19**	**852.32**	**921.54**	**1625.15**	**1004.10**	**1482.75**	**880.84**
	SGT	1051.55	1242.89	1241.94	848.65	915.29	1619.44	998.38	1476.47	875.87
Normal Distribution	LR Statistic	50.8671	148.3052	81.2750	45.1816	51.6207	33.0145	53.6751	80.6653	123.9457
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	0.4609	2.8840	0.2688	4.9984	0.0595	1.4853	0.9249	0.5356	2.1768
	P value	0.7942	0.2365	0.8743	0.0821	0.9707	0.4758	0.6297	0.7650	0.3368
Skewed T Distribution	LR Statistic	0.4323	2.5398	0.2532	4.9016	0.0264	1.3909	0.7929	0.3981	2.0715
	P value	0.5108	0.1110	0.6149	0.0268	0.8710	0.2383	0.3732	0.5280	0.1501

Note: Table 59 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each ESE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 59 (Cont.) Goodness of Fit of Probability Density Models of the Emerging Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel B. Bear Markets											
-	-	South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
-Log Likelihood	N	-592.971	-713.146	-833.372	-634.796	-448.029	-672.354	-623.824	-575.265	-581.587	-610.726
	ST	-597.672	-782.203	-864.975	-656.811	-471.941	-701.036	-641.283	-606.333	-582.173	-634.928
	HST	-597.695	-783.039	-864.982	-656.812	-472.160	-701.105	-641.289	-606.468	**-582.328**	-634.948
	SGT	**-598.869**	**-783.390**	**-865.094**	**-657.277**	**-472.160**	**-701.181**	**-641.367**	**-606.480**	-582.264	**-635.096**
Akaike Information Criterion	N	-1181.942	-1422.292	-1662.745	-1265.592	-892.059	-1340.708	-1243.648	-1146.531	**-1159.174**	-1217.452
	ST	-1189.344	-1558.406	-1723.949	-1307.622	-937.882	-1396.073	-1276.565	-1206.667	-1158.346	-1263.855
	HST	**-1189.389**	**-1560.078**	**-1723.964**	**-1307.623**	**-938.320**	**-1396.210**	**-1276.577**	**-1206.935**	-1158.656	**-1263.897**
	SGT	-1187.738	-1556.781	-1720.187	-1304.554	-934.321	-1392.362	-1272.734	-1202.960	-1154.528	-1260.193
Schwartz Bayesian Criterion	N	587.326	707.429	827.270	628.864	442.508	666.660	618.059	569.442	**575.822**	604.927
	ST	589.204	773.628	855.821	647.913	463.659	692.496	632.635	597.599	573.525	626.229
	HST	**589.226**	**774.463**	**855.828**	**647.913**	**463.878**	**692.564**	**632.641**	**597.733**	573.680	**626.250**
	SGT	584.76	769.10	849.84	642.45	458.36	686.95	626.95	591.92	567.85	620.60
Normal Distribution	LR Statistic	11.7957	140.4887	63.4427	44.9624	48.2622	57.6545	35.0862	62.4292	1.3546	48.7406
	P value	0.0081	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.7162	0.0000
Student's T Distribution	LR Statistic	2.3940	2.3744	0.2379	0.9324	0.4386	0.2896	0.1690	0.2933	0.1820	0.3371
	P value	0.3021	0.3051	0.8879	0.6274	0.8031	0.8652	0.9190	0.8636	0.9130	0.8449
Skewed T Distribution	LR Statistic	2.3484	0.7029	0.2234	0.9311	0.0009	0.1522	0.1571	0.0247	-0.1282	0.2957
	P value	0.1254	0.4018	0.6364	0.3346	0.9766	0.6964	0.6918	0.8751	1.0000	0.5866

Note: Table 59 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each ESE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 59 (Cont.). Goodness of fit of Probability Density Models of the Emerging Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

		Panel B. Bear Markets								
		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
-Log Likelihood	N	-762.85	-353.43	-495.70	-701.76	-574.97	-675.54	-664.49	-463.25	-924.88
	ST	-802.13	-369.32	-538.33	-714.23	-584.54	-695.35	-733.75	-475.49	-979.54
	HST	-802.19	-369.33	-538.45	-714.36	-584.55	-695.35	-734.55	-475.50	-979.78
	SGT	**-802.20**	**-369.36**	**-539.13**	**-715.42**	**-585.27**	**-695.52**	**-734.78**	**-476.38**	**-981.21**
Akaike Information Criterion	N	-1521.71	-702.87	-987.41	-1399.51	-1145.94	-1347.07	-1324.98	-922.50	-1845.76
	ST	-1598.26	-732.65	-1070.65	-1422.47	-1163.08	-1384.70	-1461.50	-944.98	-1953.08
	HST	**-1598.38**	**-732.67**	**-1070.91**	**-1422.73**	**-1163.09**	**-1384.70**	**-1463.09**	**-945.01**	**-1953.57**
	SGT	-1594.41	-728.71	-1068.25	-1420.83	-1160.55	-1381.04	-1459.56	-942.76	-1952.43
Schwartz Bayesian Criterion	N	756.87	347.95	490.01	695.69	569.08	669.90	658.61	457.78	918.71
	ST	793.15	361.10	529.79	705.14	575.70	686.89	724.93	467.29	970.28
	HST	**793.21**	**361.11**	**529.92**	**705.27**	**575.70**	**686.89**	**725.73**	**467.30**	**970.53**
	SGT	787.24	355.65	524.90	700.26	570.54	681.43	720.09	462.71	965.79
Normal Distribution	LR Statistic	78.7001	31.8423	86.8468	27.3218	20.6043	39.9736	140.5875	26.2546	112.6691
	P value	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	0.1467	0.0612	1.6043	2.3658	1.4633	0.3473	2.0634	1.7708	3.3512
	P value	0.9293	0.9698	0.4484	0.3064	0.4811	0.8406	0.3564	0.4125	0.1872
Skewed T Distribution	LR Statistic	0.0259	0.0447	1.3493	2.1036	1.4570	0.3471	0.4734	1.7490	2.8606
	P value	0.8722	0.8326	0.2454	0.1470	0.2274	0.5557	0.4914	0.1860	0.0908

Note: Table 59 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each ESE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 62. Normality Test Results of the Developed Stock Exchanges (Weekly Data)

Panel A. High Quarterly volatility regime											
		Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
Jaque Bera Test	Test Statistic	428.16	216.92	559.38	279.11	462.25	423.17	777.19	81.59	61.28	90.64
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4664	0.4633	0.4648	0.4622	0.4689	0.4773	0.4598	0.4728	0.4455	0.4570
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		Germany	Greece	Italy	Ireland	NL	Portugal	Switzerland	Sweden	UK	
Jaque Bera Test	Test Statistic	95.48	182.50	184.98	283.77	276.96	86.90	323.99	163.05	235.76	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Kolmogorov–Smirnov Normality test	Test Statistic	0.4561	0.4583	0.4548	0.4613	0.4587	0.4728	0.4621	0.4663	0.4650	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Panel B. Low Quarterly volatility regime											
		Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
Jaque Bera Test	Test Statistic	68.67	6.53	314.14	39.66	49.50	88.15	9.76	1312.94	229.97	16.61
	P Value	0.0000	0.0382	0.0000	0.0000	0.0000	0.0000	0.0076	0.0000	0.0000	0.0002
Kolmogorov–Smirnov Normality test	Test Statistic	0.4809	0.4833	0.4612	0.4794	0.4812	0.4811	0.4735	0.4694	0.4693	0.4761
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK	
Jaque Bera Test	Test Statistic	13.38	125.19	167.07	81.60	4.68	369.33	31.73	343.43	8.42	
	P Value	0.0012	0.0000	0.0000	0.0000	0.0961	0.0000	0.0000	0.0000	0.0149	
Kolmogorov–Smirnov Normality test	Test Statistic	0.4739	0.4538	0.4636	0.4773	0.4794	0.4636	0.4823	0.4629	0.4814	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	

Note: Tables 62 demonstrates the normality of the distributions of weekly returns of the bull and bear subsamples (Panel A for bull market and Panel B for bear market). The test statistics values and the associated p values are presented of Jaque Bera Test and Kolmogorov–Smirnov Normality Test are presented. The results of Table 63 indicate that the normality of the distributions of daily returns is rejected for every DSE for both high quarterly volatility regime and low quarterly volatility regime. The data source is DataStream.

Table 63. Normality Test Results of the Emerging Stock Exchanges (Weekly Data)

Panel A. High Quarterly volatility regime

		South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
Jaque Bera Test	Test Statistic	92.25	178.17	74.95	412.23	504.87	561.65	606.76	957.09	29.97	412.23
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4638	0.4767	0.4574	0.4556	0.4576	0.4702	0.4604	0.4555	0.4581	0.4602
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
Jaque Bera Test	Test Statistic	1989.91	1450.44	470.81	51.87	117.45	220.42	391.31	238.93	3686.40
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4576	0.4379	0.4471	0.4356	0.4364	0.4723	0.4677	0.4571	0.4526
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Panel B. Low Quarterly volatility regime

		South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
Jaque Bera Test	Test Statistic	9.16	541.52	447.51	132.49	421.88	240.99	143.35	606.66	75.48	278.29
	P Value	0.0102	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4782	0.4680	0.4577	0.4658	0.4648	0.4806	0.4643	0.4606	0.4743	0.4674
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
Jaque Bera Test	Test Statistic	13.62	21.48	2434.89	33.50	49.60	74.27	5184.42	80.68	40.14
	P Value	0.0011	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4682	0.4592	0.4583	0.4531	0.4541	0.4798	0.4555	0.4694	0.4624
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: Tables 63 demonstrates the normality of the distributions of weekly returns of the bull and bear subsamples (Panel A for bull market and Panel B for bear market). The test statistics values and the associated p values are presented of Jaque Bera Test and Kolmogorov–Smirnov Normality Test are presented. The results of Table 63 indicate that the normality of the distributions of daily returns is rejected for every DSE for both high quarterly volatility regime and low quarterly volatility regime. The data source is DataStream.

Table 64. Probability Density Models and Parameters of the Developed Stock Exchanges(Weekly Data)

Panel A. High Quarterly volatility regime

		Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
N	σ	0.0271	0.0296	0.0298	0.0310	0.0253	0.0174	0.0375	0.0225	0.0474	0.0357
ST	ν	4.3882	5.2213	6.4541	3.5050	4.5706	4.3599	3.0104	4.4741	5.1227	5.7847
	σ	0.0274	0.0296	0.0291	0.0326	0.0251	0.0175	0.0408	0.0230	0.0482	0.0357
HST	ν	4.4111	5.2512	6.4717	3.5034	4.5843	4.3694	2.9864	4.4721	5.1474	5.8381
	λ	-0.0045	-0.0101	-0.0066	0.0033	-0.0036	-0.0019	0.0069	0.0036	-0.0072	-0.0119
	σ	0.0274	0.0296	0.0291	0.0326	0.0251	0.0175	0.0410	0.0230	0.0482	0.0357
SGT	ν	4.8726	3.8468	3.4220	3.8285	3.5819	3.9452	3.6118	8.6435	21.3184	3.8776
	λ	-0.0047	-0.0117	-0.0108	0.0033	-0.0051	-0.0018	0.0063	-0.0006	-0.0053	-0.0136
	k	1.8818	2.6025	3.9584	1.8690	2.5621	2.1700	1.6999	1.5143	1.3674	2.7310
	σ	0.0272	0.0301	0.0300	0.0321	0.0256	0.0176	0.0389	0.0225	0.0474	0.0365

		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK
N	σ	0.0395	0.0442	0.0394	0.0371	0.0359	0.0250	0.0312	0.0274	0.0289
ST	ν	6.4641	4.8142	4.8934	3.7395	4.3678	6.1414	3.7559	3.7673	4.4835
	σ	0.0395	0.0445	0.0395	0.0384	0.0362	0.0250	0.0319	0.0286	0.0293
HST	ν	6.6111	4.8489	4.9469	3.7566	4.4002	6.1715	3.7496	3.7725	4.4962
	λ	-0.0143	-0.0055	-0.0112	-0.0029	-0.0070	-0.0026	0.0028	-0.0034	-0.0053
	σ	0.0394	0.0444	0.0394	0.0384	0.0362	0.0250	0.0319	0.0286	0.0293
SGT	ν	3.5509	3.8765	3.6786	5.3136	3.0181	6.6446	2.7261	7.3994	6.9679
	λ	-0.0144	-0.0036	-0.0121	-0.0035	-0.0058	-0.0033	0.0055	-0.0039	-0.0054
	k	3.3121	2.3697	2.5348	1.5996	3.0084	1.9279	2.9573	1.4476	1.5866
	σ	0.0408	0.0452	0.0404	0.0374	0.0385	0.0250	0.0352	0.0275	0.0289

Note: Tables 64 demonstrates the estimated values of the parameters for different probability density models for each DSE. The estimated values of parameters of the same probability density models are heterogenous for different stock exchanges and for different market regimes. The data source is DataStream.

Table 64 (Cont.). Probability Density Models and Parameters of the Developed Stock Exchanges (Weekly Data)

Panel B. Low Quarterly volatility regime

		Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
N	σ	0.0161	0.0144	0.0359	0.0174	0.0151	0.0148	0.0240	0.0315	0.0248	0.0191
ST	ν	5.8482	11.7111	4.3772	6.2243	5.4914	7.2257	11.5311	3.4901	5.7485	7.5761
	σ	0.0162	0.0144	0.0361	0.0176	0.0153	0.0148	0.0240	0.0312	0.0246	0.0192
HST	ν	6.1239	12.8244	4.4991	6.4951	5.5744	7.4006	12.1500	3.4980	5.7916	7.6792
	λ	-0.0157	-0.0271	-0.0178	-0.0142	-0.0088	-0.0160	-0.0209	-0.0018	-0.0084	-0.0135
	σ	0.0162	0.0144	0.0359	0.0175	0.0153	0.0147	0.0240	0.0312	0.0246	0.0192
SGT	ν	5.0355	54990.3331	4.2525	52.3272	5.5701	6.4340	17.3513	2.3734	5.5348	12.8783
	λ	-0.0136	-0.0233	-0.0184	-0.0183	-0.0087	-0.0158	-0.0205	-0.0026	-0.0085	-0.0116
	k	2.1958	1.6126	2.0872	1.4304	2.0007	2.1430	1.8670	3.8454	2.0570	1.7286
	σ	0.0163	0.0144	0.0360	0.0173	0.0153	0.0147	0.0240	0.0392	0.0247	0.0191
		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK	
N	σ	0.0210	0.0414	0.0275	0.0203	0.0175	0.0326	0.0163	0.0327	0.0151	
ST	ν	7.5630	4.3581	3.1729	6.5184	15.0998	3.2611	8.3316	4.0481	8.0333	
	σ	0.0211	0.0422	0.0302	0.0203	0.0175	0.0348	0.0163	0.0333	0.0152	
HST	ν	7.6563	4.3878	3.1766	6.7711	15.7277	3.2773	8.5508	4.1564	8.1974	
	λ	-0.0118	-0.0208	-0.0025	-0.0146	-0.0158	-0.0047	-0.0092	-0.0198	-0.0117	
	σ	0.0211	0.0421	0.0302	0.0203	0.0175	0.0347	0.0163	0.0331	0.0152	
SGT	ν	7662.0206	4.1726	12.5048	4.1887	14.1491	5.0513	15.2819	5.4185	1657.2160	
	λ	-0.0108	-0.0217	-0.0001	-0.0079	-0.0159	-0.0023	-0.0130	-0.0168	-0.0119	
	k	1.4344	2.0707	1.1640	2.7622	2.0402	1.4969	1.7356	1.6924	1.4498	
	σ	0.0209	0.0423	0.0276	0.0206	0.0175	0.0329	0.0162	0.0326	0.0151	

Note: Tables 64 demonstrates the estimated values of the parameters for different probability density models for each DSE. The estimated values of parameters of the same probability density models are heterogenous for different stock exchanges and for different market regimes. The data source is DataStream.

Table 65 Emerging Stock Exchanges Probability Density Models and Parameters(Weekly Data)

Panel A. Bull Market Regime

		South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
N	σ	0.0311	0.0163	0.0361	0.0426	0.0355	0.0243	0.0344	0.0398	0.0369	0.0342
ST	ν	6.3231	3.1443	4.8985	3.0554	3.2104	2.9807	3.5073	2.1498	6.4966	4.3569
	σ	0.0311	0.0178	0.0369	0.0470	0.0378	0.0269	0.0357	0.0757	0.0373	0.0343
HST	ν	6.3608	3.1435	4.9111	3.0115	3.1655	2.9660	3.5101	2.1168	6.7323	4.3581
	λ	-0.0059	-0.0019	-0.0035	0.0166	0.0211	0.0149	-0.0009	0.0372	-0.0173	0.0004
	σ	0.0311	0.0178	0.0369	0.0474	0.0381	0.0270	0.0357	0.0844	0.0372	0.0343
SGT	ν	5.6924	6.1458	49.5008	5.7219	3.1257	4.7791	5.5983	4.2725	65.3290	3.5735
	λ	-0.0054	-0.0008	-0.0070	0.0103	0.0212	0.0103	0.0002	0.0356	-0.0147	0.0004
	k	2.1251	1.3535	1.2792	1.3528	2.0239	1.4413	1.4865	1.1116	1.3946	2.3839
	σ	0.0311	0.0165	0.0361	0.0432	0.0383	0.0247	0.0343	0.0415	0.0369	0.0350

		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
N	σ	0.0379	0.0553	0.0415	0.0528	0.0566	0.0226	0.0268	0.0335	0.0414
ST	ν	4.2476	2.9143	2.3152	3.7312	5.7278	4.3366	3.8616	3.5056	2.3783
	σ	0.0369	0.0592	0.0617	0.0562	0.0567	0.0230	0.0272	0.0353	0.0544
HST	ν	4.2378	2.9044	2.3150	3.7401	5.7247	4.3304	3.8562	3.5080	2.3659
	λ	0.0058	0.0097	0.0105	-0.0036	-0.0066	0.0010	0.0046	-0.0005	0.0190
	σ	0.0369	0.0593	0.0617	0.0561	0.0567	0.0230	0.0272	0.0353	0.0550
SGT	ν	3.1920	2.4334	6.3869	14.5072	4.3574	5.4458	3.3219	4.9458	2.7998
	λ	0.0077	0.0118	0.0054	-0.0043	-0.0083	-0.0004	0.0052	-0.0003	0.0156
	k	2.7074	2.5632	1.0743	1.3111	2.4216	1.7557	2.3112	1.6030	1.6773
	σ	0.0384	0.0686	0.0422	0.0530	0.0572	0.0227	0.0278	0.0340	0.0458

Note: Tables 65 demonstrates the estimated values of the parameters for different probability density models for each ESE. The estimated values of parameters of the same probability density models are heterogenous for different stock exchanges and for different market regimes. The data source is DataStream.

Table 65 (Cont.). Emerging Stock Exchanges Probability Density Models and Parameters (Weekly Data)

Panel B. Bear Market Regime

		South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
N	σ	0.0191	0.0263	0.0369	0.0302	0.0287	0.0155	0.0270	0.0332	0.0217	0.0284
ST	ν	15.9162	2.4604	4.5037	5.6922	4.1292	4.7878	4.6032	2.9469	3.8671	4.8523
	σ	0.0191	0.0343	0.0370	0.0302	0.0289	0.0156	0.0272	0.0370	0.0228	0.0285
HST	ν	17.4384	2.4827	4.4765	6.0335	4.1285	4.7890	4.6045	2.9002	3.8671	4.8805
	λ	-0.0157	0.0265	0.0075	-0.0224	0.0008	-0.0015	-0.0010	0.0129	0.0004	-0.0054
	σ	0.0191	0.0337	0.0370	0.0301	0.0289	0.0156	0.0272	0.0375	0.0228	0.0284
SGT	ν	1377.5076	4.3931	3.7885	3.3218	4.9777	6.4316	3.8265	6.7271	62.5662	5.1535
	λ	-0.0170	0.0142	0.0098	-0.0181	0.0010	-0.0012	-0.0005	0.0106	-0.0077	-0.0054
	k	1.6586	1.2865	2.2829	3.2292	1.7571	1.7025	2.3265	1.2350	1.1863	1.9352
	σ	0.0191	0.0270	0.0376	0.0316	0.0286	0.0155	0.0276	0.0334	0.0216	0.0284

		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
N	σ	0.0262	0.0351	0.0336	0.0376	0.0394	0.0158	0.0402	0.0234	0.0291
ST	ν	7.8427	6.7151	2.5466	6.9044	7.5377	9.1551	3.1125	5.1397	5.3037
	σ	0.0263	0.0354	0.0405	0.0377	0.0394	0.0157	0.0407	0.0236	0.0295
HST	ν	7.8667	6.9297	2.5552	7.1411	7.5858	9.5200	3.0811	5.1400	5.3129
	λ	-0.0037	-0.0158	0.0164	-0.0223	-0.0043	-0.0205	0.0249	-0.0074	0.0062
	σ	0.0263	0.0353	0.0403	0.0376	0.0394	0.0157	0.0410	0.0236	0.0295
SGT	ν	36.2044	51.5429	3.3704	4.2240	3.9610	3.9250	3.0163	4.3960	8.6654
	λ	-0.0041	-0.0151	0.0140	-0.0266	0.0031	-0.0246	0.0255	-0.0084	0.0053
	k	1.5363	1.4479	1.5610	2.7894	3.1493	3.8534	2.0459	2.2107	1.6493
	σ	0.0262	0.0352	0.0347	0.0383	0.0402	0.0160	0.0413	0.0238	0.0292

Note: Tables 65 demonstrates the estimated values of the parameters for different probability density models for each ESE. The estimated values of parameters of the same probability density models are heterogenous for different stock exchanges and for different market regimes. The data source is DataStream.

Table 66. Goodness of Fit of Probability Density Models on Weekly Data of the Developed Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel A. High Quarterly volatility regime											
-	-	Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
-Log Likelihood	N	-1116.50	-1070.72	-820.91	-1047.94	-1151.51	-1205.91	-951.17	-938.84	-830.85	-976.58
	ST	-1144.04	-1093.31	-839.96	-1084.74	-1185.20	**-1234.38**	-1006.11	-953.85	-845.32	-992.15
	HST	-1144.05	-1093.37	-839.98	-1084.75	-1185.20	-1234.38	-1006.14	-953.86	**-845.35**	-992.24
	SGT	**-1144.09**	**-1093.98**	**-843.45**	**-1084.78**	**-1185.79**	-1234.43	**-1006.37**	**-954.41**	-846.87	**-992.87**
Akaike Information Criterion	N	-2229.00	-2137.44	-1637.82	-2091.89	-2299.01	-2407.83	-1898.34	-1873.69	-1657.69	-1949.17
	ST	-2282.08	-2180.61	-1673.92	-2163.49	-2364.39	-2462.75	-2006.23	-1901.70	-1684.65	-1978.31
	HST	**-2282.11**	**-2180.73**	-1673.97	**-2163.50**	**-2364.41**	**-2462.76**	**-2006.27**	**-1901.71**	**-1684.70**	**-1978.47**
	SGT	-2278.18	-2177.97	**-1676.91**	-2159.57	-2361.59	-2458.86	-2002.75	-1898.82	-1683.75	-1975.75
Schwartz Bayesian Criterion	N	1110.27	1064.49	814.94	1041.71	1145.27	1199.79	944.94	932.86	824.61	970.35
	ST	1134.69	1083.96	831.01	1075.39	1175.84	1225.19	996.76	944.88	835.97	982.80
	HST	**1134.70**	**1084.01**	**831.03**	**1075.40**	**1175.85**	**1225.19**	**996.79**	**944.89**	**836.00**	**982.89**
	SGT	1128.50	1078.40	828.53	1069.20	1170.21	1219.11	990.79	939.46	831.29	977.29
Normal Distribution	LR Statistic	55.2	46.5	45.1	73.7	68.6	57.0	110.4	31.1	32.1	32.6
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	0.1	1.4	7.0	0.1	1.2	0.1	0.5	1.1	3.1	1.4
	P value	0.9521	0.5081	0.0304	0.9599	0.5505	0.9476	0.7726	0.5706	0.2120	0.4867
Skewed T Distribution	LR Statistic	0.1	1.2	6.9	0.1	1.2	0.1	0.5	1.1	3.0	1.3
	P value	0.7836	0.2661	0.0084	0.7903	0.2775	0.7468	0.4922	0.2918	0.0811	0.2590

Note: Table 66 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each DSE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 66 (Cont.). Goodness of Fit of Probability Density Models on Weekly Data of the Developed Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel A. High Quarterly volatility regime										
		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK
-Log Likelihood	N	-924.161	-759.551	-762.841	-955.750	-972.447	-856.454	-1043.914	-882.795	-1083.560
	ST	-937.318	-780.361	-782.375	-989.708	-1002.474	-866.574	-1083.843	-904.772	-1108.792
	HST	-937.440	-780.376	-782.432	-989.712	-1002.501	-866.577	-1083.847	-904.777	-1108.806
	SGT	**-938.995**	**-780.623**	**-782.810**	**-990.178**	**-1003.390**	**-866.584**	**-1084.904**	**-905.695**	**-1109.345**
Akaike Information Criterion	N	-1844.321	-1515.102	-1521.681	-1907.499	-1940.894	-1708.908	-2083.829	-1761.589	-2163.120
	ST	-1868.636	-1554.723	-1558.750	-1973.416	-1998.947	-1727.147	-2161.686	-1803.545	-2211.583
	HST	**-1868.879**	**-1554.752**	**-1558.864**	**-1973.424**	**-1999.001**	**-1727.154**	**-2161.694**	**-1803.555**	**-2211.611**
	SGT	-1867.990	-1551.245	-1555.620	-1970.356	-1996.781	-1723.168	-2159.808	-1801.389	-2208.689
Schwartz Bayesian Criterion	N	917.926	753.449	756.800	949.515	966.212	850.522	1037.680	876.791	1077.326
	ST	927.966	771.207	773.315	980.356	993.122	857.675	1074.491	895.767	1099.440
	HST	**928.088**	**771.222**	**773.372**	**980.361**	**993.149**	**857.678**	**1074.495**	**895.771**	**1099.454**
	SGT	923.409	765.366	767.709	974.592	987.804	851.753	1069.318	890.685	1093.759
Normal Distribution	LR Statistic	29.67	42.14	39.94	68.86	61.89	20.26	81.98	45.80	51.57
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	3.35	0.52	0.87	0.94	1.83	0.02	2.12	1.84	1.11
	P value	0.1869	0.7701	0.6472	0.6247	0.3998	0.9898	0.3460	0.3976	0.5752
Skewed T Distribution	LR Statistic	3.11	0.49	0.76	0.93	1.78	0.01	2.11	1.83	1.08
	P value	0.0778	0.4824	0.3847	0.3344	0.1822	0.9057	0.1459	0.1755	0.2991

Note: Table 66 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each DSE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 66 (Cont.). Goodness of Fit of Probability Density Models on Weekly Data of the Developed Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel B. Low Quarterly volatility regime											
-	-	Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
-Log Likelihood	N	-1019.181	-1061.505	-742.504	-989.563	-1042.392	-1050.767	-869.303	-793.447	-856.675	-954.559
	ST	-1027.945	-1062.863	-766.280	-996.058	-1051.591	-1059.157	-871.404	-844.488	-871.305	-959.560
	HST	-1028.044	-1063.217	-766.409	-996.139	**-1051.624**	-1059.269	-871.615	-844.489	-871.335	-959.643
	SGT	**-1028.095**	**-1063.988**	**-766.424**	**-997.001**	-1051.624	**-1059.314**	**-871.650**	**-846.686**	**-871.341**	**-959.768**
Akaike Information Criterion	N	-2034.363	-2119.010	-1481.008	-1975.127	-2080.784	-2097.534	-1734.605	-1582.895	-1709.350	-1905.119
	ST	-2049.891	-2119.727	-1526.561	-1986.115	-2097.182	-2112.313	-1736.807	-1682.975	-1736.609	-1913.120
	HST	**-2050.089**	**-2120.435**	**-1526.818**	**-1986.278**	**-2097.248**	**-2112.538**	**-1737.230**	-1682.978	**-1736.670**	**-1913.286**
	SGT	-2046.190	-2117.975	-1522.849	-1984.001	-2093.248	-2108.629	-1733.299	**-1683.372**	-1732.683	-1909.536
Schwartz Bayesian Criterion	N	1013.252	**1055.576**	736.540	983.634	1036.462	1044.837	**863.373**	787.484	850.745	948.630
	ST	1019.051	1053.969	757.335	987.163	1042.697	1050.262	862.509	835.542	862.410	950.665
	HST	**1019.150**	1054.323	**757.464**	**987.245**	**1042.730**	**1050.375**	862.721	**835.544**	**862.440**	**950.749**
	SGT	1013.271	1049.164	751.516	982.177	1036.800	1044.490	856.826	831.777	856.517	944.944
Normal Distribution	LR Statistic	17.83	4.96	47.84	14.87	18.46	17.10	4.69	106.48	29.33	10.42
	P value	0.0005	0.1744	0.0000	0.0019	0.0004	0.0007	0.1956	0.0000	0.0000	0.0153
Student's T Distribution	LR Statistic	0.30	2.25	0.29	1.89	0.07	0.32	0.49	4.40	0.07	0.42
	P value	0.8610	0.3249	0.8657	0.3895	0.9675	0.8542	0.7819	0.1110	0.9640	0.8118
Skewed T Distribution	LR Statistic	0.10	1.54	0.03	1.72	0.00	0.09	0.07	4.39	0.01	0.25
	P value	0.7505	0.2145	0.8607	0.1893	1.0000	0.7630	0.7923	0.0361	0.9090	0.6169

Note: Table 66 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each DSE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 66 (Cont.). Goodness of fit of Probability Density Models on Weekly Data of the Developed Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel B. Low Quarterly volatility regime										
		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK
-Log Likelihood	N	-919.969	-667.248	-1013.659	-932.057	-986.935	-840.134	-1015.407	-752.380	-1042.108
	ST	-924.099	-685.335	-1045.361	-940.875	-988.106	-875.746	-1019.919	-776.434	-1045.234
	HST	-924.162	-685.513	-1045.364	-940.964	-988.230	-875.755	-1019.956	-776.584	-1045.296
	SGT	**-925.177**	**-685.521**	**-1048.322**	**-941.461**	**-988.232**	**-876.553**	**-1020.071**	**-776.776**	**-1046.739**
Akaike Information Criterion	N	-1835.938	-1330.495	-2023.318	-1860.114	-1969.870	-1676.267	-2026.814	-1500.760	-2080.216
	ST	-1842.198	-1364.669	-2084.722	-1875.751	-1970.213	-1745.492	-2033.838	-1546.868	-2084.467
	HST	**-1842.323**	**-1365.026**	-2084.727	**-1875.927**	**-1970.460**	**-1745.510**	**-2033.913**	**-1547.168**	**-2084.592**
	SGT	-1840.354	-1361.042	**-2086.643**	-1872.921	-1966.464	-1743.106	-2030.142	-1543.553	-2083.479
Schwartz Bayesian Criterion	N	914.039	661.313	1007.515	926.128	**981.005**	834.096	1009.477	746.450	1036.179
	ST	915.205	676.432	1036.145	931.981	979.212	866.689	1011.025	767.540	1036.339
	HST	**915.267**	**676.611**	**1036.147**	**932.069**	979.335	**866.698**	**1011.062**	**767.690**	**1036.402**
	SGT	910.353	670.684	1032.961	926.637	973.408	861.458	1005.247	761.952	1031.915
Normal Distribution	LR Statistic	10.42	36.55	69.33	18.81	2.59	72.84	9.33	48.79	9.26
	P value	0.0153	0.0000	0.0000	0.0003	0.4585	0.0000	0.0252	0.0000	0.0260
Student's T Distribution	LR Statistic	2.16	0.37	5.92	1.17	0.25	1.61	0.30	0.68	3.01
	P value	0.3402	0.8301	0.0518	0.5569	0.8819	0.4463	0.8592	0.7101	0.2218
Skewed T Distribution	LR Statistic	2.03	0.02	5.92	0.99	0.00	1.60	0.23	0.39	2.89
	P value	0.1541	0.9003	0.0150	0.3188	0.9475	0.2064	0.6323	0.5349	0.0893

Note: Table 66 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each DSE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 67. Goodness of Fit of Probability Density Models on Weekly Data of the Emerging Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel A. High Quarterly volatility regime											
-	-	South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
-Log Likelihood	N	-1046.51	-1091.64	-895.72	-885.18	-979.25	-1171.93	-995.43	-707.48	-958.69	-998.08
	ST	-1059.92	-1123.81	-909.48	-929.17	-1026.56	-1221.89	-1037.15	-780.65	-966.64	-1030.31
	HST	-1059.94	-1123.81	-909.48	-929.31	-1026.78	-1222.00	-1037.16	-781.13	-966.82	-1030.31
	SGT	**-1059.98**	**-1124.72**	**-911.15**	**-930.75**	**-1026.78**	**-1223.28**	**-1038.15**	**-783.55**	**-968.63**	**-1030.61**
Akaike Information Criterion	N	-2089.01	-2179.28	-1787.44	-1766.35	-1954.49	-2339.85	-1986.87	-1410.96	-1913.39	-1992.16
	ST	-2113.85	-2241.62	-1812.95	-1852.34	-2047.11	-2437.78	-2068.31	-1555.30	-1927.28	-2054.63
	HST	**-2113.89**	**-2241.63**	**-1812.96**	**-1852.62**	**-2047.56**	**-2438.00**	**-2068.31**	-1556.26	**-1927.63**	**-2054.63**
	SGT	-2109.96	-2239.45	-1812.31	-1851.51	-2043.56	-2436.56	-2066.31	**-1557.10**	-1927.26	-2051.22
Schwartz Bayesian Criterion	N	1040.27	1085.64	889.57	878.94	973.01	1165.69	989.20	701.51	952.46	991.84
	ST	1050.57	1114.81	900.24	919.82	1017.20	1212.54	1027.80	771.69	957.29	1020.96
	HST	**1050.59**	**1114.81**	**900.25**	**919.96**	**1017.43**	**1212.65**	**1027.80**	**772.17**	**957.46**	**1020.96**
	SGT	1044.39	1109.71	895.77	915.17	1011.20	1207.69	1022.57	768.62	953.04	1015.02
Normal Distribution	LR Statistic	26.94	66.17	30.86	91.15	95.07	102.70	85.44	152.15	19.87	65.06
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000
Student's T Distribution	LR Statistic	0.11	1.82	3.35	3.16	0.45	2.78	2.00	5.81	3.98	0.59
	P value	0.9455	0.4022	0.1869	0.2056	0.7974	0.2496	0.3685	0.0548	0.1369	0.7447
Skewed T Distribution	LR Statistic	0.07	1.82	3.34	2.89	0.00	2.55	2.00	4.84	3.63	0.59
	P value	0.7886	0.1775	0.0675	0.0890	0.9614	0.1100	0.1577	0.0278	0.0568	0.4426

Note: Table 67 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each ESE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 67 (Cont.). Goodness of Fit of Probability Density Models on Weekly Data of the Emerging Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel A. High Quarterly volatility regime										
		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
-Log Likelihood	N	-946.04	-752.34	-899.69	-776.14	-740.62	-929.02	-951.26	-1008.68	-805.02
	ST	-995.91	-827.59	-968.32	-796.47	-757.53	-948.54	-984.83	-1043.38	-893.76
	HST	-995.92	-827.64	-968.37	-796.48	-757.56	-948.54	-984.84	-1043.38	-893.91
	SGT	**-996.86**	**-828.12**	**-972.01**	**-798.10**	**-757.90**	**-948.68**	**-985.03**	**-1043.79**	**-894.23**
Akaike Information Criterion	N	-1888.09	-1500.68	-1795.37	-1548.28	-1477.24	-1854.05	-1898.52	-2013.37	-1606.03
	ST	-1985.81	-1649.18	-1930.64	-1586.94	-1509.06	-1891.07	-1963.66	-2080.75	-1781.52
	HST	**-1985.85**	**-1649.28**	-1930.74	**-1586.95**	**-1509.11**	**-1891.07**	**-1963.67**	**-2080.75**	**-1781.82**
	SGT	-1983.73	-1646.25	**-1934.02**	-1586.20	-1505.81	-1887.36	-1960.05	-2077.59	-1778.46
Schwartz Bayesian Criterion	N	939.81	746.10	893.45	769.90	734.39	923.05	945.19	1002.45	798.89
	ST	986.55	818.24	958.97	787.12	748.18	939.58	975.73	1034.02	884.57
	HST	**986.57**	**818.29**	**959.02**	**787.13**	**748.20**	**939.58**	**975.73**	**1034.02**	**884.73**
	SGT	981.28	812.54	956.42	782.52	742.32	933.75	969.86	1028.21	878.93
Normal Distribution	LR Statistic	101.6402	151.5718	144.6475	43.9260	34.5613	39.3133	67.5344	70.2202	178.4296
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	1.9159	1.0668	7.3779	3.2610	0.7458	0.2872	0.3971	0.8366	0.9461
	P value	0.3837	0.5866	0.0250	0.1958	0.6887	0.8662	0.8199	0.6581	0.6231
Skewed T Distribution	LR Statistic	1.8795	0.9717	7.2772	3.2481	0.6936	0.2862	0.3791	0.8364	0.6452
	P value	0.1704	0.3242	0.0070	0.0715	0.4049	0.5927	0.5381	0.3604	0.4218

Note: Table 67 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each ESE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 67 (Cont.) Goodness of Fit of Probability Density Models onn Weekly Data of the Emerging Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel B. Low Quarterly volatility regime											
-	-	South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
-Log Likelihood	N	-954.120	-834.761	-780.130	-782.792	-802.212	-1032.208	-824.821	-981.052	-906.989	-805.930
	ST	-955.207	-886.107	-804.725	-795.151	-827.696	-1049.991	-843.294	-1029.132	-923.349	-823.882
	HST	-955.325	-886.354	-804.751	-795.350	-827.696	-1049.992	-843.294	-1029.207	-923.349	-823.894
	SGT	**-955.833**	**-887.577**	**-804.874**	**-796.740**	**-827.843**	**-1050.278**	**-843.430**	**-1031.322**	**-924.170**	**-823.903**
Akaike Information Criterion	N	-1904.241	-1665.523	-1556.260	-1561.584	-1600.424	-2060.416	-1645.643	-1958.104	-1809.978	-1607.860
	ST	-1904.414	-1766.214	-1603.451	-1584.301	-1649.392	-2093.983	-1680.587	-2052.265	-1840.697	-1641.764
	HST	**-1904.650**	**-1766.708**	**-1603.502**	**-1584.701**	**-1649.393**	**-2093.984**	**-1680.588**	-2052.415	**-1840.697**	**-1641.788**
	SGT	-1901.665	-1765.155	-1599.749	-1583.481	-1645.686	-2090.555	-1676.860	**-2052.644**	-1838.340	-1637.807
Schwartz Bayesian Criterion	N	**948.191**	828.832	774.102	776.863	796.282	1026.278	818.892	974.849	901.060	800.000
	ST	946.313	877.213	795.683	786.256	818.802	1041.097	834.399	1019.829	914.454	814.987
	HST	946.431	**877.459**	**795.709**	**786.456**	**818.802**	**1041.098**	**834.400**	**1019.904**	**914.454**	**815.000**
	SGT	941.01	872.75	789.80	781.92	813.02	1035.45	828.61	1015.82	909.35	809.08
Normal Distribution	LR Statistic	3.4243	105.6320	49.4886	27.8967	51.2628	36.1396	37.2171	100.5408	34.3622	35.9470
	P value	0.3307	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	1.2510	2.9402	0.2980	3.1795	0.2944	0.5726	0.2726	4.3795	1.6432	0.0431
	P value	0.5350	0.2299	0.8616	0.2040	0.8631	0.7510	0.8726	0.1119	0.4397	0.9787
Skewed T Distribution	LR Statistic	1.0153	2.4470	0.2467	2.7801	0.2939	0.5708	0.2717	4.2295	1.6431	0.0186
	P value	0.3136	0.1178	0.6194	0.0954	0.5878	0.4499	0.6022	0.0397	0.1999	0.8915

Note: Table 67 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each ESE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 67 (Cont.). Goodness of fit of Probability Density Models on Weekly Data of the Emerging Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
Panel B. Low Quarterly volatility regime										
-Log Likelihood	N	-835.22	-725.69	-742.10	-699.71	-682.30	-1348.68	-674.92	-878.36	-910.67
	ST	-839.75	-731.43	-803.46	-706.93	-689.16	-1356.55	-734.99	-891.57	-921.77
	HST	-839.75	-731.54	-803.56	-707.15	-689.17	-1356.80	-735.22	-891.59	-921.78
	SGT	**-840.11**	**-732.30**	**-804.09**	**-707.64**	**-690.23**	**-1359.56**	**-735.23**	**-891.66**	**-922.12**
Akaike Information Criterion	N	-1666.44	-1447.39	-1480.19	-1395.43	-1360.60	-2693.37	-1345.84	-1752.71	-1817.33
	ST	-1673.49	-1456.86	-1600.93	-1407.86	-1372.32	-2707.09	-1463.98	-1777.14	-1837.53
	HST	**-1673.51**	**-1457.07**	**-1601.12**	**-1408.30**	**-1372.34**	-2707.60	**-1464.44**	**-1777.19**	**-1837.57**
	SGT	-1670.21	-1454.59	-1598.19	-1405.27	-1370.46	**-2709.11**	-1460.45	-1773.32	-1834.23
Schwartz Bayesian Criterion	N	829.29	719.76	736.17	693.78	676.37	1342.48	668.99	872.43	904.60
	ST	830.85	722.53	794.57	698.03	680.27	1347.24	726.10	882.68	912.67
	HST	**830.86**	**722.64**	**794.66**	**698.25**	**680.28**	**1347.50**	**726.33**	**882.70**	**912.69**
	SGT	825.28	717.47	789.27	692.81	675.40	1344.05	720.40	876.84	906.96
Normal Distribution	LR Statistic	9.7695	13.2045	123.9927	15.8445	15.8530	21.7461	120.6124	26.6141	22.8980
	P value	0.0206	0.0042	0.0000	0.0012	0.0012	0.0001	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	0.7198	1.7351	1.2584	1.4178	2.1322	6.0229	0.4700	0.1825	0.7012
	P value	0.6977	0.4200	0.5330	0.4922	0.3443	0.0492	0.7906	0.9128	0.7043
Skewed T Distribution	LR Statistic	0.7075	1.5196	1.0683	0.9760	2.1158	5.5135	0.0072	0.1351	0.6639
	P value	0.4003	0.2177	0.3013	0.3232	0.1458	0.0189	0.9322	0.7132	0.4152

Note: Table 67 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each ESE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 70. Normality Test Results of the Developed Stock Exchanges (Weekly Data)

Panel A. High Quarterly Skewness Regime											
		Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
Jaque Bera Test	Test Statistic	85.59	303.54	4.08	398.71	15.32	386.60	23.83	1562.21	116.11	133.00
	P Value	0.0000	0.0000	0.1303	0.0000	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4734	0.4697	0.4683	0.4707	0.4783	0.4781	0.4665	0.4677	0.4521	0.4614
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		Germany	Greece	Italy	Ireland	NL	Portugal	Switzerland	Sweden	UK	
Jaque Bera Test	Test Statistic	232.00	266.09	92.88	172.46	350.11	95.68	615.18	84.23	214.88	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Kolmogorov–Smirnov Normality test	Test Statistic	0.4608	0.4572	0.4561	0.4697	0.4631	0.4703	0.4690	0.4601	0.4683	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Panel B. Low Quarterly Skewness Regime											
		Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
Jaque Bera Test	Test Statistic	1165.98	738.43	919.76	446.11	984.95	241.49	956.96	112.13	276.19	307.57
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4685	0.4710	0.4574	0.4633	0.4693	0.4781	0.4609	0.4710	0.4537	0.4666
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK	
Jaque Bera Test	Test Statistic	143.86	80.77	519.72	766.71	909.91	492.40	432.46	691.49	778.85	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Kolmogorov–Smirnov Normality test	Test Statistic	0.4657	0.4488	0.4605	0.4636	0.4636	0.4673	0.4694	0.4640	0.4703	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	

Note: Tables 70 demonstrates the normality of the distributions of weekly returns of the bull and bear subsamples (Panel A for bull market and Panel B for bear market). The test statistics values and the associated p values are presented of Jaque Bera Test and Kolmogorov–Smirnov Normality Test are presented. The results of Table 13 indicate that the normality of the distributions of daily returns is rejected for every DSE for both with high quarterly skewness regime and low quarterly skewness regime. The data source is DataStream.

Table 71. Normality Test Results of the Emerging Stock Exchanges (Weekly Data)

Panel A. High Quarterly Skewness Regime											
		South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
Jaque Bera Test	Test Statistic	23.54	676.82	24.76	270.51	117.16	576.56	135.63	264.56	43.90	286.35
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4722	0.4709	0.4585	0.4655	0.4596	0.4726	0.4672	0.4674	0.4636	0.4646
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru	
Jaque Bera Test	Test Statistic	19.27	376.86	1639.92	83.01	88.48	14.91	210.19	136.14	133.73	
	P Value	0.0001	0.0000	0.0000	0.0000	0.0000	0.0006	0.0000	0.0000	0.0000	
Kolmogorov–Smirnov Normality test	Test Statistic	0.4648	0.4525	0.4553	0.4378	0.4400	0.4769	0.4628	0.4630	0.4688	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Panel B. Low Quarterly Skewness Regime											
		South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
Jaque Bera Test	Test Statistic	236.28	861.56	375.72	509.34	845.38	927.79	671.89	848.44	138.83	465.47
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kolmogorov–Smirnov Normality test	Test Statistic	0.4627	0.4684	0.4570	0.4570	0.4586	0.4744	0.4598	0.4552	0.4606	0.4597
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru	
Jaque Bera Test	Test Statistic	2406.61	1784.10	476.24	68.86	236.21	567.16	8606.18	402.13	2540.12	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Kolmogorov–Smirnov Normality test	Test Statistic	0.4558	0.4414	0.4471	0.4469	0.4487	0.4721	0.4608	0.4593	0.4512	
	P Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	

Note: Tables 71 demonstrates the normality of the distributions of weekly returns of the bull and bear subsamples (Panel A for bull market and Panel B for bear market). The test statistics values and the associated p values are presented of Jaque Bera Test and Kolmogorov–Smirnov Normality Test are presented. The results of Table 13 indicate that the normality of the distributions of daily returns is rejected for every ESE for both with high quarterly skewness regime and low quarterly skewness regime. The data source is DataStream.

Table 72. Probability Density Models and Parameters of the Developed Stock Exchanges (Weekly Data)

Panel A. High Quarterly Skewness Regime

		Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
N	σ	0.0219	0.0247	0.0299	0.0246	0.0190	0.0159	0.0271	0.0313	0.0424	0.0316
ST	ν	5.0084	4.5644	16.3872	5.2053	11.1155	4.9979	5.6732	2.9643	4.2208	4.5704
	σ	0.0222	0.0246	0.0300	0.0245	0.0190	0.0158	0.0275	0.0324	0.0435	0.0320
HST	ν	5.0823	4.5783	17.2525	5.2034	11.4771	4.9815	5.8231	2.9002	4.2306	4.5797
	λ	-0.0085	-0.0128	-0.0179	-0.0008	-0.0151	0.0028	-0.0156	0.0229	-0.0052	-0.0003
	σ	0.0221	0.0246	0.0299	0.0245	0.0190	0.0158	0.0274	0.0329	0.0435	0.0320
SGT	ν	4.7338	3.8778	9.9160	4.8215	16.7941	3.9914	279.8469	2.7882	9.8898	4.9455
	λ	-0.0078	-0.0156	-0.0186	-0.0010	-0.0153	0.0054	-0.0134	0.0233	-0.0044	-0.0006
	k	2.0851	2.3272	2.2708	2.1064	1.8470	2.3963	1.3520	2.1070	1.3911	1.8974
	σ	0.0222	0.0249	0.0300	0.0245	0.0189	0.0160	0.0270	0.0336	0.0425	0.0319

		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK
N	σ	0.0356	0.0429	0.0339	0.0292	0.0309	0.0266	0.0280	0.0313	0.0244
ST	ν	5.3212	3.9745	5.1977	4.2006	3.9812	4.0035	3.3696	3.8486	4.2951
	σ	0.0354	0.0435	0.0340	0.0300	0.0313	0.0274	0.0287	0.0327	0.0248
HST	ν	5.3652	4.0184	5.2305	4.1765	3.9555	4.0391	3.3393	3.8544	4.2851
	λ	-0.0074	-0.0102	-0.0071	0.0026	0.0064	-0.0070	0.0120	-0.0003	0.0050
	σ	0.0354	0.0434	0.0340	0.0301	0.0313	0.0274	0.0288	0.0327	0.0248
SGT	ν	3.5671	3.3514	3.3807	8.1104	3.2890	5.0048	2.5352	8.9393	10.2219
	λ	-0.0068	-0.0106	-0.0097	-0.0054	0.0080	-0.0084	0.0159	-0.0022	0.0006
	k	2.9483	2.3587	2.9757	1.4933	2.4252	1.7546	2.9705	1.3964	1.3521
	σ	0.0363	0.0446	0.0353	0.0293	0.0322	0.0269	0.0330	0.0314	0.0243

Note: Tables 72 demonstrates the estimated values of the parameters for different probability density models for each DSE. The estimated values of parameters of the same probability density models are heterogenous for different stock exchanges and for different market regimes. The data source is DataStream.

Table 72 (Cont.). Probability Density Models and Parameters of the Developed Stock Exchanges (Weekly Data)

Panel B. Low Quarterly Skewness Regime

Model	Parameter	Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
N	σ	0.0244	0.0242	0.0347	0.0277	0.0240	0.0165	0.0374	0.0241	0.0365	0.0281
ST	ν	3.3837	3.4751	3.6645	2.7051	2.8949	5.3121	2.9298	4.5695	3.1017	4.2921
	σ	0.0253	0.0251	0.0349	0.0325	0.0262	0.0165	0.0403	0.0245	0.0400	0.0284
HST	ν	3.3730	3.4742	3.6773	2.6962	2.8611	5.4232	2.8680	4.6581	3.0874	4.3985
	λ	0.0019	-0.0003	-0.0031	0.0047	0.0132	-0.0160	0.0185	-0.0118	0.0057	-0.0216
	σ	0.0253	0.0252	0.0349	0.0326	0.0264	0.0165	0.0409	0.0245	0.0401	0.0282
SGT	ν	3.6164	4.2926	2.8818	3.3934	2.8288	4.2670	2.6515	4.1313	3.4503	4.0517
	λ	0.0023	0.0010	-0.0053	0.0058	0.0133	-0.0182	0.0192	-0.0112	0.0048	-0.0228
	k	1.8848	1.7084	2.6639	1.6207	2.0221	2.3772	2.2119	2.1713	1.8268	2.1345
	σ	0.0250	0.0245	0.0372	0.0295	0.0266	0.0166	0.0430	0.0247	0.0389	0.0284

Model	Parameter	Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK
N	σ	0.0305	0.0431	0.0337	0.0332	0.0285	0.0309	0.0240	0.0292	0.0239
ST	ν	3.9599	5.4151	3.0485	2.9992	3.6573	3.8239	3.9580	3.5815	3.2203
	σ	0.0315	0.0434	0.0371	0.0355	0.0287	0.0315	0.0243	0.0302	0.0253
HST	ν	3.9975	5.4322	3.0637	2.9753	3.6910	3.8198	3.9740	3.6318	3.2302
	λ	-0.0066	-0.0091	-0.0075	0.0091	-0.0100	0.0004	-0.0035	-0.0128	-0.0037
	σ	0.0314	0.0433	0.0370	0.0356	0.0286	0.0315	0.0243	0.0301	0.0253
SGT	ν	4.5688	5.1458	6.9653	2.4207	3.0241	5.4007	4.0035	5.7714	3.4975
	λ	-0.0068	-0.0093	-0.0024	0.0109	-0.0127	-0.0003	-0.0035	-0.0090	-0.0039
	k	1.8314	2.0616	1.2780	2.6659	2.5216	1.5854	1.9871	1.5076	1.8683
	σ	0.0310	0.0434	0.0338	0.0420	0.0299	0.0308	0.0243	0.0291	0.0248

Note: Tables 72 demonstrates the estimated values of the parameters for different probability density models for each DSE. The estimated values of parameters of the same probability density models are heterogenous for different stock exchanges and for different market regimes. The data source is DataStream.

Table 73 Emerging Stock Exchanges Probability Density Models and Parameters (Weekly Data)

Panel A. High Quarterly Skewness Regime

		South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
N	σ	0.0247	0.0199	0.0329	0.0351	0.0306	0.0208	0.0278	0.0258	0.0315	0.0306
ST	ν	12.9775	2.3986	4.8442	3.7745	5.3971	3.2326	6.0994	3.5694	4.4217	5.6409
	σ	0.0246	0.0269	0.0338	0.0361	0.0308	0.0222	0.0278	0.0268	0.0326	0.0304
HST	ν	13.3742	2.3839	4.8637	3.7263	5.3985	3.2308	6.1388	3.5600	4.5101	5.6650
	λ	-0.0116	0.0224	-0.0054	0.0110	0.0013	0.0042	-0.0157	0.0071	-0.0101	-0.0073
	σ	0.0246	0.0273	0.0338	0.0363	0.0308	0.0222	0.0277	0.0269	0.0325	0.0304
SGT	ν	8.5857	5.6068	23.6941	2.8343	5.7642	4.3566	7.0519	7.6023	1529.3537	5.1105
	λ	-0.0108	0.0147	-0.0056	0.0167	0.0008	0.0029	-0.0145	0.0050	-0.0125	-0.0078
	k	2.3167	1.1256	1.3910	2.6817	1.9271	1.6137	1.8705	1.3142	1.2128	2.1400
	σ	0.0246	0.0201	0.0329	0.0392	0.0307	0.0211	0.0277	0.0258	0.0315	0.0305

		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
N	σ	0.0286	0.0413	0.0356	0.0480	0.0527	0.0174	0.0286	0.0282	0.0250
ST	ν	10.0211	5.1300	2.5511	3.6096	6.3236	6.8904	4.0864	3.8614	4.9164
	σ	0.0286	0.0412	0.0429	0.0509	0.0527	0.0175	0.0290	0.0293	0.0252
HST	ν	10.0235	5.1446	2.5505	3.6163	6.3110	6.8858	4.0839	3.8788	4.8919
	λ	-0.0007	-0.0085	0.0015	-0.0060	-0.0078	0.0008	0.0109	-0.0050	0.0074
	σ	0.0286	0.0412	0.0430	0.0508	0.0527	0.0175	0.0290	0.0292	0.0252
SGT	ν	5.0844	5.4196	2.8916	4.2025	4.8890	8.4109	3.6732	5.3348	5.2391
	λ	0.0032	-0.0084	0.0026	-0.0051	-0.0098	0.0011	0.0122	-0.0041	0.0067
	k	2.7867	1.9383	1.7499	1.8148	2.3339	1.8630	2.1963	1.6503	1.9197
	σ	0.0289	0.0411	0.0393	0.0498	0.0530	0.0174	0.0293	0.0286	0.0251

Note: Tables 73 demonstrates the estimated values of the parameters for different probability density models for each ESE. The estimated values of parameters of the same probability density models are heterogenous for different stock exchanges and for different market regimes. The data source is DataStream.

Table 73 (Cont.).Emerging Stock Exchanges Probability Density Models and Parameters (Weekly Data)

Panel B. Low Quarterly Skewness Regime

		South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
N	σ	0.0288	0.0229	0.0393	0.0406	0.0349	0.0213	0.0348	0.0411	0.0313	0.0330
ST	ν	3.8126	2.6252	4.6273	3.4371	2.6835	2.9719	2.9797	2.5313	3.4163	3.7252
	σ	0.0297	0.0272	0.0394	0.0424	0.0402	0.0232	0.0381	0.0516	0.0336	0.0338
HST	ν	3.8127	2.6357	4.5994	3.4230	2.6320	2.9474	2.9546	2.4719	3.4122	3.7133
	λ	0.0004	0.0084	0.0053	0.0034	0.0304	0.0199	0.0180	0.0237	0.0021	0.0053
	σ	0.0297	0.0271	0.0395	0.0424	0.0411	0.0233	0.0384	0.0535	0.0336	0.0338
SGT	ν	6.7175	3.9537	4.6605	3.7278	2.3686	3.5745	4.3893	4.6087	56.6780	3.1684
	λ	-0.0016	0.0051	0.0052	0.0032	0.0313	0.0180	0.0135	0.0238	-0.0027	0.0062
	k	1.4617	1.4265	1.9832	1.8652	2.2946	1.6843	1.4837	1.2596	1.0860	2.3110
	σ	0.0288	0.0235	0.0394	0.0418	0.0469	0.0220	0.0354	0.0423	0.0312	0.0350

		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
N	σ	0.0377	0.0536	0.0411	0.0460	0.0475	0.0200	0.0370	0.0310	0.0426
ST	ν	3.4232	2.7220	2.3206	4.4940	4.9079	4.5243	3.0572	3.4282	2.9473
	σ	0.0378	0.0589	0.0611	0.0472	0.0475	0.0200	0.0373	0.0324	0.0457
HST	ν	3.4105	2.6916	2.3188	4.5723	4.9159	4.5724	3.0174	3.4259	2.9419
	λ	0.0058	0.0197	0.0254	-0.0119	-0.0018	-0.0070	0.0197	0.0017	0.0114
	σ	0.0378	0.0595	0.0612	0.0471	0.0475	0.0200	0.0376	0.0324	0.0458
SGT	ν	3.5000	2.2592	7.5066	5.0462	3.6857	3.0438	2.5250	3.3078	3.5637
	λ	0.0057	0.0219	0.0121	-0.0120	0.0008	-0.0059	0.0223	0.0016	0.0088
	k	1.9517	2.6768	1.0288	1.8925	2.5734	2.9879	2.5203	2.0640	1.6918
	σ	0.0376	0.0765	0.0417	0.0468	0.0485	0.0213	0.0423	0.0326	0.0433

Note: Tables 73 demonstrates the estimated values of the parameters for different probability density models for each ESE. The estimated values of parameters of the same probability density models are heterogenous for different stock exchanges and for different market regimes. The data source is DataStream.

Table 74. Goodness of Fit of Probability Density Models on Weekly Data of the Developed Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel A. High Quarterly Skewness Regime											
-	-	Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
-Log Likelihood	N	-1064.45	-1011.34	-647.72	-1012.62	-1128.23	-1029.10	-970.29	-668.83	-771.23	-901.56
	ST	-1079.18	-1038.54	-648.61	-1034.07	-1131.13	**-1049.98**	-978.42	-723.39	-792.06	-922.04
	HST	-1079.21	-1038.62	-648.74	-1034.08	-1131.25	-1049.99	-978.54	-723.55	**-792.07**	-922.04
	SGT	**-1079.22**	**-1038.81**	**-648.84**	**-1034.10**	**-1131.30**	-1050.22	**-979.66**	**-723.57**	-793.16	**-922.06**
Akaike Information Criterion	N	-2124.91	-2018.68	-1291.44	-2021.24	-2252.46	-2054.21	-1936.58	-1333.67	-1538.46	-1799.11
	ST	-2152.36	-2071.07	-1291.22	-2062.15	-2256.25	-2093.96	-1950.84	-1440.79	-1578.11	-1838.08
	HST	**-2152.42**	**-2071.23**	**-1291.49**	**-2062.15**	**-2256.51**	**-2093.97**	**-1951.08**	**-1441.11**	**-1578.14**	**-1838.08**
	SGT	-2148.45	-2067.61	-1287.68	-2058.20	-2252.61	-2090.44	-1949.33	-1437.13	-1576.31	-1834.11
Schwartz Bayesian Criterion	N	1058.36	1005.25	**641.98**	1006.52	**1122.14**	1023.17	964.19	663.04	765.14	895.46
	ST	1070.04	1029.40	640.01	1024.93	1121.99	1041.08	969.28	714.71	782.92	912.90
	HST	**1070.07**	**1029.48**	640.14	**1024.93**	1122.11	**1041.08**	**969.40**	**714.87**	**782.93**	**912.90**
	SGT	1063.99	1023.57	634.50	1018.87	1116.07	1035.38	964.43	709.09	777.92	906.82
Normal Distribution	LR Statistic	29.5	54.9	2.2	43.0	6.1	42.2	18.8	109.5	43.8	41.0
	P value	0.0000	0.0000	0.5232	0.0000	0.1048	0.0000	0.0003	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	0.1	0.5	0.5	0.1	0.4	0.5	2.5	0.3	2.2	0.0
	P value	0.9544	0.7627	0.7949	0.9747	0.8379	0.7870	0.2877	0.8408	0.3332	0.9835
Skewed T Distribution	LR Statistic	0.0	0.4	0.2	0.1	0.1	0.5	2.2	0.0	2.2	0.0
	P value	0.8688	0.5382	0.6591	0.8222	0.7537	0.4918	0.1339	0.8670	0.1405	0.8555

Note: Table 74 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each DSE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 74 (Cont.). Goodness of Fit of Probability Density Models on Weekly Data of the Developed Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel A. High Quarterly Skewness Regime										
		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK
-Log Likelihood	N	-849.384	-659.408	-693.875	-936.702	-911.913	-717.691	-955.611	-660.950	-1017.138
	ST	-869.426	-685.903	-707.544	-956.603	-944.064	-734.748	-1004.949	-676.486	-1040.473
	HST	-869.452	-685.945	-707.565	-956.606	-944.082	-734.764	-1005.011	-676.486	-1040.485
	SGT	**-870.413**	**-686.125**	**-708.282**	**-957.290**	**-944.273**	**-734.828**	**-1006.108**	**-677.480**	**-1041.908**
Akaike Information Criterion	N	-1694.769	-1314.817	-1383.749	-1869.404	-1819.826	-1431.381	-1907.223	-1317.899	-2030.275
	ST	-1732.851	-1365.807	-1409.089	-1907.206	-1882.128	-1463.496	-2003.899	-1346.972	-2074.947
	HST	**-1732.905**	**-1365.889**	**-1409.130**	**-1907.212**	**-1882.165**	**-1463.529**	**-2004.022**	**-1346.972**	**-2074.971**
	SGT	-1730.825	-1362.250	-1406.564	-1904.581	-1878.546	-1459.657	-2002.215	-1344.960	-2073.816
Schwartz Bayesian Criterion	N	843.291	653.466	688.008	930.608	905.820	711.907	949.518	655.172	1011.044
	ST	860.285	676.989	698.745	947.462	934.924	726.072	995.809	667.819	1031.333
	HST	**860.312**	**677.030**	**698.765**	**947.465**	**934.942**	**726.089**	**995.871**	**667.819**	**1031.345**
	SGT	855.179	671.268	693.616	942.056	929.039	720.369	990.874	663.036	1026.674
Normal Distribution	LR Statistic	42.06	53.43	28.81	41.18	64.72	34.28	100.99	33.06	49.54
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	1.97	0.44	1.47	1.37	0.42	0.16	2.32	1.99	2.87
	P value	0.3727	0.8014	0.4783	0.5028	0.8114	0.9229	0.3140	0.3700	0.2382
Skewed T Distribution	LR Statistic	1.92	0.36	1.43	1.37	0.38	0.13	2.19	1.99	2.85
	P value	0.1658	0.5482	0.2312	0.2420	0.5368	0.7205	0.1386	0.1585	0.0916

Note: Table 74 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each DSE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 74 (Cont.). Goodness of Fit of Probability Density Models on Weekly Data of the Developed Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel B. Low Quarterly Skewness Regime											
-	-	Canada	US	Japan	Singapore	Australia	New Zealand	Austria	Denmark	Finland	France
-Log Likelihood	N	-1015.958	-1019.624	-914.236	-959.543	-1022.769	-1223.880	-827.427	-1054.002	-837.991	-953.648
	ST	-1059.786	-1057.805	-961.872	-1012.469	-1082.007	-1242.886	-887.084	-1072.980	-874.734	-980.178
	HST	-1059.787	-1057.805	-961.876	-1012.478	-1082.080	-1243.019	-887.224	-1073.045	-874.748	-980.396
	SGT	**-1059.814**	**-1058.061**	**-962.531**	**-1012.749**	**-1082.081**	**-1243.281**	**-887.287**	**-1073.096**	**-874.788**	**-980.428**
Akaike Information Criterion	N	-2027.915	-2035.247	-1824.473	-1915.086	-2041.538	-2443.760	-1650.854	-2104.004	-1671.981	-1903.297
	ST	-2113.571	-2109.610	-1917.743	-2018.938	-2158.015	-2479.771	-1768.168	-2139.960	-1743.469	-1954.357
	HST	**-2113.575**	**-2109.611**	**-1917.751**	**-2018.956**	**-2158.160**	**-2480.037**	**-1768.448**	**-2140.090**	**-1743.496**	**-1954.793**
	SGT	-2109.627	-2106.123	-1915.062	-2015.498	-2154.162	-2476.561	-1764.574	-2136.191	-1739.576	-1950.856
Schwartz Bayesian Criterion	N	1009.864	1013.530	908.081	953.449	1016.675	1217.757	821.334	1047.877	831.897	947.555
	ST	1050.645	1048.665	952.639	1003.329	1072.867	1233.702	877.943	1063.793	865.594	971.038
	HST	**1050.647**	**1048.665**	**952.643**	**1003.338**	**1072.940**	**1233.835**	**878.084**	**1063.858**	**865.608**	**971.256**
	SGT	1044.580	1042.828	947.144	997.515	1066.847	1227.974	872.053	1057.784	859.554	965.194
Normal Distribution	LR Statistic	87.71	76.88	96.59	106.41	118.62	38.80	119.72	38.19	73.59	53.56
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	0.06	0.51	1.32	0.56	0.15	0.79	0.41	0.23	0.11	0.50
	P value	0.9724	0.7740	0.5173	0.7558	0.9291	0.6736	0.8160	0.8907	0.9477	0.7790
Skewed T Distribution	LR Statistic	0.05	0.51	1.31	0.54	0.00	0.52	0.13	0.10	0.08	0.06
	P value	0.8188	0.4741	0.2523	0.4617	0.9647	0.4691	0.7226	0.7510	0.7776	0.8011

Note: Table 74 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each DSE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 74 (Cont.). Goodness of fit of Probability Density Models on Weekly Data of the Developed Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel B. Low Quarterly Skewness Regime										
		Germany	Greece	Italy	Ireland	Netherlands	Portugal	Switzerland	Sweden	UK
-Log Likelihood	N	-918.134	-766.491	-1051.281	-880.462	-947.292	-968.909	-1023.443	-968.704	-1025.729
	ST	-941.745	-780.347	-1097.326	-937.199	-991.613	-1004.539	-1056.502	-1004.794	-1069.278
	HST	-941.765	-780.389	-1097.355	-937.233	-991.658	-1004.539	-1056.507	-1004.869	-1069.284
	SGT	**-941.818**	**-780.397**	**-1099.732**	**-937.686**	**-992.029**	**-1005.055**	**-1056.508**	**-1005.644**	**-1069.321**
Akaike Information Criterion	N	-1832.268	-1528.981	-2098.562	-1756.924	-1890.585	-1933.819	-2042.886	-1933.409	-2047.458
	ST	-1877.490	-1554.695	-2188.651	-1868.399	-1977.227	-2003.078	-2107.004	-2003.588	-2132.556
	HST	**-1877.530**	**-1554.779**	-2188.709	**-1868.467**	**-1977.315**	**-2003.078**	**-2107.015**	**-2003.738**	**-2132.569**
	SGT	-1873.635	-1550.794	**-2189.464**	-1865.373	-1974.058	-2000.109	-2103.016	-2001.288	-2128.643
Schwartz Bayesian Criterion	N	912.040	760.395	1045.002	874.369	941.199	962.754	1017.350	962.577	1019.635
	ST	932.605	771.204	1087.908	928.059	982.473	995.307	1047.361	995.604	1060.138
	HST	**932.624**	**771.246**	**1087.937**	**928.093**	**982.517**	**995.307**	**1047.367**	**995.679**	**1060.144**
	SGT	926.584	765.158	1084.036	922.453	976.795	989.668	1041.274	990.327	1054.087
Normal Distribution	LR Statistic	47.37	27.81	96.90	114.45	89.47	72.29	66.13	73.88	87.18
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	0.14	0.10	4.81	0.97	0.83	1.03	0.01	1.70	0.09
	P value	0.9302	0.9515	0.0901	0.6145	0.6600	0.5970	0.9940	0.4275	0.9576
Skewed T Distribution	LR Statistic	0.11	0.02	4.76	0.91	0.74	1.03	0.00	1.55	0.07
	P value	0.7455	0.9004	0.0292	0.3412	0.3888	0.3098	0.9783	0.2133	0.7858

Note: Table 74 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each DSE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 75. Goodness of Fit of Probability Density Models on Weekly Data of the Emerging Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel A. High Quarterly Skewness Regime											
-	-	South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
-Log Likelihood	N	-1011.70	-807.12	-805.98	-855.64	-915.52	-1087.01	-958.97	-727.36	-903.83	-915.69
	ST	-1014.69	-854.43	-815.96	-885.95	-930.67	-1127.21	-971.99	-752.15	-915.85	-934.01
	HST	-1014.76	-854.58	-815.98	-886.00	-930.68	-1127.22	-972.11	-752.17	-915.90	-934.03
	SGT	**-1014.93**	**-856.36**	**-816.82**	**-886.41**	**-930.69**	**-1127.68**	**-972.15**	**-753.41**	**-918.88**	**-934.07**
Akaike Information Criterion	N	-2019.40	-1610.23	-1607.96	-1707.28	-1827.05	-2170.02	-1913.95	-1450.72	-1803.67	-1827.39
	ST	-2023.37	-1702.86	-1625.93	-1765.90	-1855.35	-2248.42	-1937.97	-1498.30	-1825.71	-1862.01
	HST	**-2023.53**	**-1703.16**	**-1625.96**	**-1766.01**	**-1855.35**	**-2248.44**	**-1938.23**	**-1498.33**	-1825.80	**-1862.07**
	SGT	-2019.86	-1702.72	-1623.63	-1762.82	-1851.37	-2245.37	-1934.31	-1496.81	**-1827.76**	-1858.14
Schwartz Bayesian Criterion	N	1005.61	801.34	799.98	849.55	909.43	1080.92	952.88	721.58	897.74	909.60
	ST	1005.55	845.76	806.96	876.81	921.53	1118.07	962.85	743.47	906.71	924.87
	HST	**1005.62**	**845.91**	**806.98**	**876.86**	**921.54**	**1118.08**	**962.97**	**743.49**	**906.76**	**924.89**
	SGT	999.70	841.91	801.81	871.17	915.45	1112.45	956.92	738.95	903.65	918.84
Normal Distribution	LR Statistic	6.46	98.48	21.68	61.54	30.33	81.35	26.36	52.09	30.10	36.75
	P value	0.0913	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	0.49	3.86	1.70	0.92	0.02	0.94	0.33	2.52	6.06	0.13
	P value	0.7823	0.1451	0.4267	0.6321	0.9878	0.6237	0.8466	0.2843	0.0484	0.9390
Skewed T Distribution	LR Statistic	0.33	3.56	1.68	0.81	0.02	0.93	0.08	2.48	5.97	0.07
	P value	0.5629	0.0592	0.1953	0.3687	0.8797	0.3343	0.7819	0.1152	0.0146	0.7903

Note: Table 75 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each ESE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 75 (Cont.). Goodness of Fit of Probability Density Models on Weekly Data of the Emerging Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel A. High Quarterly Skewness Regime										
		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
-Log Likelihood	N	-945.44	-783.04	-848.95	-716.75	-675.16	-855.81	-724.24	-952.04	-883.18
	ST	-949.72	-803.71	-919.22	-740.34	-687.05	-860.90	-746.54	-976.59	-898.92
	HST	-949.72	-803.75	-919.22	-740.36	-687.08	-860.90	-746.59	-976.60	-898.94
	SGT	**-950.51**	**-803.76**	**-919.37**	**-740.43**	**-687.30**	**-860.92**	**-746.65**	**-976.84**	**-898.96**
Akaike Information Criterion	N	-1886.89	-1562.08	-1693.91	-1429.49	-1346.33	-1707.62	-1444.47	-1900.07	-1762.35
	ST	-1893.44	-1601.43	-1832.43	-1474.68	-1368.09	-1715.79	-1487.08	-1947.18	-1791.84
	HST	**-1893.44**	**-1601.50**	**-1832.44**	**-1474.71**	**-1368.16**	**-1715.79**	**-1487.17**	**-1947.20**	**-1791.89**
	SGT	-1891.03	-1597.52	-1828.73	-1470.86	-1364.59	-1711.83	-1483.30	-1943.67	-1787.91
Schwartz Bayesian Criterion	N	939.35	776.94	842.86	710.65	669.07	850.02	718.41	945.94	877.21
	ST	940.58	794.57	910.08	731.20	677.91	852.22	737.80	967.45	889.97
	HST	**940.58**	**794.61**	**910.08**	**731.22**	**677.94**	**852.22**	**737.85**	**967.46**	**890.00**
	SGT	935.28	788.53	904.13	725.20	672.06	846.46	732.09	961.60	884.05
Normal Distribution	LR Statistic	10.1391	41.4449	140.8263	47.3677	24.2656	10.2186	44.8293	49.6037	31.5632
	P value	0.0174	0.0000	0.0000	0.0000	0.0000	0.0168	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	1.5869	0.0955	0.3008	0.1816	0.5020	0.0430	0.2215	0.4935	0.0776
	P value	0.4523	0.9534	0.8604	0.9132	0.7780	0.9787	0.8951	0.7813	0.9619
Skewed T Distribution	LR Statistic	1.5865	0.0217	0.2990	0.1494	0.4383	0.0424	0.1331	0.4706	0.0293
	P value	0.2078	0.8830	0.5845	0.6991	0.5079	0.8368	0.7153	0.4927	0.8641

Note: Table 75 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each ESE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Table 75 (Cont.) Goodness of Fit of Probability Density Models von Weekly Data of the Emerging Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel B. Low Quarterly Skewness Regime											
-	-	South Africa	Morocco	China	India	Pakistan	Malaysia	Philippines	Saudi Arabia	Taiwan	Thailand
-Log Likelihood	N	-943.555	-1080.516	-876.707	-791.226	-858.300	-1075.712	-859.282	-994.424	-906.234	-882.083
	ST	-971.582	-1142.318	-901.929	-828.868	-921.290	-1128.349	-906.516	-1067.736	-932.359	-917.447
	HST	-971.582	-1142.348	-901.944	-828.872	-921.674	-1128.517	-906.657	-1068.015	-932.361	-917.460
	SGT	**-972.340**	**-1143.128**	**-901.944**	**-828.913**	**-921.809**	**-1128.856**	**-907.339**	**-1070.372**	**-934.747**	**-917.666**
Akaike Information Criterion	N	-1883.110	-2157.033	-1749.414	-1578.452	-1712.599	-2147.425	-1714.565	-1984.847	-1808.467	-1760.166
	ST	-1937.163	-2278.636	-1797.859	-1651.735	-1836.580	-2250.699	-1807.031	-2129.471	-1858.718	-1828.894
	HST	**-1937.163**	**-2278.697**	**-1797.887**	**-1651.745**	**-1837.349**	**-2251.034**	**-1807.314**	-2130.029	-1858.722	**-1828.920**
	SGT	-1934.679	-2276.256	-1793.889	-1647.826	-1833.618	-2247.712	-1804.677	**-2130.744**	**-1859.493**	-1825.333
Schwartz Bayesian Criterion	N	937.462	1074.390	870.529	785.133	852.206	1069.619	853.189	988.094	900.140	875.990
	ST	962.441	1133.128	892.662	819.727	912.150	1119.209	897.375	1058.241	923.218	908.307
	HST	**962.441**	**1133.158**	**892.677**	**819.732**	**912.534**	**1119.376**	**897.517**	**1058.520**	**923.220**	**908.319**
	SGT	957.11	1127.81	886.50	813.68	906.58	1113.62	892.10	1054.55	919.51	902.43
Normal Distribution	LR Statistic	57.5687	125.2231	50.4743	75.3734	127.0190	106.2874	96.1126	151.8969	57.0261	71.1664
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	1.5162	1.6198	0.0299	0.0907	1.0387	1.0133	1.6462	5.2725	4.7755	0.4388
	P value	0.4686	0.4449	0.9851	0.9557	0.5949	0.6025	0.4391	0.0716	0.0918	0.8030
Skewed T Distribution	LR Statistic	1.5160	1.5591	0.0012	0.0809	0.2696	0.6784	1.3634	4.7148	4.7716	0.4133
	P value	0.2182	0.2118	0.9720	0.7761	0.6036	0.4101	0.2429	0.0299	0.0289	0.5203

Note: Table 75 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each ESE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

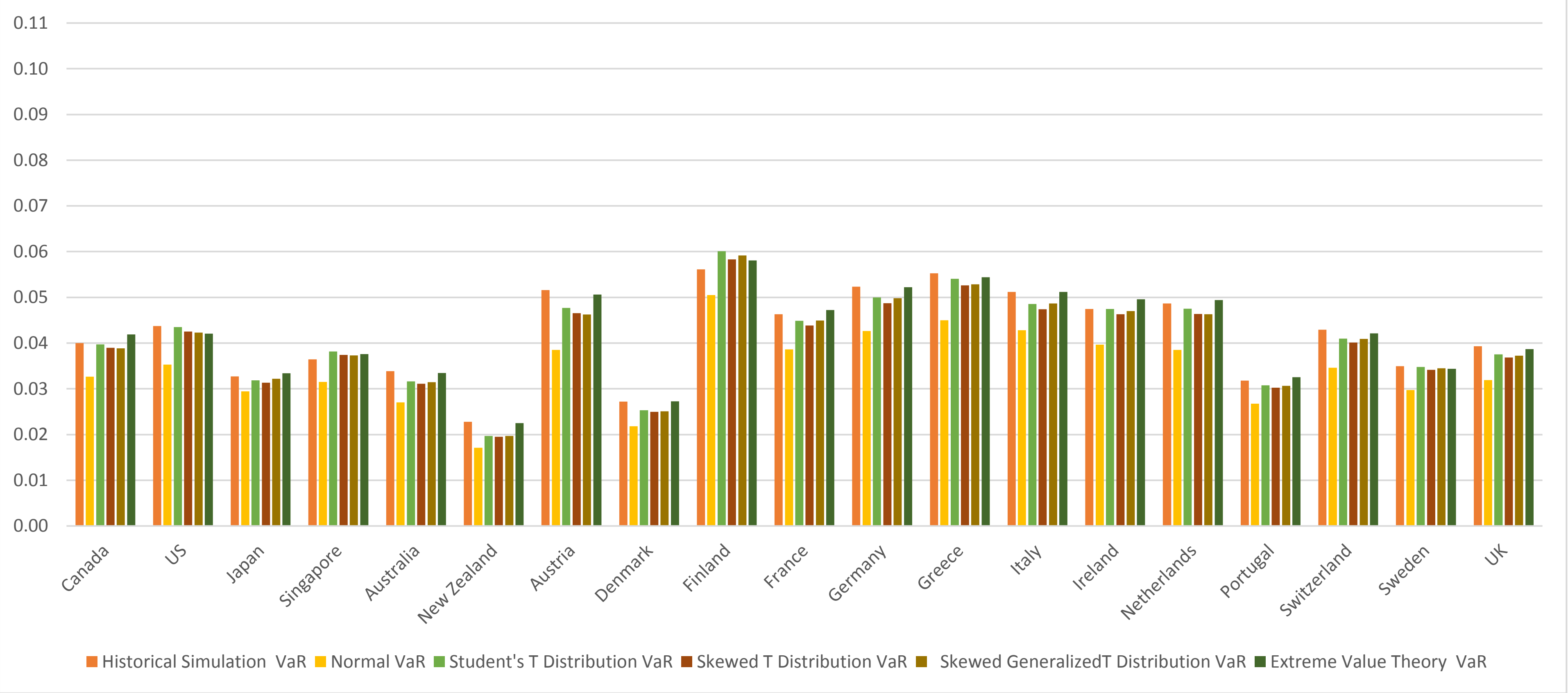
Table 75 (Cont.). Goodness of fit of Probability Density Models on Weekly Data of the Emerging Stock Exchanges (The most optimal value for Loglikelihood, AIC and SBC are in bold)

Panel B. Low Quarterly Skewness Regime										
		Hungary	Russia	Romania	Turkey	Argentina	Chile	Columbia	Mexico	Peru
-Log Likelihood	N	-823.44	-667.77	-784.89	-735.21	-721.13	-1397.24	-881.35	-910.58	-862.67
	ST	-880.31	-746.38	-842.76	-751.46	-743.16	-1431.37	-962.59	-948.39	-930.57
	HST	-880.33	-746.55	-843.01	-751.53	-743.16	-1431.39	-962.77	-948.39	-930.64
	SGT	**-880.33**	**-747.04**	**-847.35**	**-751.55**	**-743.56**	**-1432.77**	**-963.15**	**-948.40**	**-931.00**
Akaike Information Criterion	N	-1642.88	-1331.54	-1565.77	-1466.41	-1438.25	-2790.48	-1758.69	-1817.16	-1721.33
	ST	-1754.62	-1486.77	-1679.52	-1496.92	-1480.32	-2856.73	-1919.18	-1890.78	-1855.14
	HST	**-1754.65**	**-1487.10**	-1680.02	**-1497.05**	**-1480.32**	**-2856.79**	**-1919.53**	**-1890.78**	**-1855.27**
	SGT	-1750.67	-1484.07	**-1684.69**	-1493.09	-1477.13	-2855.54	-1916.30	-1886.80	-1852.00
Schwartz Bayesian Criterion	N	817.34	661.68	778.79	729.11	715.03	1390.91	875.20	904.48	856.46
	ST	871.17	737.24	833.62	742.32	734.02	1421.87	953.36	939.25	921.26
	HST	**871.19**	**737.41**	**833.87**	**742.39**	**734.02**	**1421.90**	**953.54**	**939.25**	**921.32**
	SGT	865.10	731.80	832.11	736.31	728.33	1416.95	947.77	933.17	915.48
Normal Distribution	LR Statistic	113.7903	158.5366	124.9191	32.6777	44.8752	71.0632	163.6067	75.6424	136.6623
	P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Student's T Distribution	LR Statistic	0.0430	1.3095	9.1718	0.1697	0.8087	2.8111	1.1207	0.0199	0.8540
	P value	0.9787	0.5196	0.0102	0.9186	0.6674	0.2452	0.5710	0.9901	0.6524
Skewed T Distribution	LR Statistic	0.0125	0.9795	8.6743	0.0363	0.8058	2.7526	0.7670	0.0175	0.7259
	P value	0.9110	0.3223	0.0032	0.8490	0.3694	0.0971	0.3811	0.8948	0.3942

Note: Table 75 presents the -LogL, AIC, SBC and the LR results (LR statistic and the associated p value) for each of the probability density model for each ESE. The optimal values of the test are highlighted in bold, indicating the best goodness-of-fit. The data source is DataStream.

Figure 63. Developed stock exchanges high quarterly volatility period daily VaRs

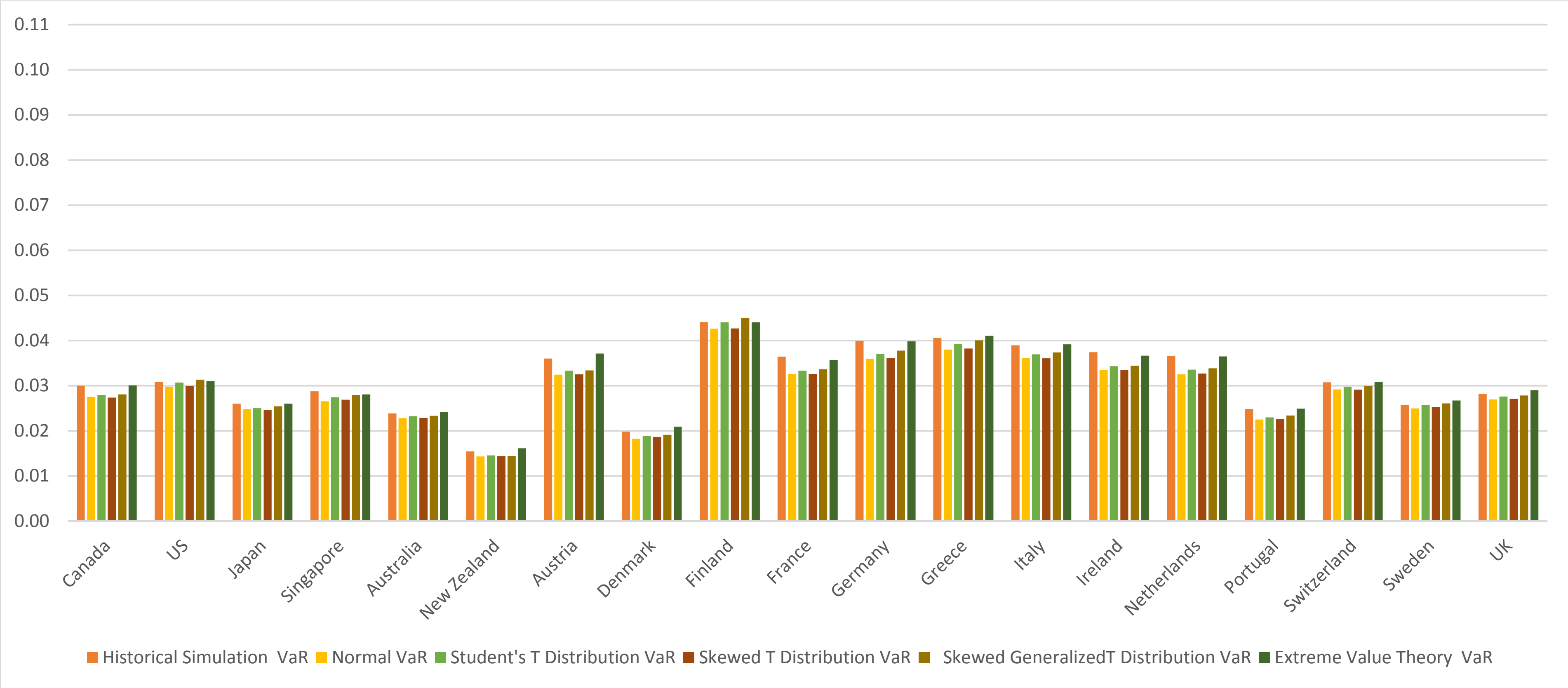
Panel A. 1% VaRs



Note: Figure 63 presents the developed stock exchanges high quarterly volatility period daily VaRs. The data source is DataStream.

Figure 63. Developed stock exchanges high quarterly volatility period daily VaRs

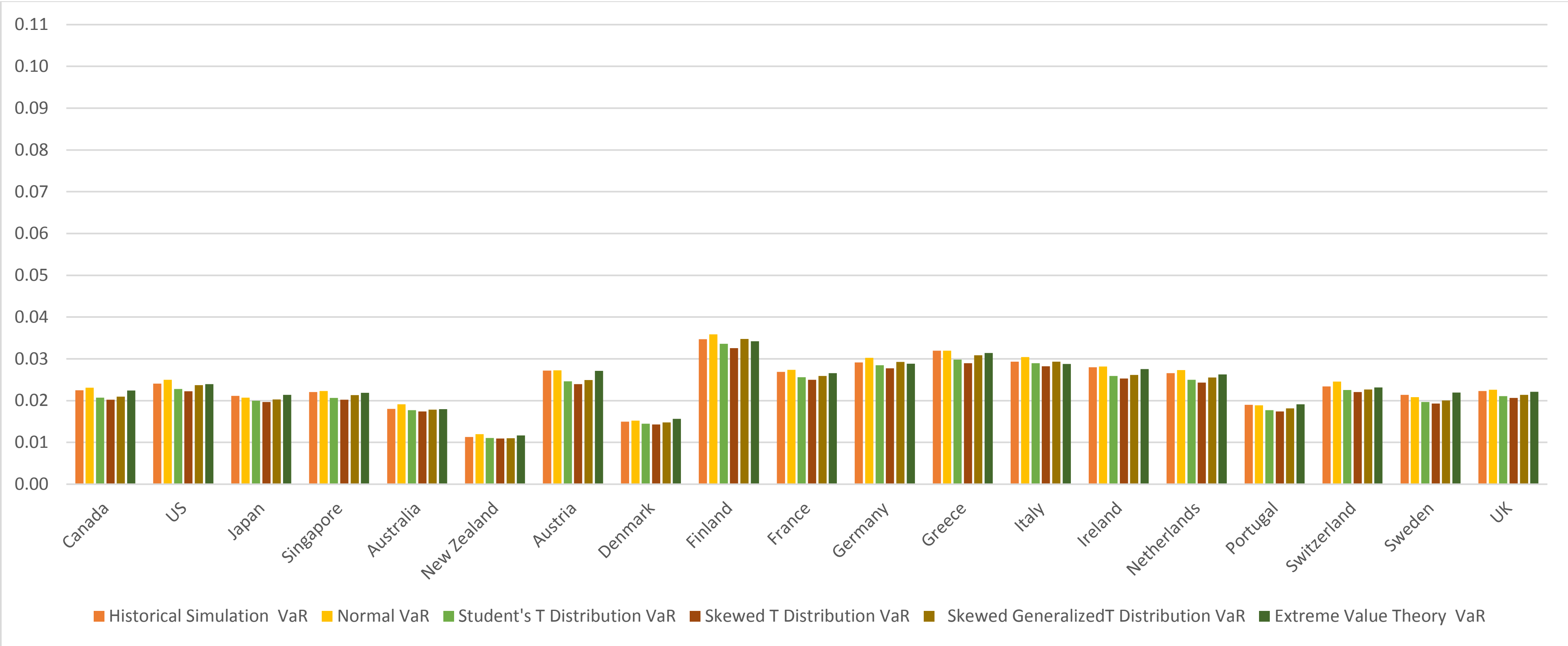
Panel B. 2.5% VaRs



Note: Figure 63 presents the developed stock exchanges high quarterly volatility period daily VaRs. The data source is DataStream.

Figure 63. Developed stock exchanges high quarterly volatility period daily VaRs

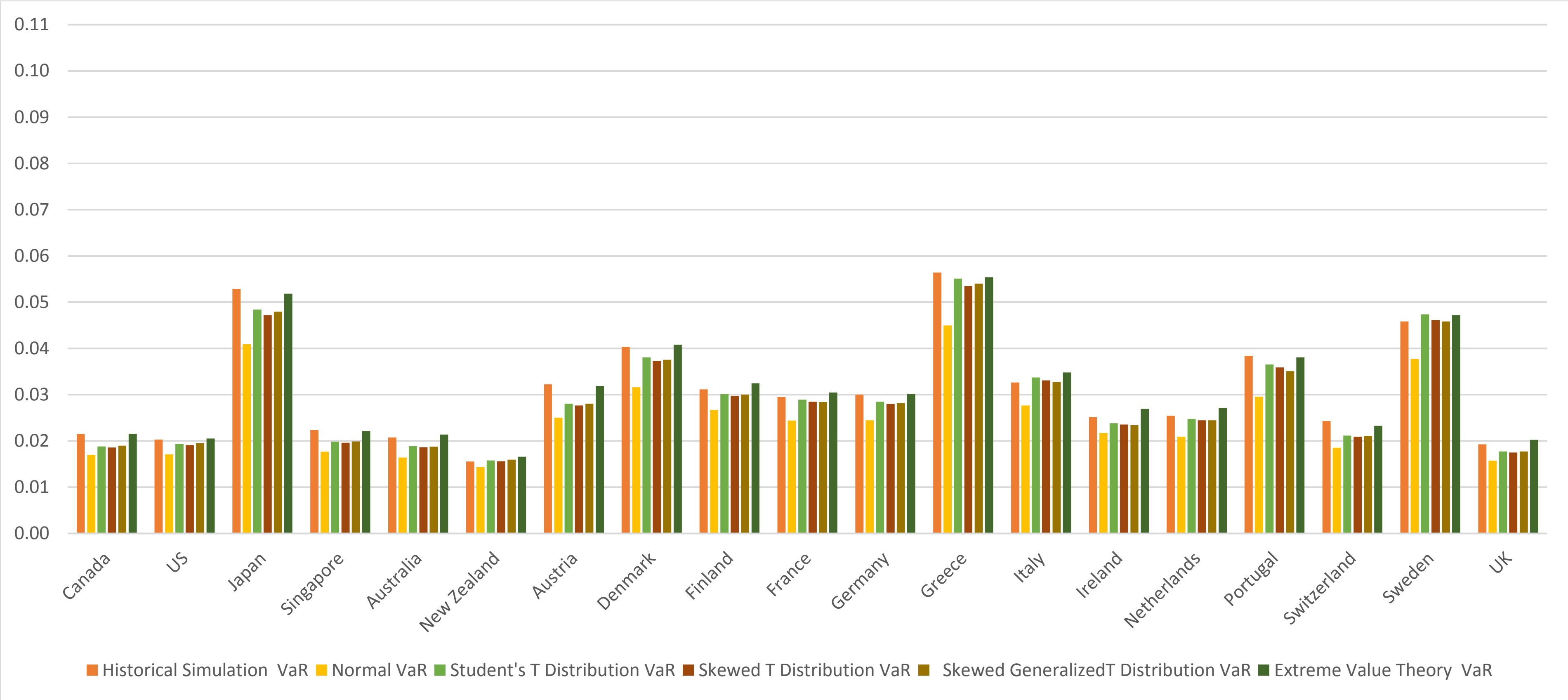
Panel C. 5% VaRs



Note: Figure 63 presents the developed stock exchanges high quarterly volatility period daily VaRs. The data source is DataStream.

Figure 64. Developed stock exchanges low quarterly volatility period daily VaRs

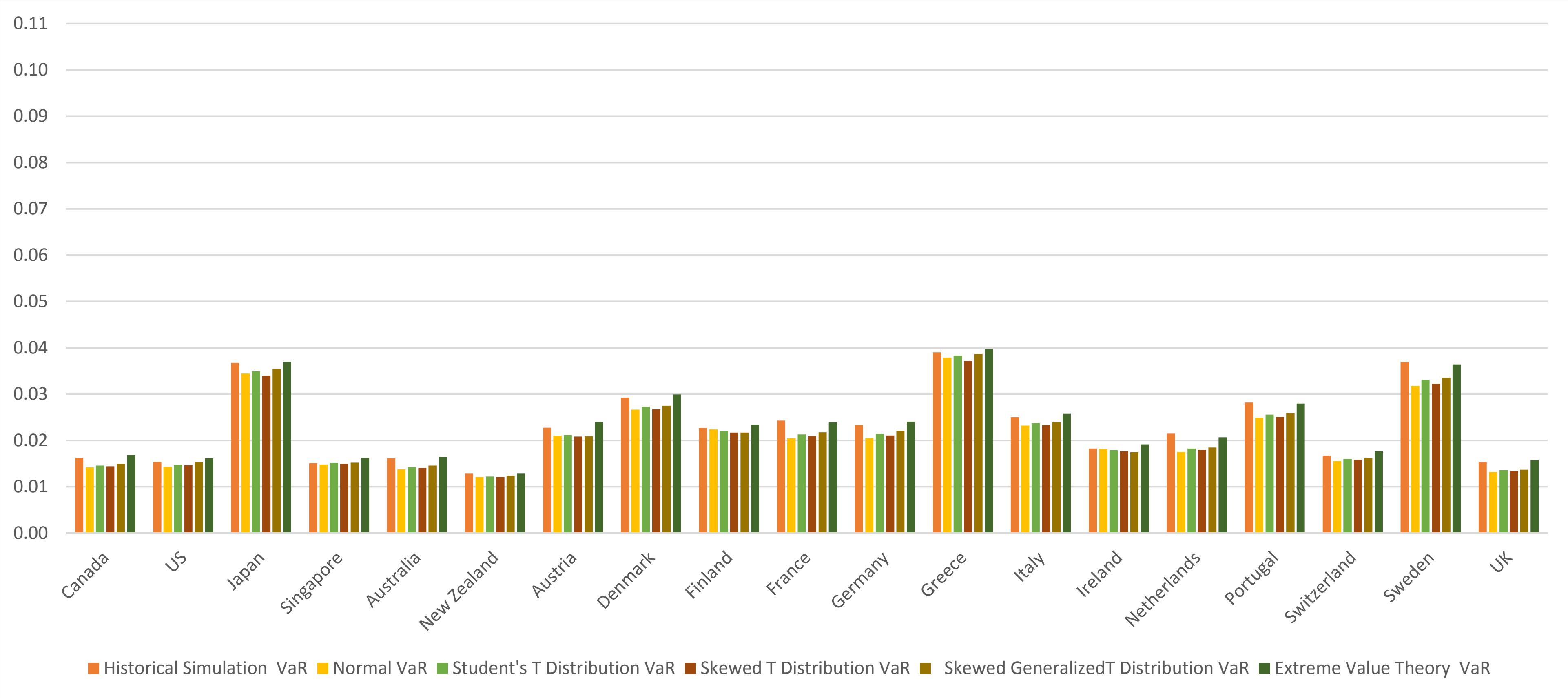
Panel A. 1% VaRs



Note: Figure 64 presents the developed stock exchanges low quarterly volatility period daily VaRs. The data source is DataStream.

Figure 64. Developed stock exchanges low quarterly volatility period daily VaRs

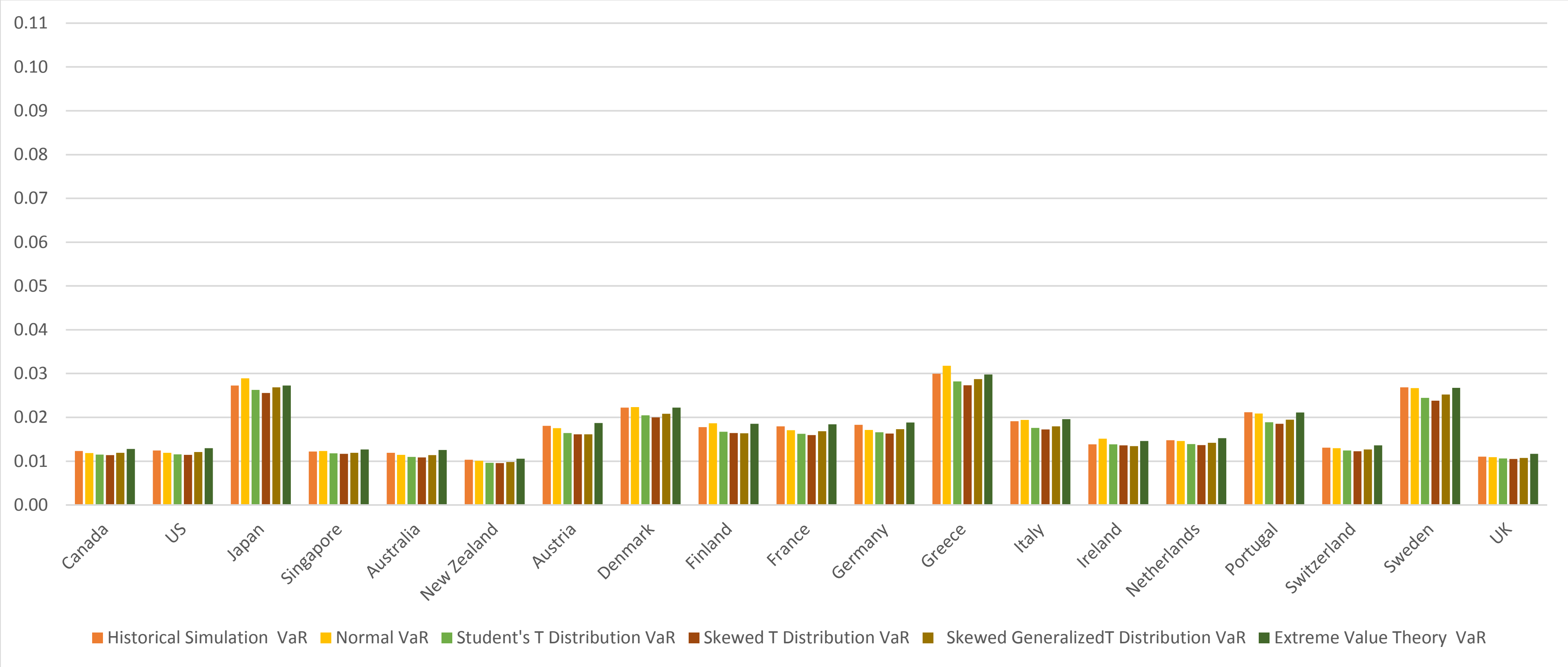
Panel B. 2.5% VaRs



Note: Figure 64 presents the developed stock exchanges low quarterly volatility period daily VaRs. The data source is DataStream.

Figure 64. Developed stock exchanges low quarterly volatility period daily VaRs

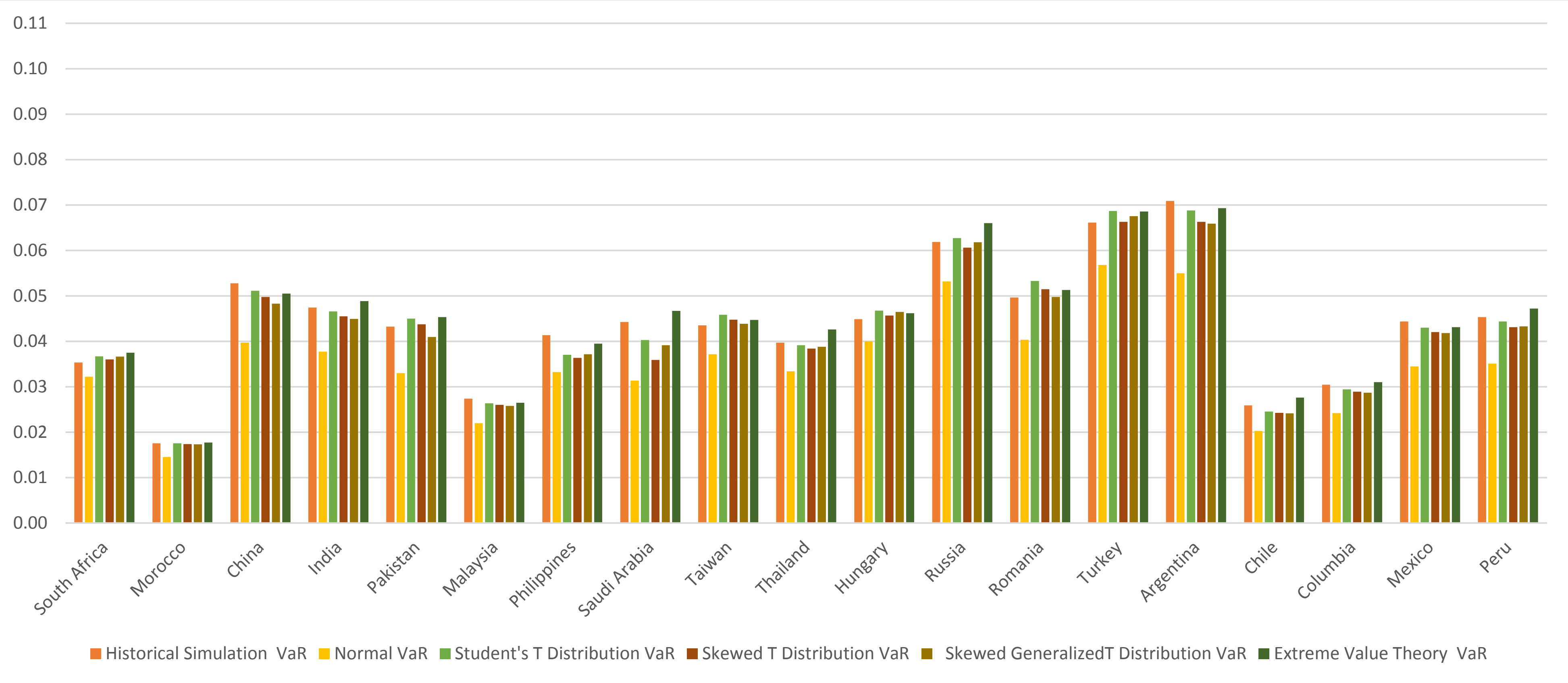
Panel C. 5% VaRs



Note: Figure 64 presents the developed stock exchanges low quarterly volatility period daily VaRs. The data source is DataStream.

Figure 65. Emerging stock exchanges high quarterly volatility period daily VaRs

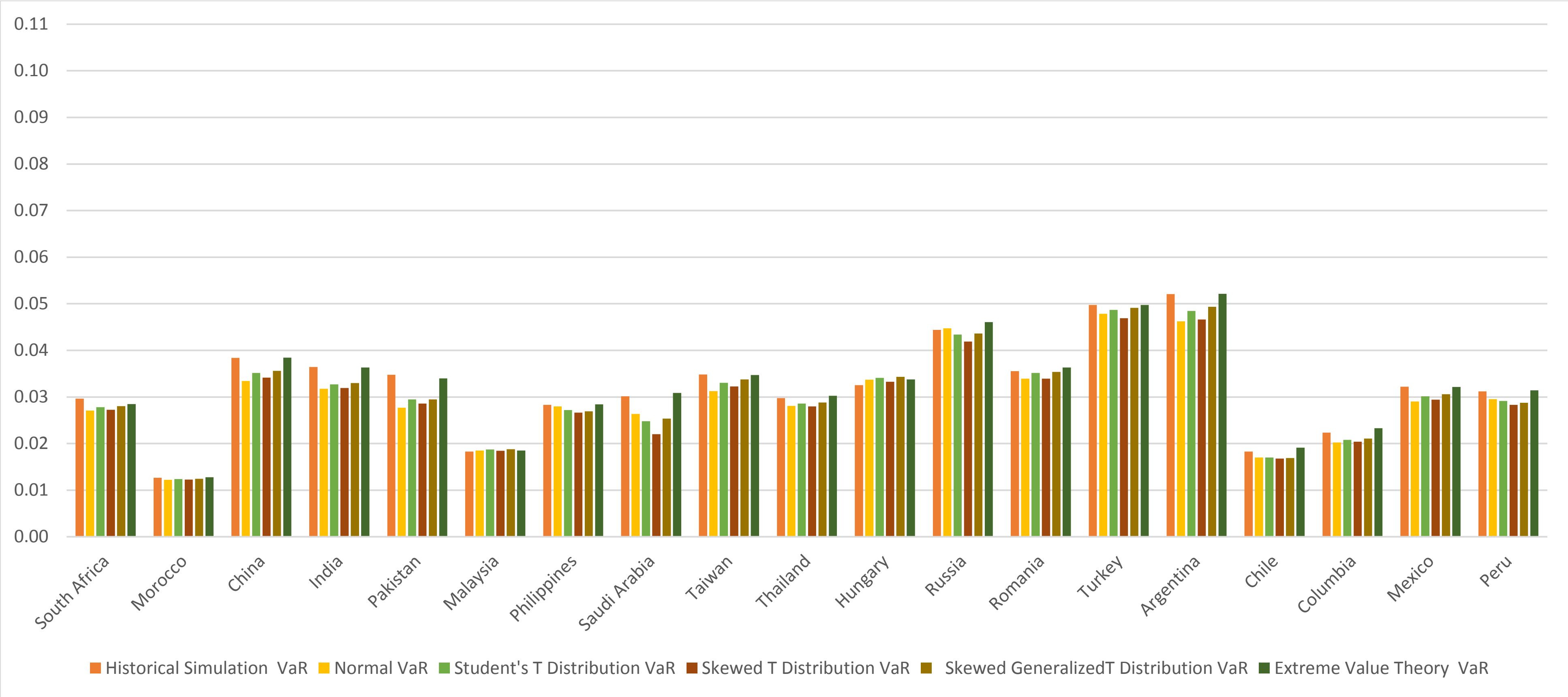
Panel A. 1% VaRs



Note: Figure 65 presents the emerging stock exchanges high quarterly volatility period daily VaRs. The data source is DataStream.

Figure 65. Emerging stock exchanges high quarterly volatility period daily VaRs

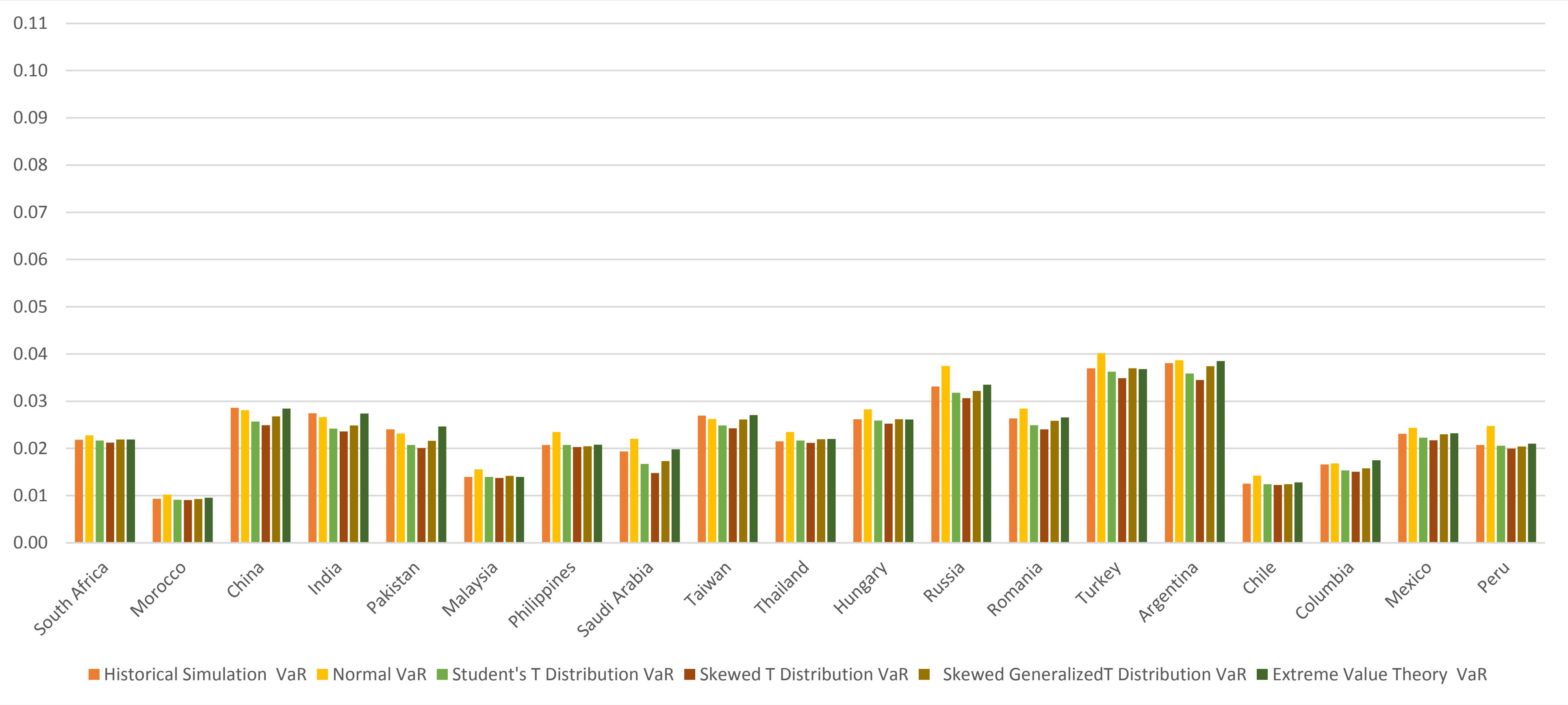
Panel B. 2.5% VaRs



Note: Figure 65 presents the emerging stock exchanges high quarterly volatility period daily VaRs. The data source is DataStream.

Figure 65. Emerging stock exchanges high quarterly volatility period daily VaRs

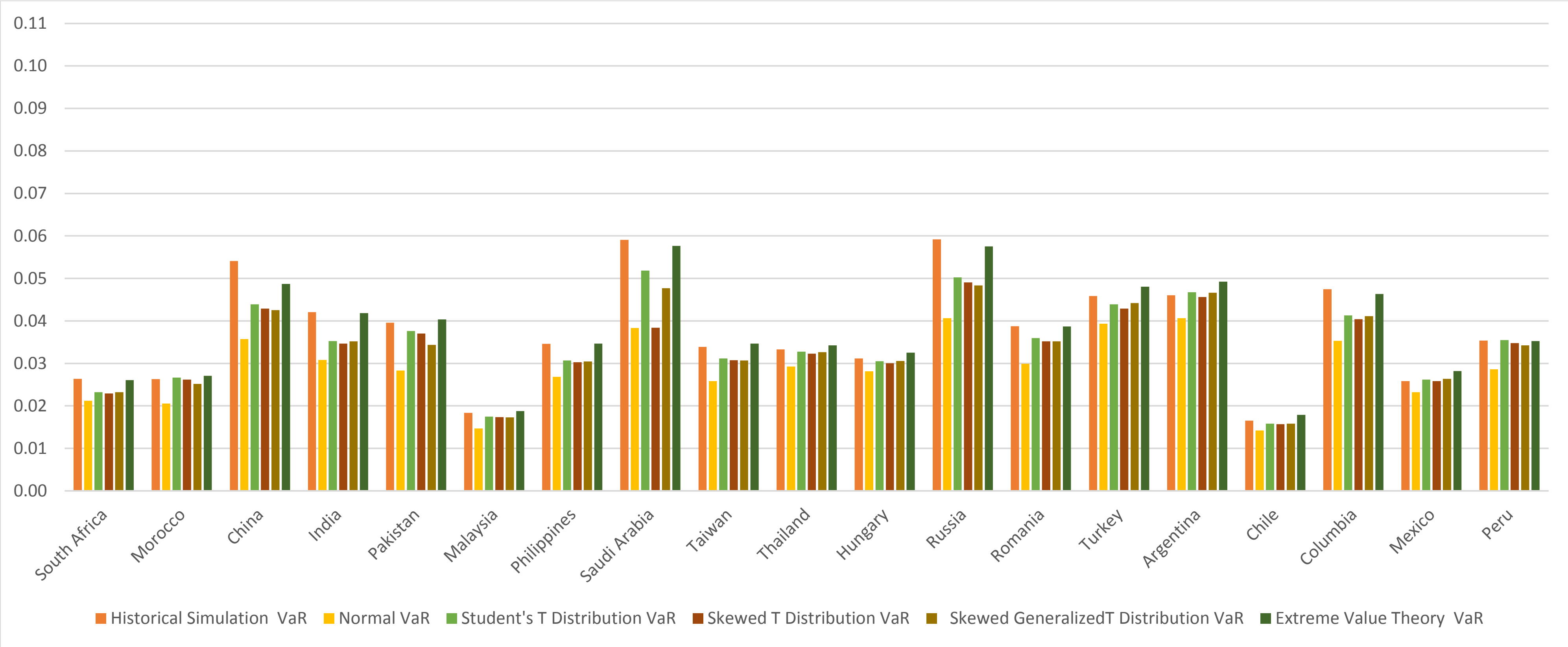
Panel C. 5% VaRs



Note: Figure 65 presents the emerging stock exchanges high quarterly volatility period daily VaRs. The data source is DataStream.

Figure 66. Emerging stock exchanges low quarterly volatility period daily VaRs

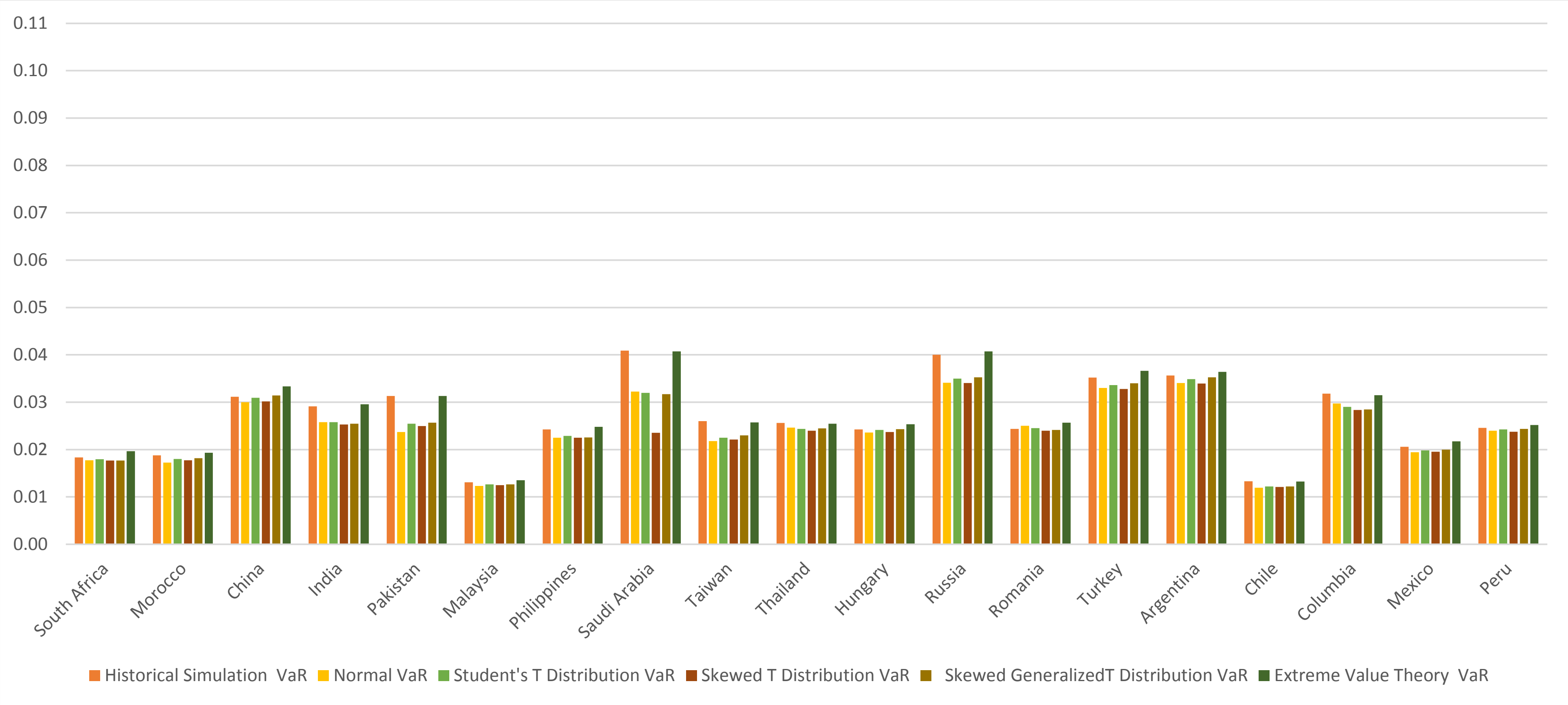
Panel A. 1% VaRs



Note: Figure 66 presents the emerging stock exchanges low quarterly volatility period daily VaRs. The data source is DataStream.

Figure 66. Emerging stock exchanges low quarterly volatility period daily VaRs

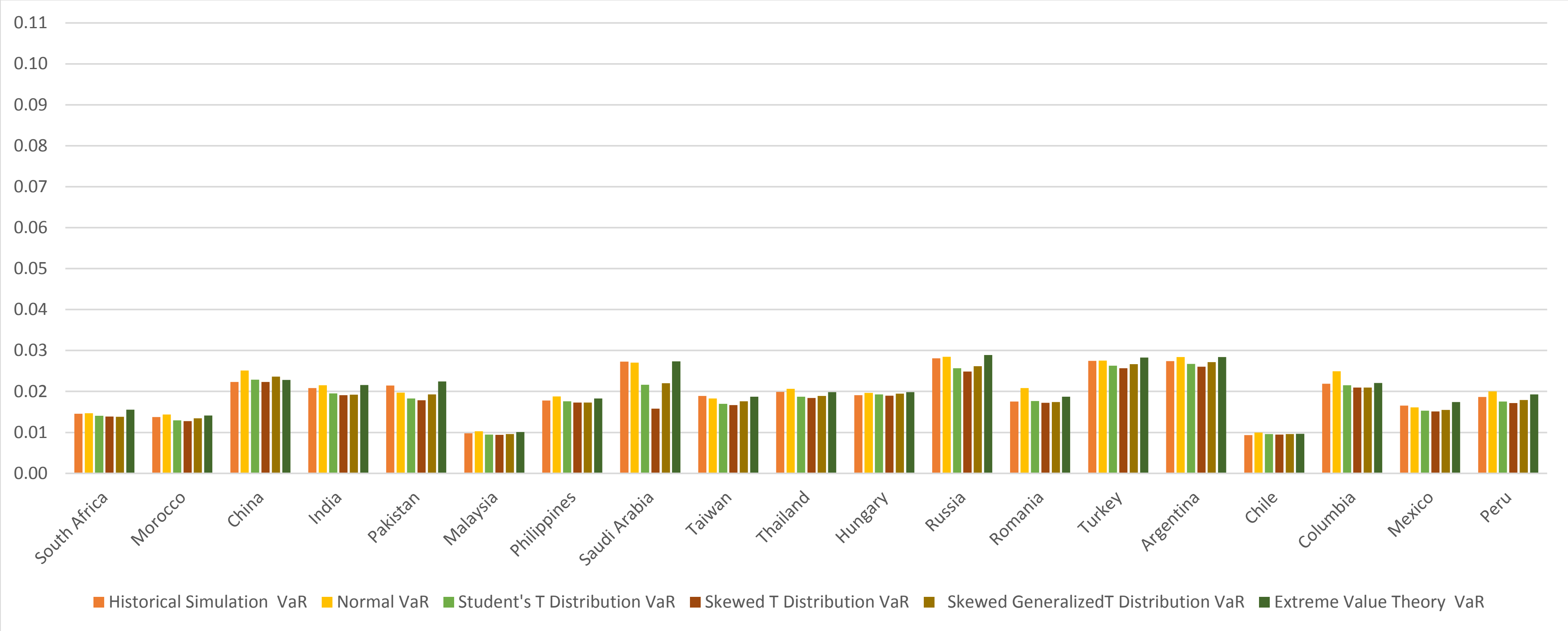
Panel B.   2.5% VaRs



Note: Figure 66 presents the emerging stock exchanges low quarterly volatility period daily VaRs. The data source is DataStream.

Figure 67. Emerging stock exchanges low quarterly volatility period daily VaRs

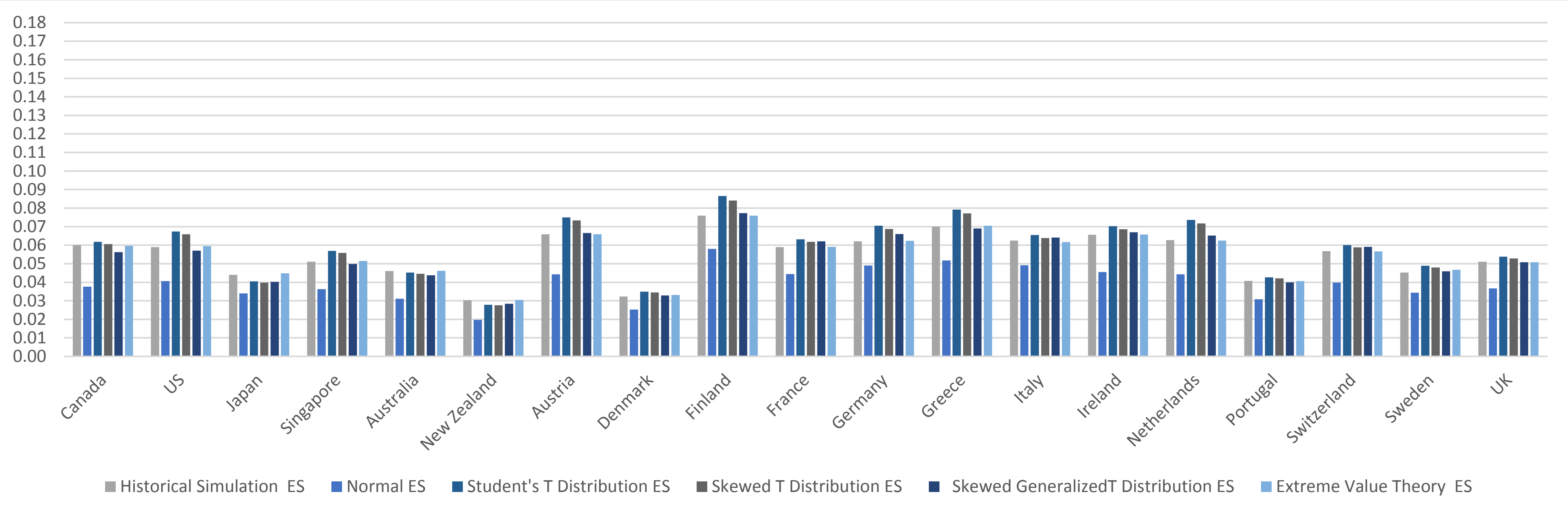
Panel C. 5% VaRs



Note: Figure 66 presents the emerging stock exchanges low quarterly volatility period daily VaRs. The data source is DataStream.

Figure 68. Developed stock exchanges high quarterly volatility period daily ESs

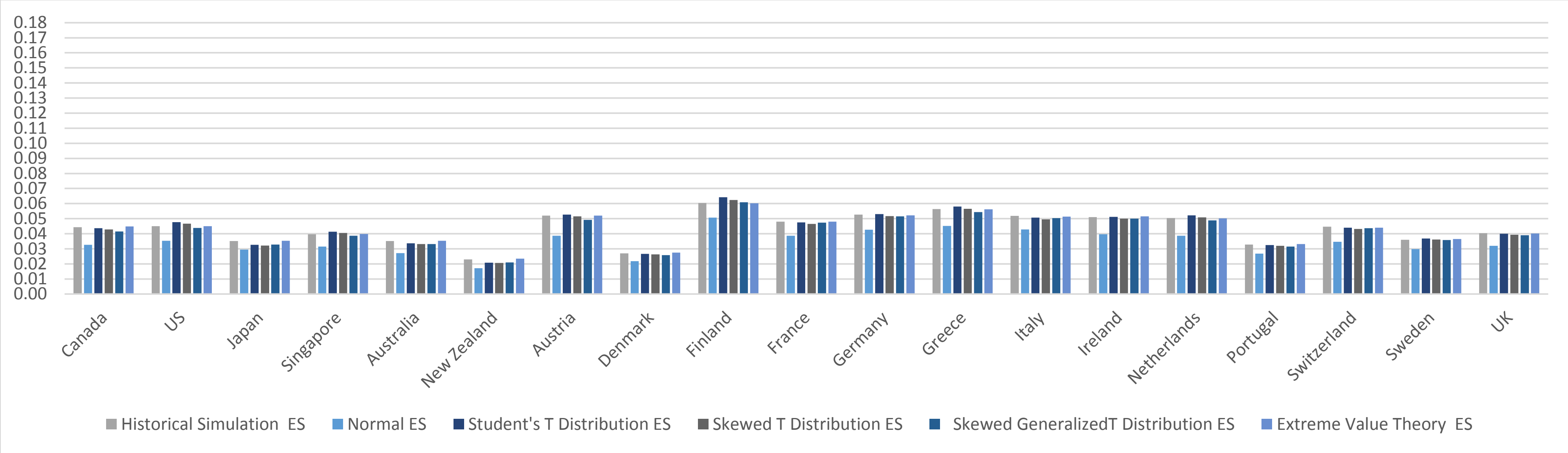
Panel A. 1% ESs



Note: Figure 68 presents the developed stock exchanges high quarterly volatility period daily ESs. The data source is DataStream.

Figure 68. Developed stock exchanges high quarterly volatility period daily ESs

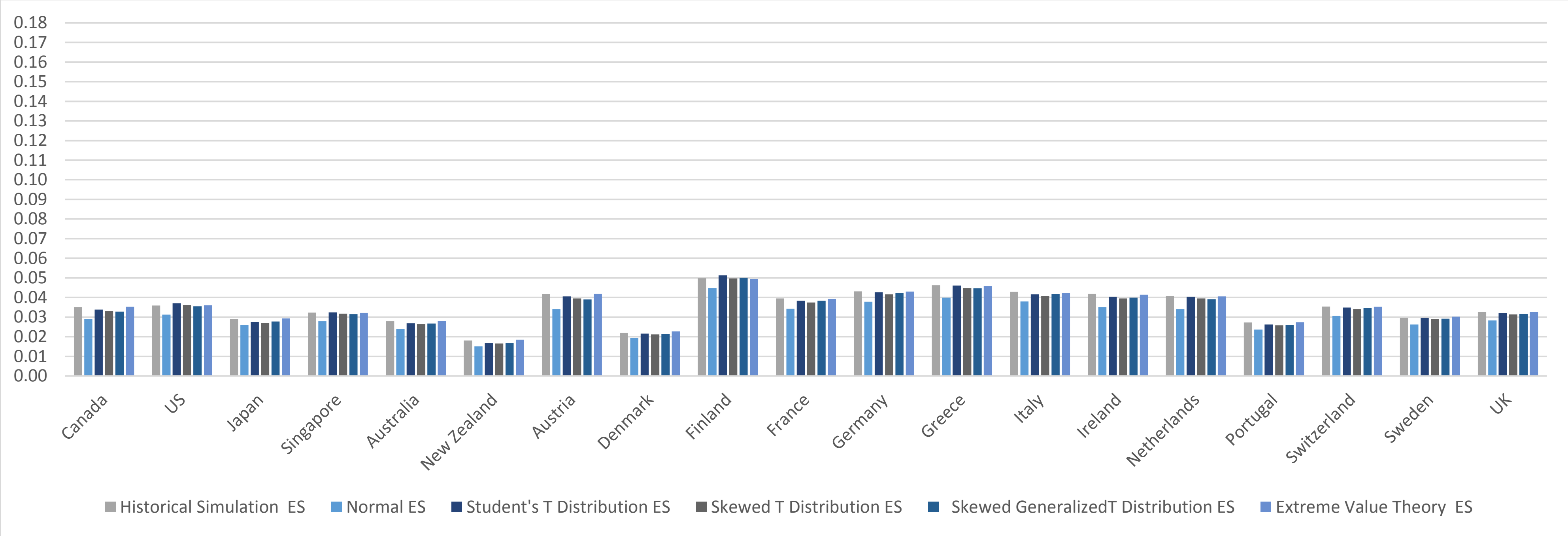
Panel B. 2.5% ESs



Note: Figure 68 presents the developed stock exchanges high quarterly volatility period daily ESs. The data source is DataStream.

Figure 68. Developed stock exchanges high quarterly volatility period daily ESs

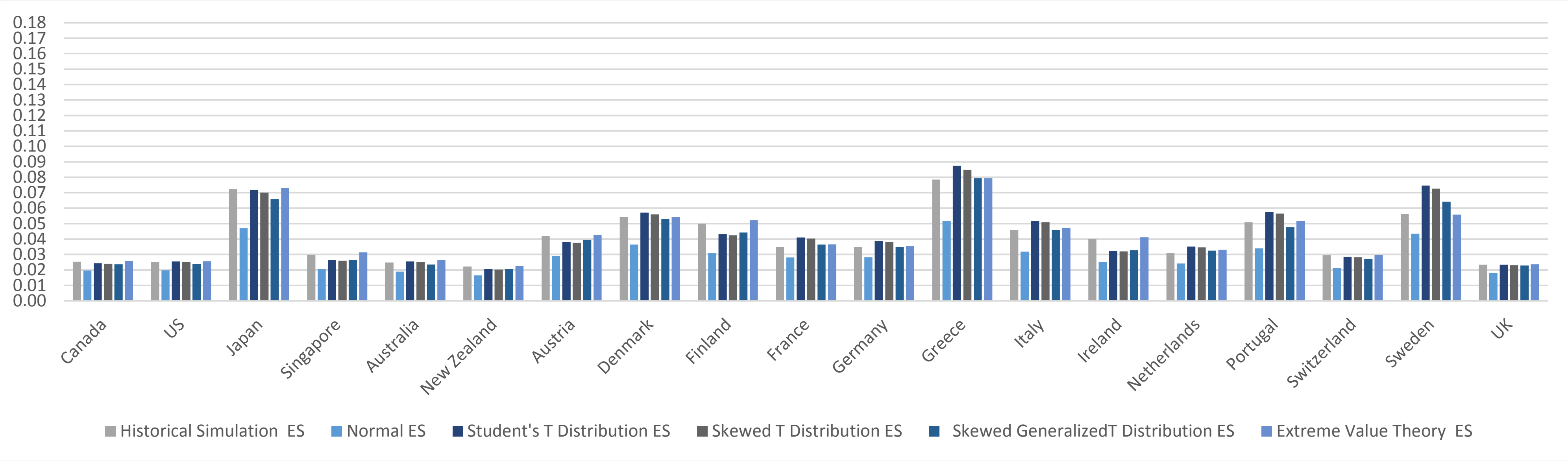
Panel C. 5% ESs



Note: Figure 68 presents the developed stock exchanges high quarterly volatility period daily ESs. The data source is DataStream.

Figure 69. Developed stock exchanges low quarterly volatility period daily ESs

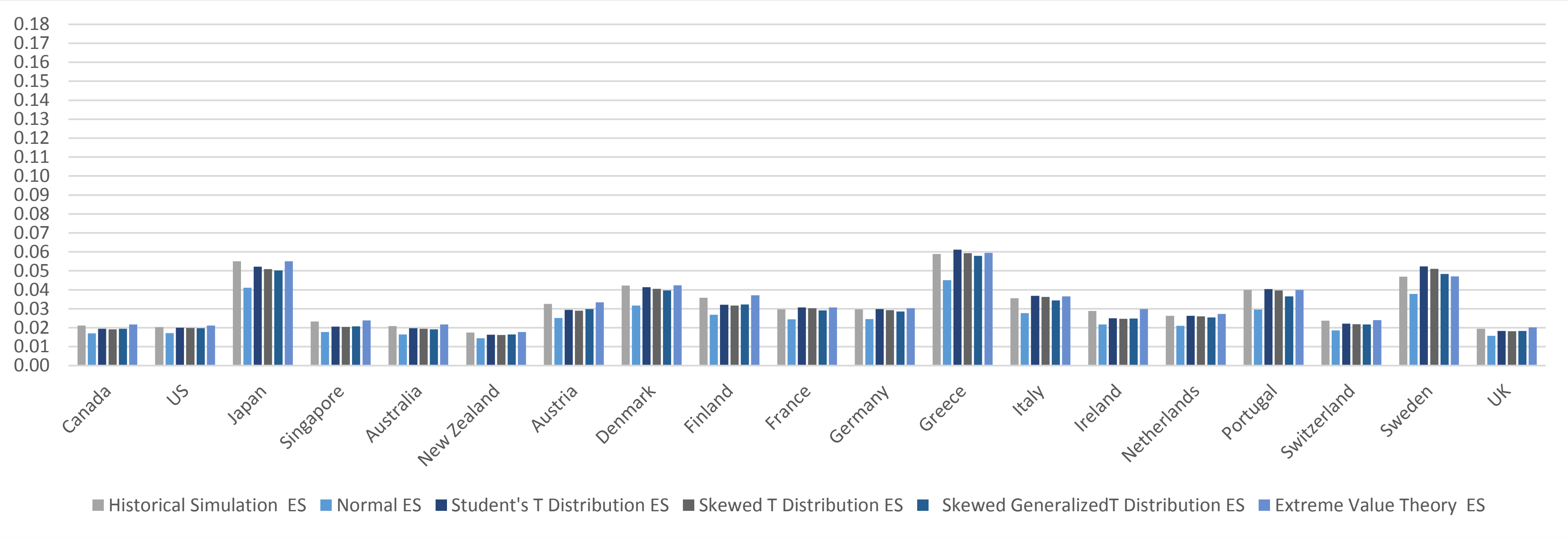
Panel A. 1% ESs



Note: Figure 69 presents the developed stock exchanges low quarterly volatility period daily ESs. The data source is DataStream.

Figure 69. Developed stock exchanges low quarterly volatility period daily ESs

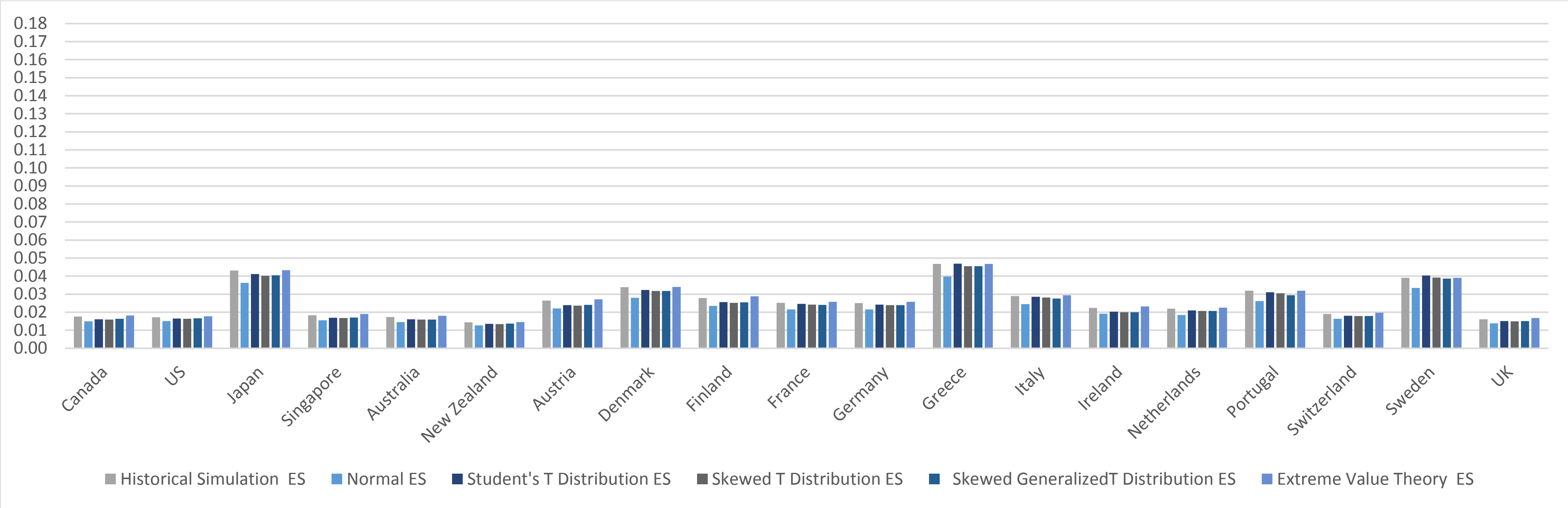
Panel B. 2.5% ESs



Note: Figure 69 presents the developed stock exchanges low quarterly volatility period daily ESs. The data source is DataStream.

Figure 69. Developed stock exchanges low quarterly volatility period daily ESs

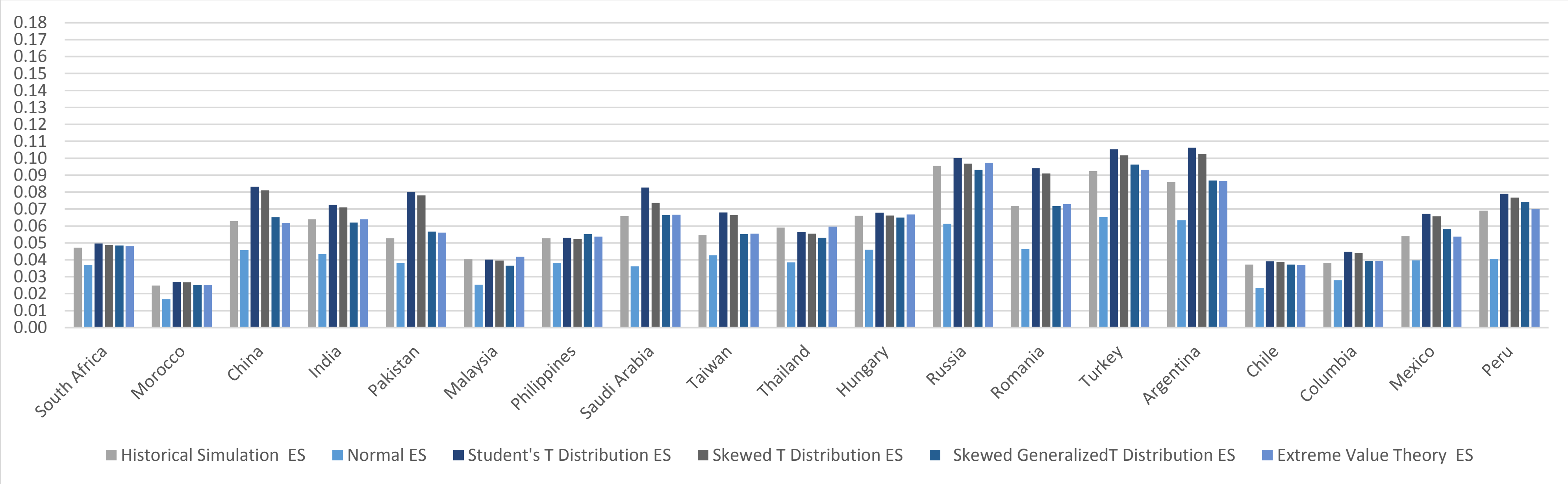
Panel C. 5% ESs



Note: Figure 69 presents the developed stock exchanges low quarterly volatility period daily ESs. The data source is DataStream.

Figure 70. Emerging stock exchanges high quarterly volatility period daily ESs

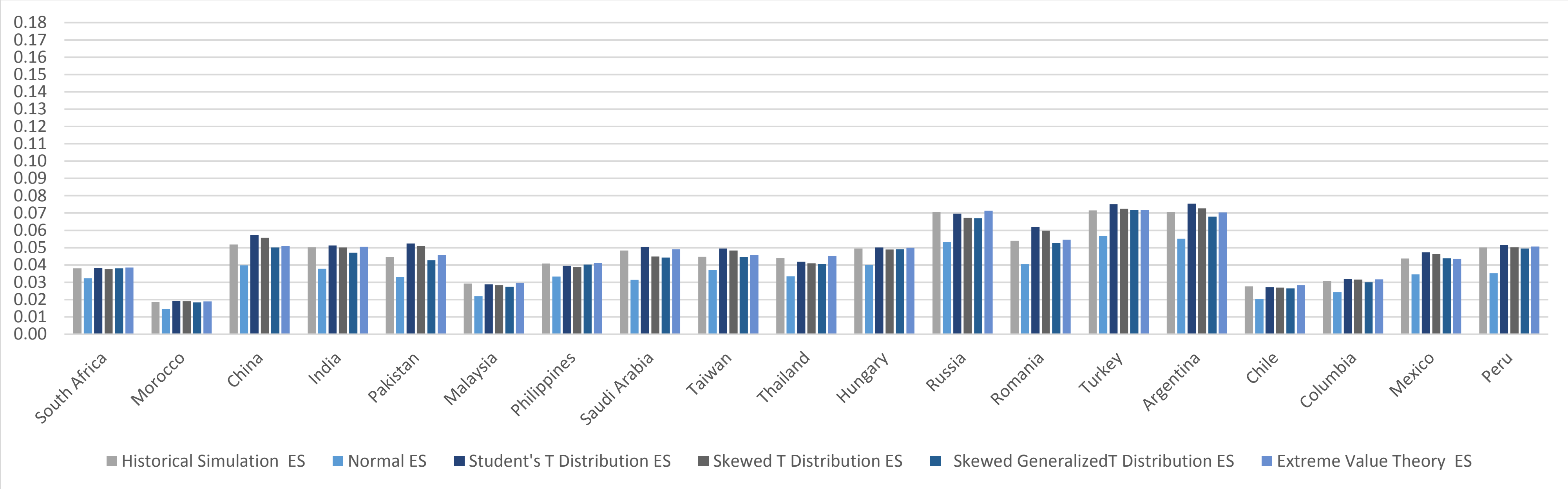
Panel A. 1% ESs



Note: Figure 70 presents the emerging stock exchanges high quarterly volatility period daily ESs. The data source is DataStream.

Figure 70. Emerging stock exchanges high quarterly volatility period daily ESs

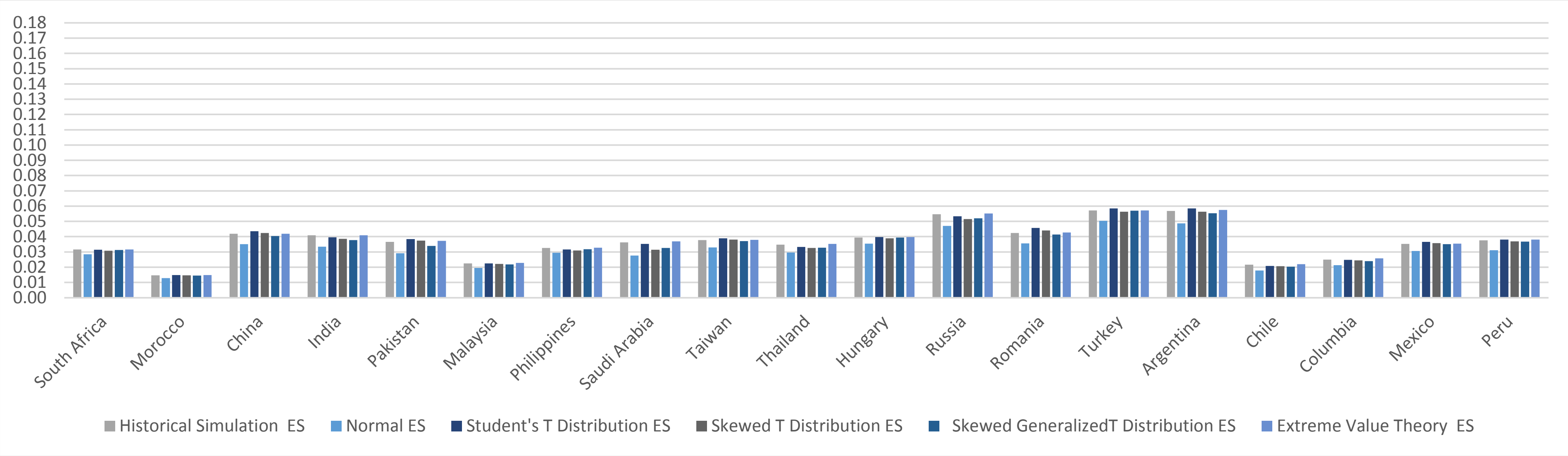
Panel B. 2.5% ESs



Note: Figure 70 presents the emerging stock exchanges high quarterly volatility period daily ESs. The data source is DataStream.

Figure 70. Emerging stock exchanges high quarterly volatility period daily ESs

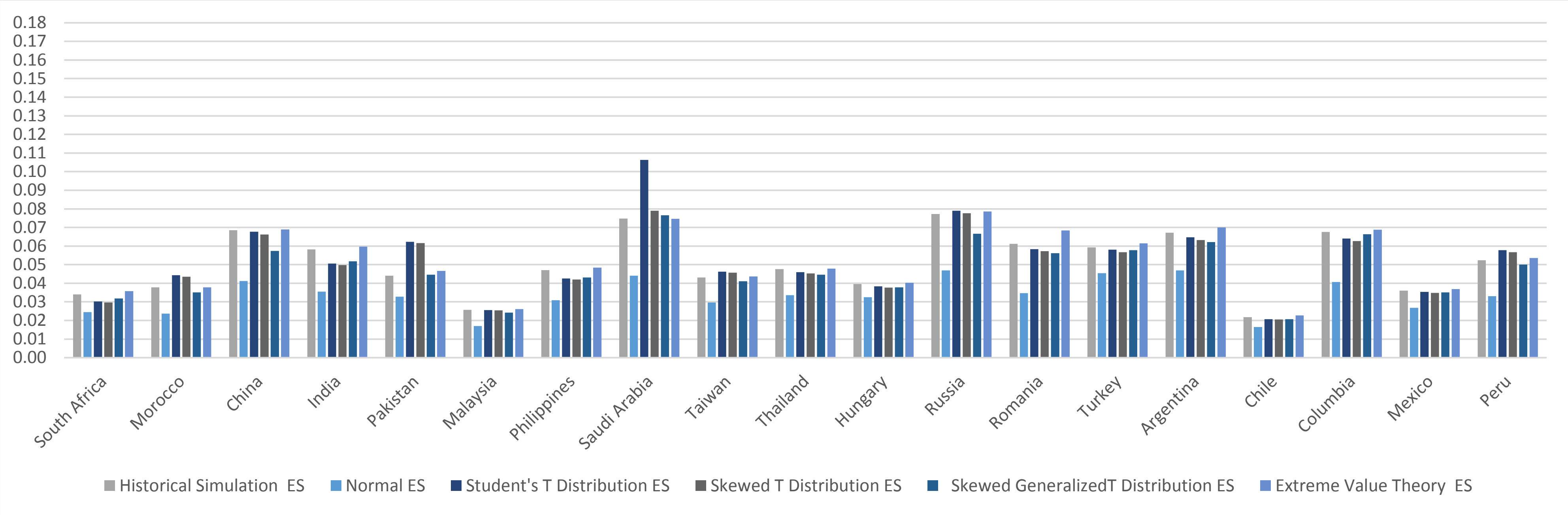
Panel C. 5% ESs



Note: Figure 70 presents the emerging stock exchanges high quarterly volatility period daily ESs. The data source is DataStream.

Figure 71. Emerging stock exchanges low quarterly volatility period daily ESs

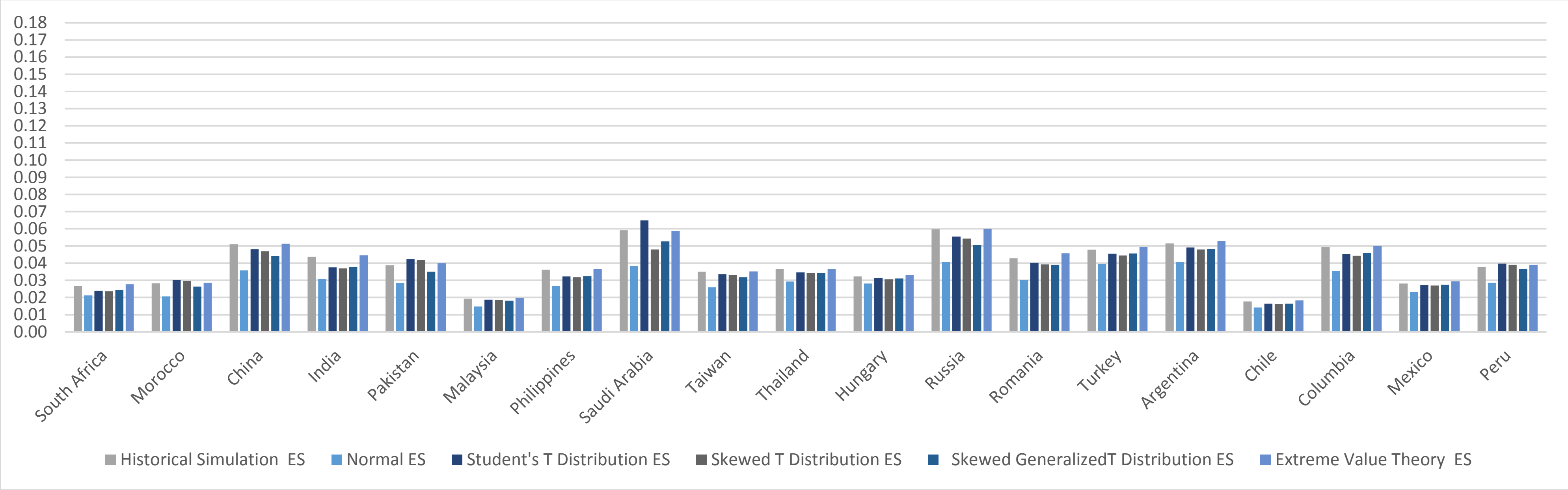
Panel A. 1% ESs



Note: Figure 71 presents the emerging stock exchanges low quarterly volatility period daily ESs. The data source is DataStream.

Figure 71. Emerging stock exchanges low quarterly volatility period daily ESs

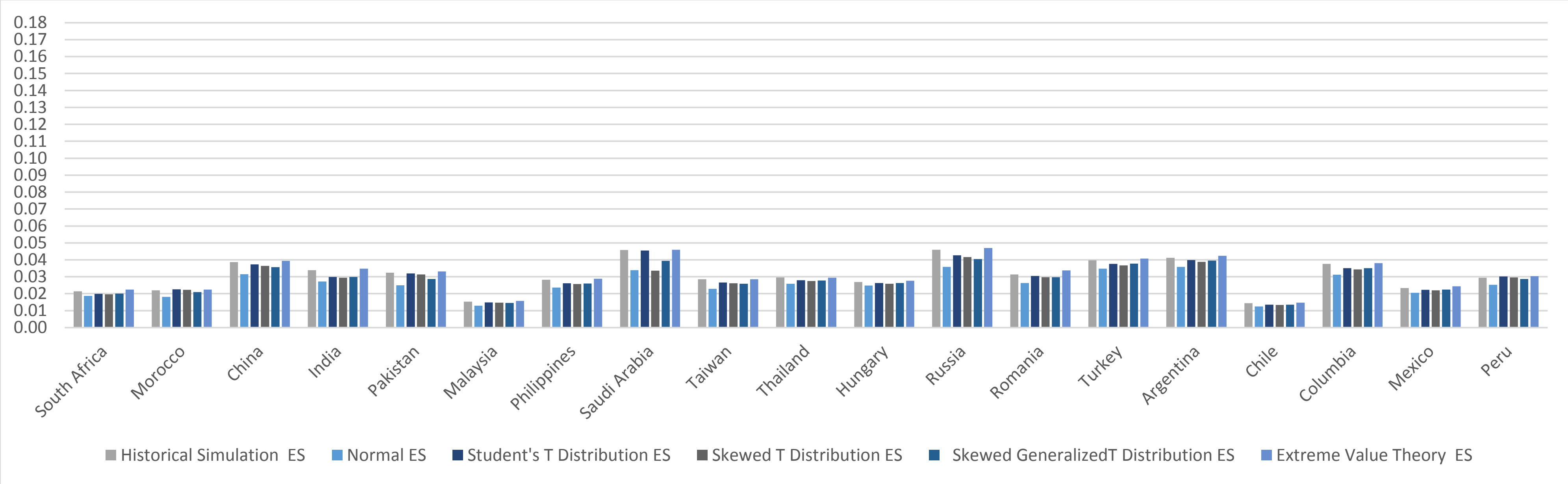
Panel B. 2.5% ESs



Note: Figure 71 presents the emerging stock exchanges low quarterly volatility period daily ESs. The data source is DataStream.

Figure 71. Emerging stock exchanges low quarterly volatility period daily ESs

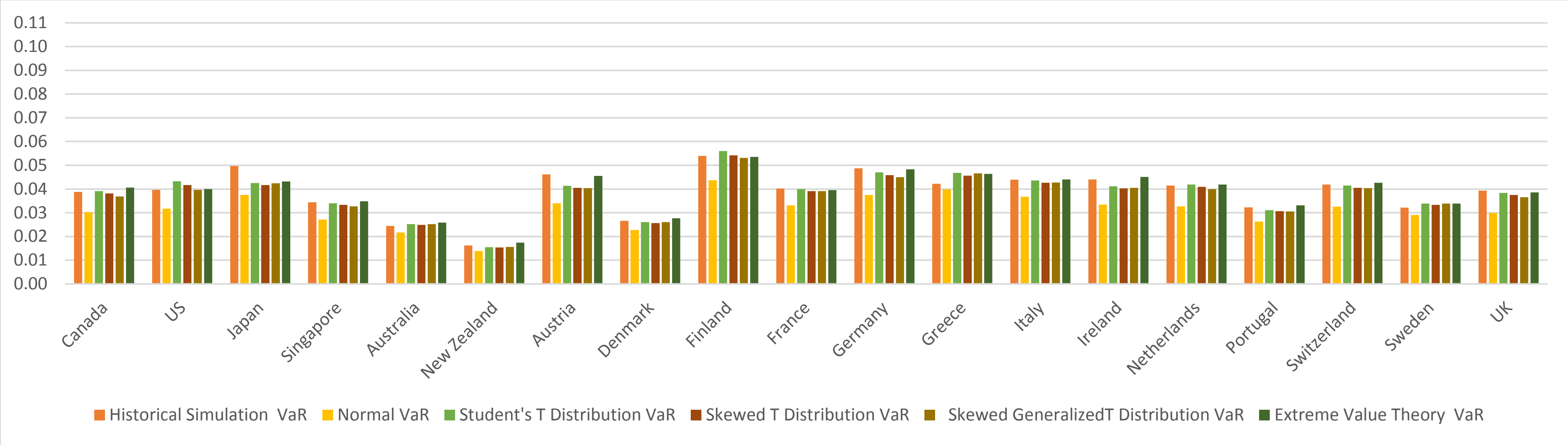
Panel C. 5% ESs



Note: Figure 71 presents the emerging stock exchanges low quarterly volatility period daily ESs. The data source is DataStream.

Figure 72. Developed stock exchanges high quarterly skewness period daily VaRs

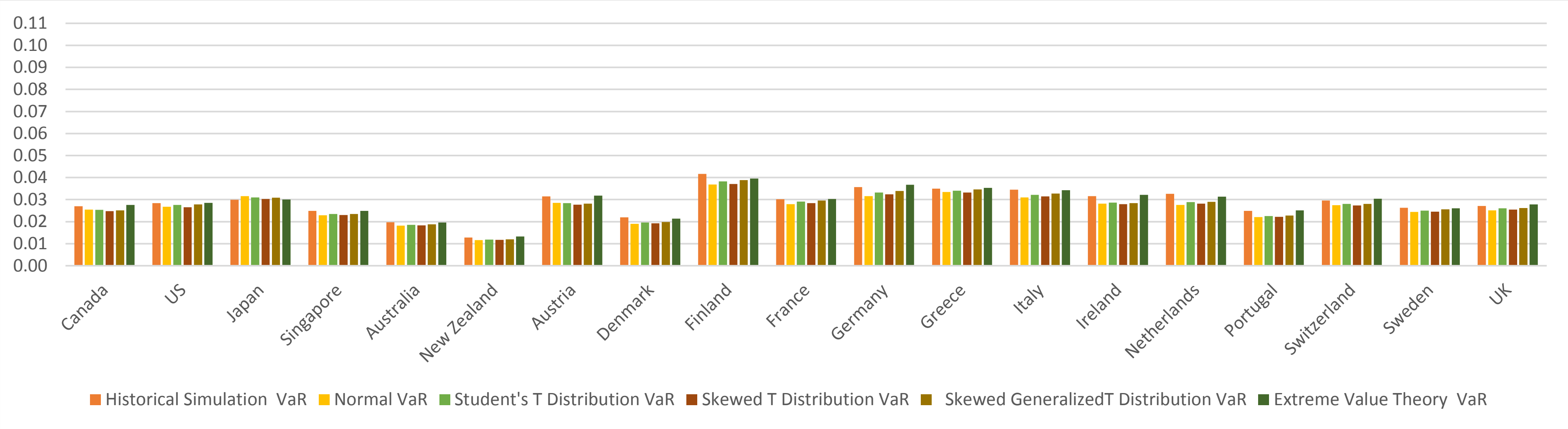
Panel A. 1% VaRs



Note: Figure 71 presents the developed stock exchanges low quarterly skewness period daily ESs. The data source is DataStream.

Figure 72. Developed stock exchanges high quarterly skewness period daily VaRs

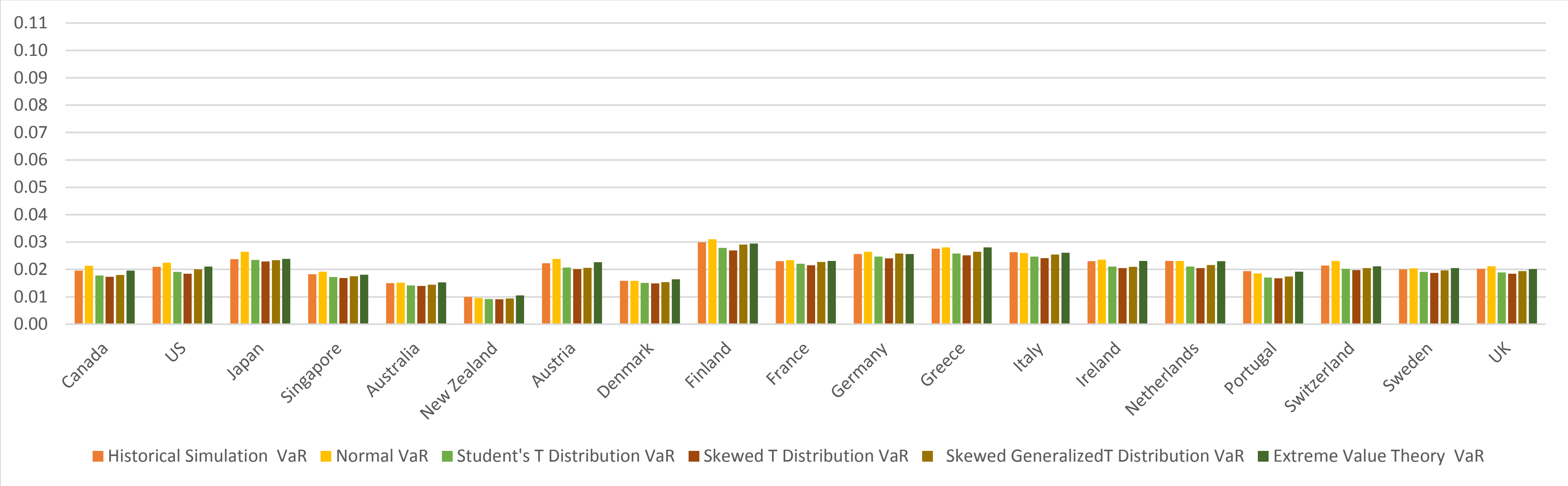
Panel B. 2.5% VaRs



Note: Figure 72 presents the developed stock exchanges high quarterly skewness period daily VaRs. The data source is DataStream.

Figure 72. Developed stock exchanges high quarterly skewness period daily VaRs

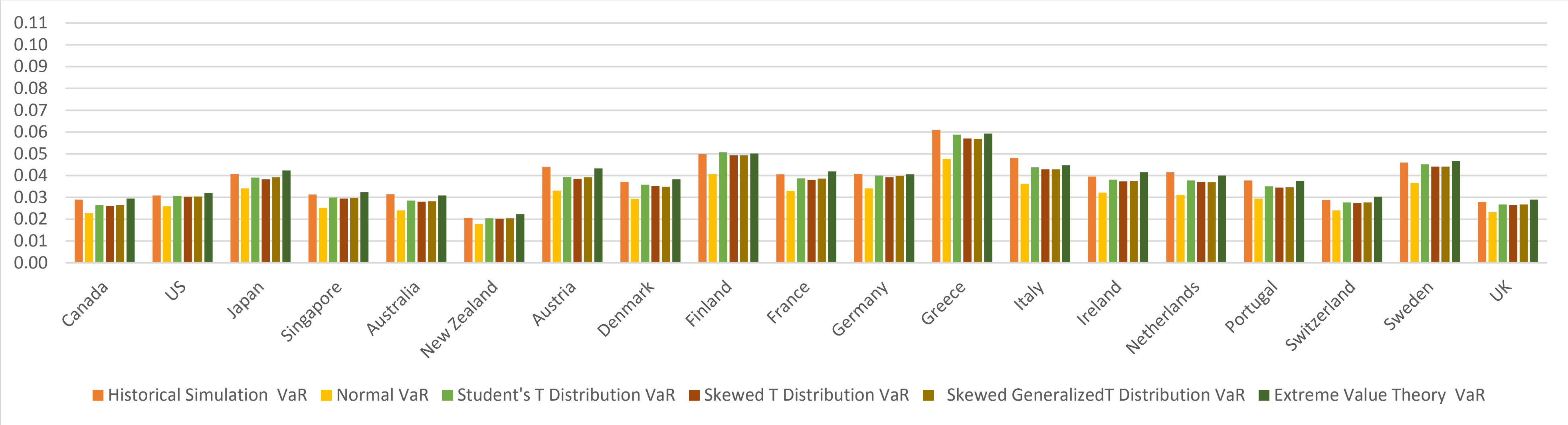
Panel C. 5% VaRs



Note: Figure 72 presents the developed stock exchanges high quarterly skewness period daily VaRs. The data source is DataStream.

Figure 73. Developed stock exchanges low quarterly skewness period daily VaRs

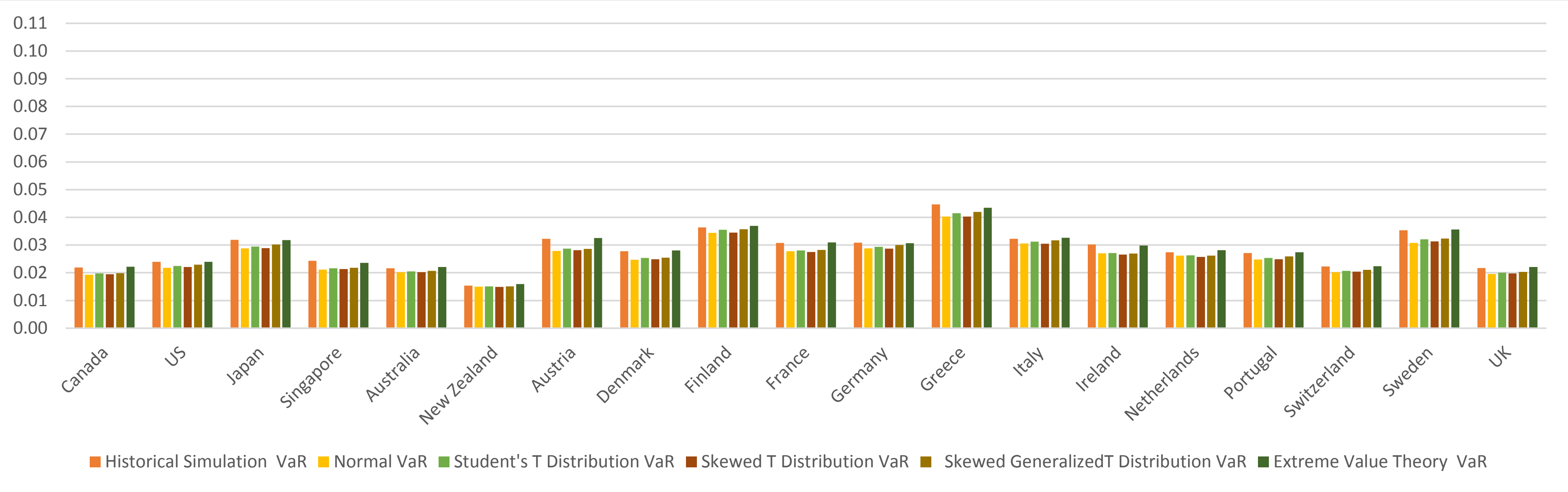
Panel A. 1% VaRs



Note: Figure 73 presents the developed stock exchanges low quarterly skewness period daily VaRs. The data source is DataStream.

Figure 73. Developed stock exchanges low quarterly skewness period daily VaRs

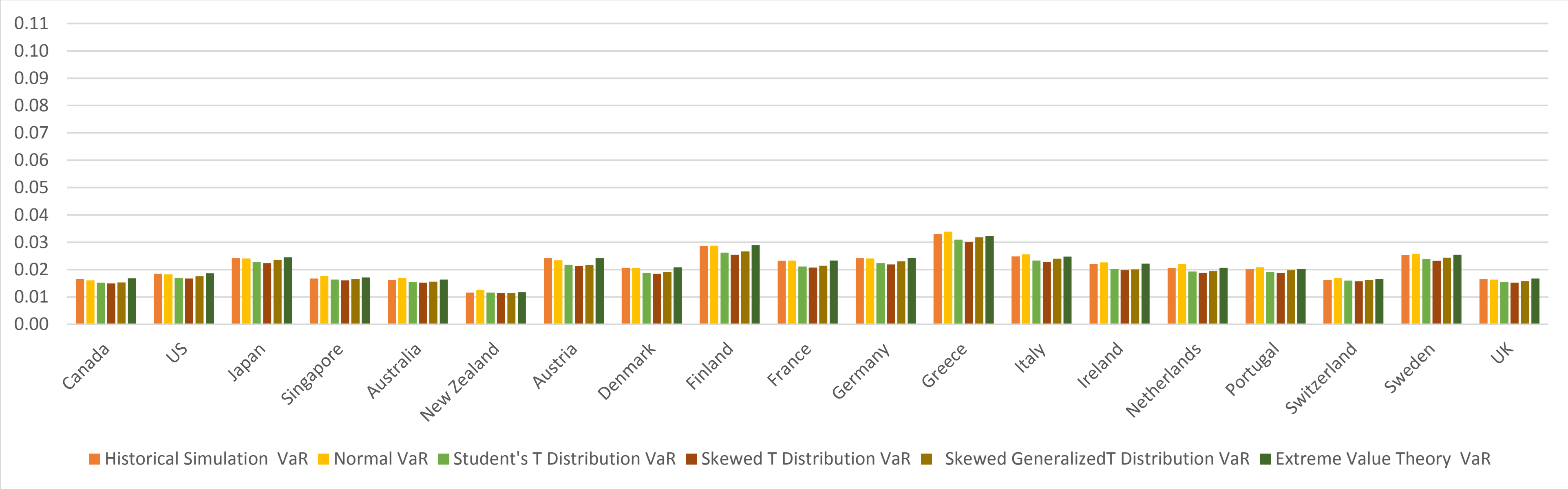
Panel B. 2.5% VaRs



Note: Figure 73 presents the developed stock exchanges low skewness volatility period daily VaRs. The data source is DataStream.

Figure 73. Developed stock exchanges low quarterly skewness period daily VaRs

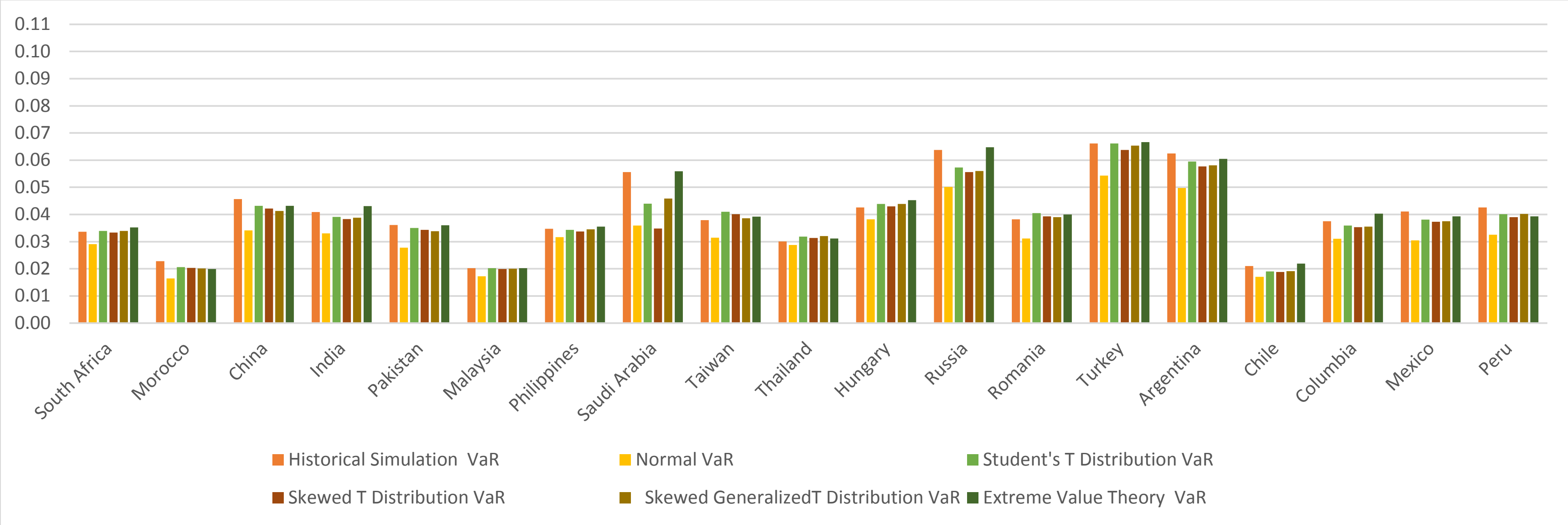
Panel C. 5% VaRs



Note: Figure 73 presents the developed stock exchanges low skewness volatility period daily VaRs. The data source is DataStream.

Figure 74. Emerging stock exchanges high quarterly skewness period daily VaRs

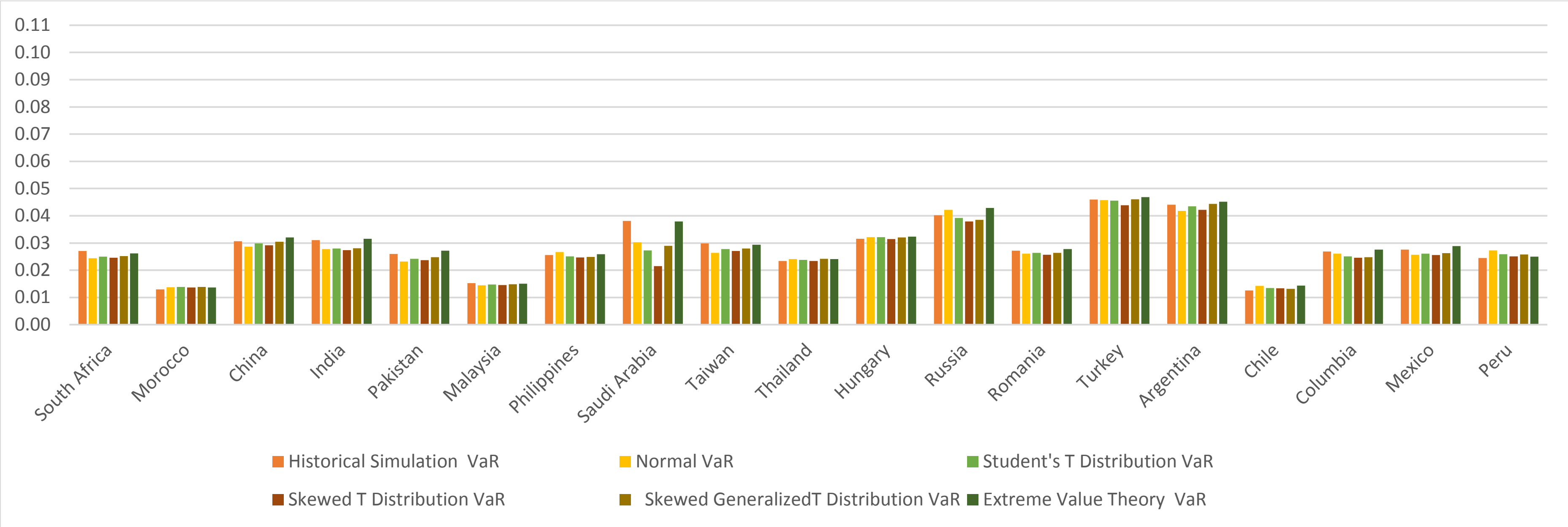
Panel A. 1% VaRs



Note: Figure 74. Presents the emerging stock exchanges high quarterly skewness period daily VaRs. The data source is DataStream.

Figure 74. Emerging stock exchanges high quarterly skewness period daily VaRs

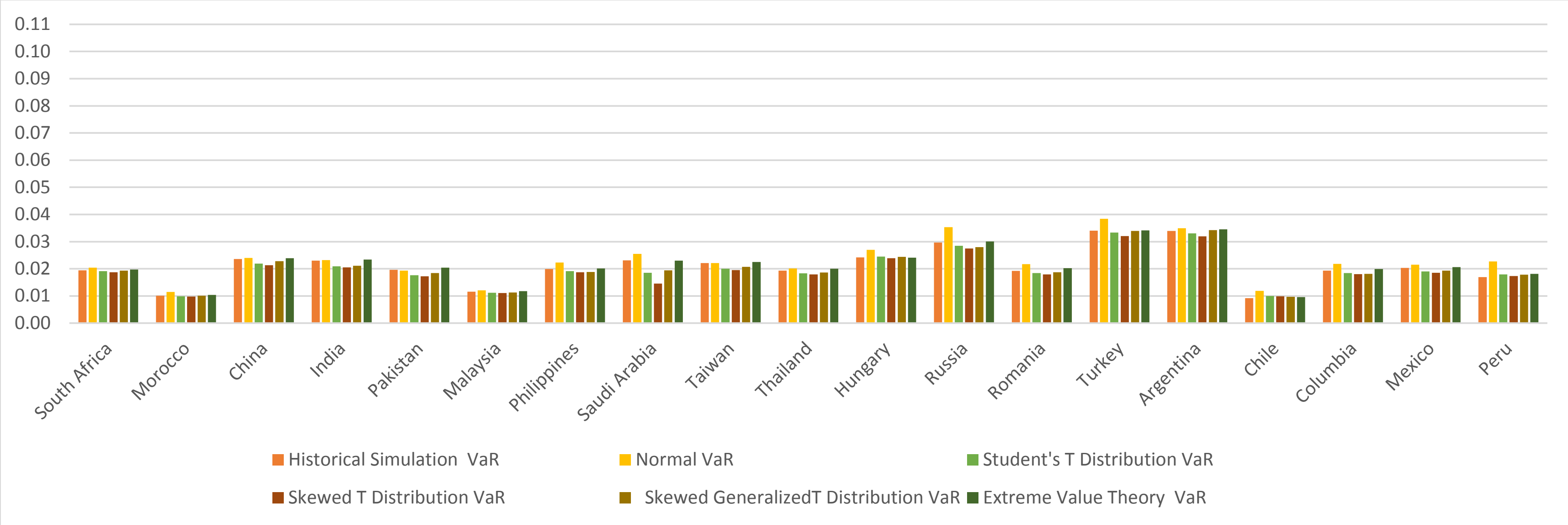
Panel B. 2.5% VaRs



Note: Figure 74. Presents the emerging stock exchanges high quarterly skewness period daily VaRs. The data source is DataStream.

Figure 74. Emerging stock exchanges high quarterly skewness period daily VaRs

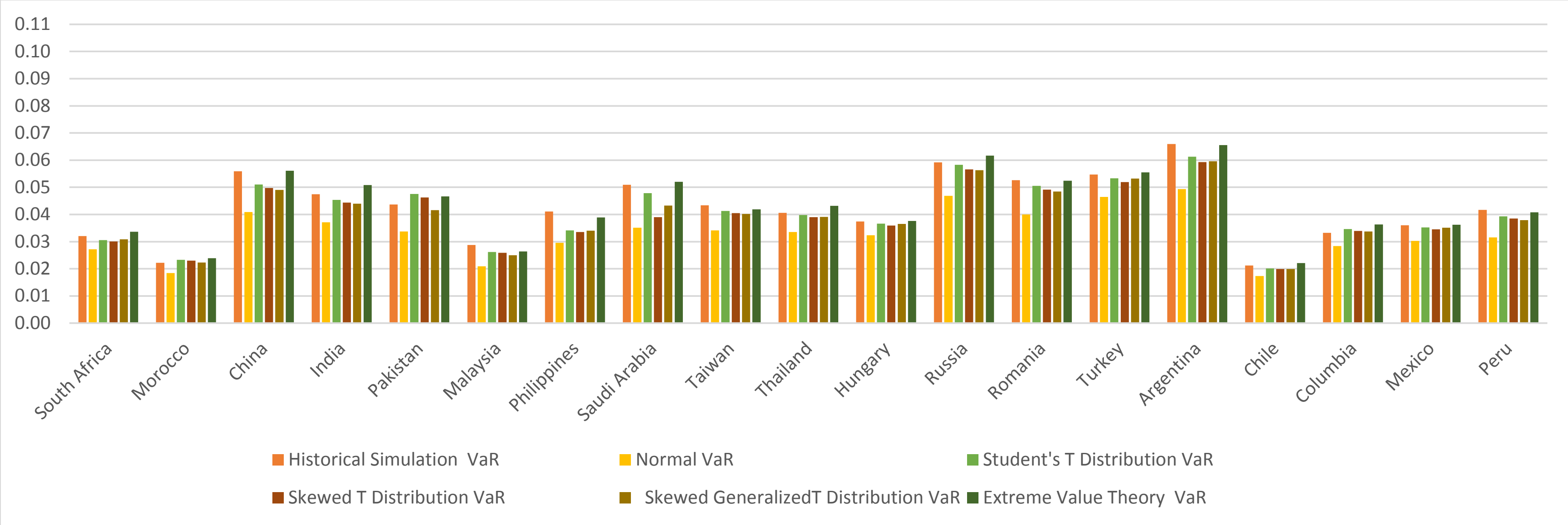
Panel C. 5% VaRs



Note: Figure 74. presents the emerging stock exchanges high quarterly skewness period daily VaRs. The data source is DataStream.

Figure 75. Emerging stock exchanges low quarterly skewness period daily VaRs

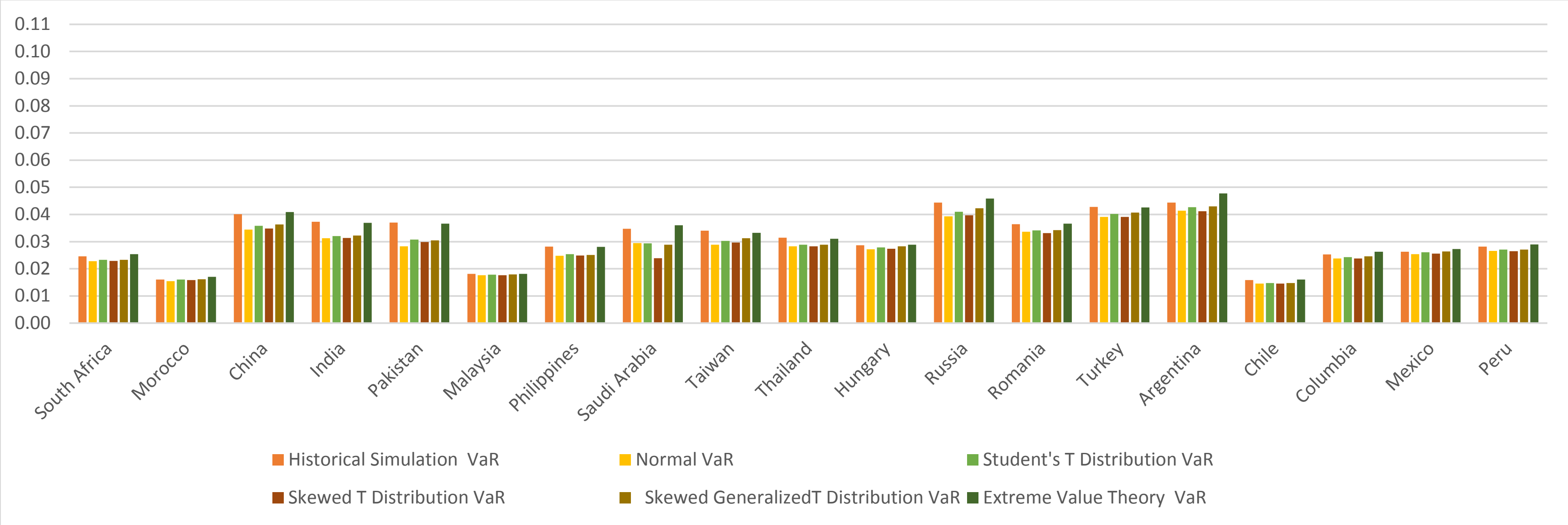
Panel A. 1% VaRs



Note: Figure 75. presents the emerging stock exchanges low quarterly skewness period daily VaRs. The data source is DataStream.

Figure 75. Emerging stock exchanges low quarterly skewness period daily VaRs

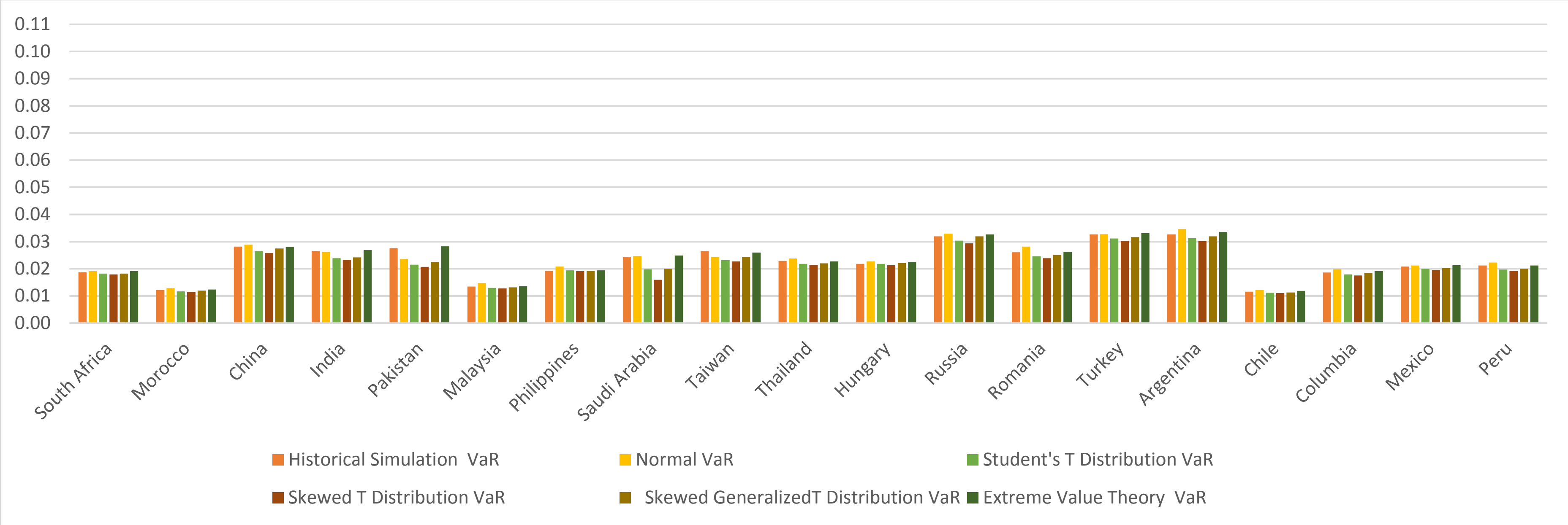
Panel B. 2.5% VaRs



Note: Figure 75. presents the emerging stock exchanges low quarterly skewness period daily VaRs. The data source is DataStream.

Figure 75. Emerging stock exchanges low quarterly skewness period daily VaRs

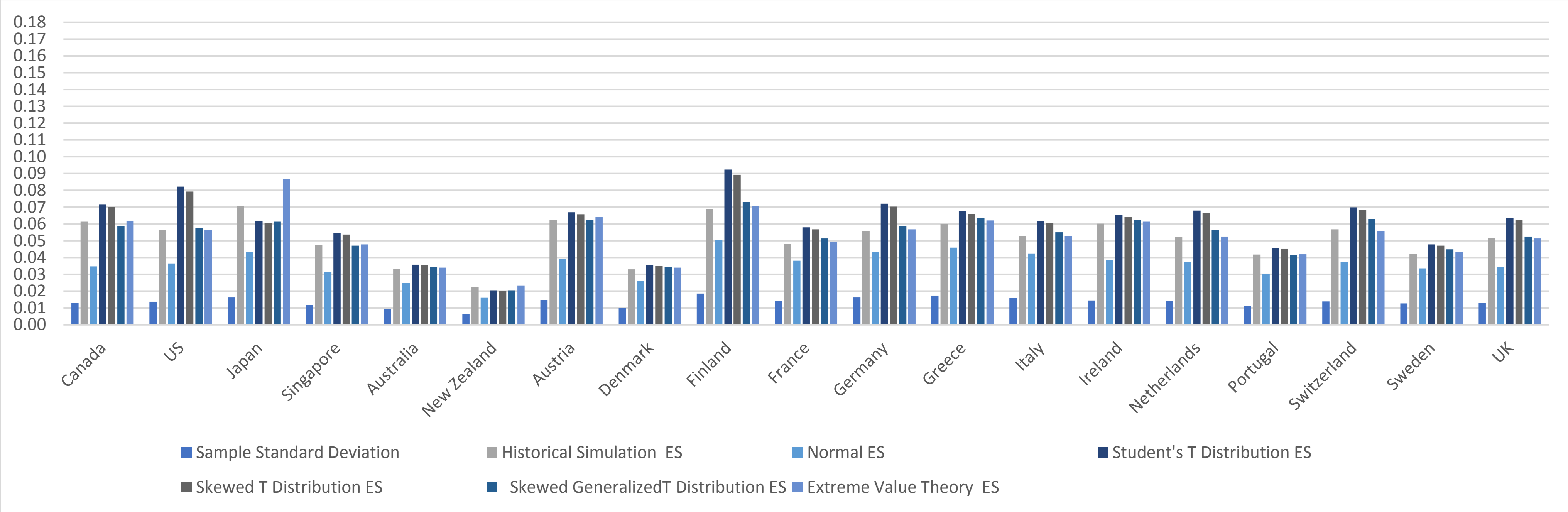
Panel C. 5% VaRs



Note: Figure 75. presents the emerging stock exchanges low quarterly skewness period daily VaRs. The data source is DataStream.

Figure 76. Developed stock exchanges high quarterly skewness period daily ESs

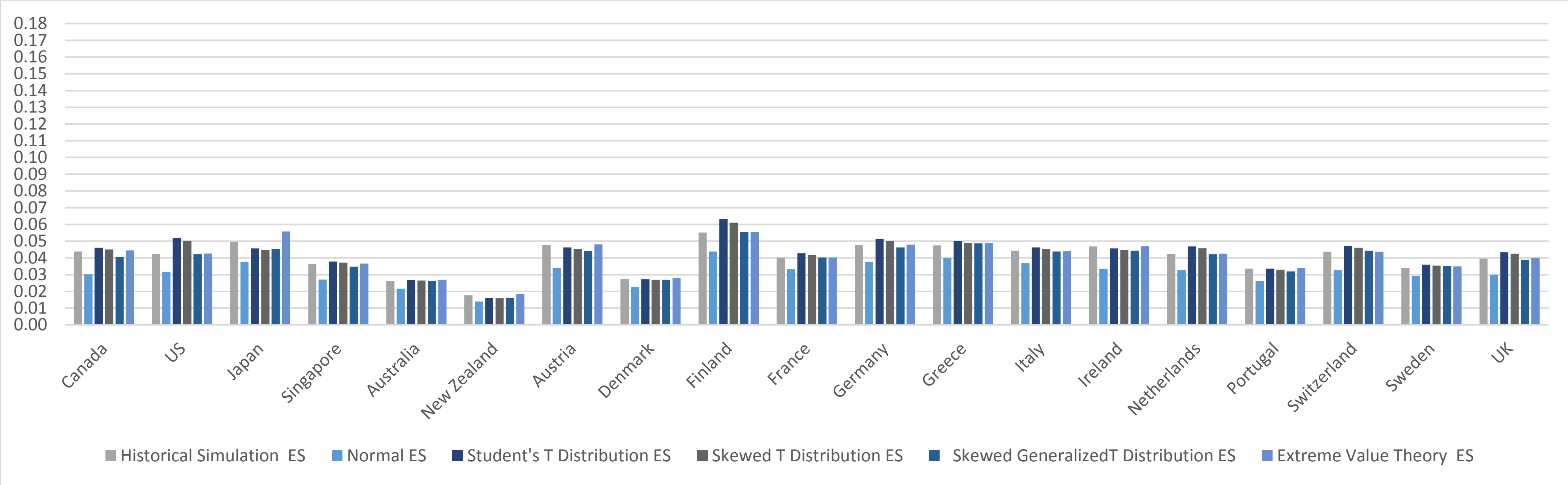
Panel A. 1% ESs



Note: Figure 76. presents the developed stock exchanges high quarterly skewness period daily ESs. The data source is DataStream.

Figure 76. Developed stock exchanges high quarterly skewness period daily ESs

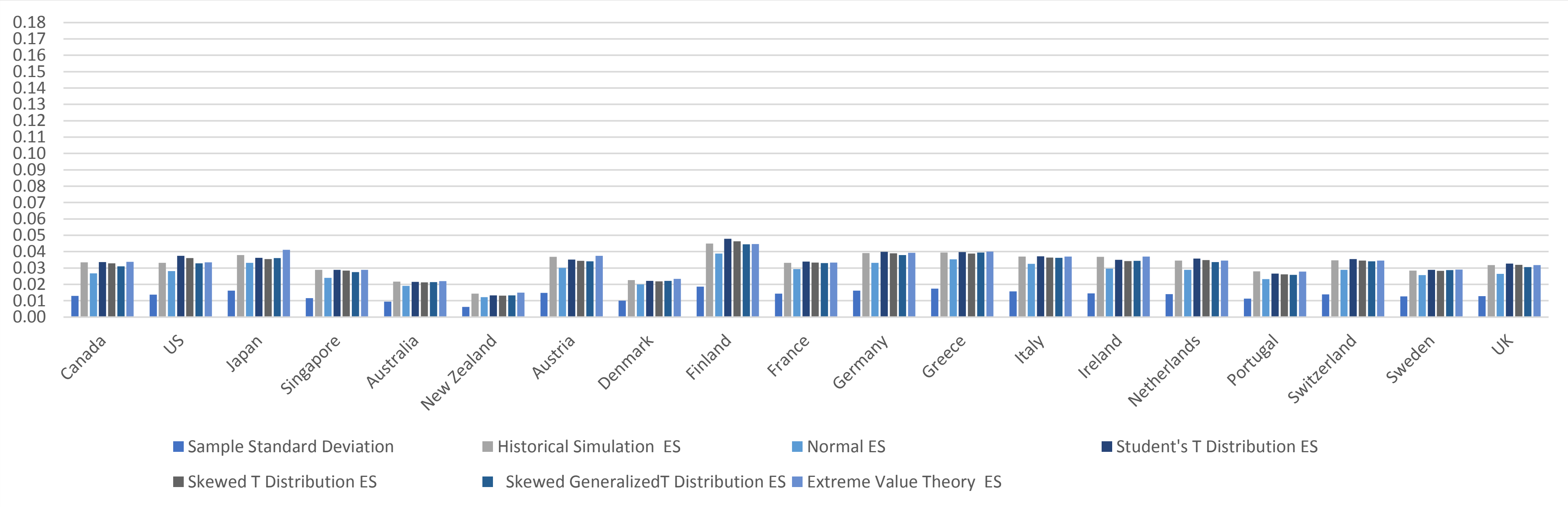
Panel B. 2.5% ESs



Note: Figure 76. Presents the developed stock exchanges high quarterly skewness period daily ESs. The data source is DataStream.

Figure 76. Developed stock exchanges high quarterly skewness period daily ESs

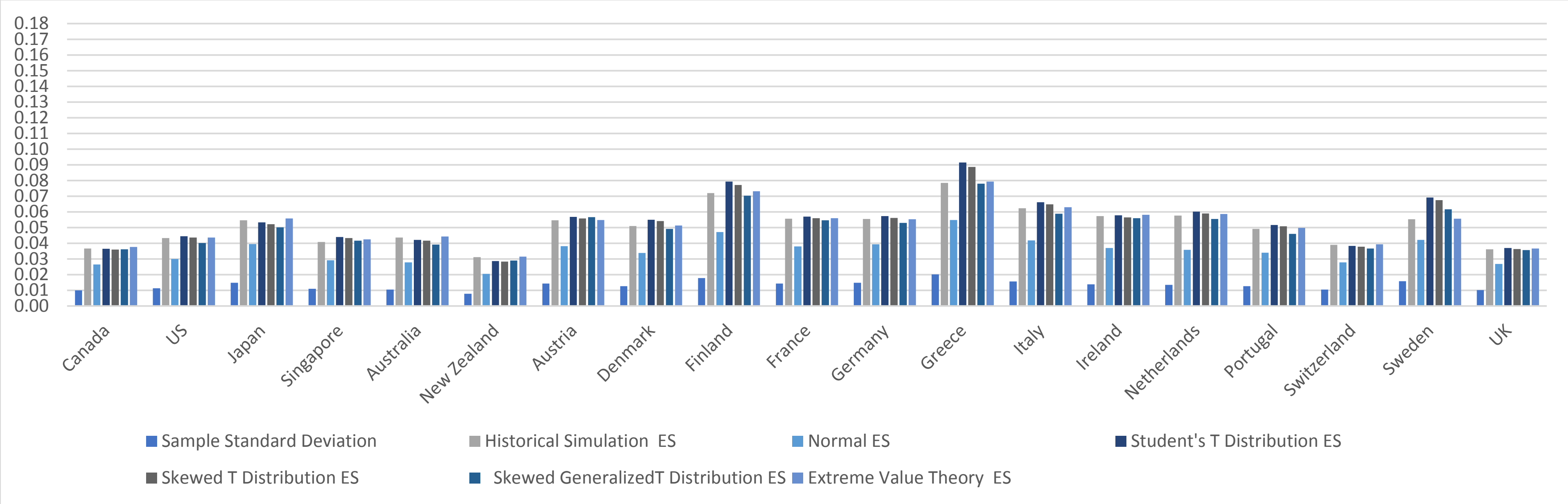
Panel C. 5% ESs



Note: Figure 76. Presents the developed stock exchanges high quarterly skewness period daily ESs. The data source is DataStream.

Figure 77. Developed stock exchanges low quarterly skewness period daily ESs

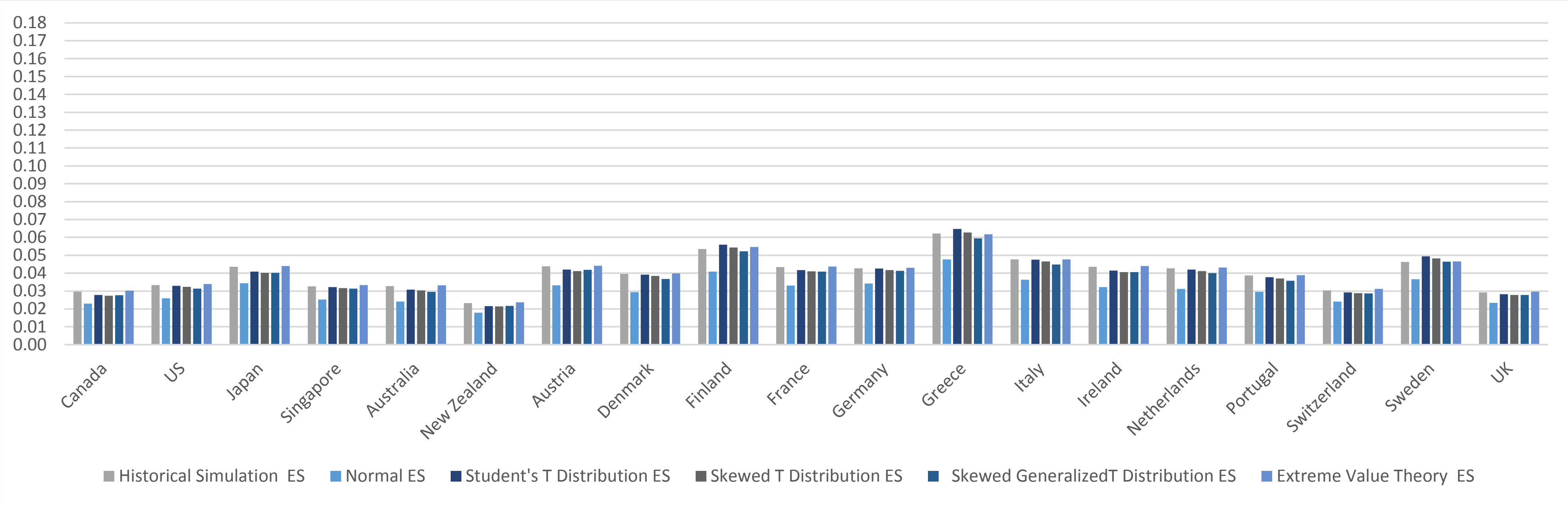
Panel A. 1% ESs



Note: Figure 77. Presents the developed stock exchanges low quarterly skewness period daily ESs. The data source is DataStream.

Figure 77. Developed stock exchanges low quarterly skewness period daily ESs

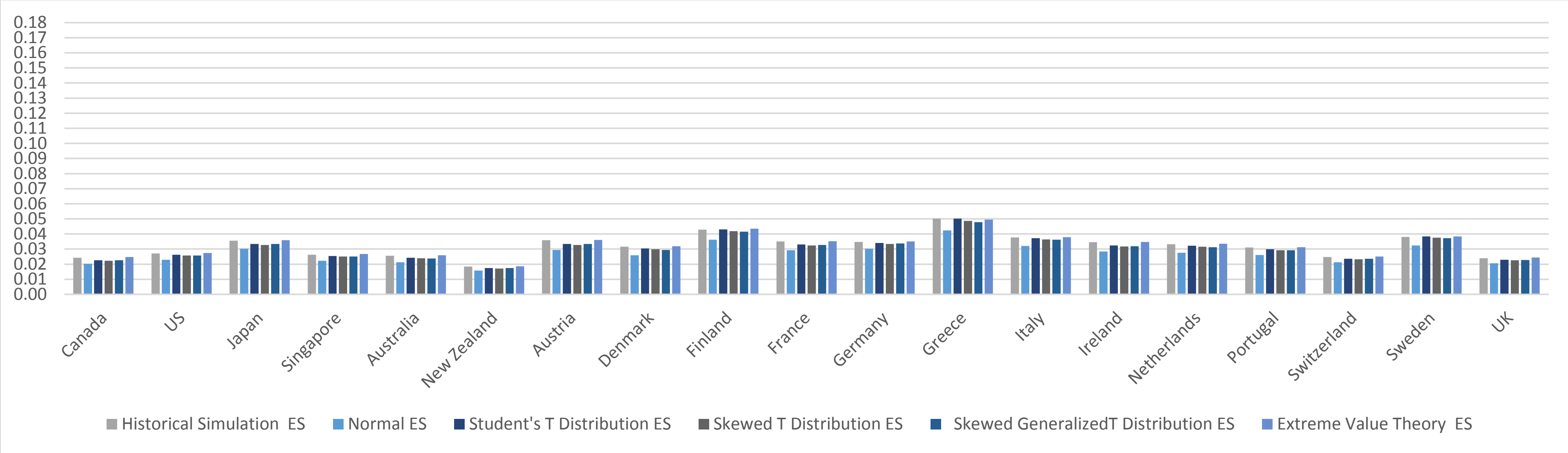
Panel B. 2.5% ESs



Note: Figure 77. Presents the developed stock exchanges low quarterly skewness period daily ESs. The data source is DataStream.

Figure 77. Developed stock exchanges low quarterly skewness period daily ESs

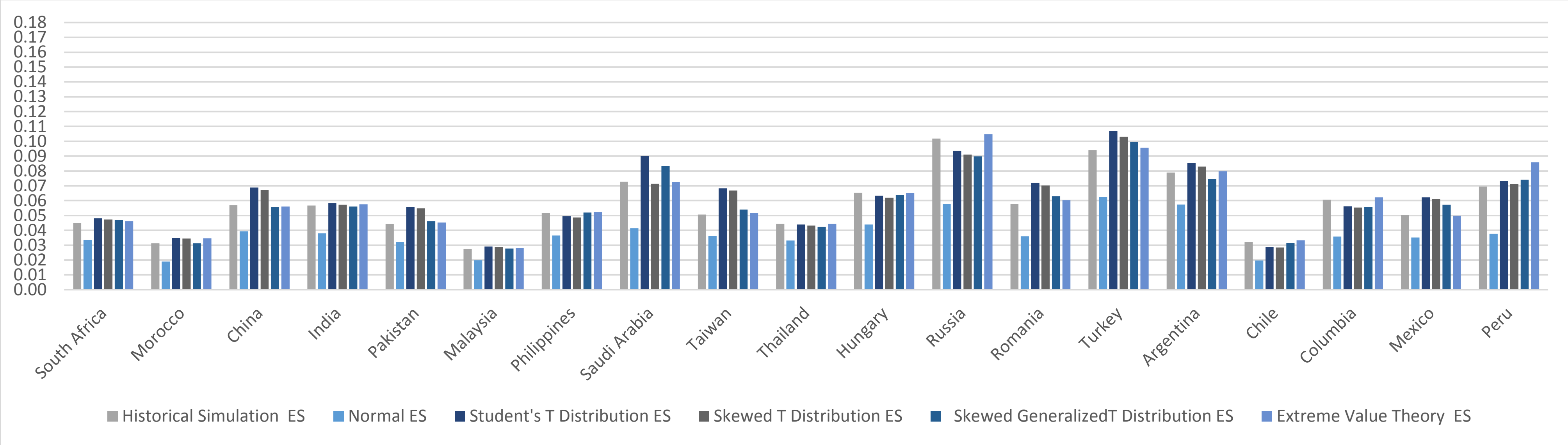
Panel C. 5% ESs



Note: Figure 77. presents the presents the developed stock exchanges low quarterly skewness period daily ESs. The data source is DataStream.

Figure 78. Emerging stock exchanges high quarterly skewness period daily ESs

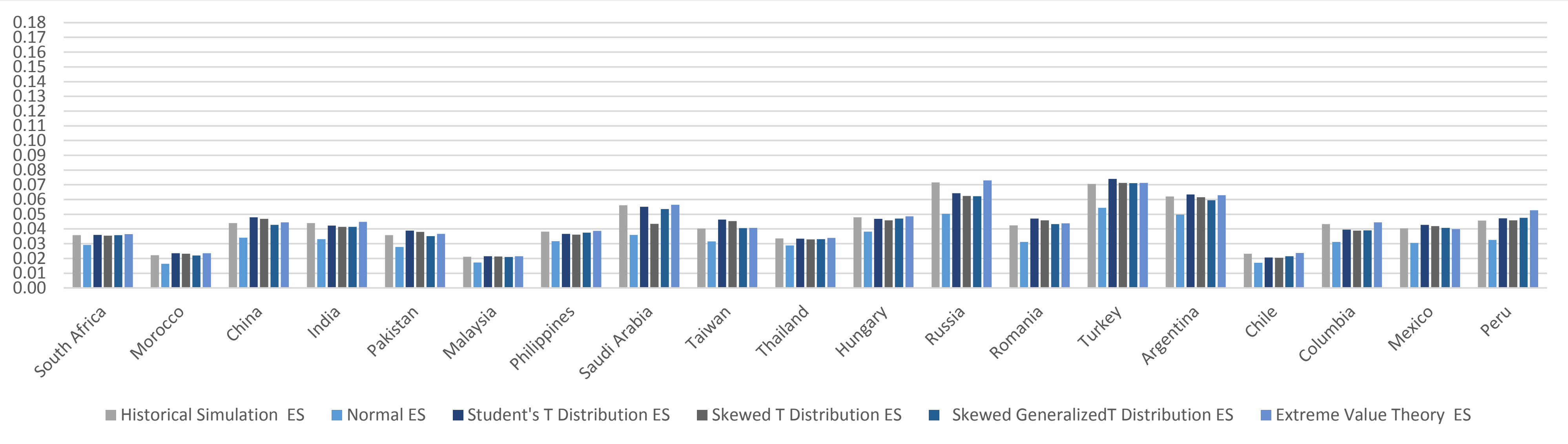
Panel A. 1% ESs



Note: Figure 78. presents the emerging stock exchanges high quarterly skewness period daily ESs. The data source is DataStream.

Figure 78. Emerging stock exchanges high quarterly skewness period daily ESs

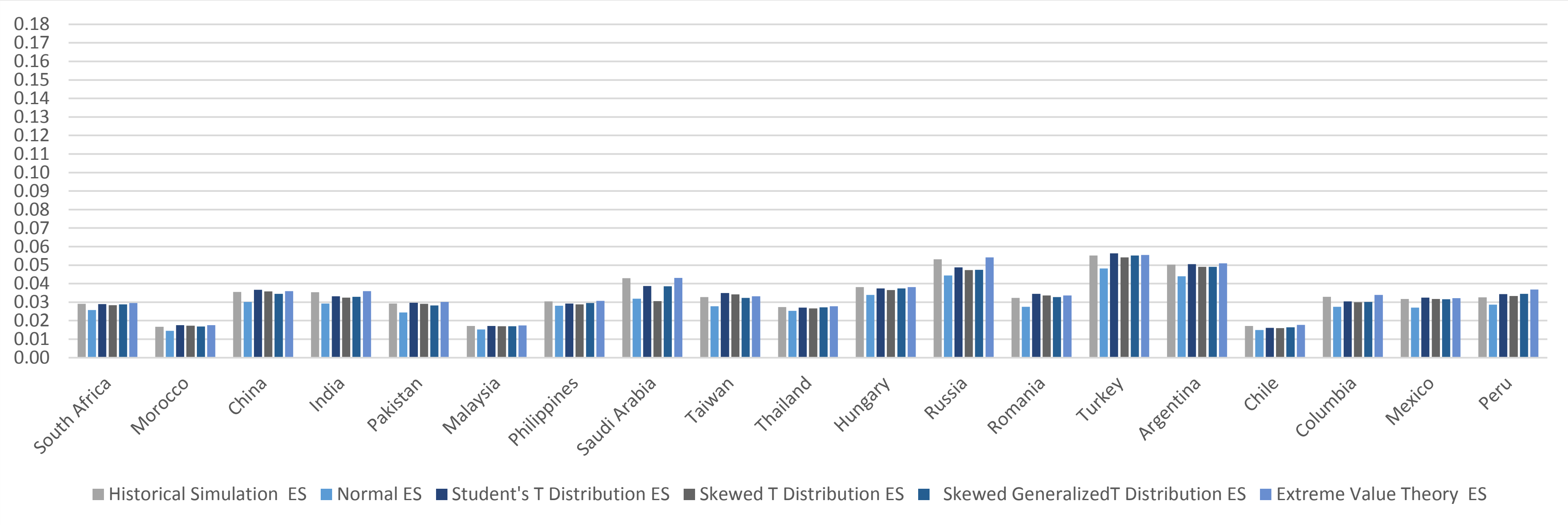
Panel B. 2.5% ESs



Note: Figure 78. presents the emerging stock exchanges high quarterly skewness period daily ESs. The data source is DataStream.

Figure 78. Emerging stock exchanges high quarterly skewness period daily ESs

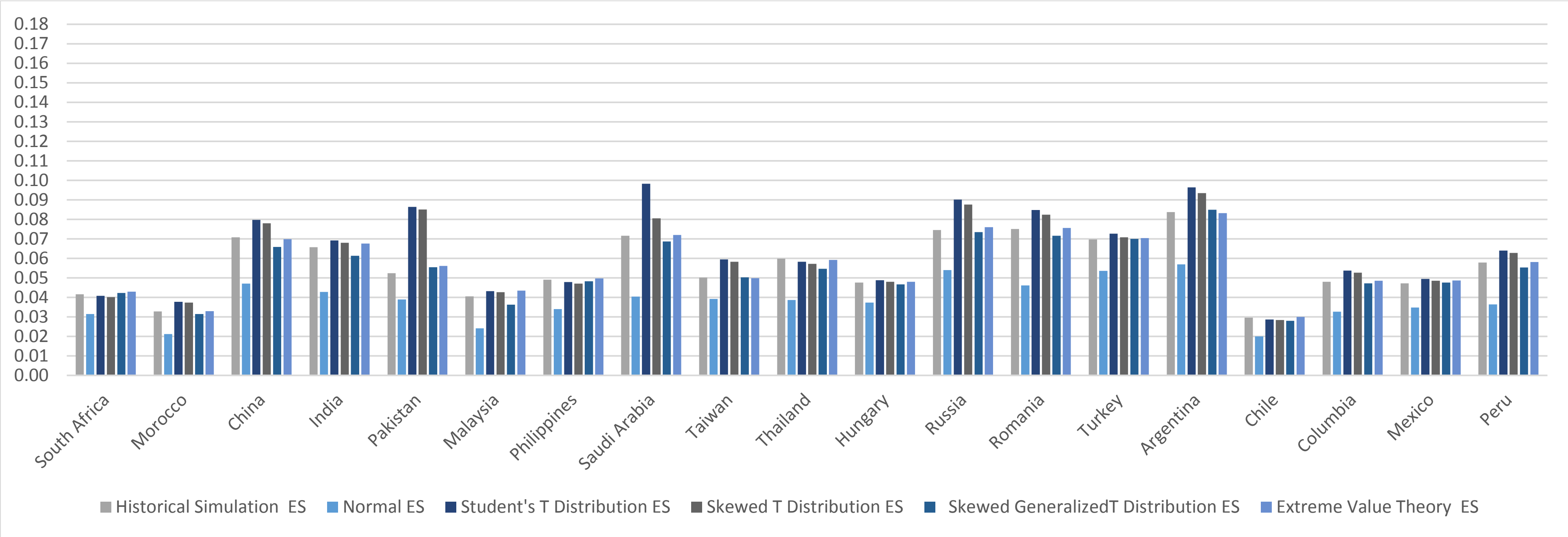
Panel C. 5% ESs



Note: Figure 78. presents the emerging stock exchanges high quarterly skewness period daily ESs. The data source is DataStream.

Figure 79. Emerging stock exchanges low quarterly skewness period daily ESs

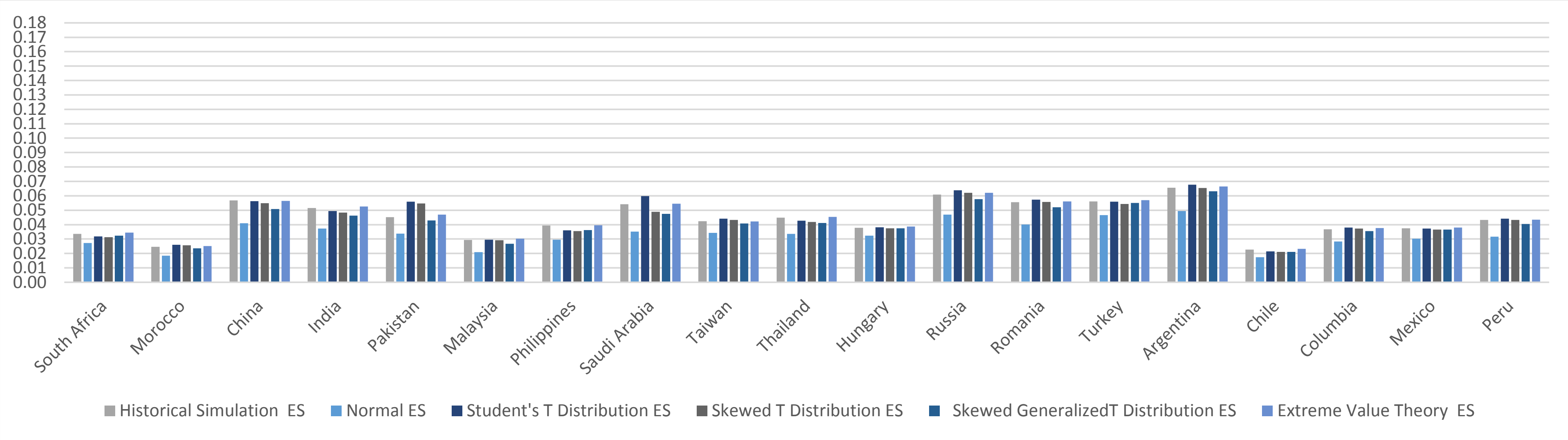
Panel A. 1% ESs



Note: Figure 79. presents the emerging stock exchanges low quarterly skewness period daily ESs. The data source is DataStream.

Figure 79. Emerging stock exchanges low quarterly skewness period daily ESs

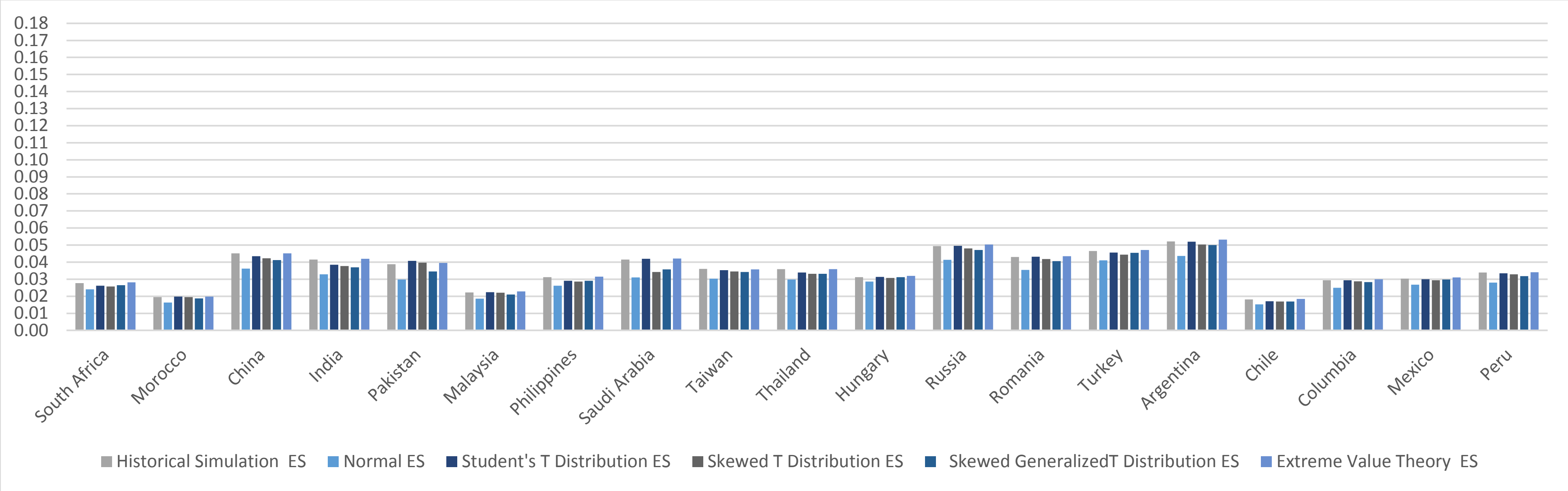
Panel B. 2.5% ESs



Note: Figure 79. presents the emerging stock exchanges low quarterly skewness period daily ESs. The data source is DataStream.

Figure 79. Emerging stock exchanges low quarterly skewness period daily ESs

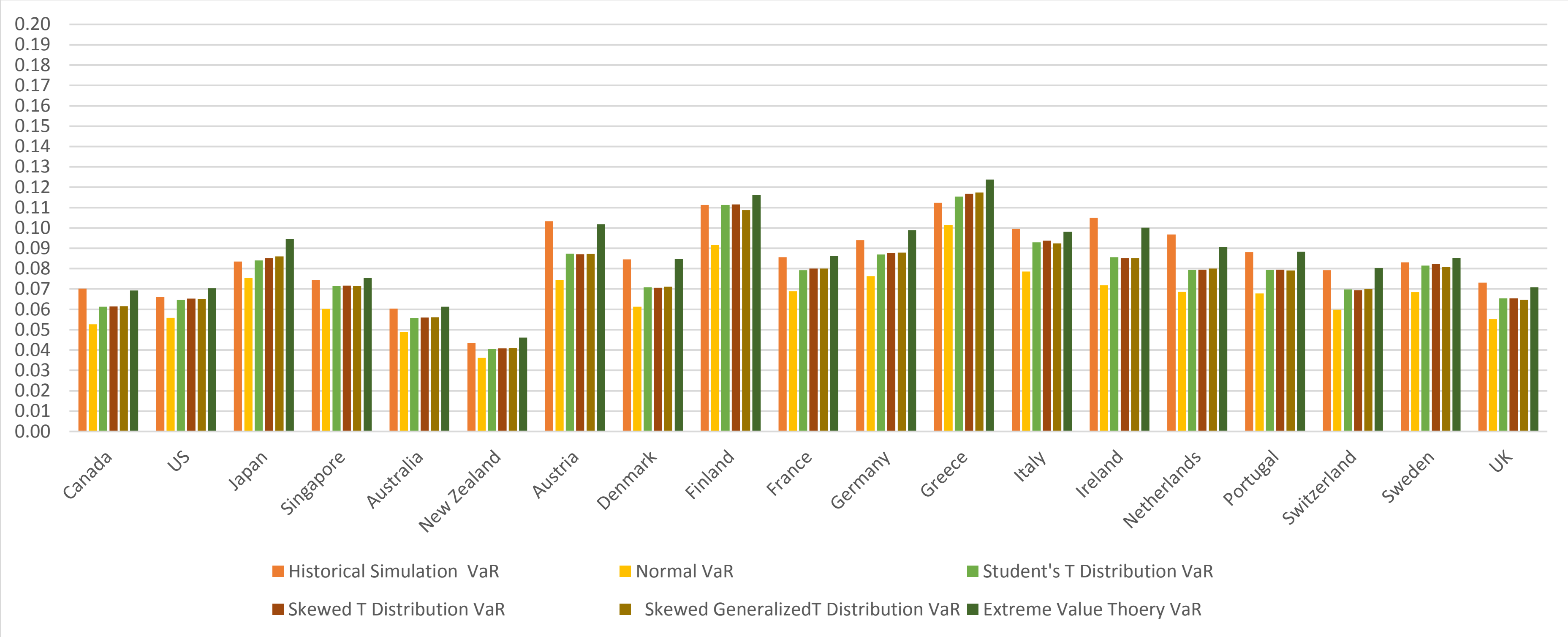
Panel C. 5% ESs



Note: Figure 79. Presents the emerging stock exchanges low quarterly skewness period daily ESs . The data source is DataStream.

Figure 80. Developed stock exchanges whole sample period weekly VaRs

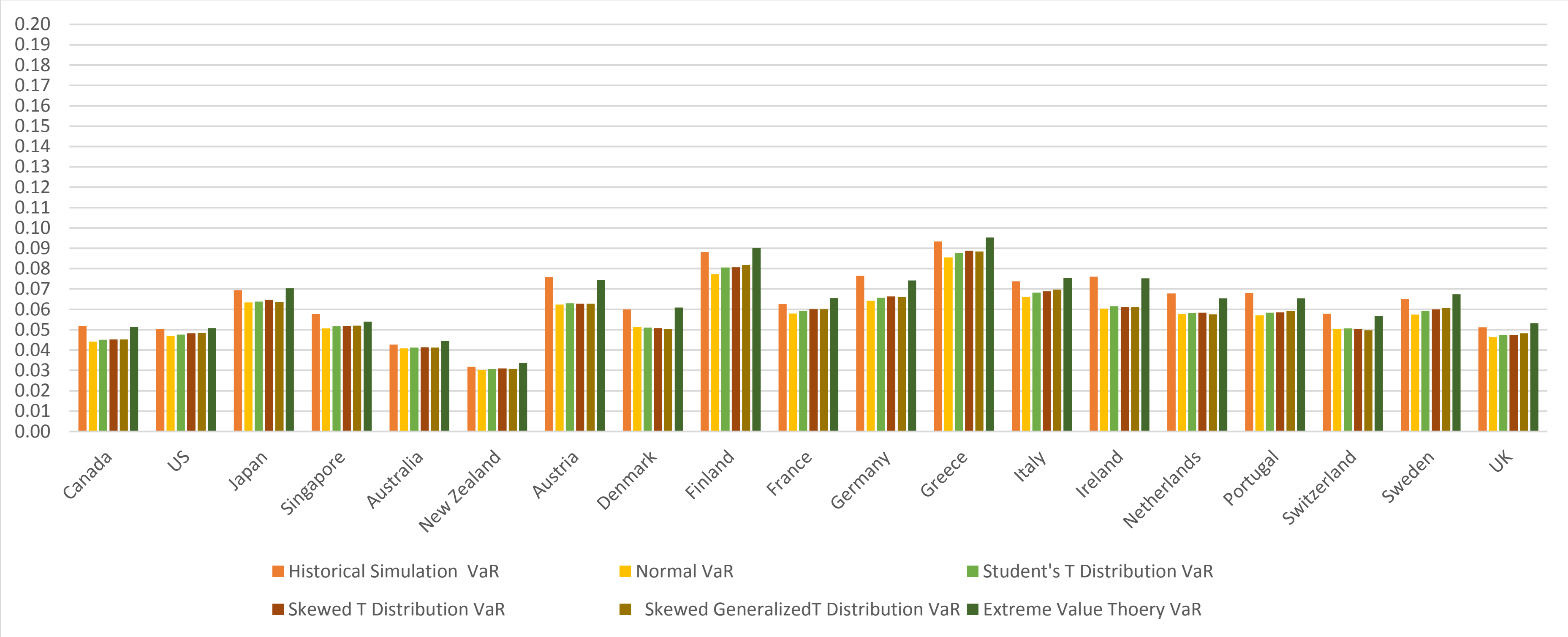
Panel A. 1% VaRs



Note: Figure 80. Presents the developed stock exchanges whole sample period weekly VaRs. The data source is DataStream.

Figure 80. Developed stock exchanges whole sample period weekly VaRs

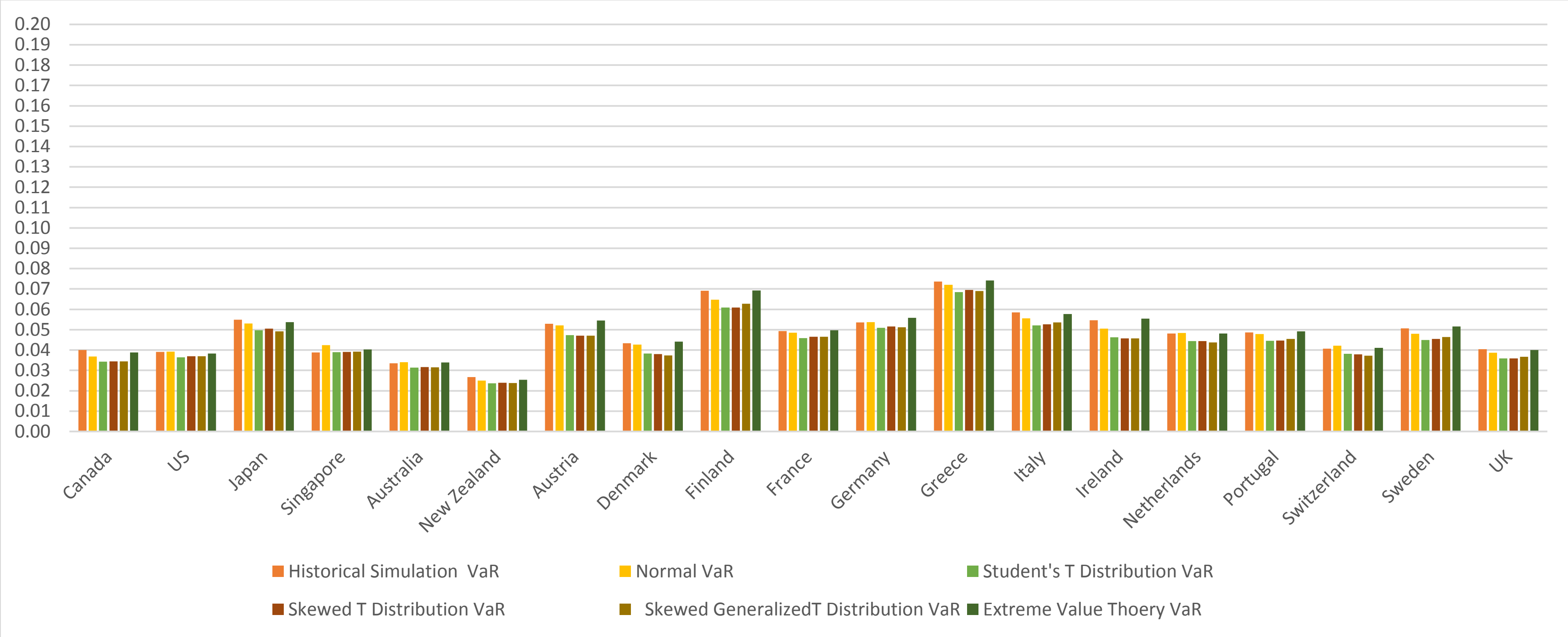
Panel B. 2.5% VaRs



Note: Figure 80. Presents the developed stock exchanges whole sample period weekly VaRs. The data source is DataStream.

Figure 80. Developed stock exchanges whole sample period weekly VaRs

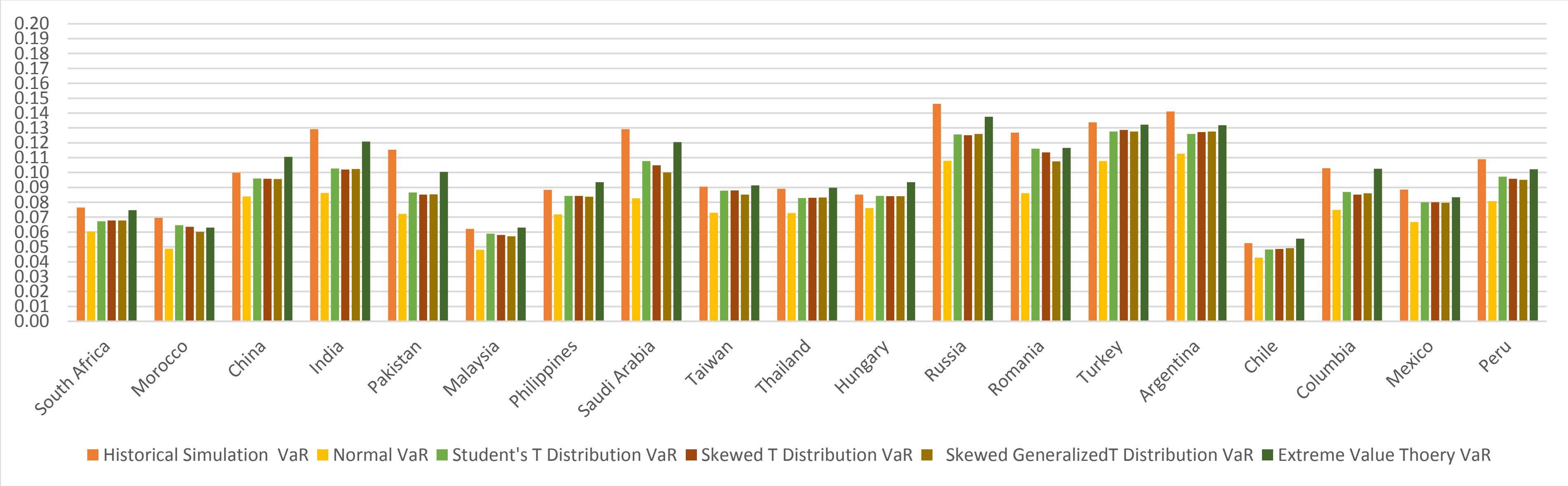
Panel C. 5% VaRs



Note: Figure 80. Presents the developed stock exchanges whole sample period weekly VaRs. The data source is DataStream.

Figure 81. Emerging stock exchanges whole sample period weekly VaRs

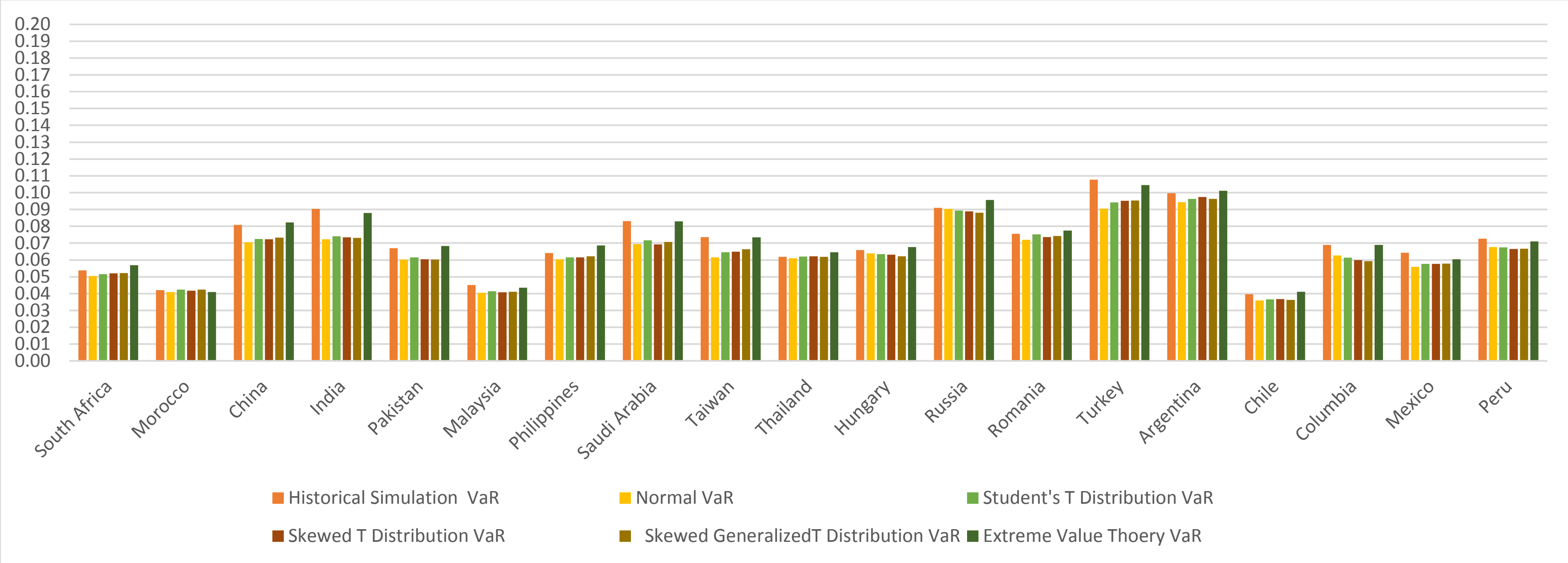
Panel A. 1% VaRs



Note: Figure 81. Presents the emerging stock exchanges whole sample period weekly VaRs. The data source is DataStream.

Figure 81. Emerging stock exchanges whole sample period weekly VaRs

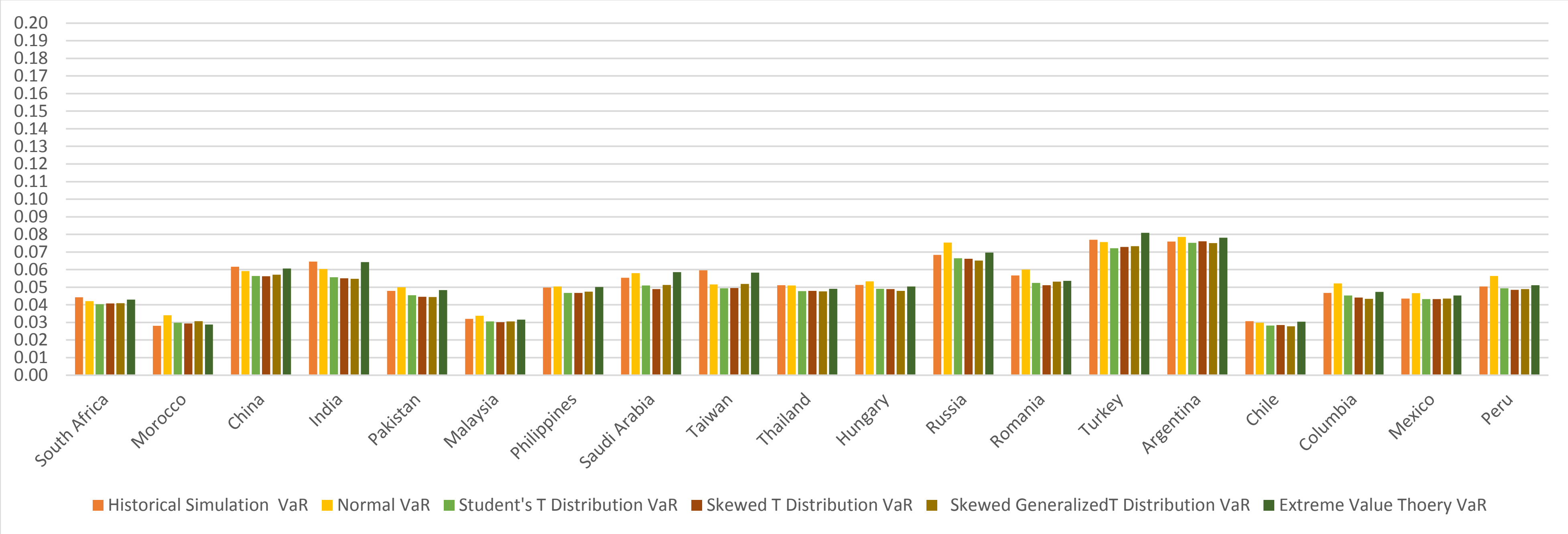
Panel B. 2.5% VaRs



Note: Figure 81. Presents the emerging stock exchanges whole sample period weekly VaRs. The data source is DataStream.

Figure 81. Emerging stock exchanges whole sample period weekly VaRs

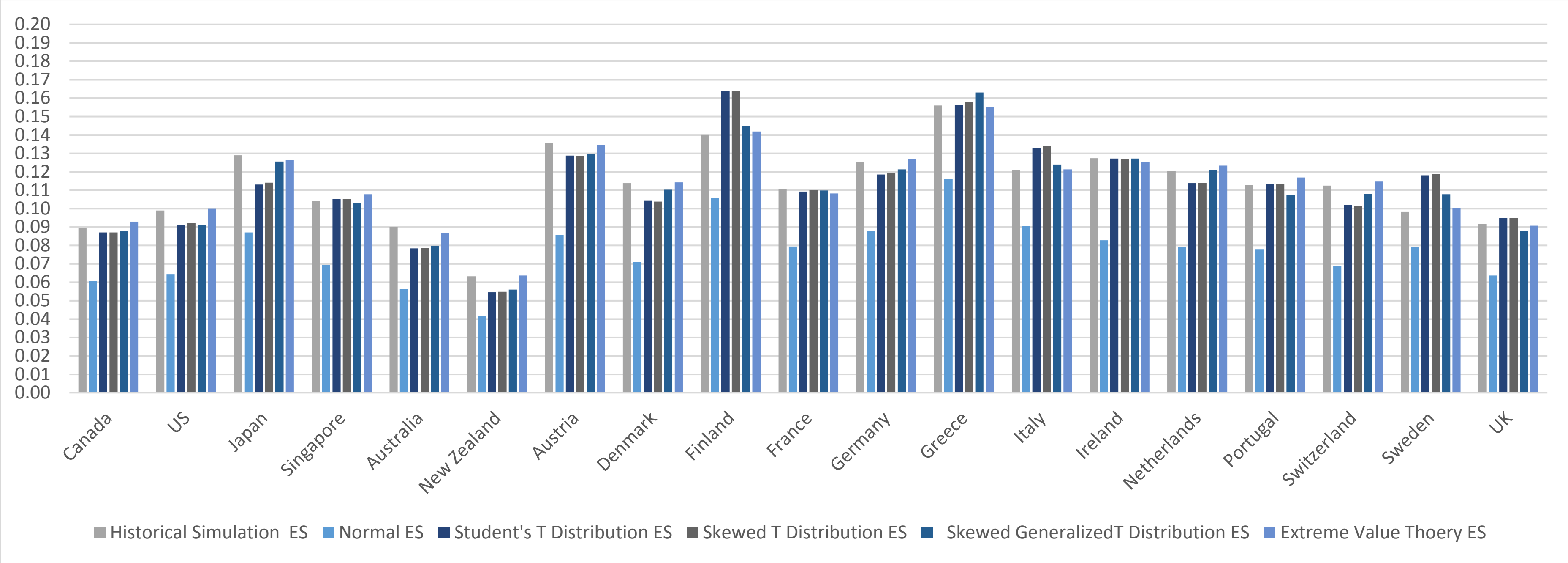
Panel C. 5% VaRs



Note: Figure 81. Presents the emerging stock exchanges whole sample period weekly VaRs. The data source is DataStream.

Figure 81. Developed stock exchanges whole sample period weekly ESs

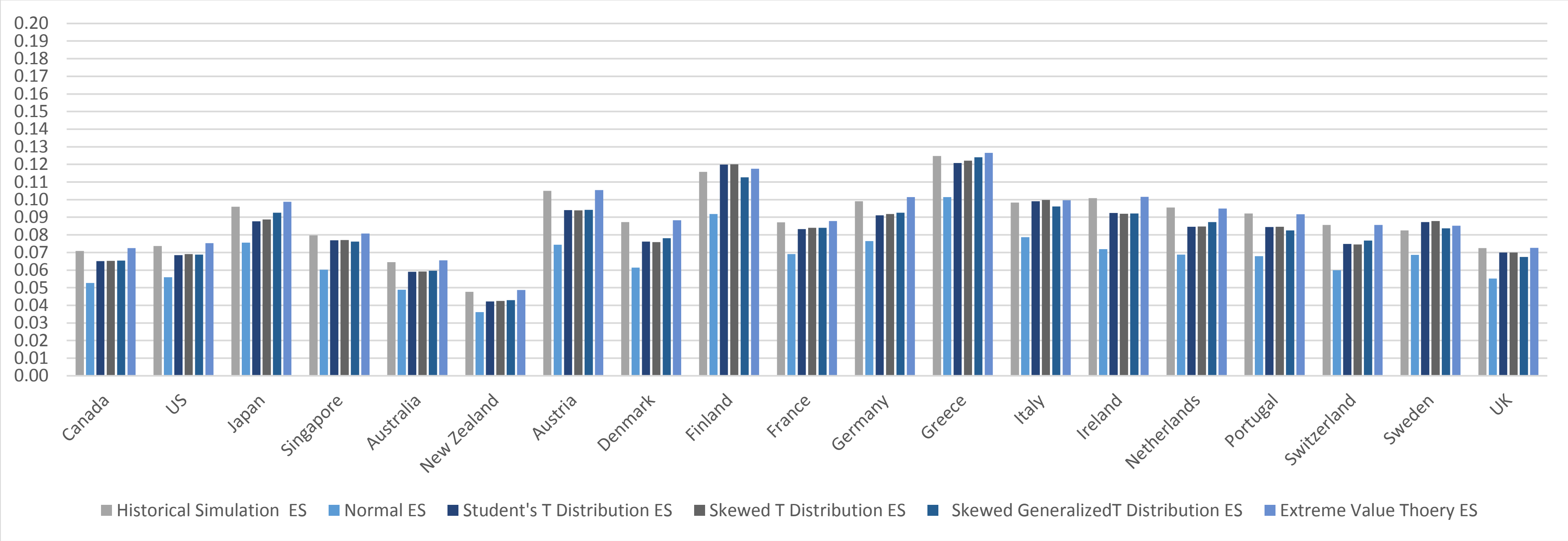
Panel A. 1% ESs



Note: Figure 81. Presents the developed stock exchanges whole sample period weekly ESs. The data source is DataStream.

Figure 81. Developed stock exchanges whole sample period weekly ESs

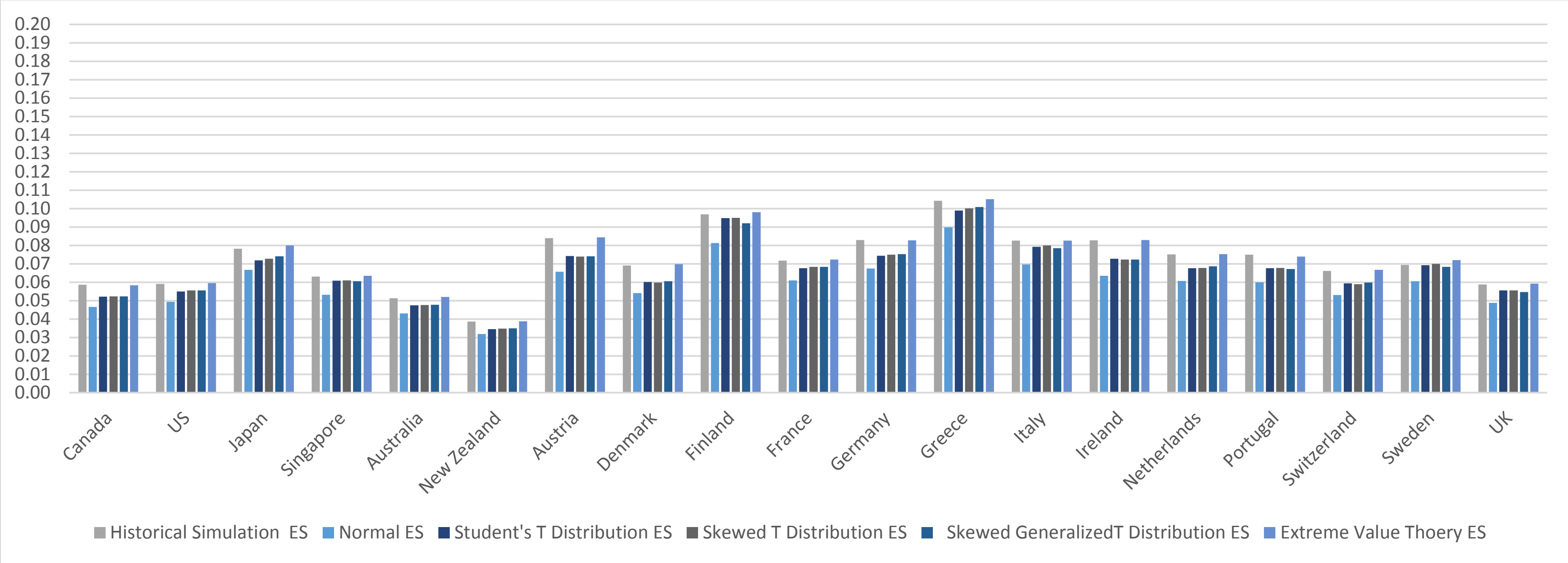
Panel B. 2.5% ESs



Note: Figure 81. Presents the developed stock exchanges whole sample period weekly ESs. The data source is DataStream.

Figure 81. Developed stock exchanges whole sample period weekly ESs

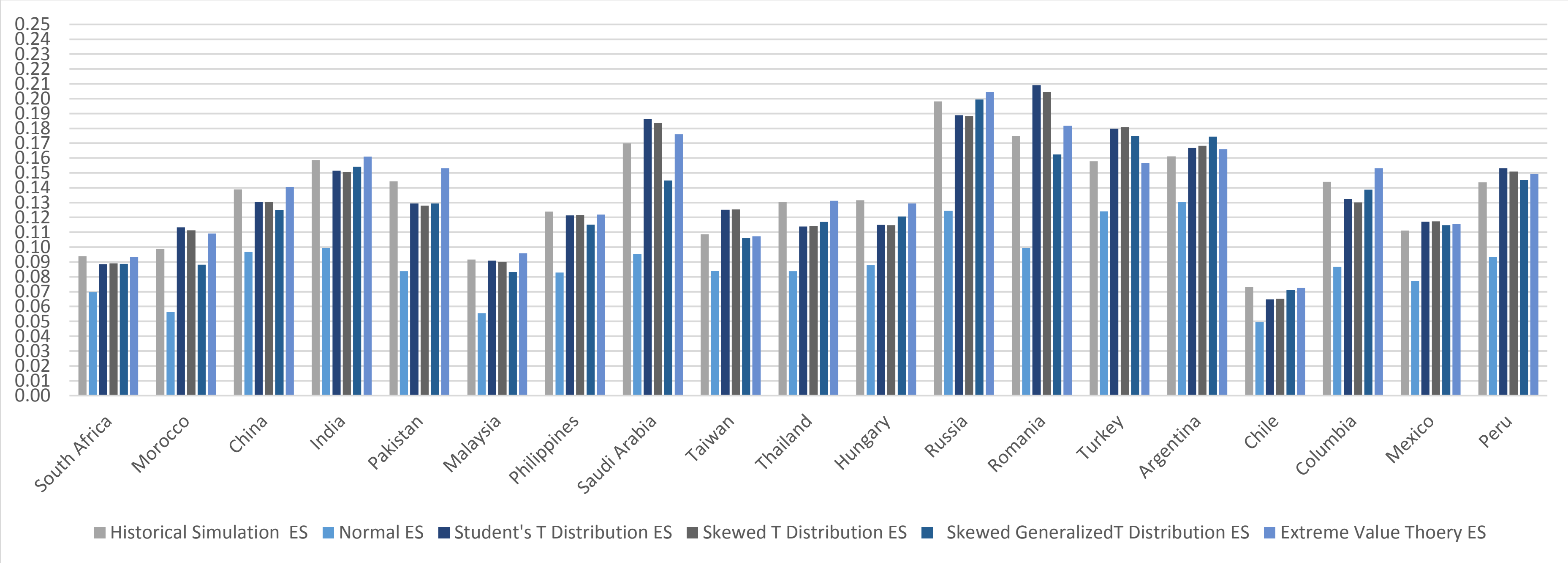
Panel C. 5% ESs



Note: Figure 81. Presents the developed stock exchanges whole sample period weekly ESs. The data source is DataStream.

Figure 82. Emerging stock exchanges whole sample period weekly ESs

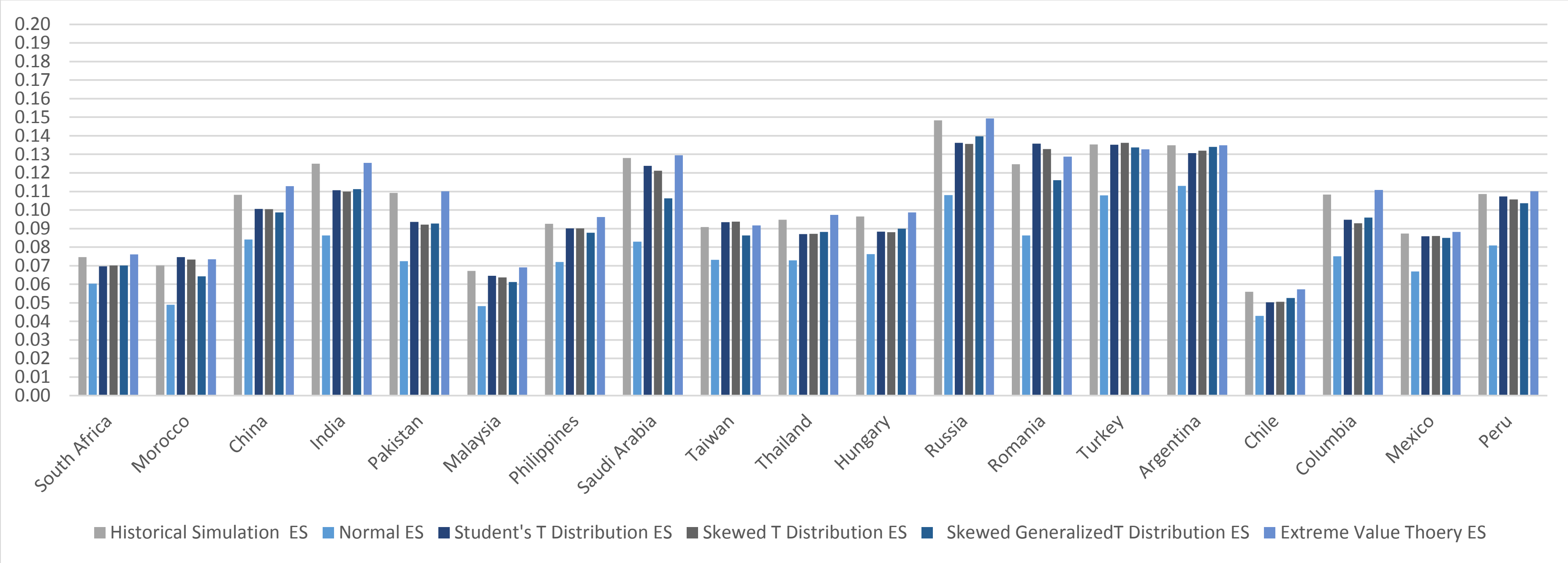
Panel A. 1% ESs



Note: Figure 82. Presents the emerging stock exchanges whole sample period weekly ESs. The data source is DataStream.

Figure 82. Emerging stock exchanges whole sample period weekly ESs

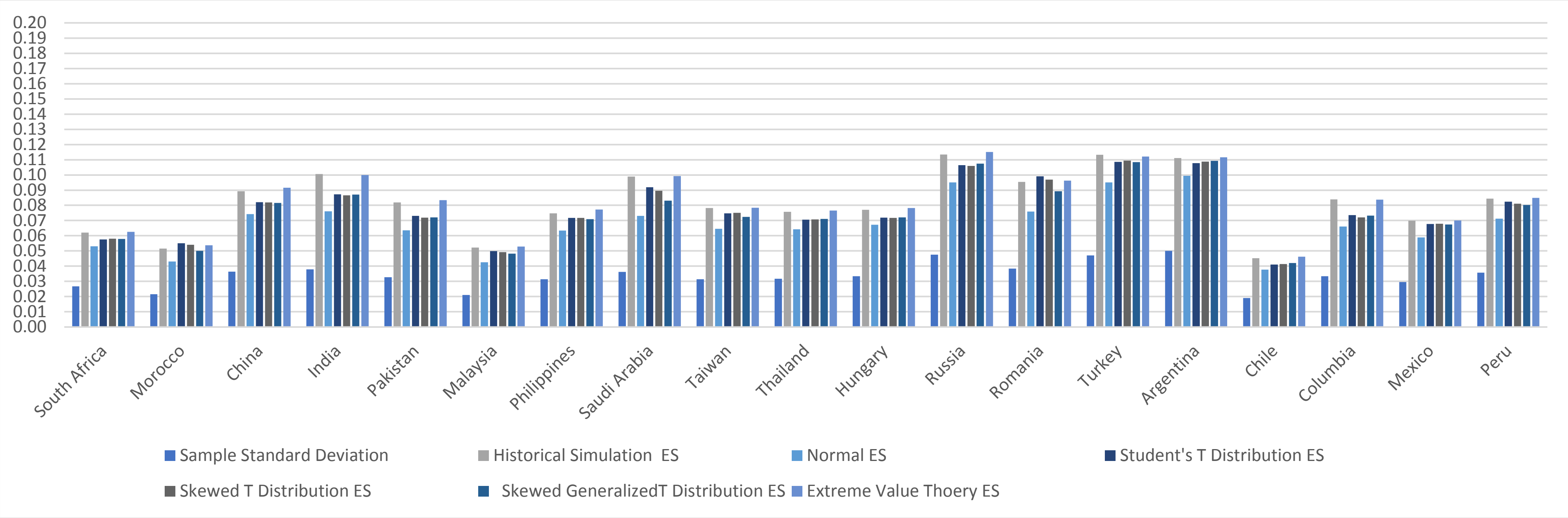
Panel B. 2.5% ESs



Note: Figure 82. Presents the emerging stock exchanges whole sample period weekly ESs. The data source is DataStream.

Figure 82. Emerging stock exchanges whole sample period weekly ESs

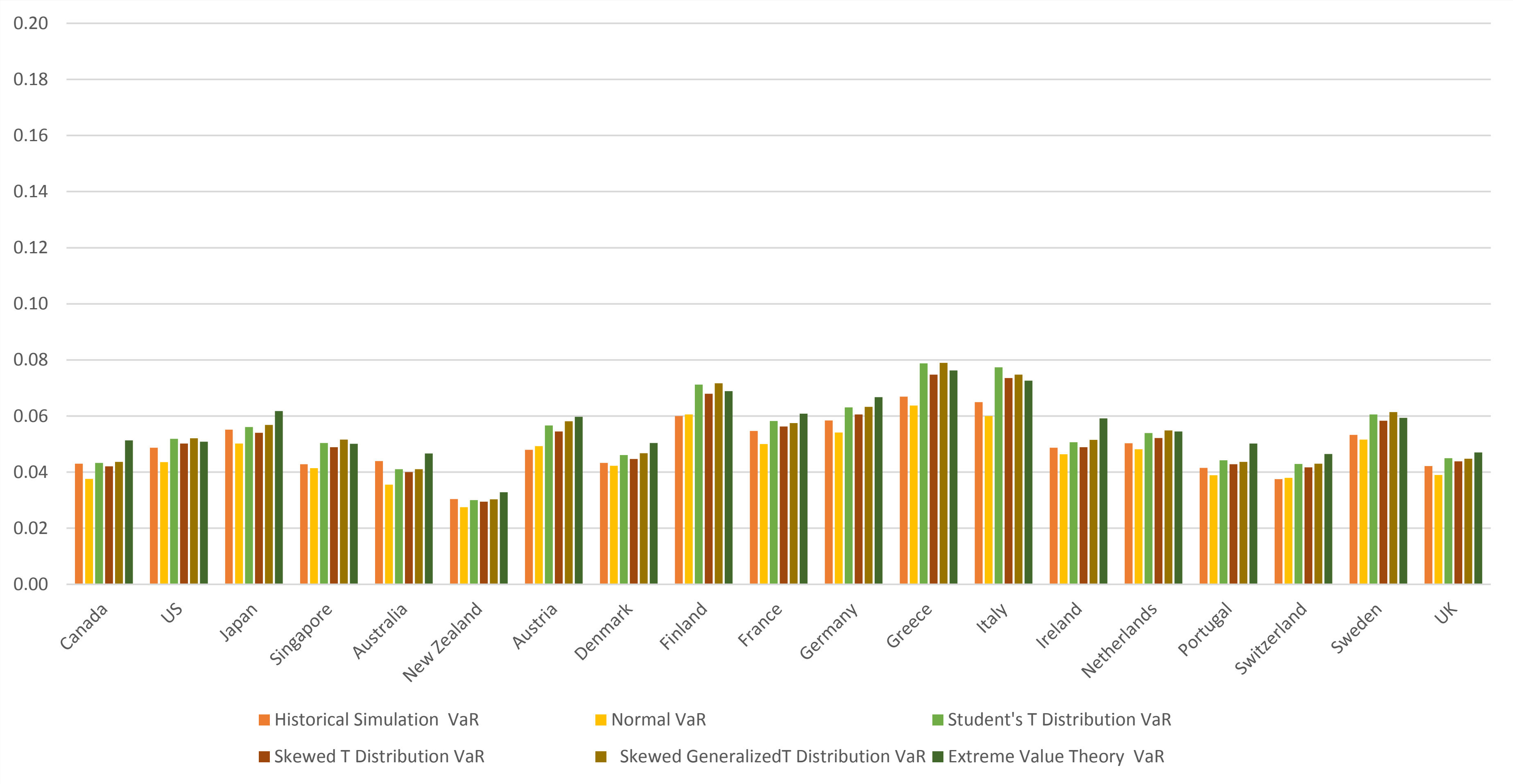
Panel C. 5% ESs



Note: Figure 82. Presents the emerging stock exchanges whole sample period weekly ESs. The data source is DataStream.

Figure 83. Developed stock exchanges bull market period weekly VaRs

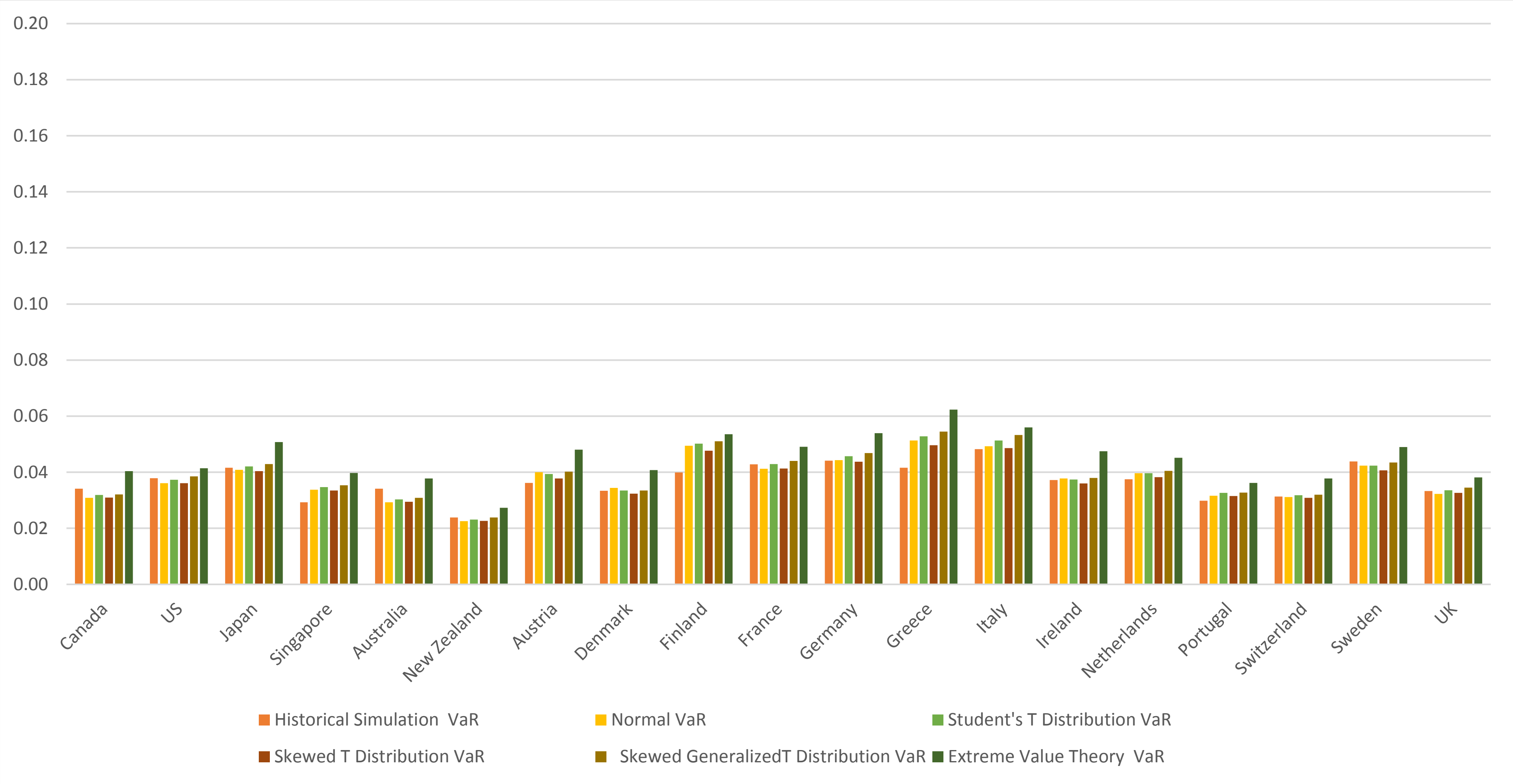
Panel A. 1% VaRs



Note: Figure 83. Presents the developed stock exchanges bull market period weekly VaRs. The data source is DataStream.

Figure 83. Developed stock exchanges bull market period weekly VaRs

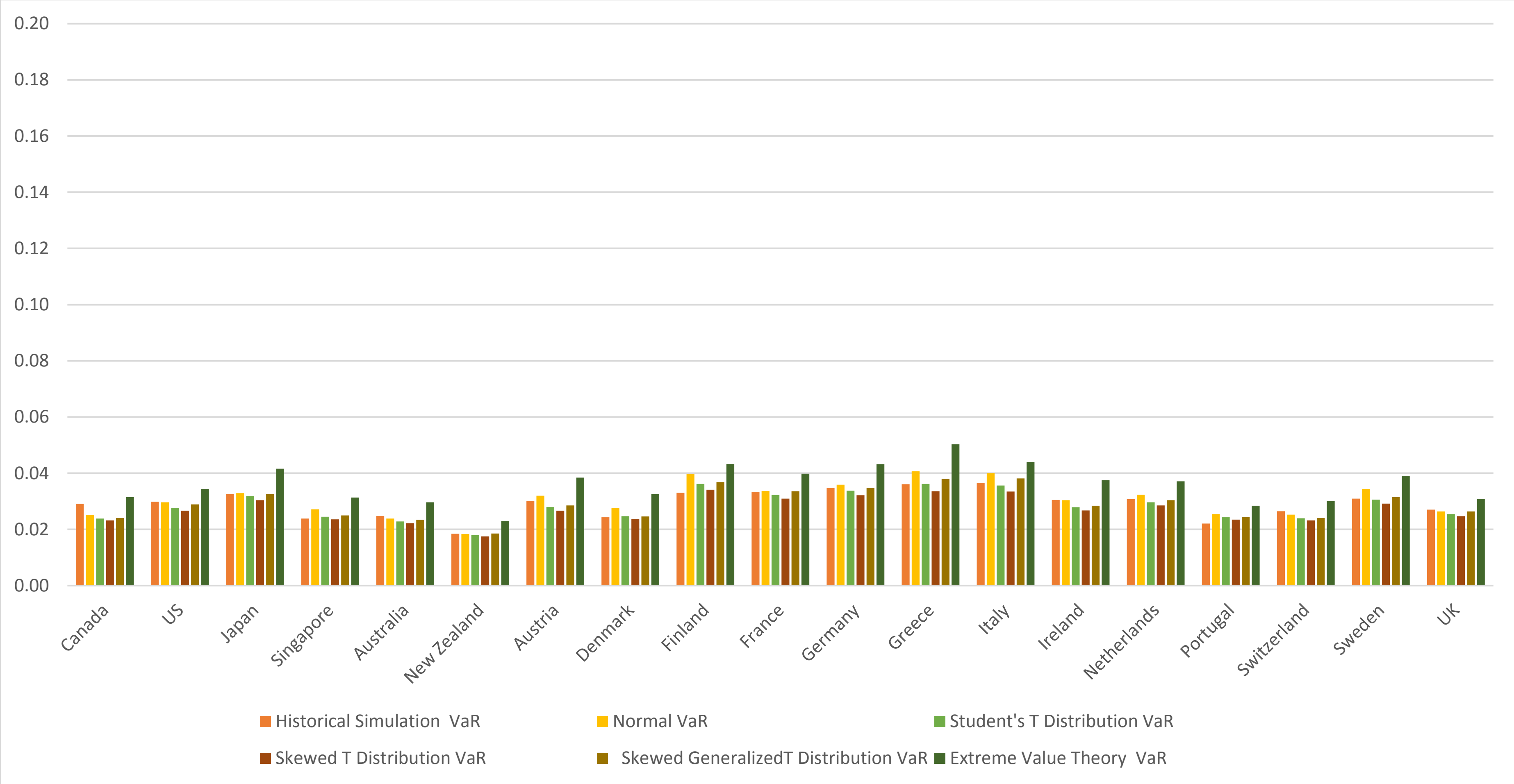
Panel B. 2.5% VaRs



Note: Figure 83. Presents the developed stock exchanges bull market period weekly VaRs. The data source is DataStream.

Figure 83. Developed stock exchanges bull market period weekly VaRs

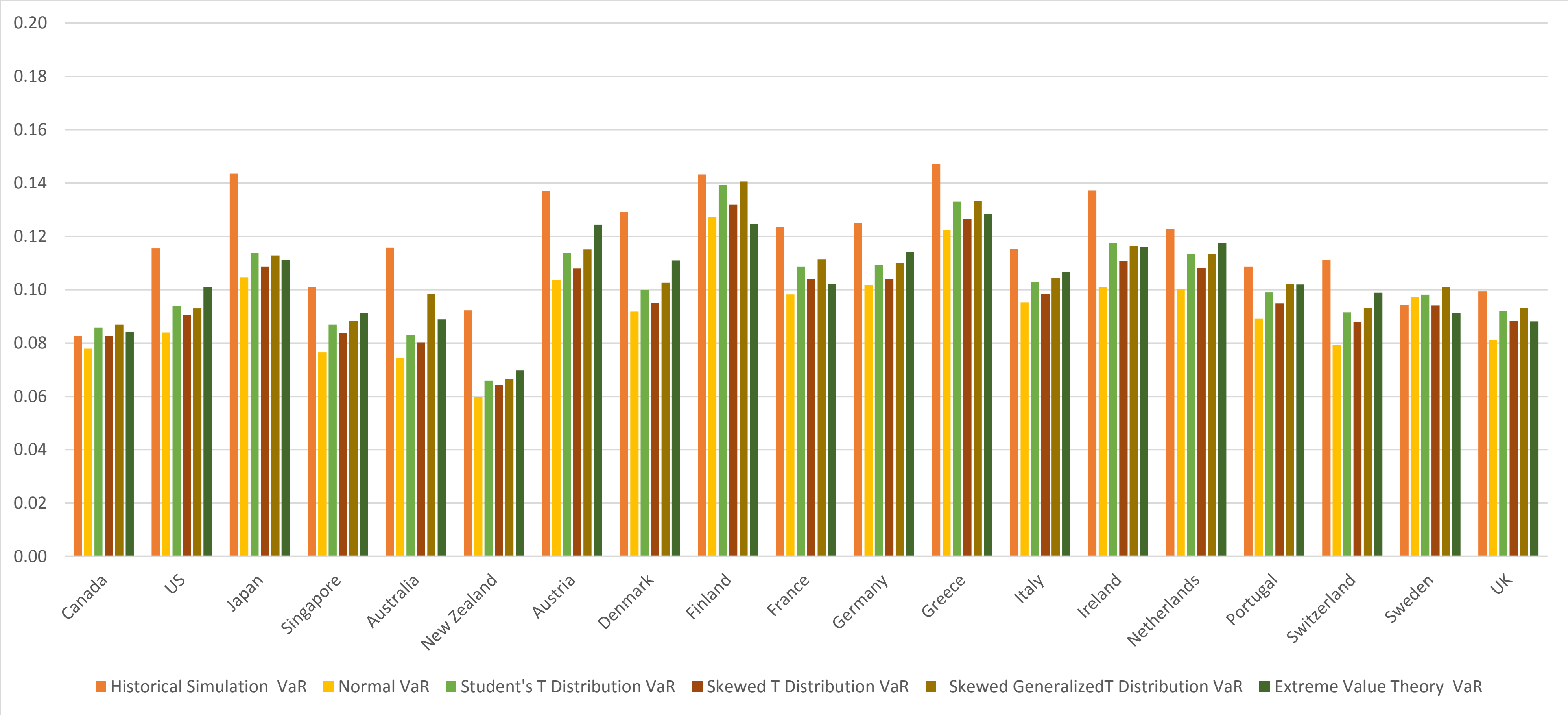
Panel C. 5% VaRs



Note: Figure 83. Presents the developed stock exchanges bull market period weekly VaRs. The data source is DataStream.

Figure 84. Developed stock exchanges bear market period weekly VaRs

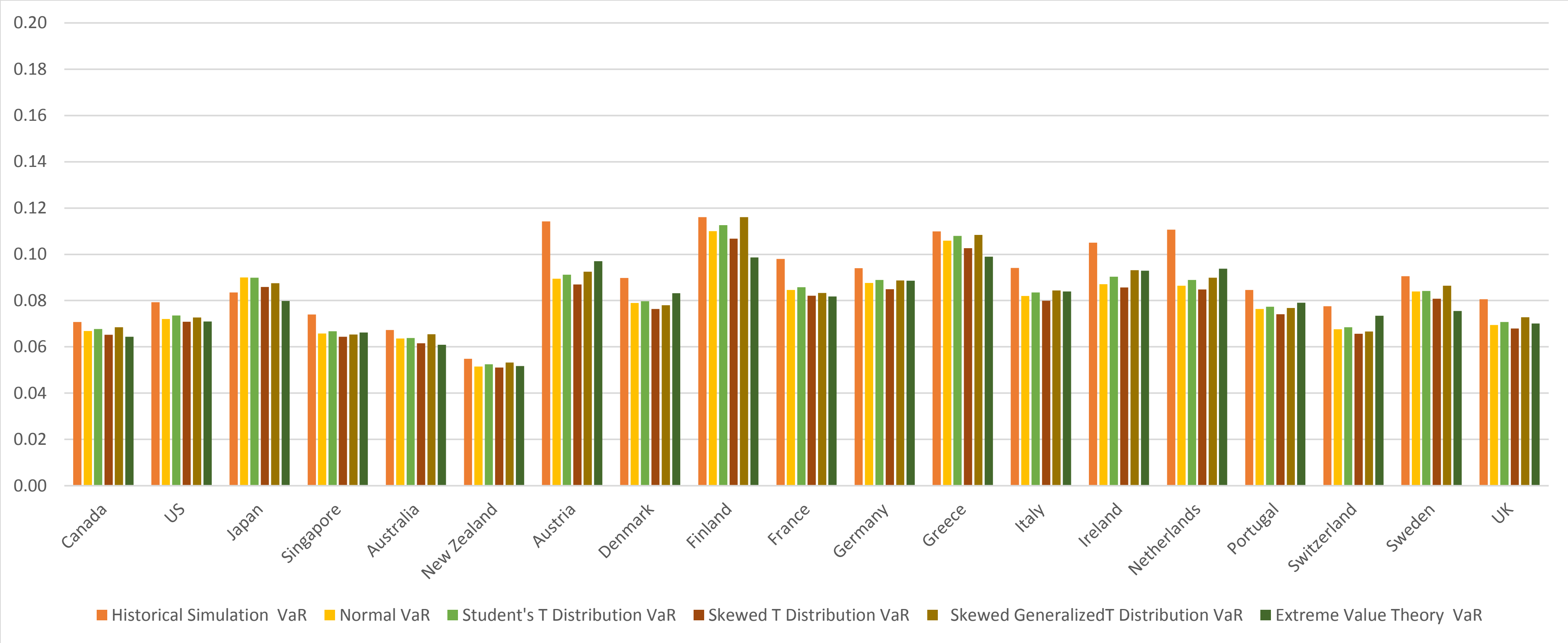
Panel A. 1% VaRs



Note: Figure 84. Presents the developed stock exchanges bear market period weekly VaRs. The data source is DataStream.

Figure 84. Developed stock exchanges bear market period weekly VaRs

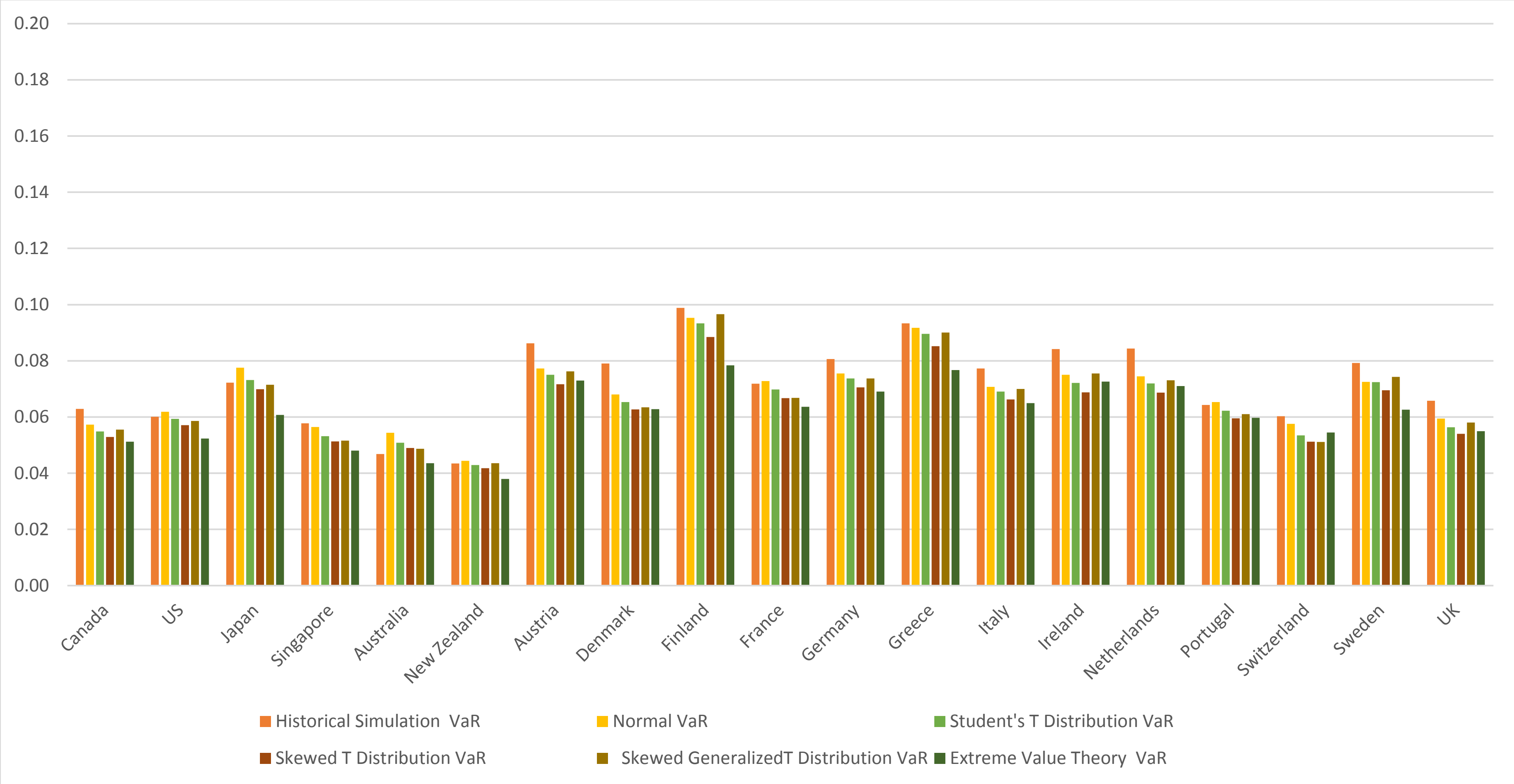
Panel B. 2.5% VaRs



Note: Figure 84. Presents the developed stock exchanges bear market period weekly VaRs. The data source is DataStream.

Figure 84. Developed stock exchanges bear market period weekly VaRs

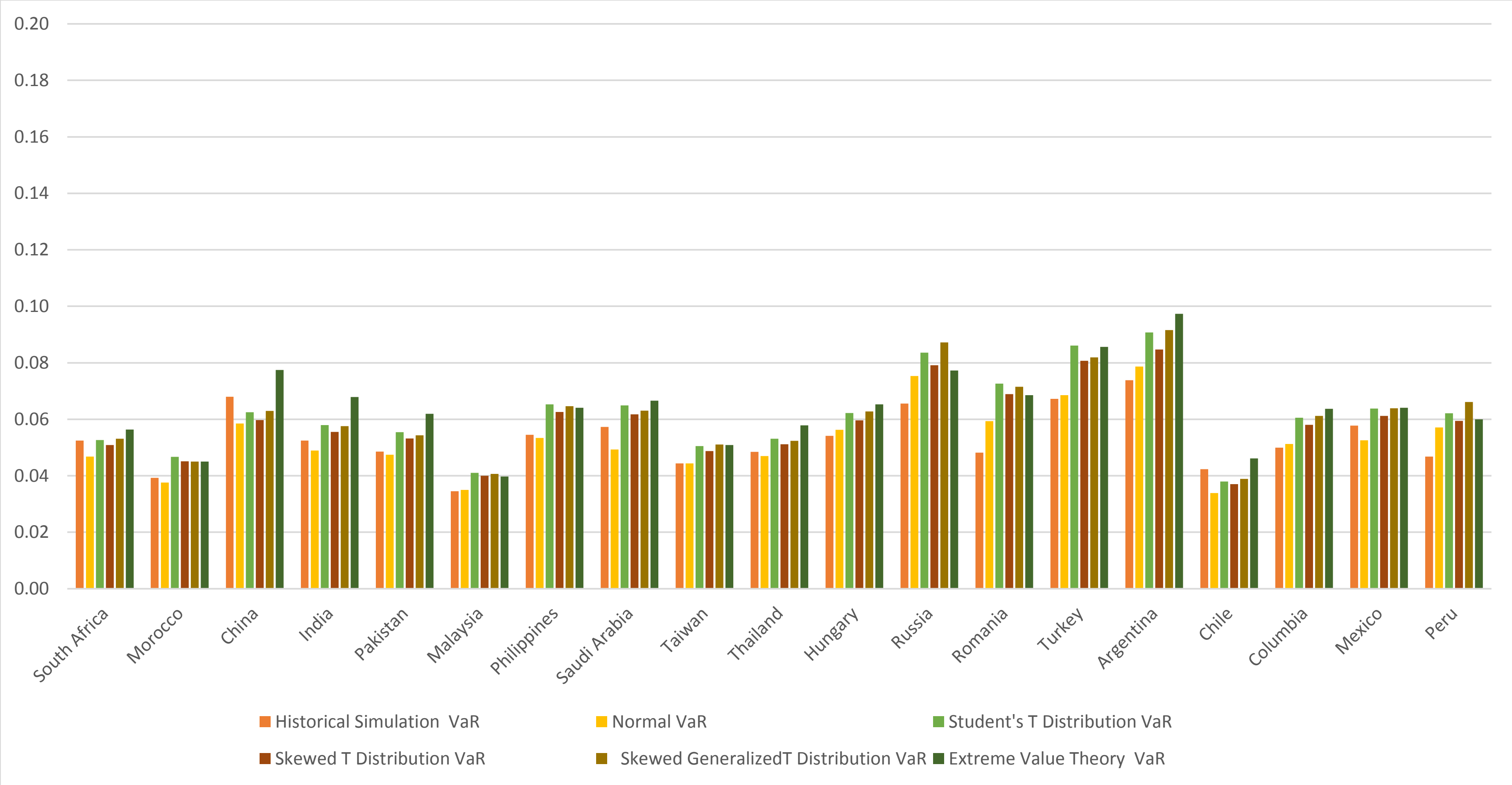
Panel C. 5% VaRs



Note: Figure 84. Presents the developed stock exchanges bear market period weekly VaRs. The data source is DataStream.

Figure 85. Emerging stock exchanges bull market period weekly VaRs

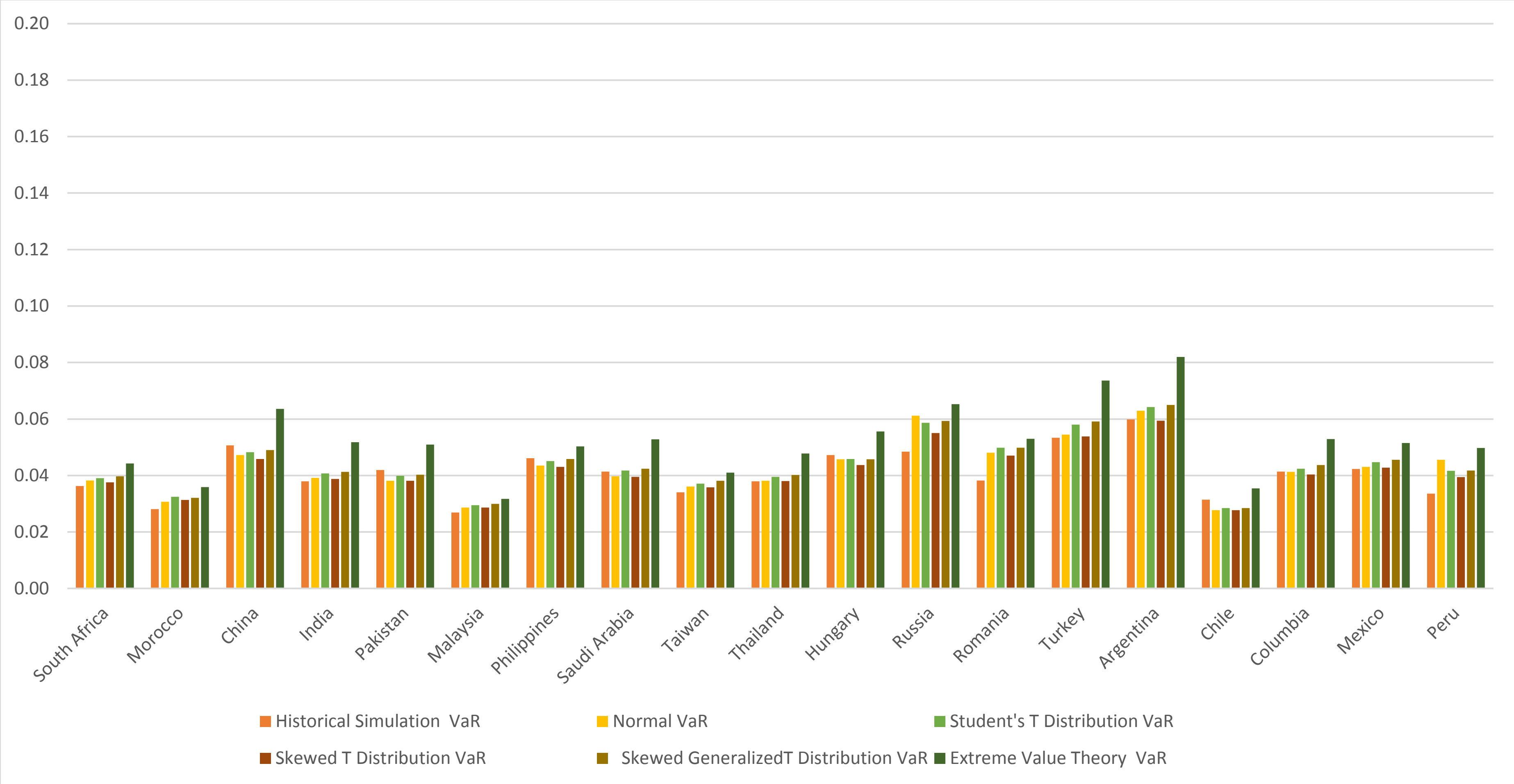
Panel A. 1% VaRs



Note: Figure 85. Presents the emerging stock exchanges bull market period weekly VaRs. The data source is DataStream.

Figure 85. Emerging stock exchanges bull market period weekly VaRs

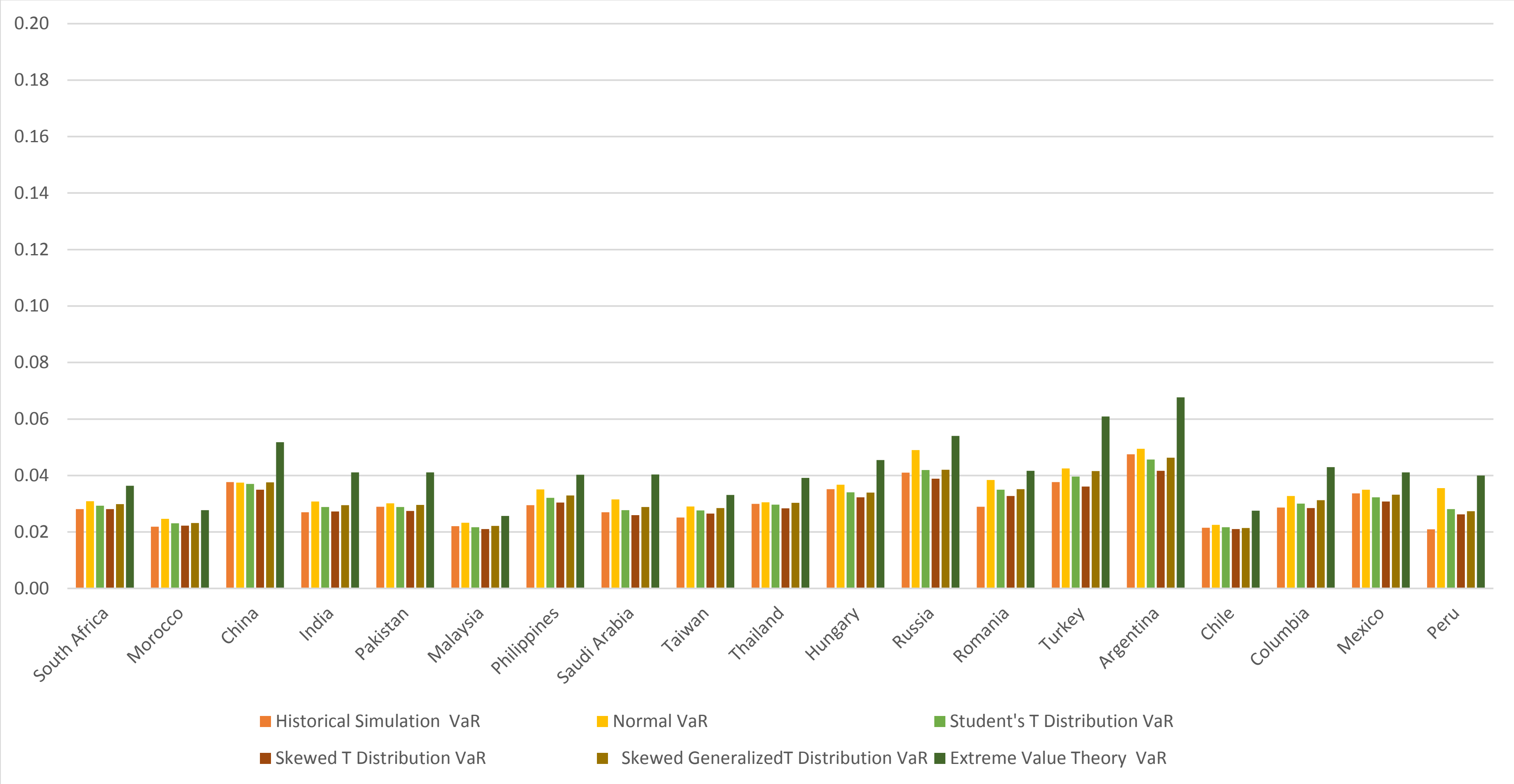
Panel B. 2.5% VaRs



Note: Figure 85. Presents the emerging stock exchanges bull market period weekly VaRs. The data source is DataStream.

Figure 85. Emerging stock exchanges bull market period weekly VaRs

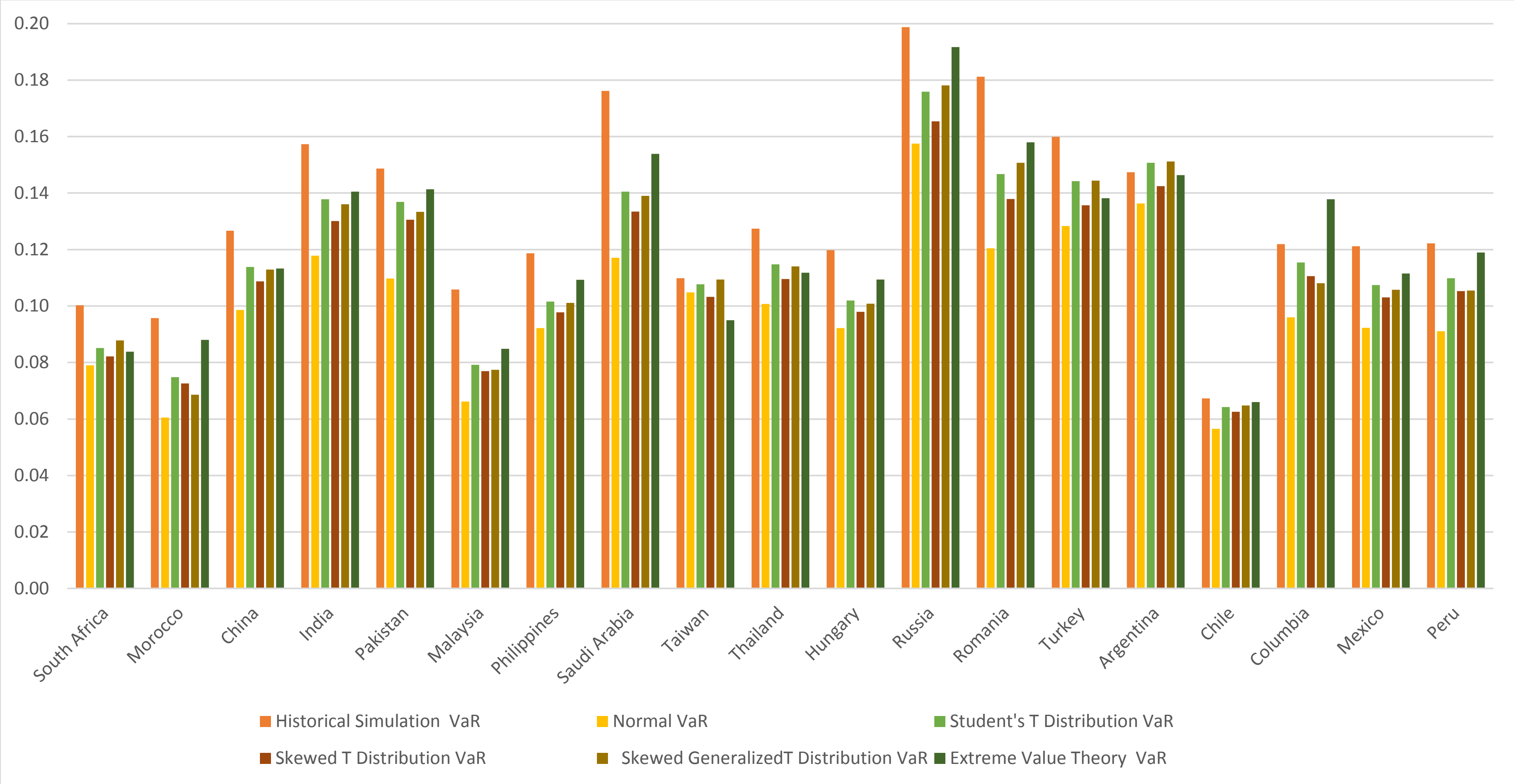
Panel C. 5% VaRs



Note: Figure 85. Presents the emerging stock exchanges bull market period weekly VaRs. The data source is DataStream.

Figure 86. Emerging stock exchanges bear market period weekly VaRs

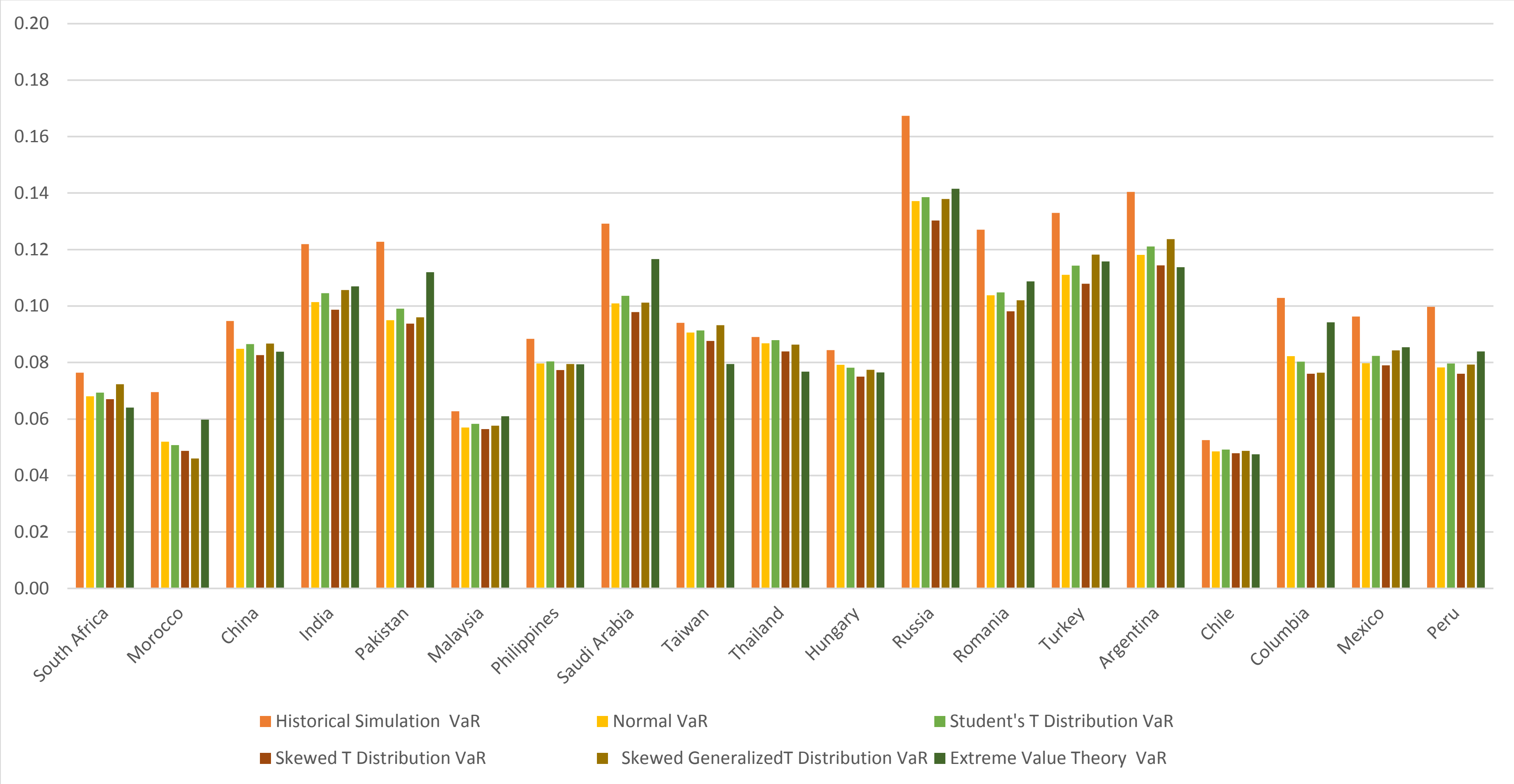
Panel A. 1% VaRs



Note: Figure 86. Presents the emerging stock exchanges bear market period weekly VaRs. The data source is DataStream.

Figure 86. Emerging stock exchanges bear market period weekly VaRs

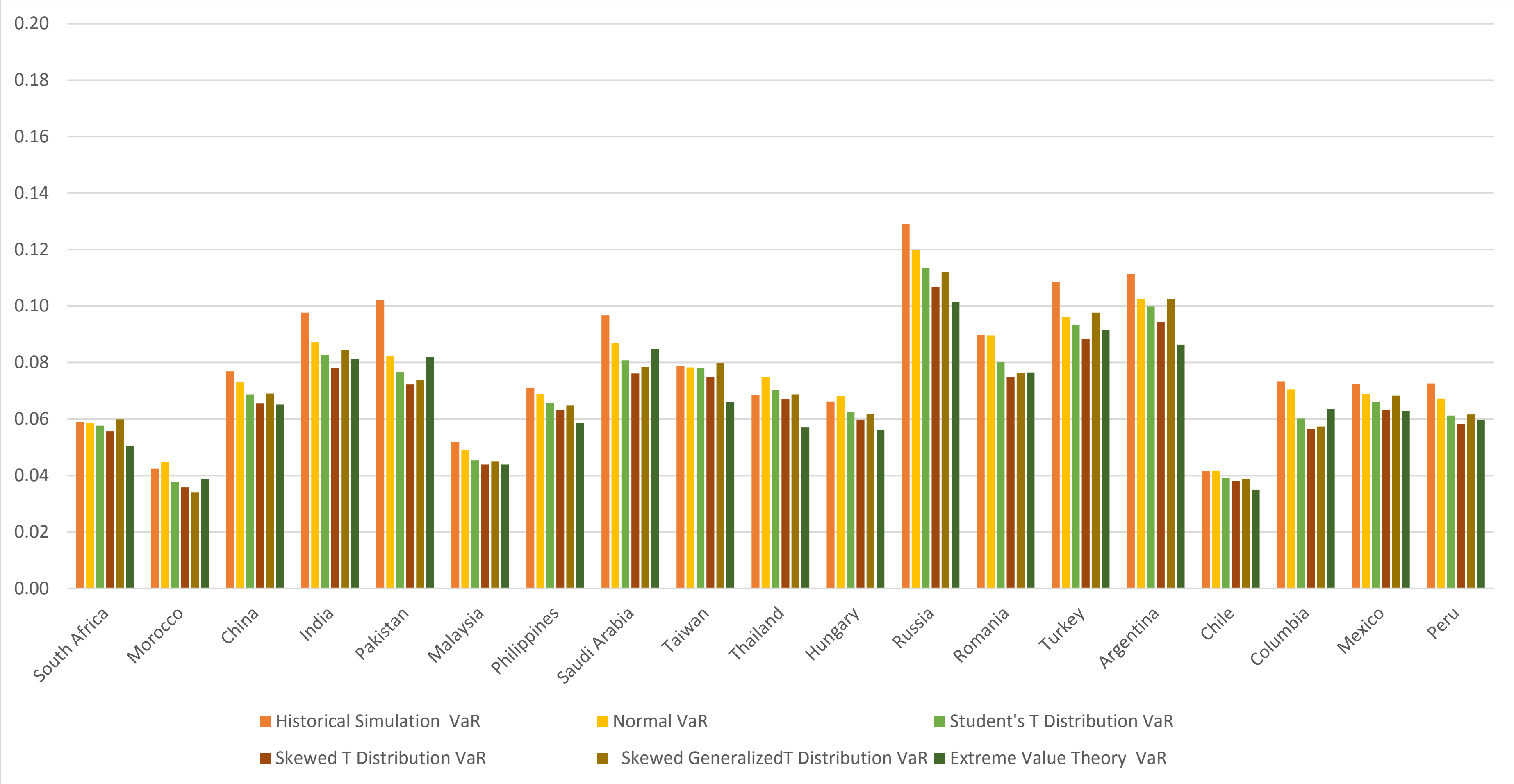
Panel B. 2.5% VaRs



Note: Figure 86. Presents the emerging stock exchanges bear market period weekly VaRs. The data source is DataStream.

Figure 86. Emerging stock exchanges bear market period weekly VaRs

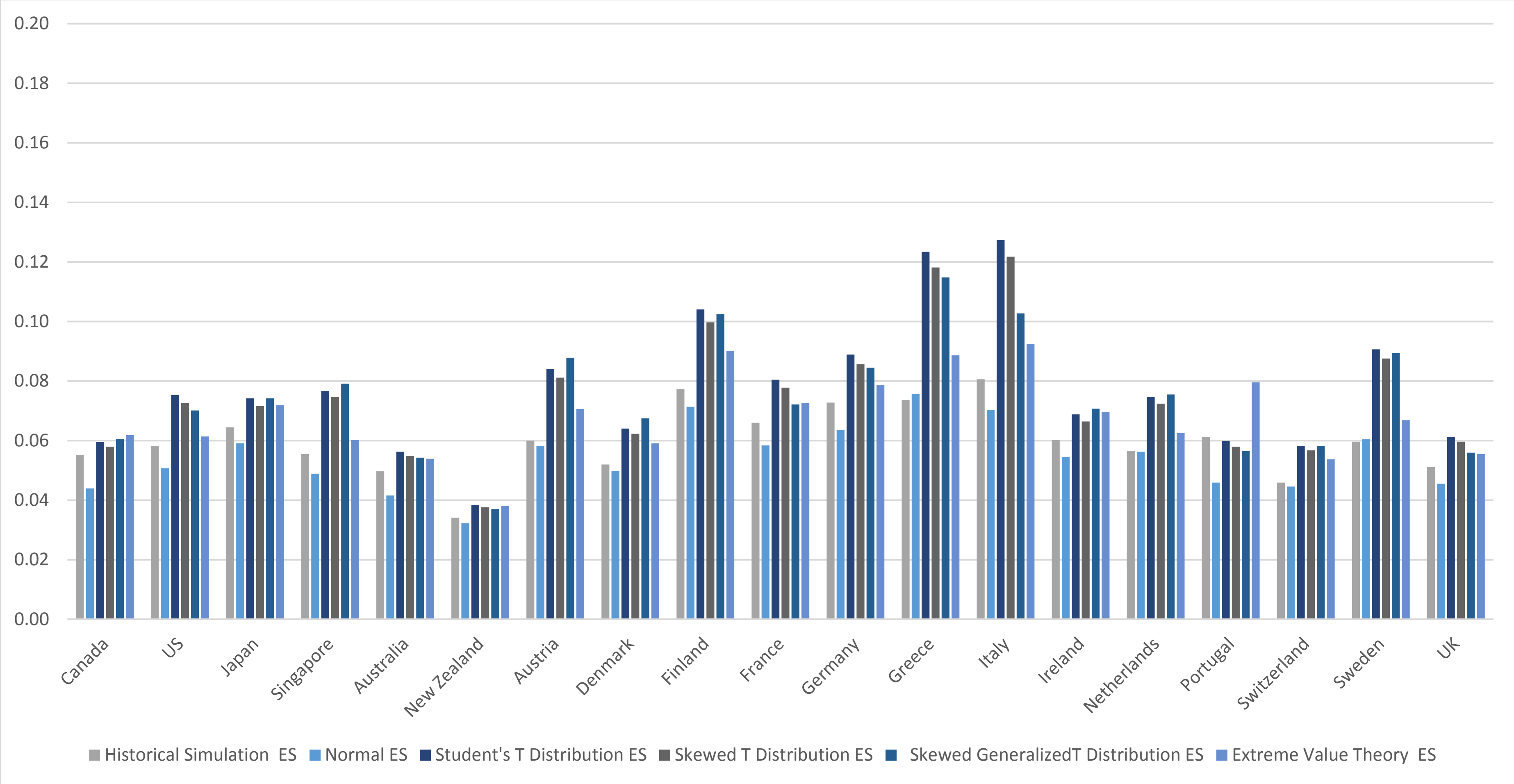
Panel C. 5% VaRs



Note: Figure 86. Presents the emerging stock exchanges bear market period weekly VaRs. The data source is DataStream.

Figure 87. Developed stock exchanges bull market period weekly ESs

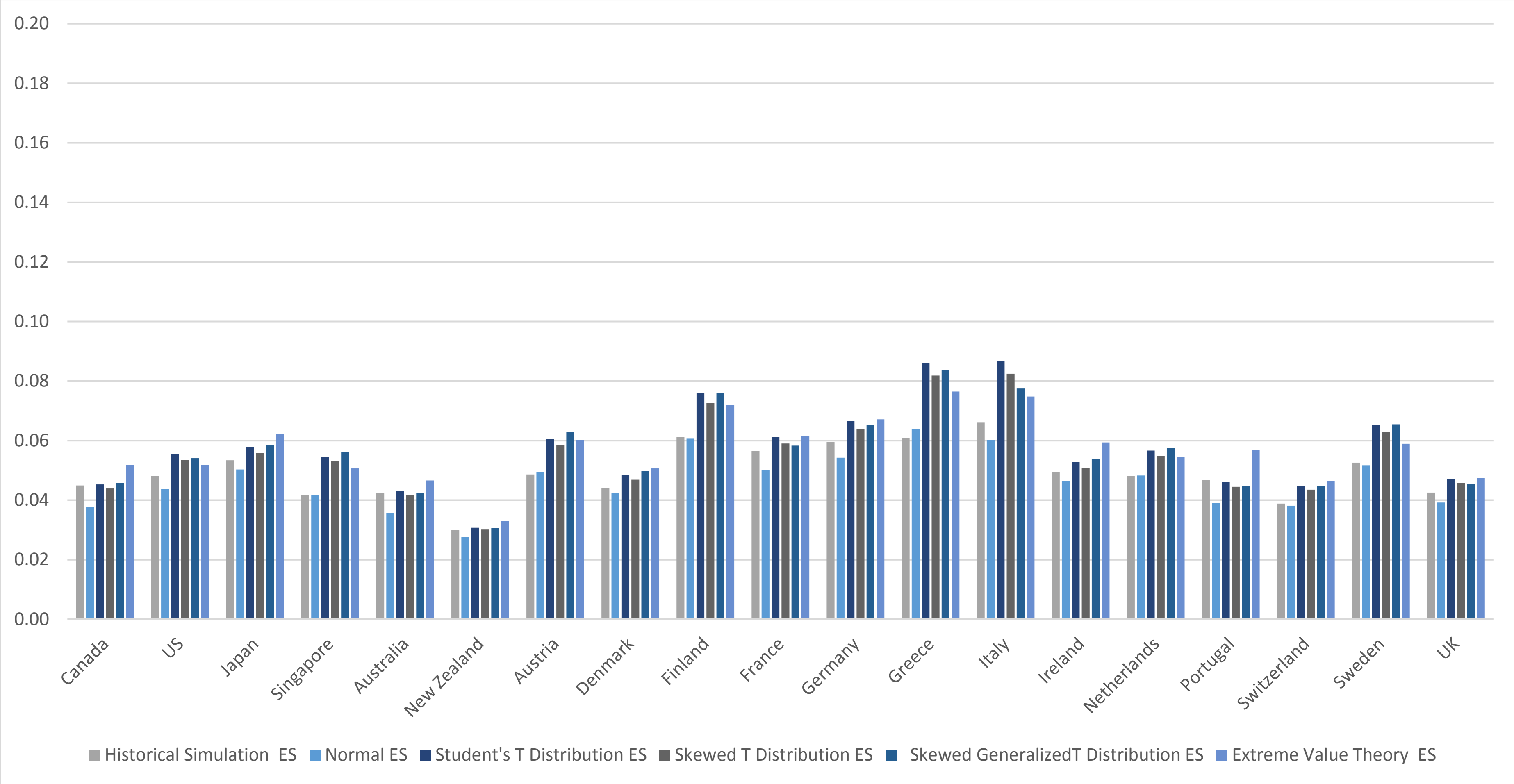
Panel A. 1% ESs



Note: Figure 87. Presents the developed stock exchanges bull market period weekly ESs. The data source is DataStream.

Figure 87. Developed stock exchanges bull market period weekly ESs

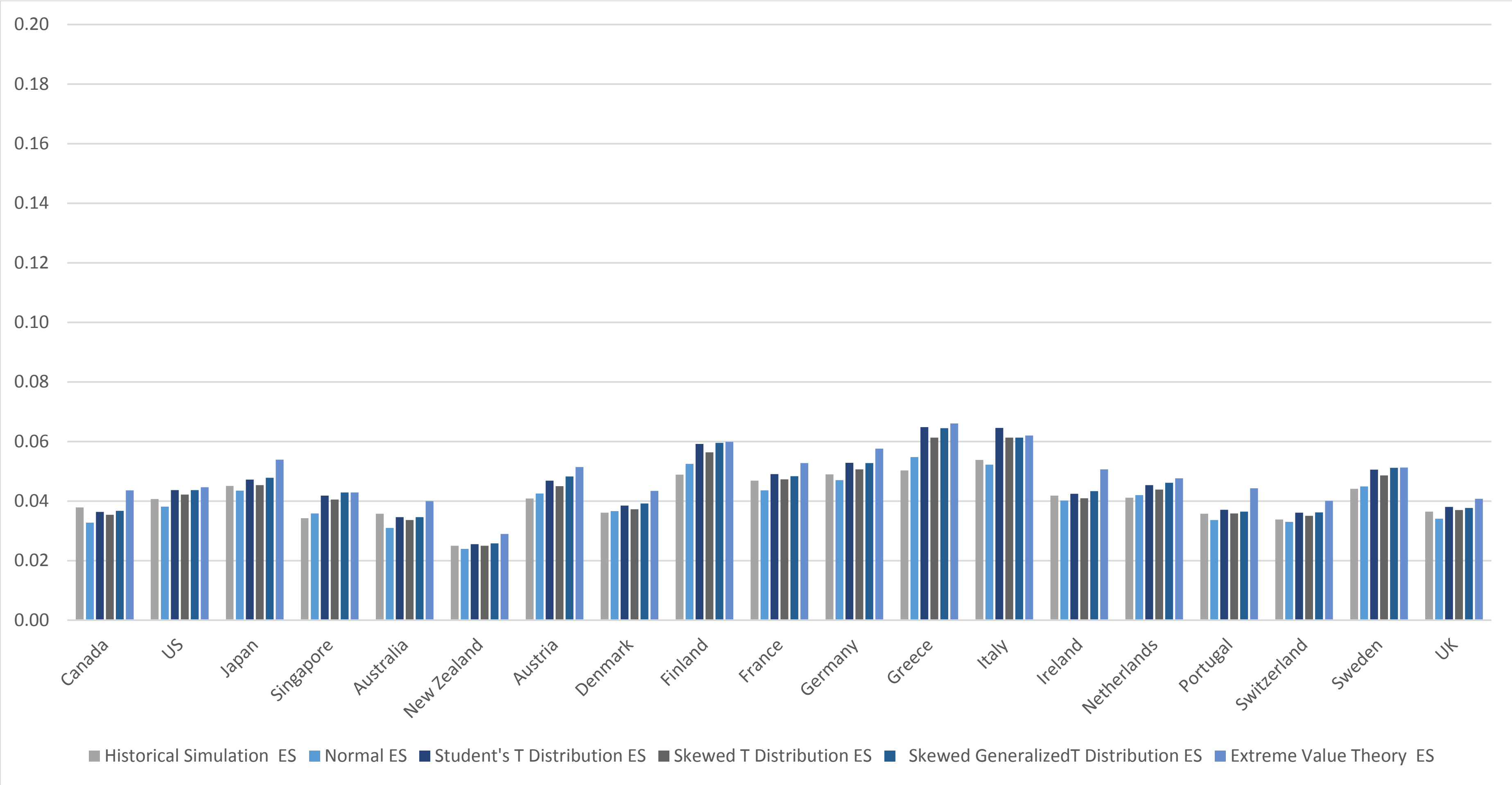
Panel B. 2.5% ESs



Note: Figure 87. Presents the developed stock exchanges bull market period weekly ESs. The data source is DataStream.

Figure 87. Developed stock exchanges bull market period weekly ESs

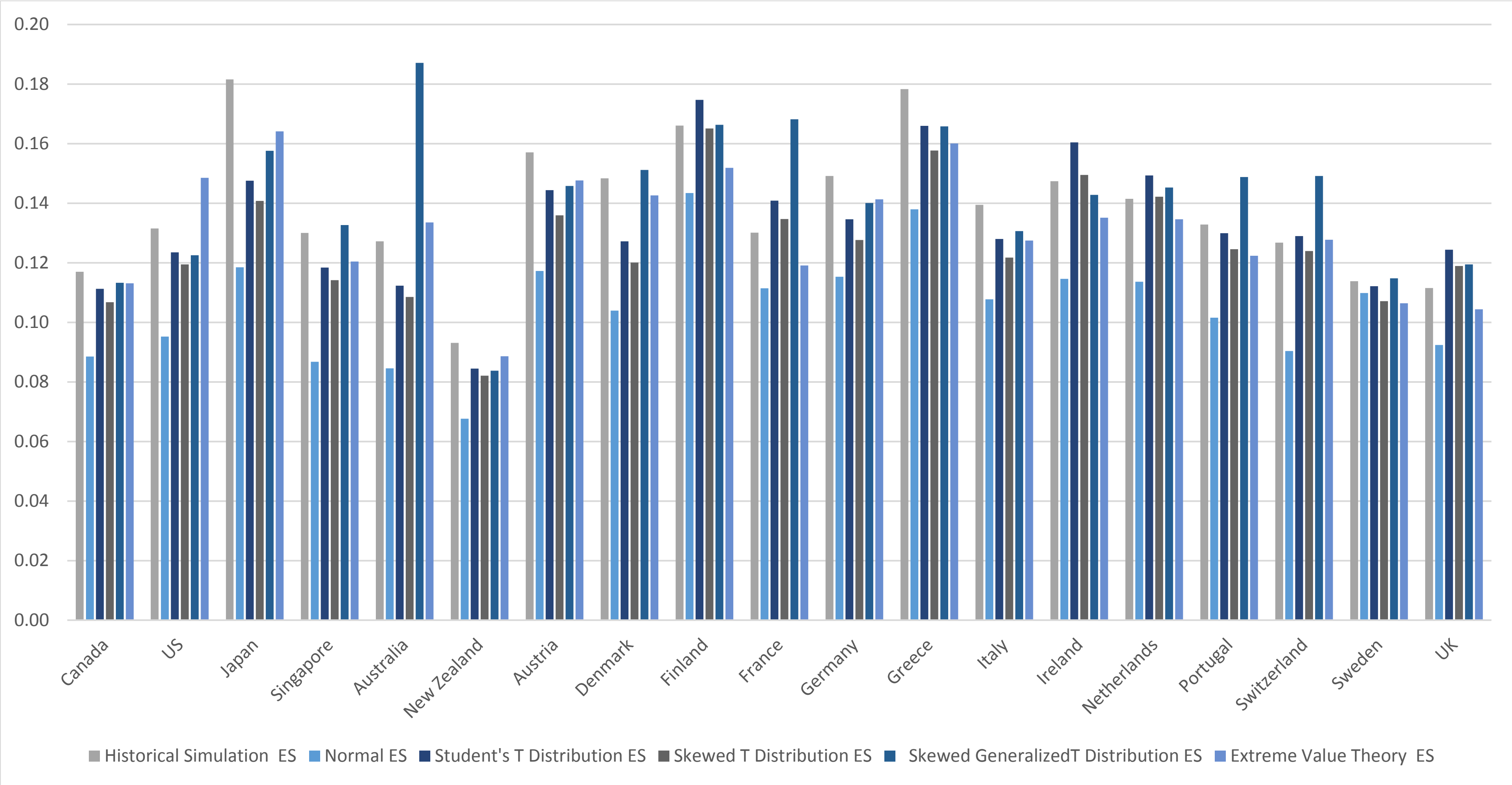
Panel C. 5% ESs



Note: Figure 87. Presents the developed stock exchanges bull market period weekly ESs. The data source is DataStream.

Figure 88. Developed stock exchanges bear market period weekly ESs

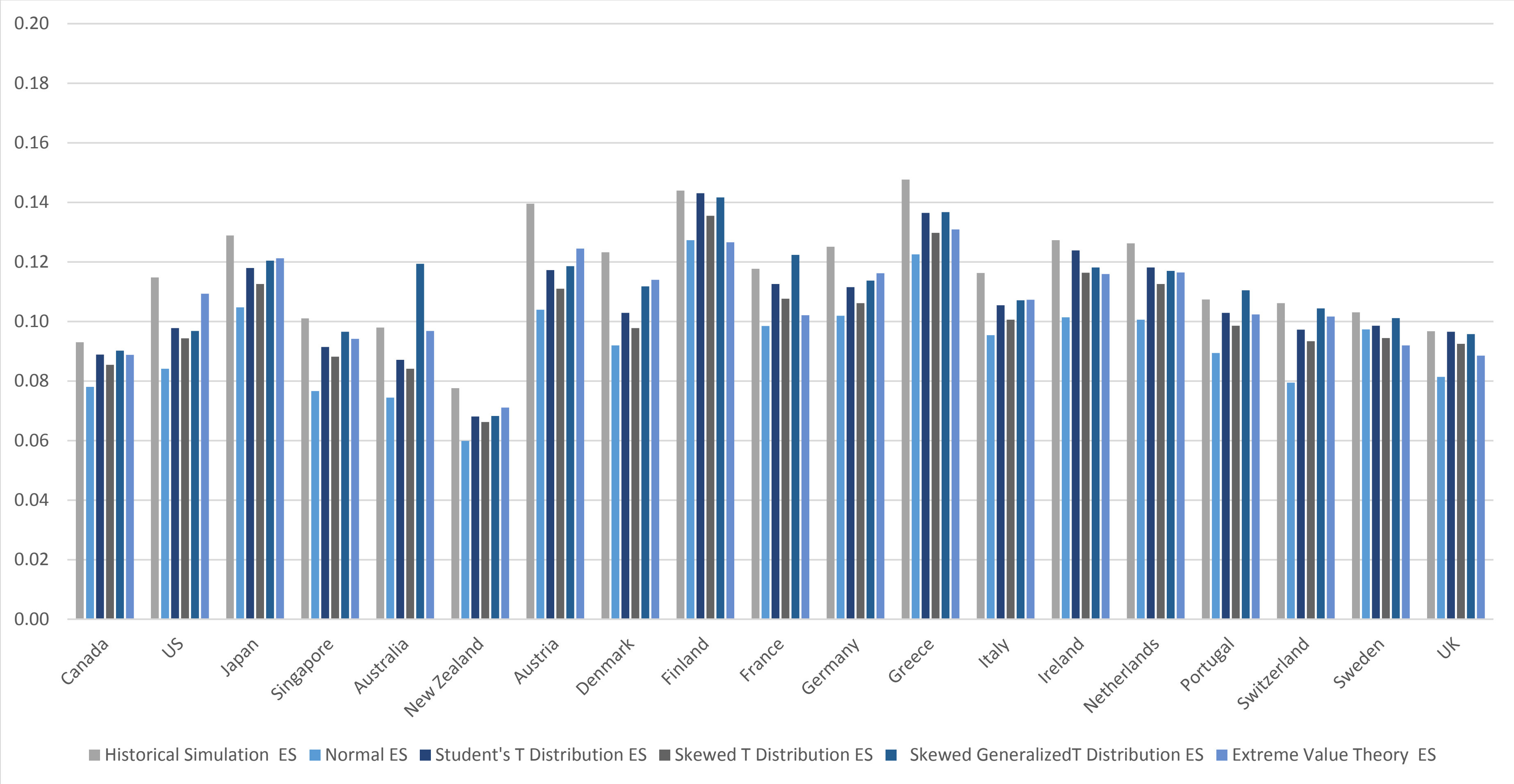
Panel A. 1% ESs



Note: Figure 88. Presents the developed stock exchanges bear market period weekly ESs. The data source is DataStream.

Figure 88. Developed stock exchanges bear market period weekly ESs

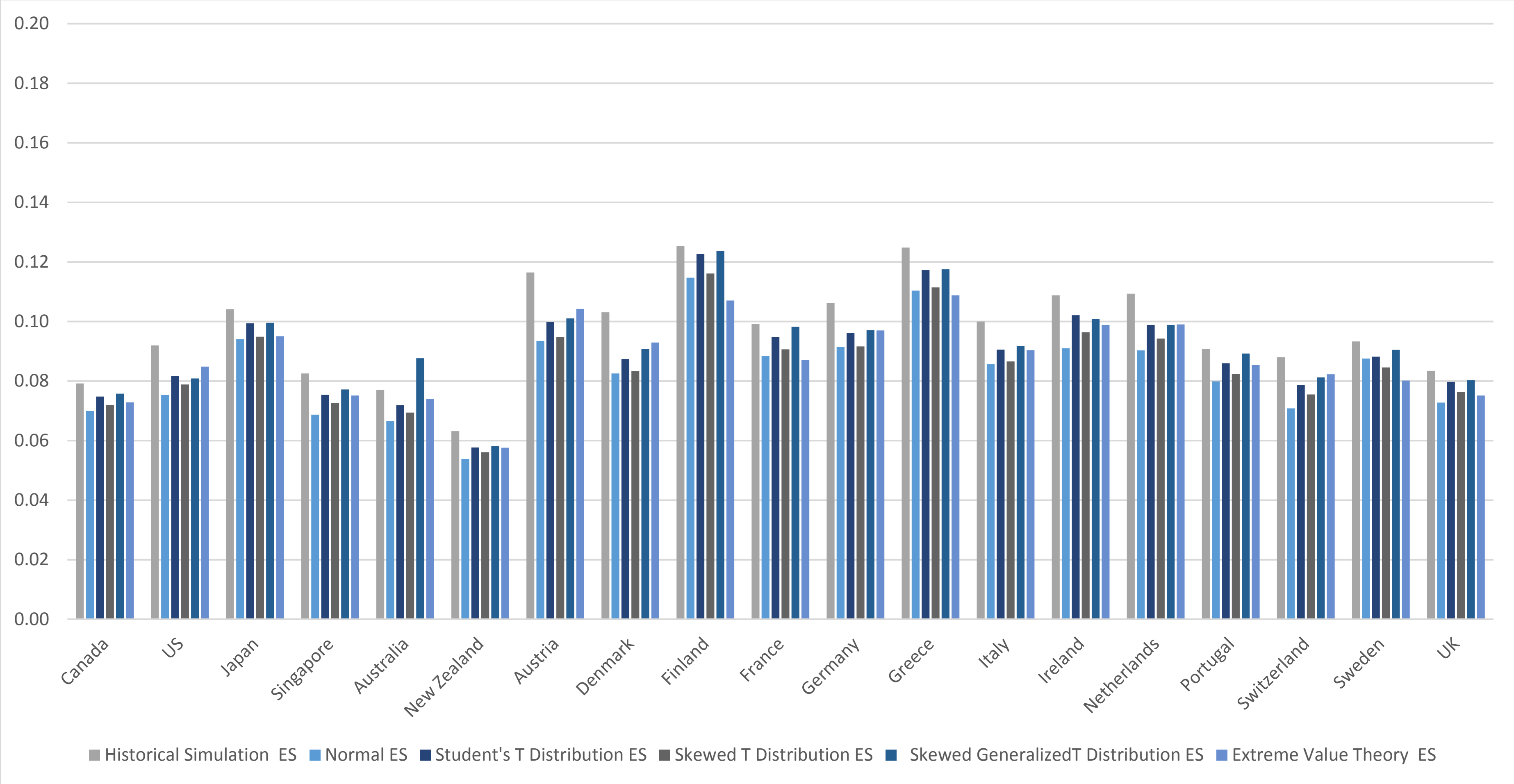
Panel B. 2.5% ESs



Note: Figure 88. Presents the developed stock exchanges bear market period weekly ESs. The data source is DataStream.

Figure 88. Developed stock exchanges bear market period weekly ESs

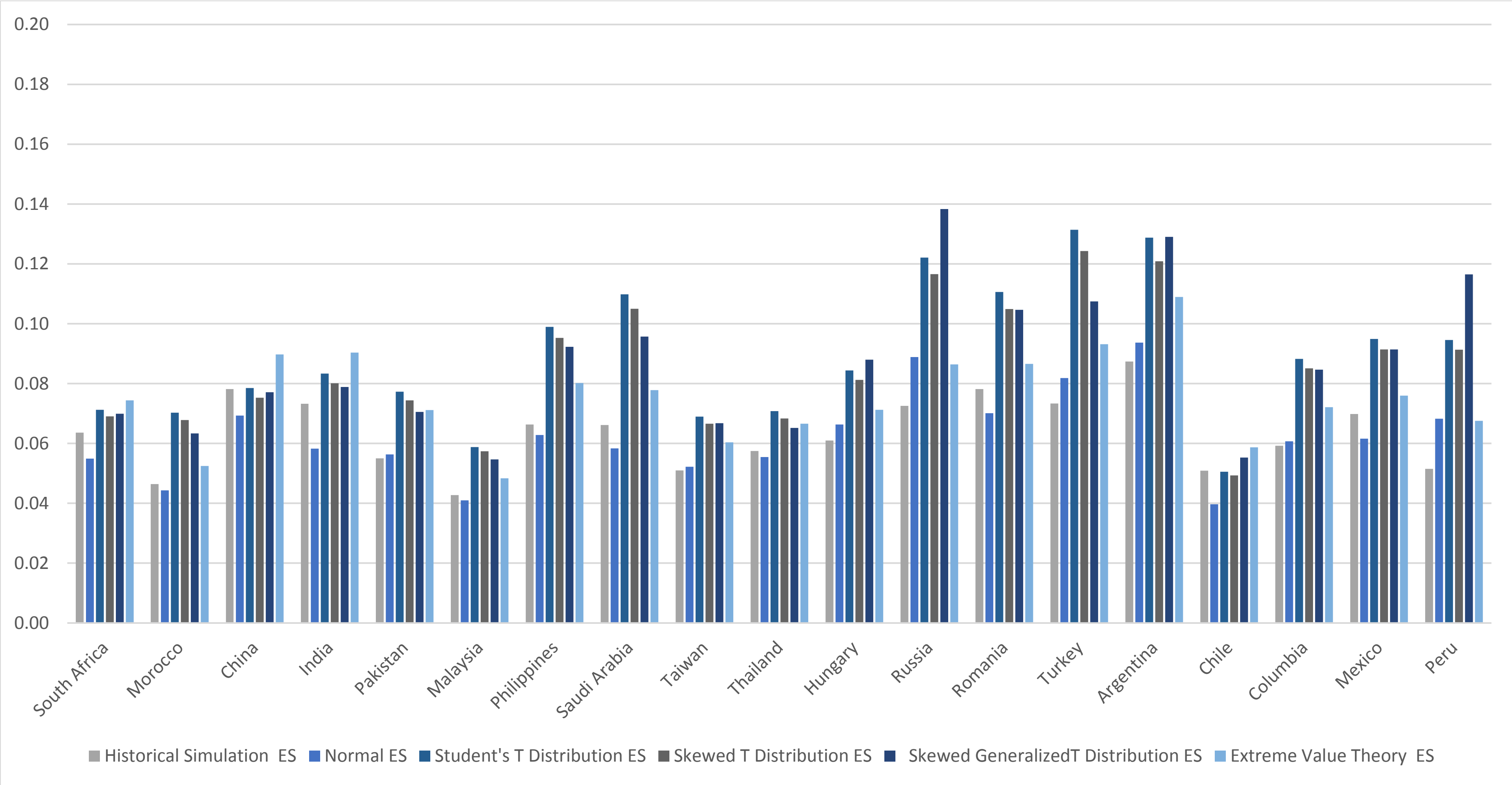
Panel C. 5% ESs



Note: Figure 88. Presents the developed stock exchanges bear market period weekly ESs. The data source is DataStream.

Figure 89. Emerging stock exchanges bull market period weekly ESs

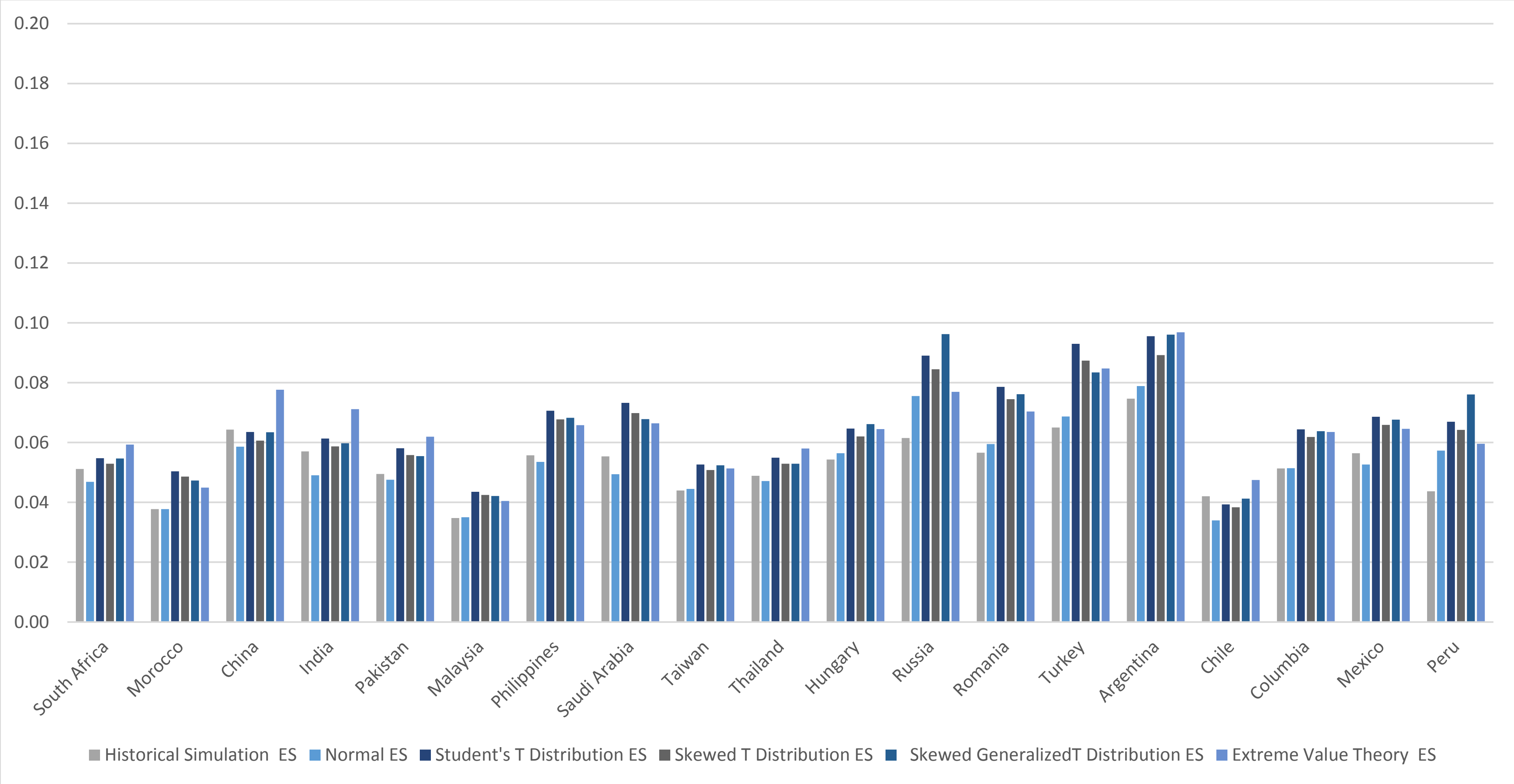
Panel A. 1% ESs



Note: Figure 89. Presents the emerging stock exchanges bull market period weekly ESs. The data source is DataStream.

Figure 89. Emerging stock exchanges bull market period weekly ESs

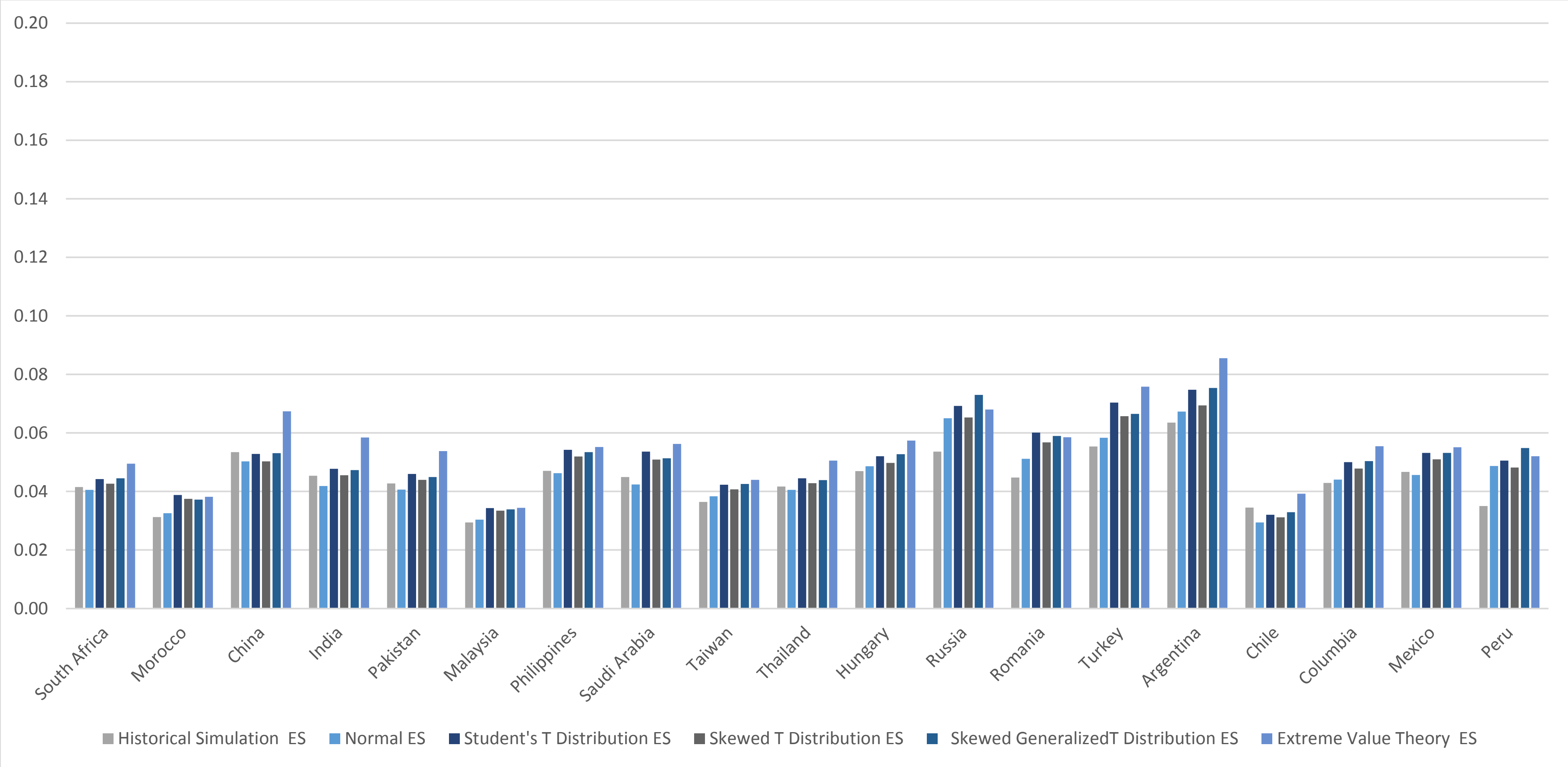
Panel B. 2.5% ESs



Note: Figure 89. Presents the emerging stock exchanges bull market period weekly ESs. The data source is DataStream.

Figure 89. Emerging stock exchanges bull market period weekly ESs

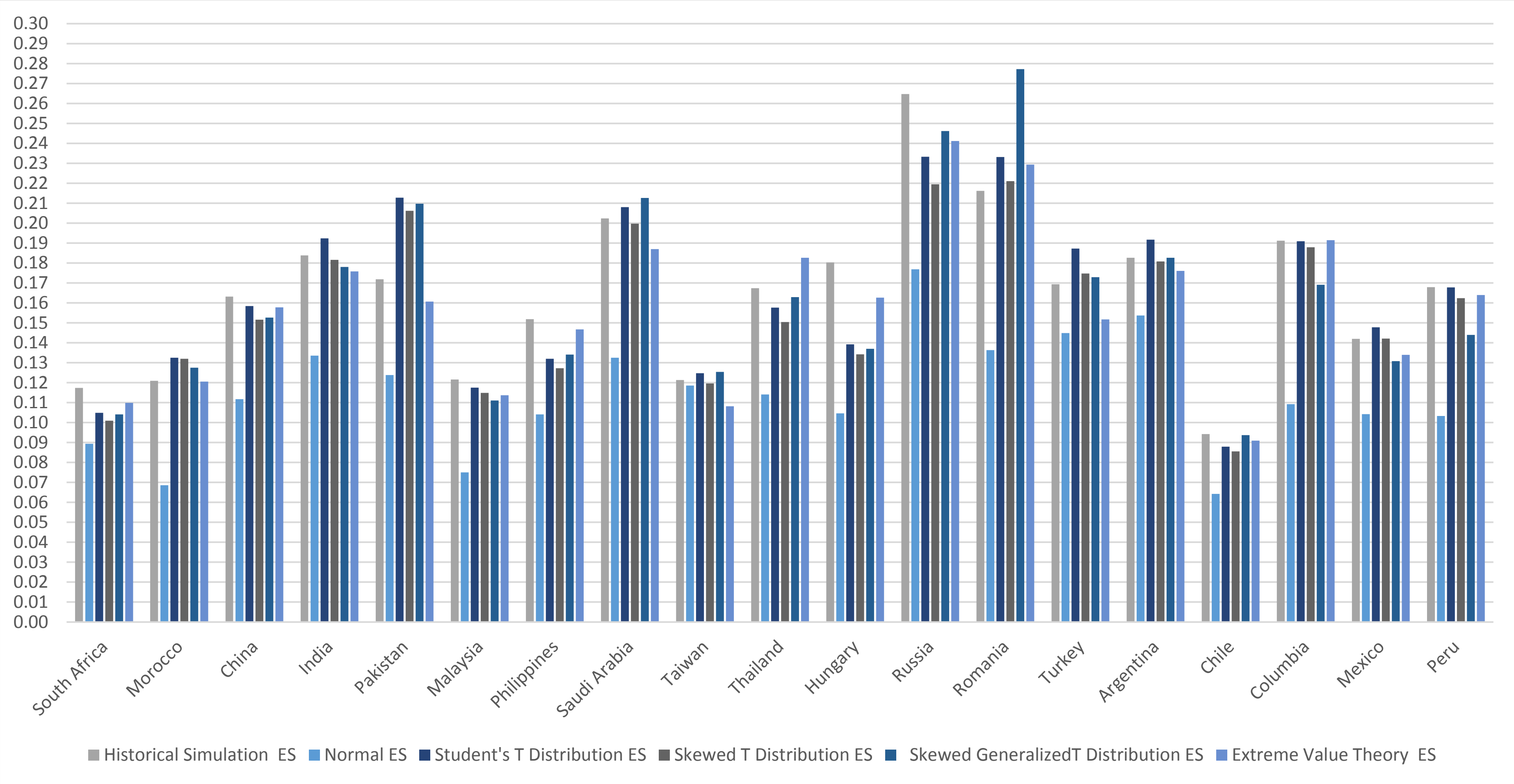
Panel C. 5% ESs



Note: Figure 89. Presents the emerging stock exchanges bull market period weekly ESs. The data source is DataStream.

Figure 90. Emerging stock exchanges bear market period weekly ESs

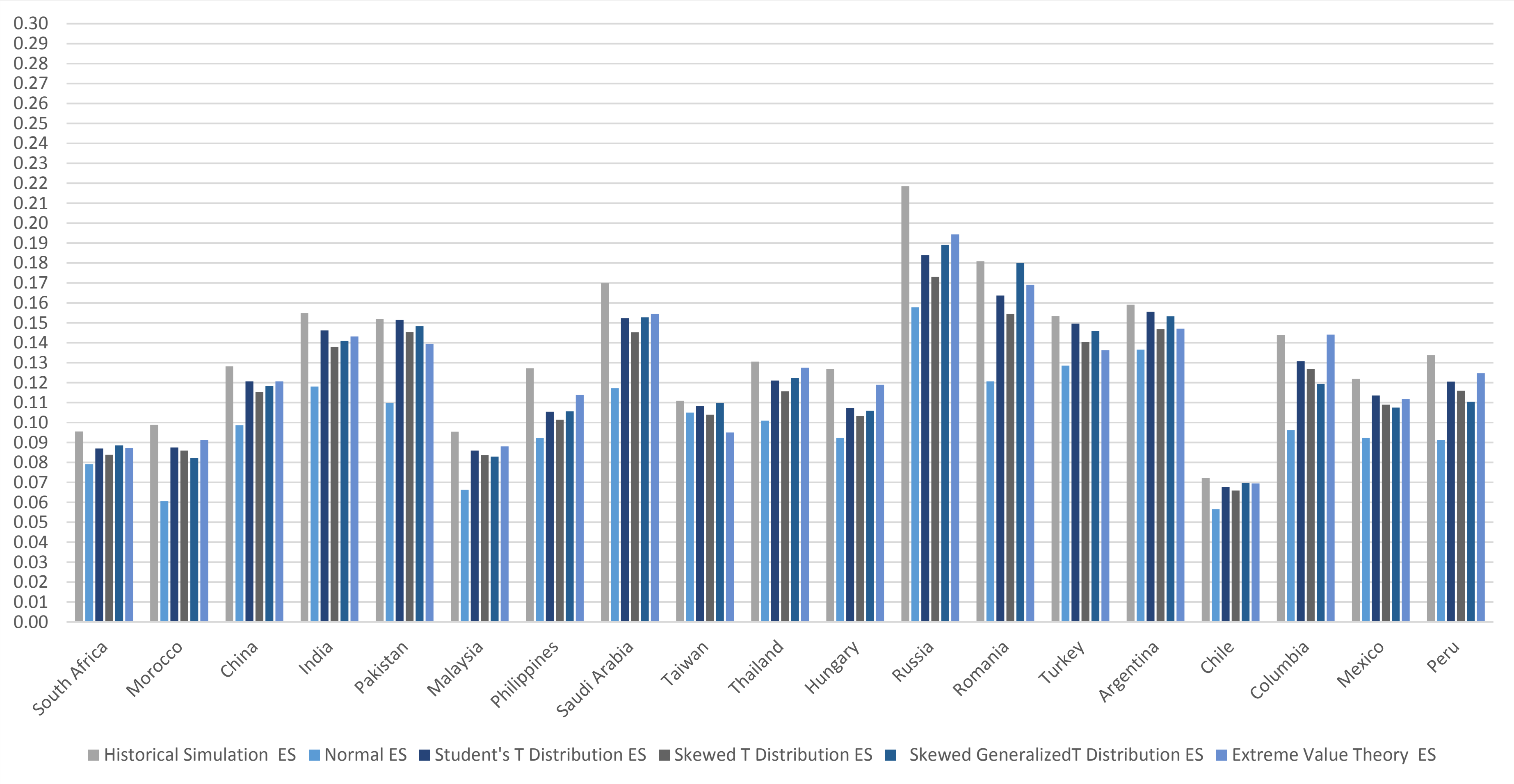
Panel A. 1% ESs



Note: Figure 90. Presents the emerging stock exchanges bear market period weekly ESs. The data source is DataStream.

Figure 90. Emerging stock exchanges bear market period weekly ESs

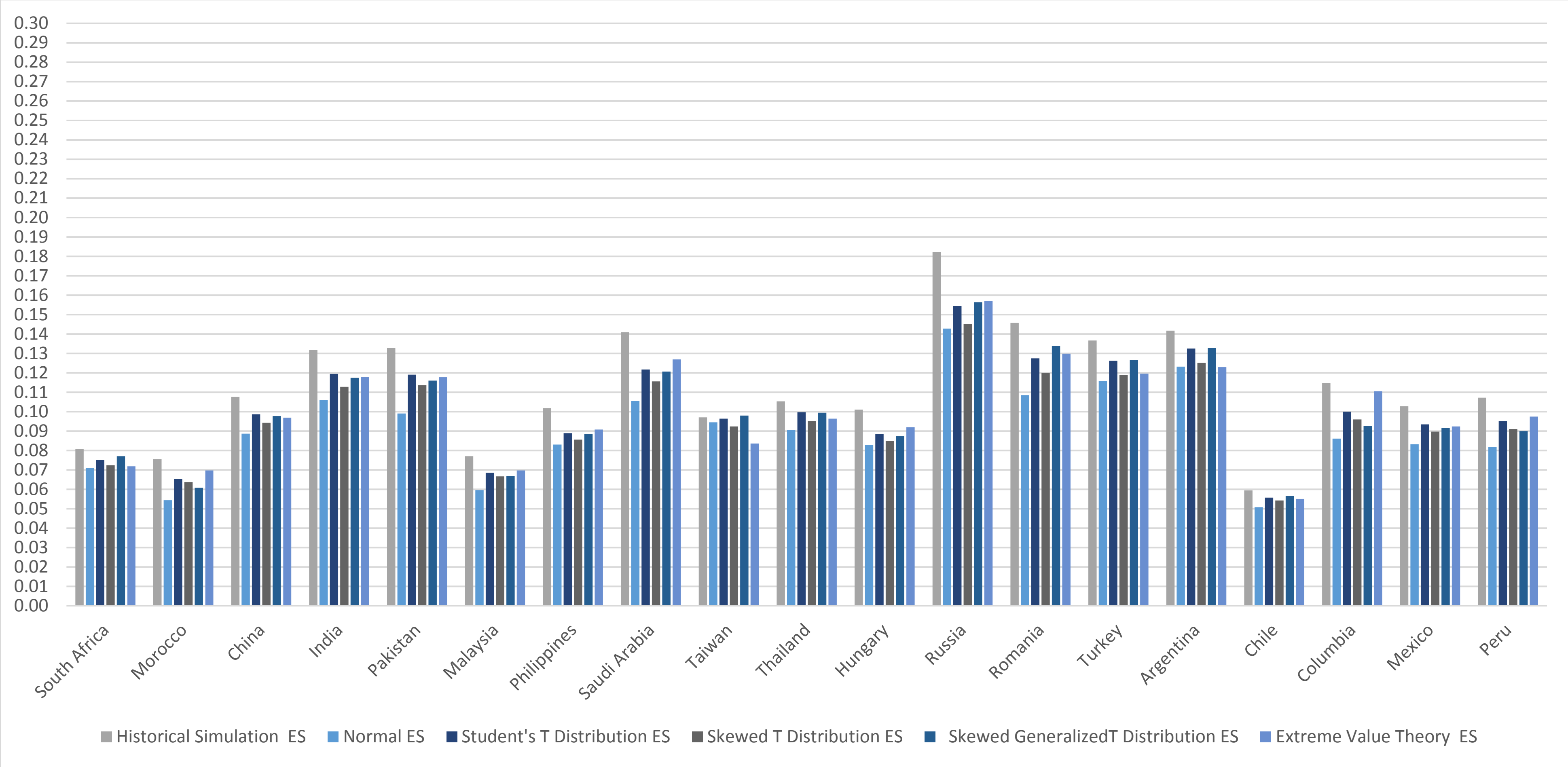
Panel B. 2.5% ESs



Note: Figure 90. Presents the emerging stock exchanges bear market period weekly ESs. The data source is DataStream.

Figure 90. Emerging stock exchanges bear market period weekly ESs

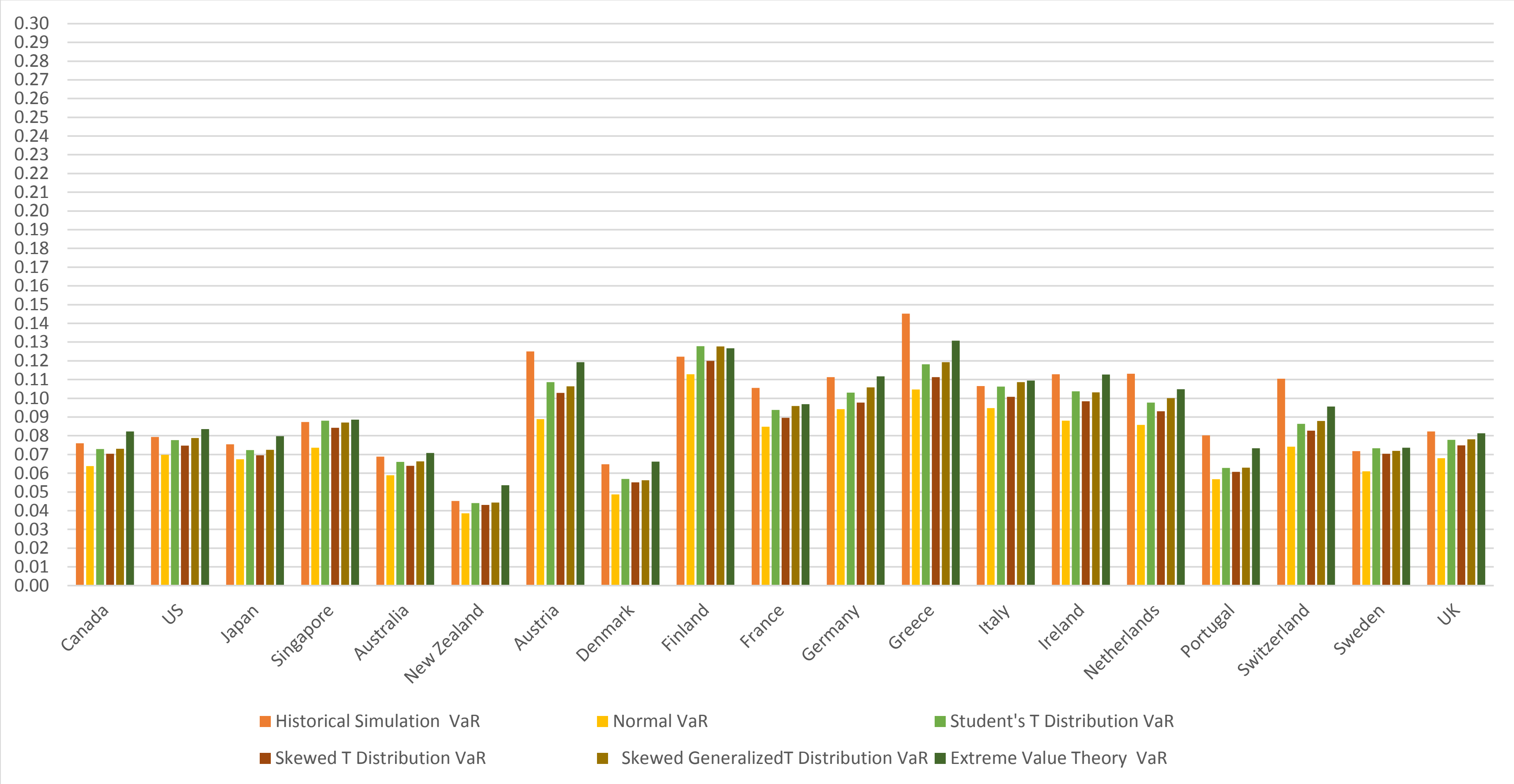
Panel C. 5% ESs



Note: Figure 90. Presents the emerging stock exchanges bear market period weekly ESs. The data source is DataStream.

Figure 91. Developed stock exchanges high quarterly volatility period weekly VaRs

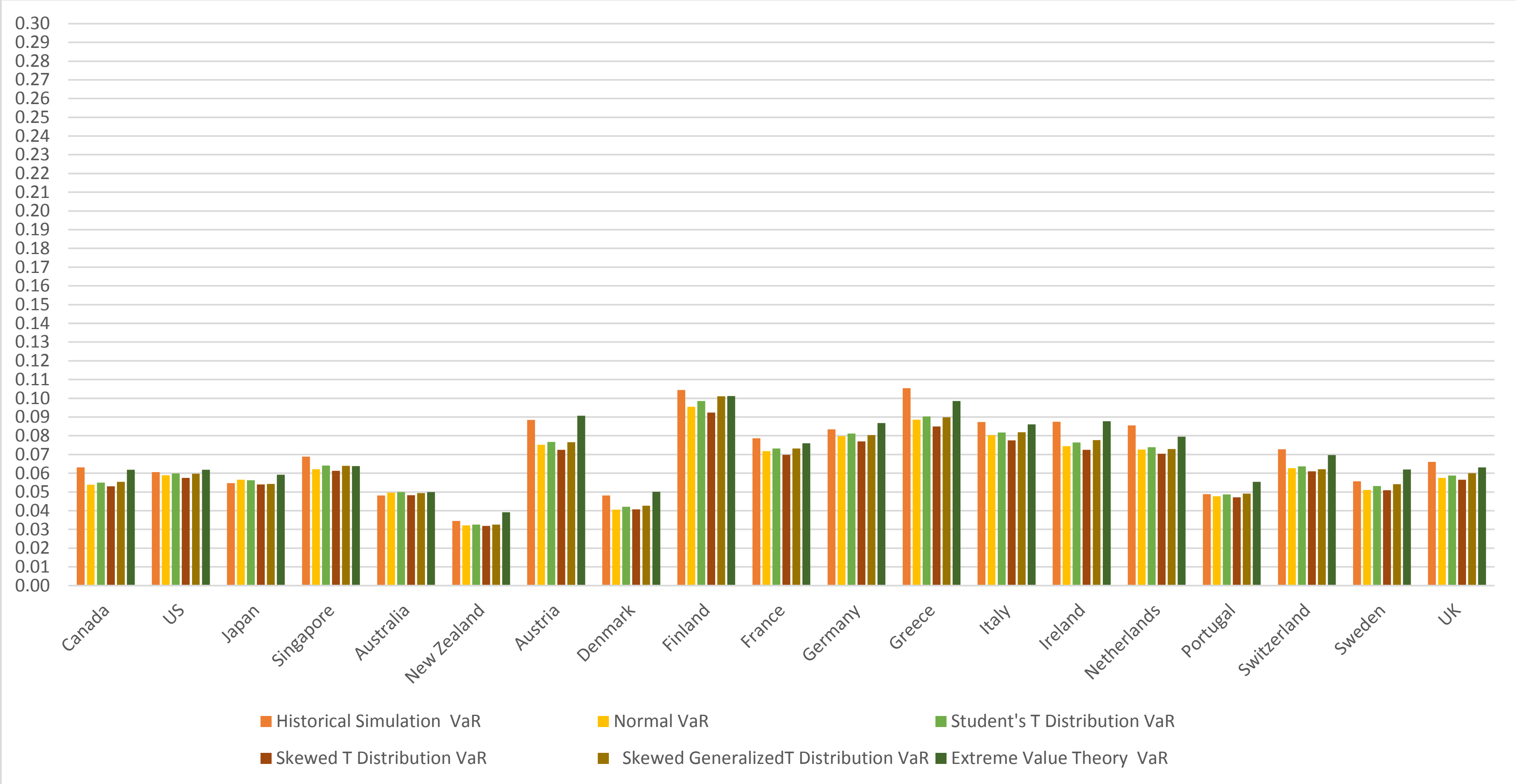
Panel A. 1% VaRs



Note: Figure 91. Presents the developed stock exchanges high quarterly volatility period weekly VaRs. The data source is DataStream.

Figure 91. Developed stock exchanges high quarterly volatility period weekly VaRs

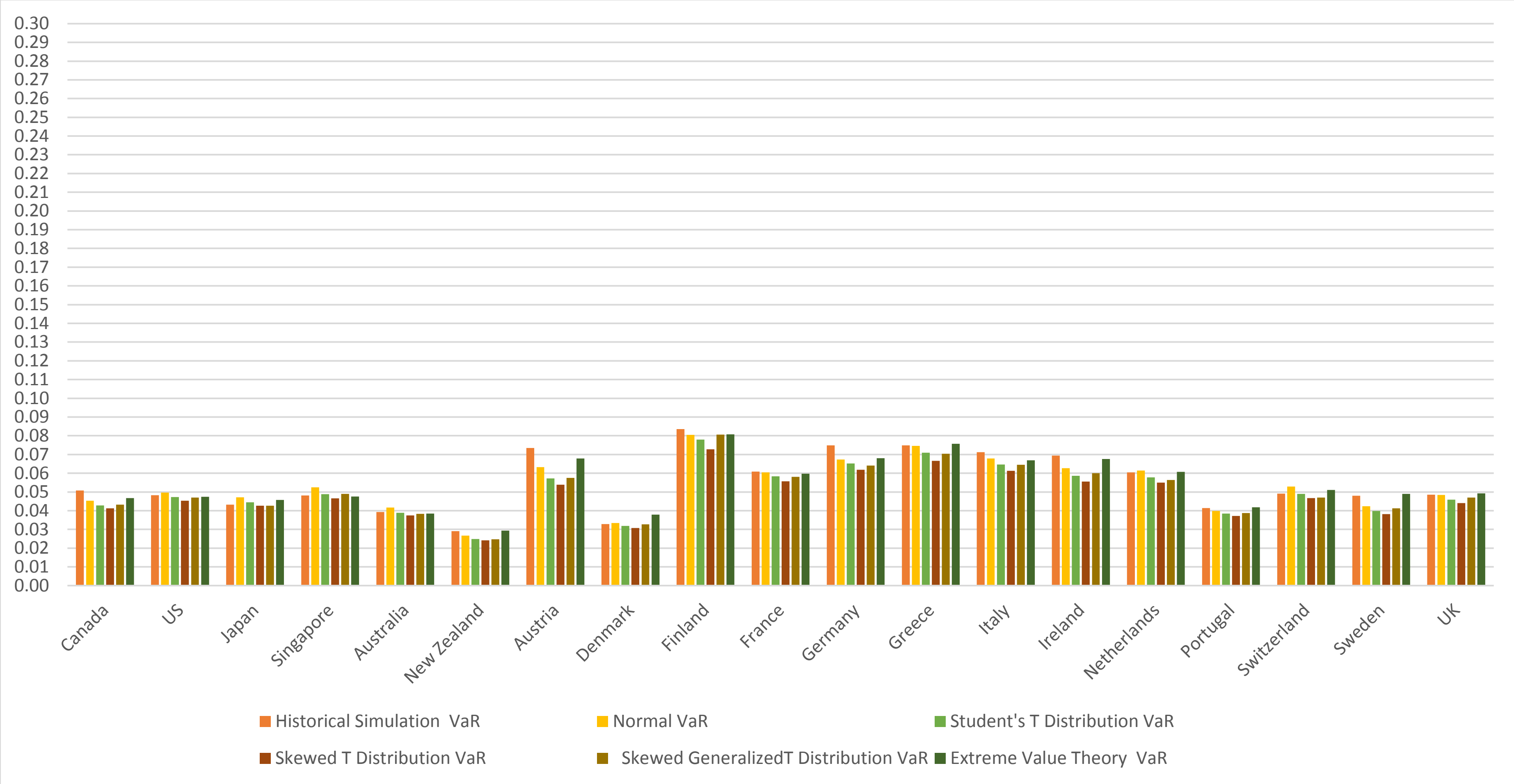
Panel B. 2.5% VaRs



Note: Figure 91. Presents the developed stock exchanges high quarterly volatility period weekly VaRs. The data source is DataStream.

Figure 91. Developed stock exchanges high quarterly volatility period weekly VaRs

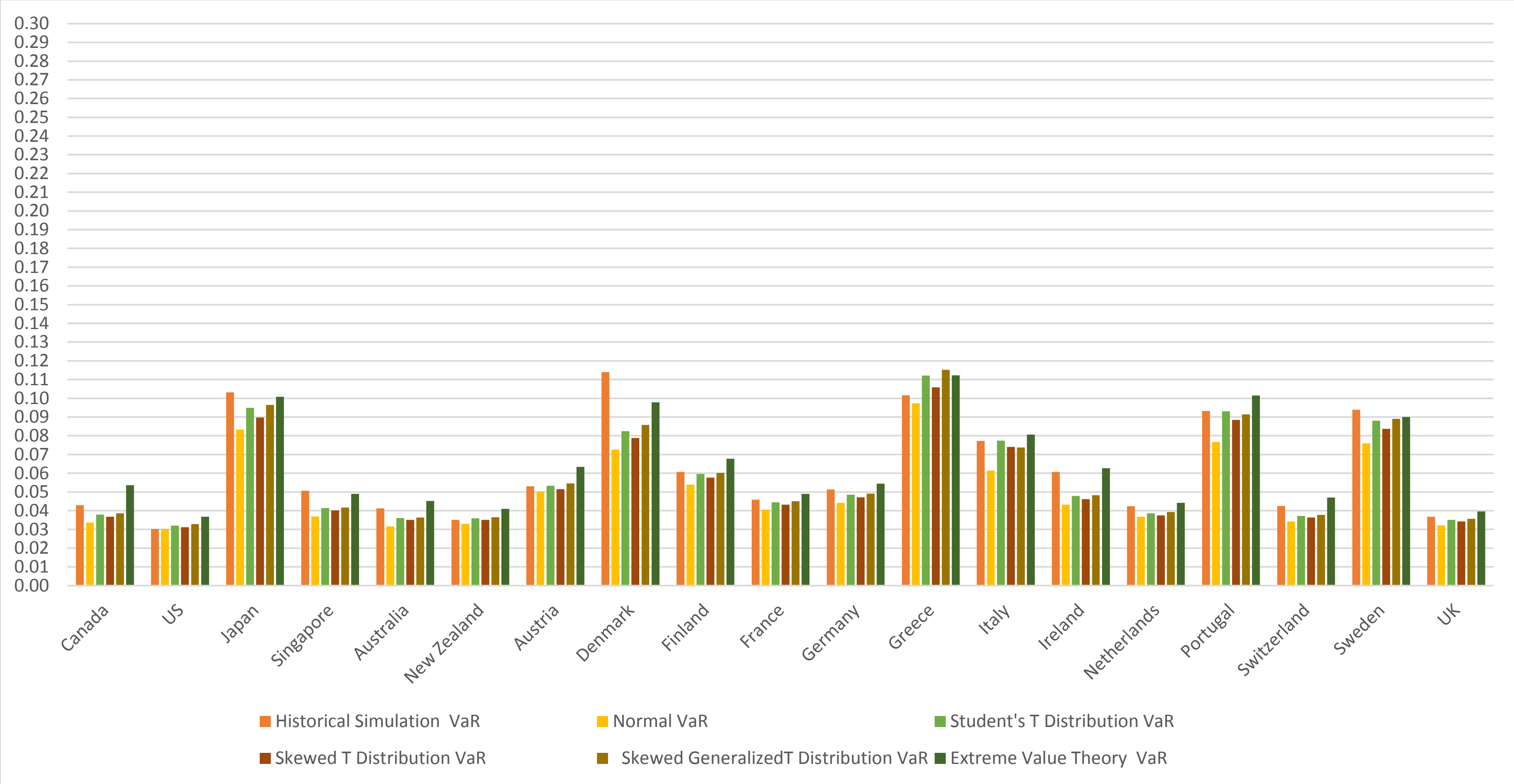
Panel C. 5% VaRs



Note: Figure 91. Presents the developed stock exchanges high quarterly volatility period weekly VaRs. The data source is DataStream.

Figure 92. Developed stock exchanges low quarterly volatility period weekly VaRs

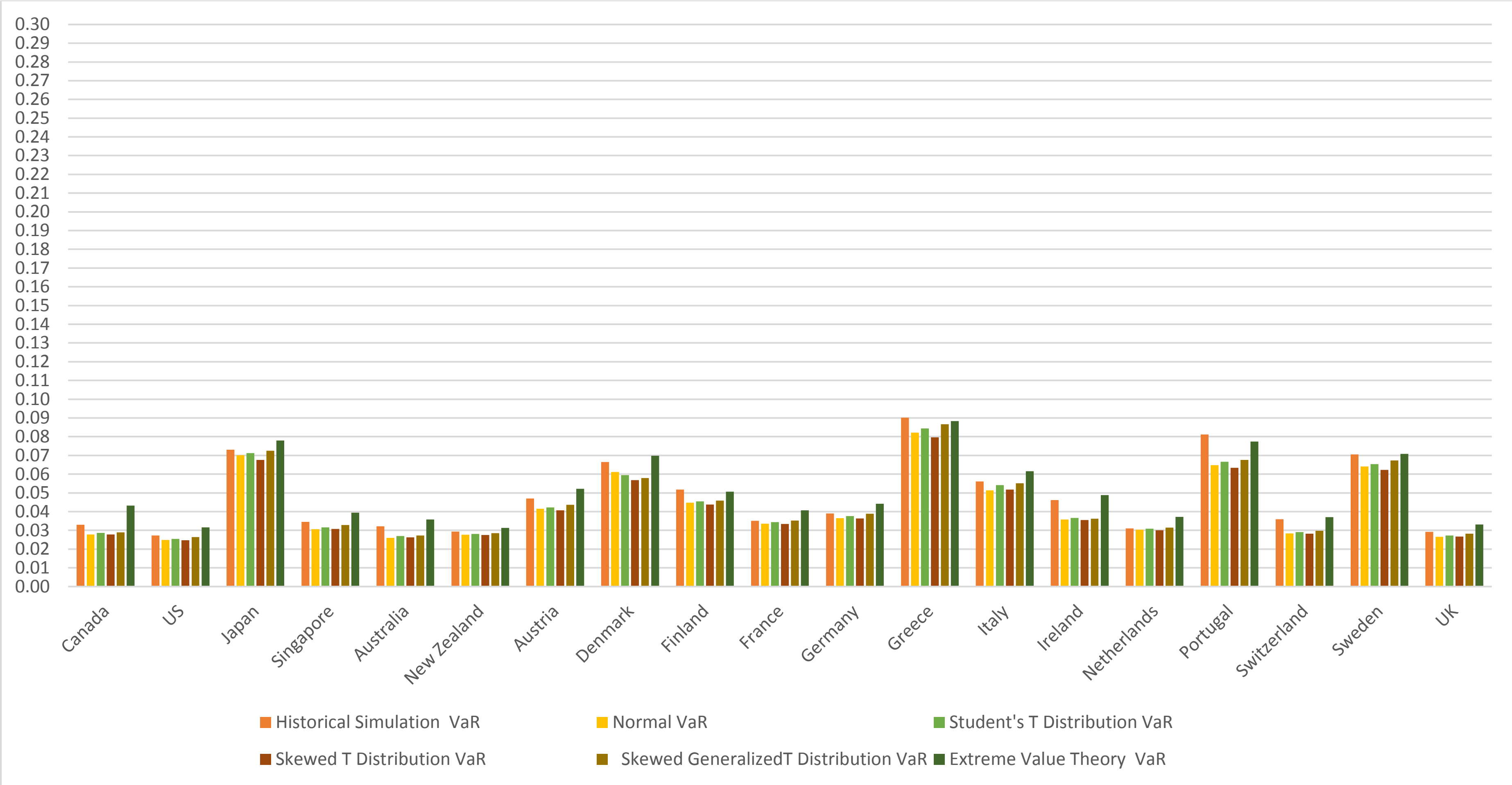
Panel A. 1% VaRs



Note: Figure 92. Presents the developed stock exchanges low quarterly volatility period weekly VaRs. The data source is DataStream.

Figure 92. Developed stock exchanges low quarterly volatility period weekly VaRs

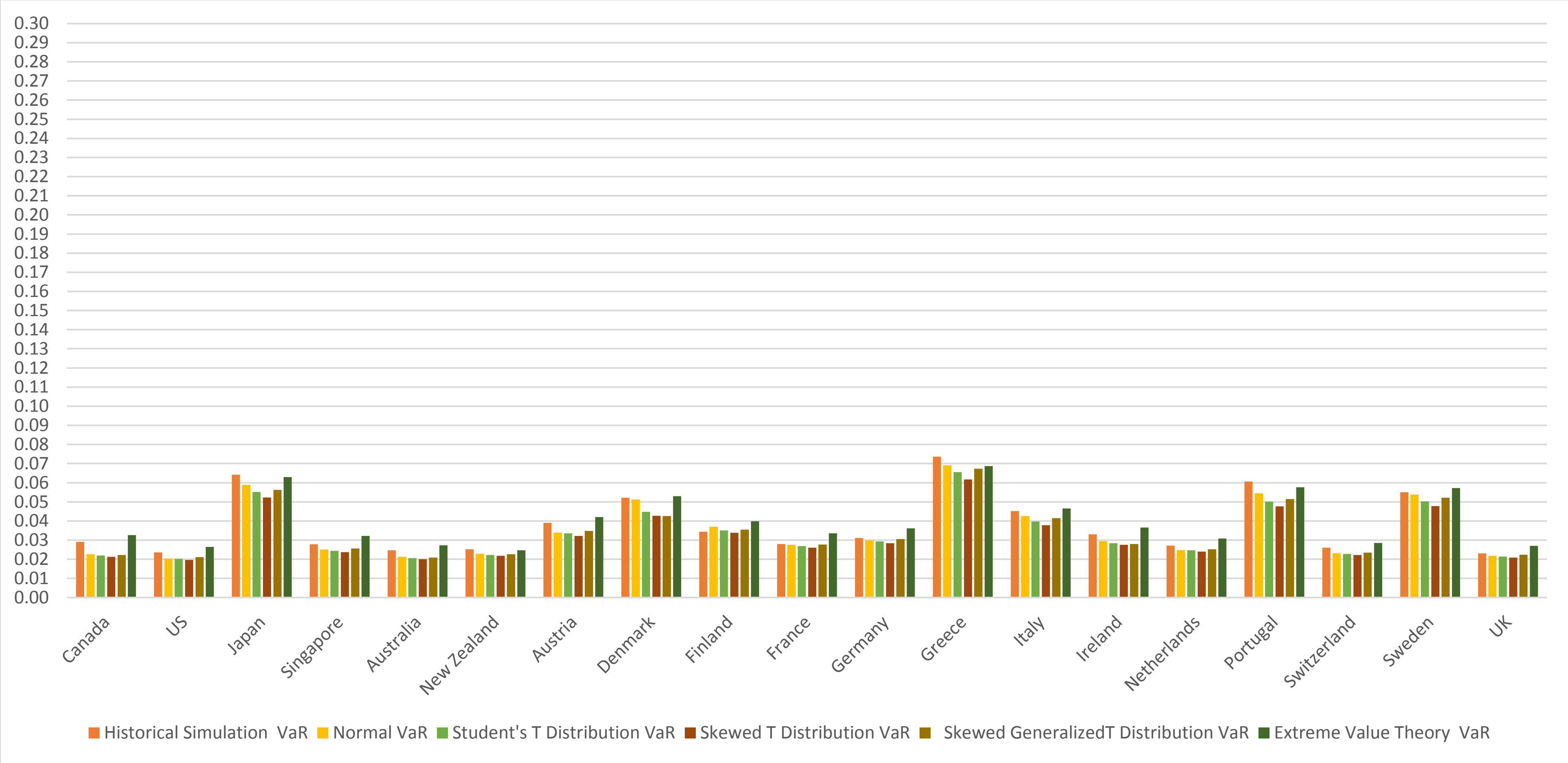
Panel B. 2.5% VaRs



Note: Figure 92. Presents the developed stock exchanges low quarterly volatility period weekly VaRs. The data source is DataStream.

Figure 92. Developed stock exchanges low quarterly volatility period weekly VaRs

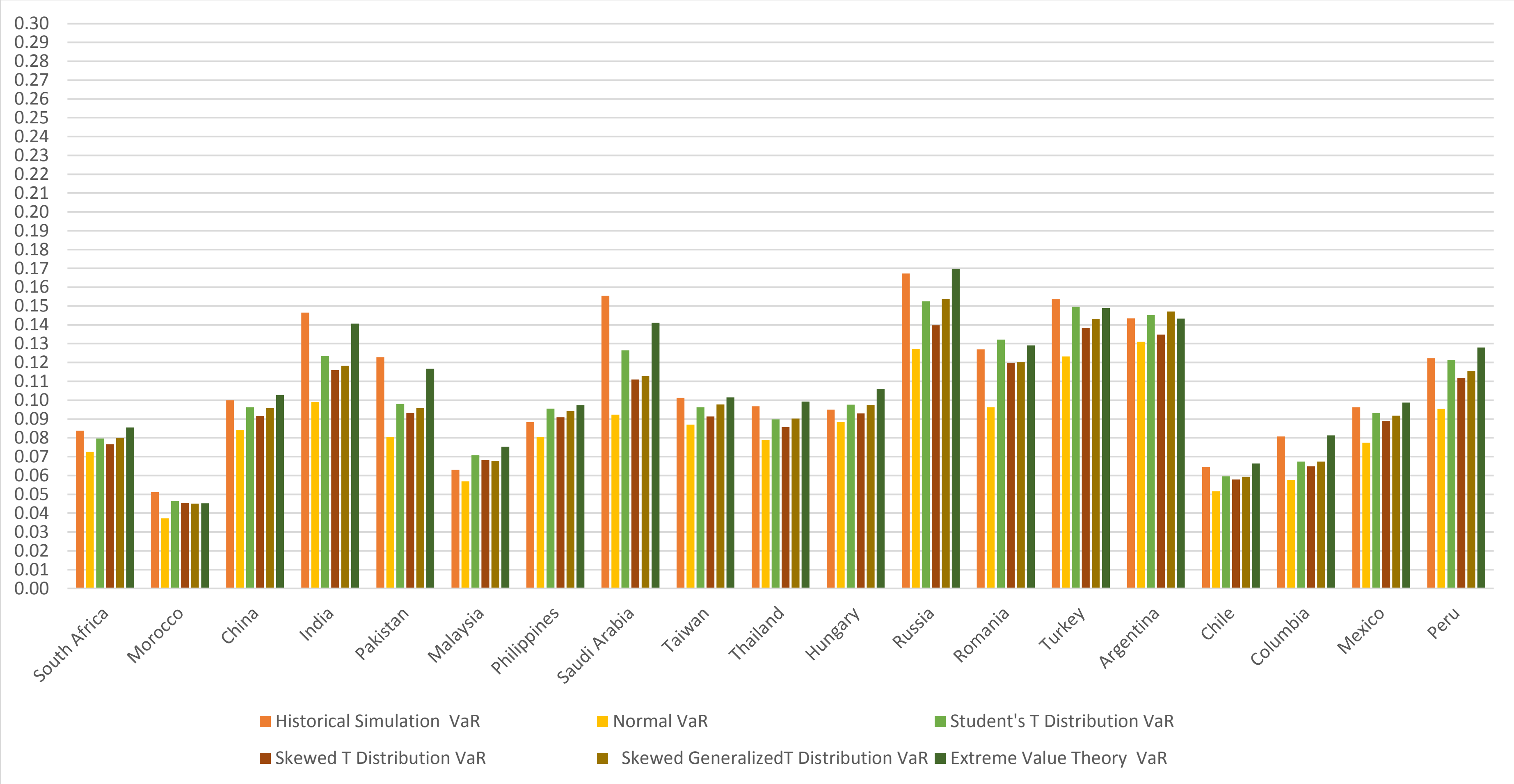
Panel C. 5% VaRs



Note: Figure 92. Presents the developed stock exchanges low quarterly volatility period weekly VaRs. The data source is DataStream.

Figure 93. Emerging stock exchanges high quarterly volatility period weekly VaRs

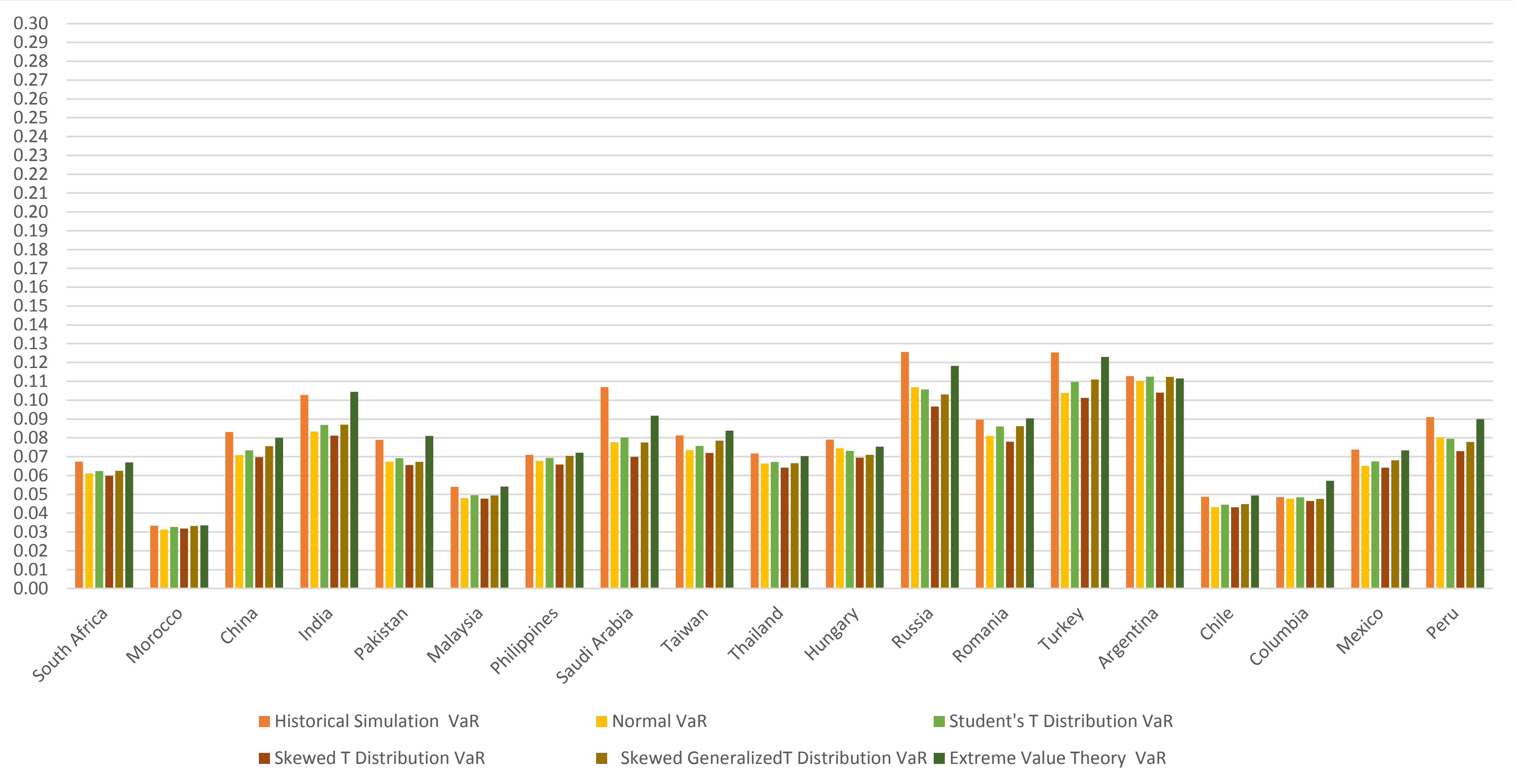
Panel A. 1% VaRs



Note: Figure 93. Presents the emerging stock exchanges high quarterly volatility period weekly VaRs. The data source is DataStream.

Figure 93. Emerging stock exchanges high quarterly volatility period weekly VaRs

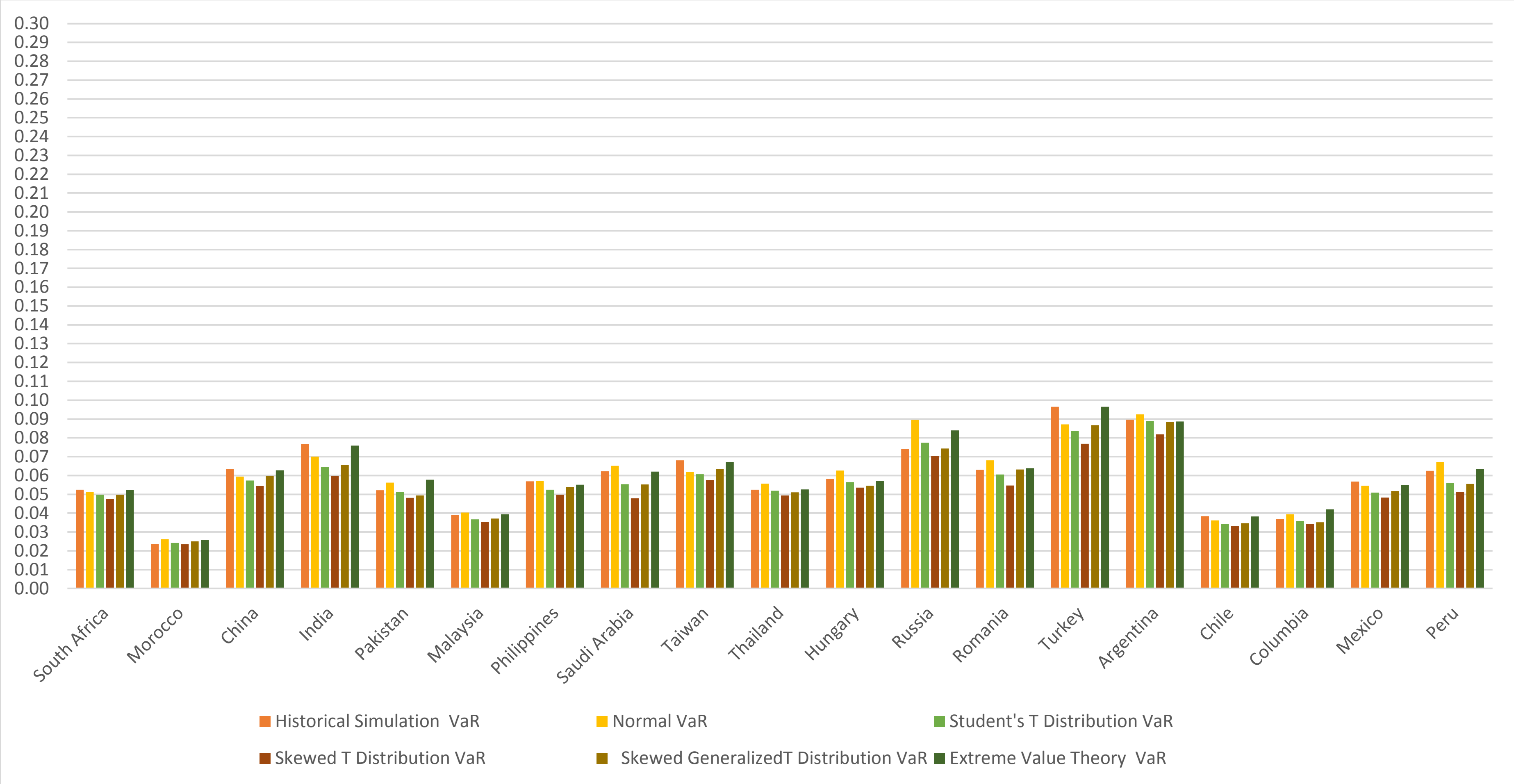
Panel B. 2.5% VaRs



Note: Figure 93. Presents the emerging stock exchanges high quarterly volatility period weekly VaRs. The data source is DataStream.

Figure 93. Emerging stock exchanges high quarterly volatility period weekly VaRs

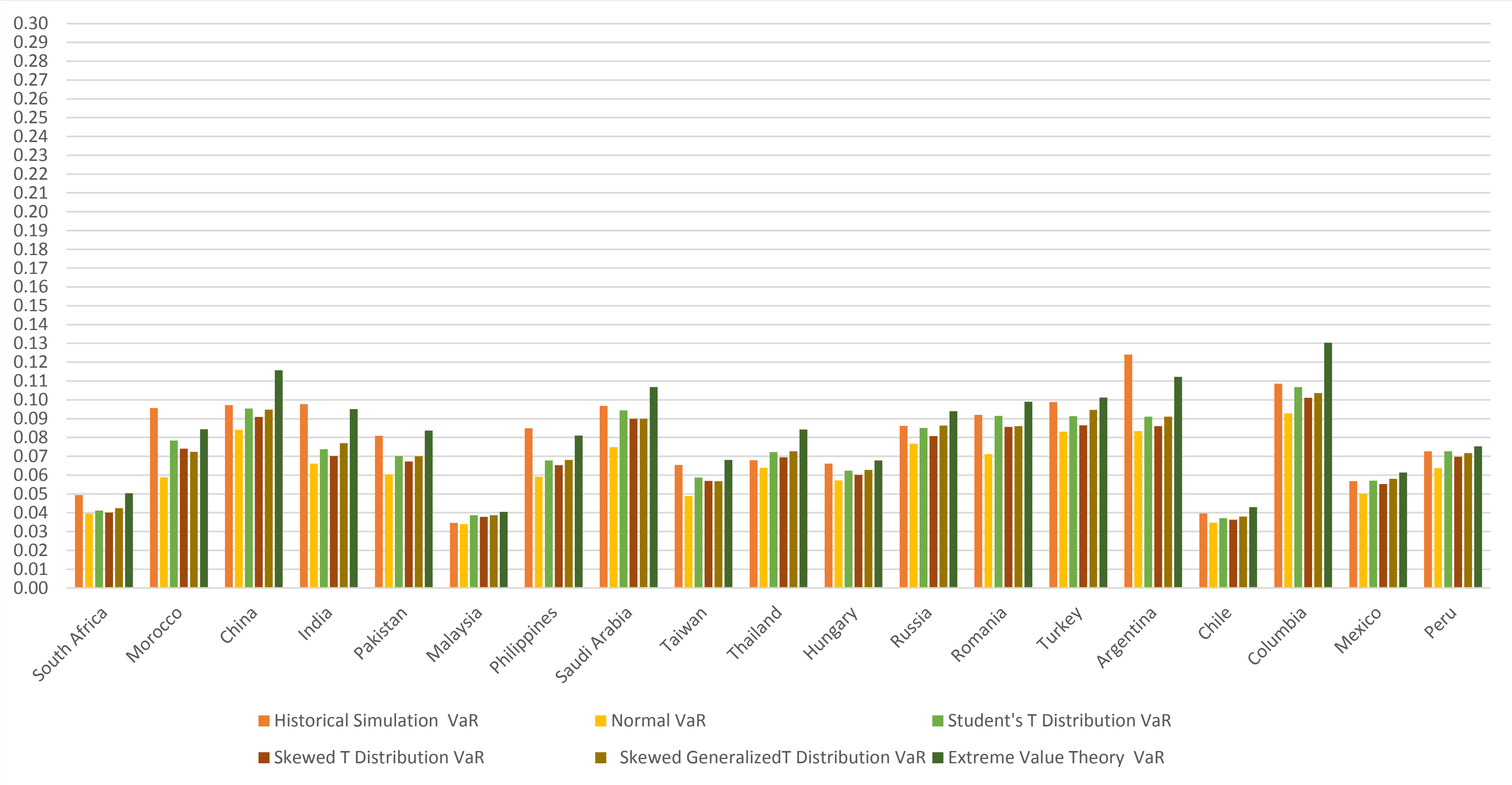
Panel C. 5% VaRs



Note: Figure 93. Presents the emerging stock exchanges high quarterly volatility period weekly VaRs. The data source is DataStream.

Figure 94. Emerging stock exchanges low quarterly volatility period weekly VaRs

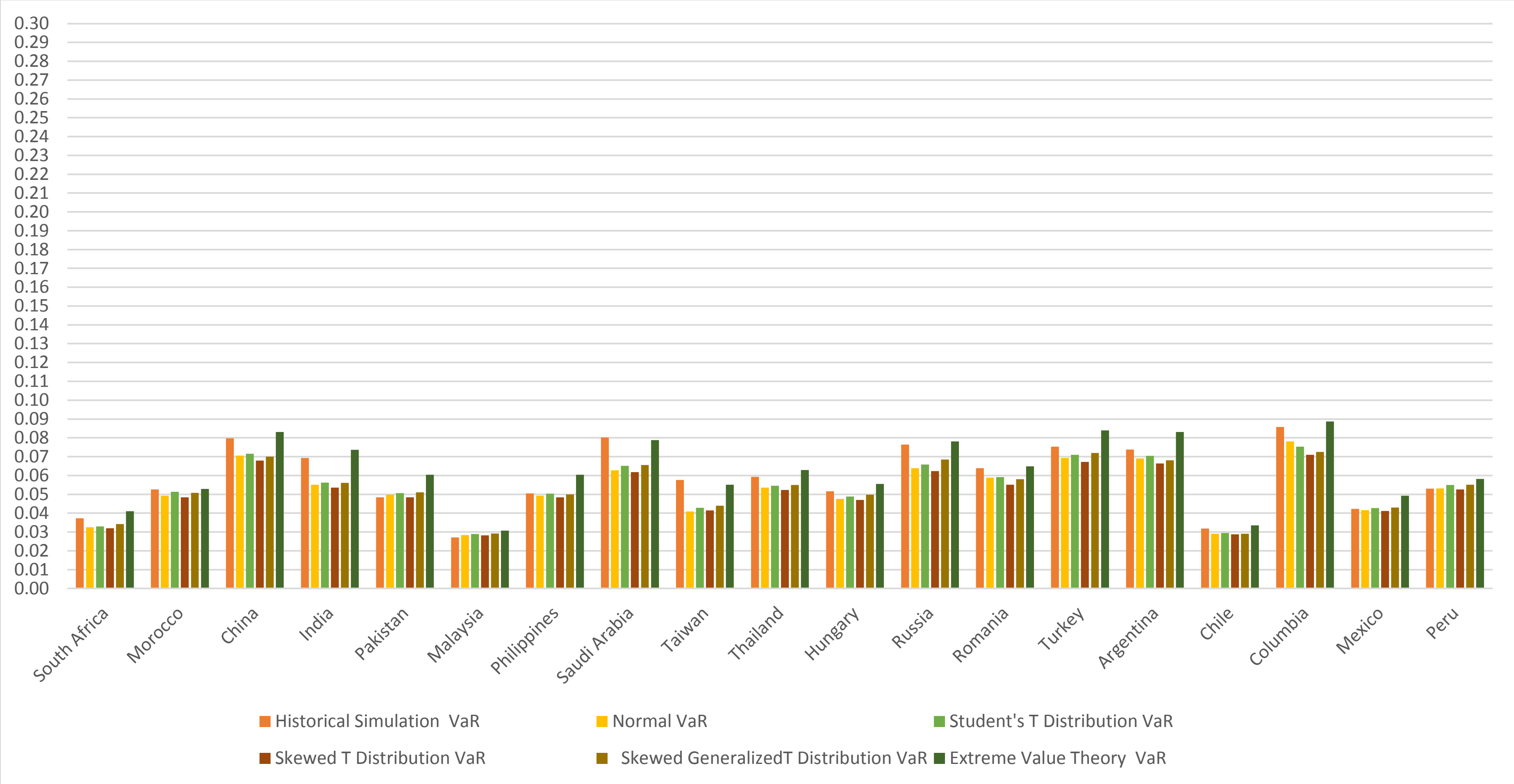
Panel A. 1% VaRs



Note: Figure 94. Presents the emerging stock exchanges low quarterly volatility period weekly VaRs. The data source is DataStream.

Figure 94. Emerging stock exchanges low quarterly volatility period weekly VaRs

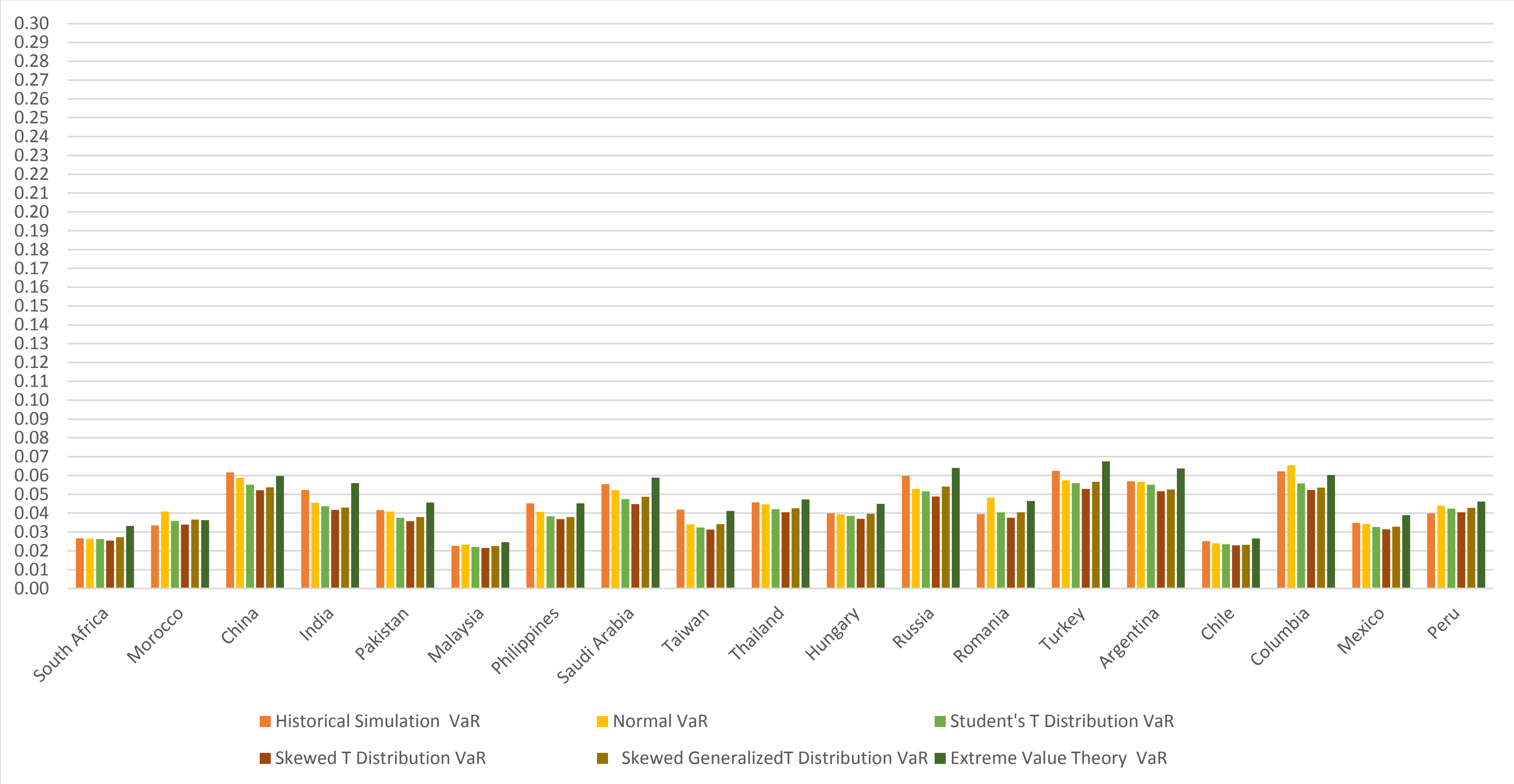
Panel B. 2.5% VaRs



Note: Figure 94. Presents the emerging stock exchanges low quarterly volatility period weekly VaRs. The data source is DataStream.

Figure 94. Emerging stock exchanges low quarterly volatility period weekly VaRs

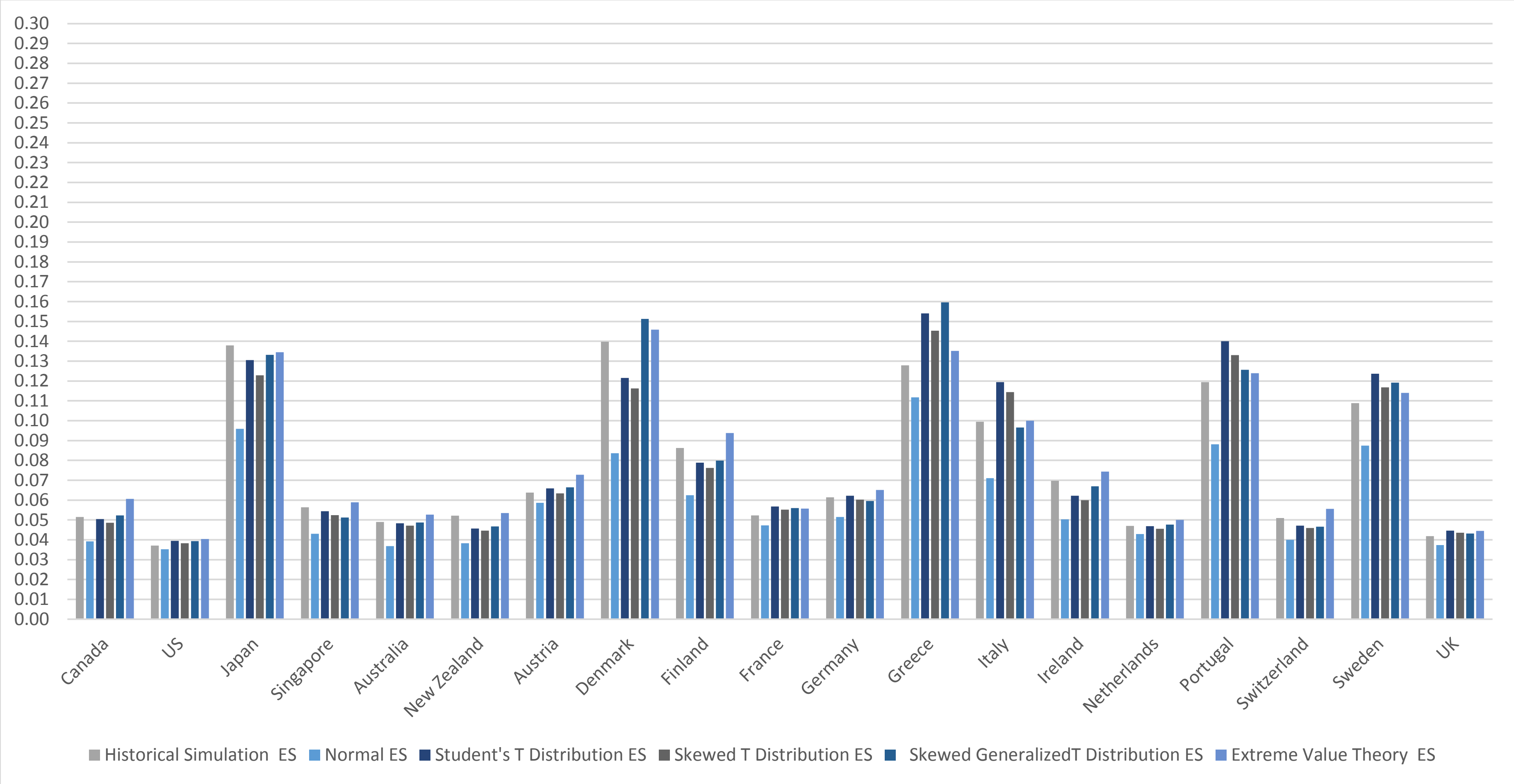
Panel C. 5% VaRs



Note: Figure 94. Presents the emerging stock exchanges low quarterly volatility period weekly VaRs. The data source is DataStream.

Figure 95. Developed stock exchanges high quarterly volatility period weekly ESs

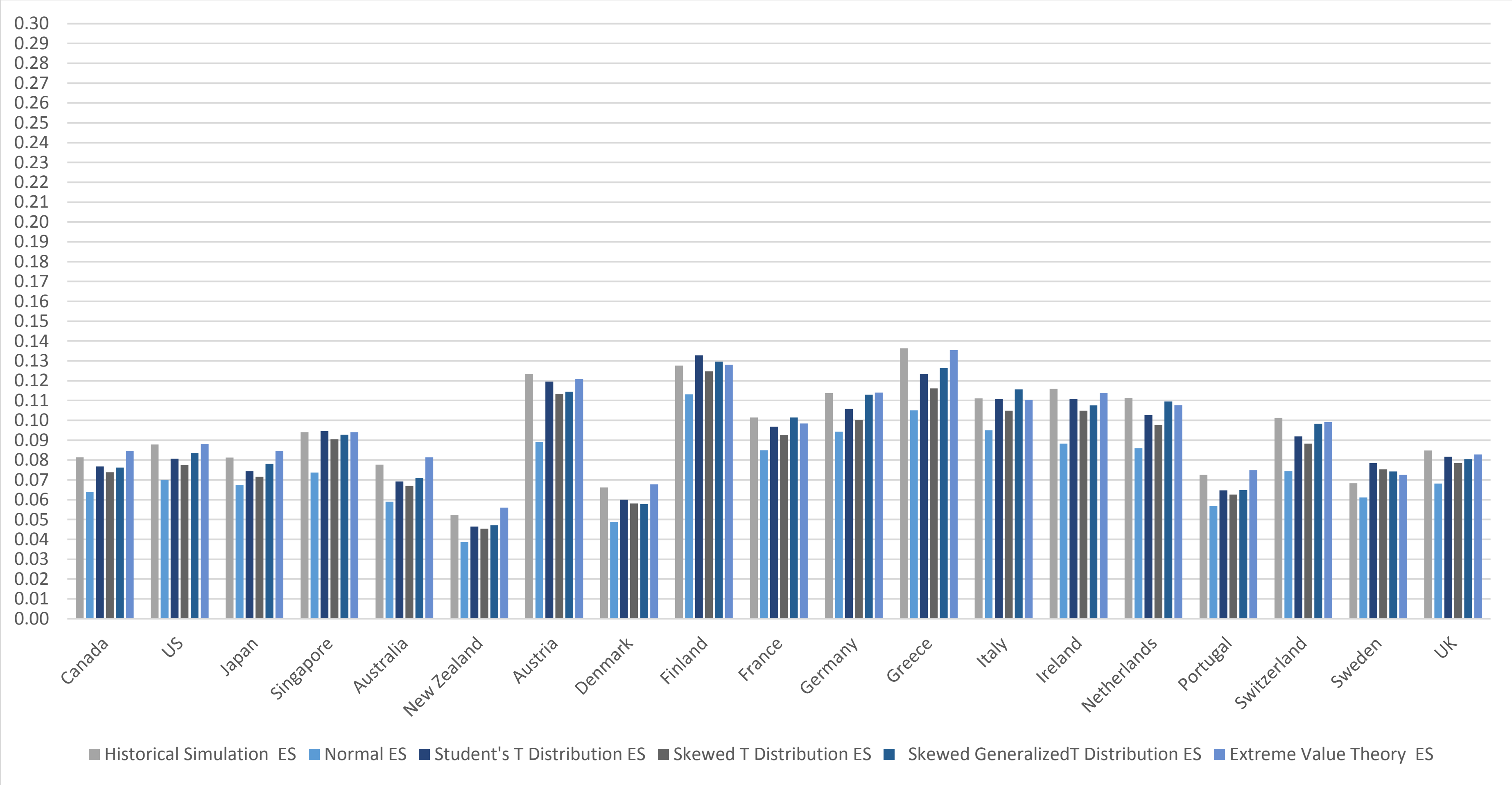
Panel A. 1% ESs



Note: Figure 95. Presents the developed stock exchanges high quarterly volatility period weekly ESs. The data source is DataStream.

Figure 95. Developed stock exchanges high quarterly volatility period weekly ESs

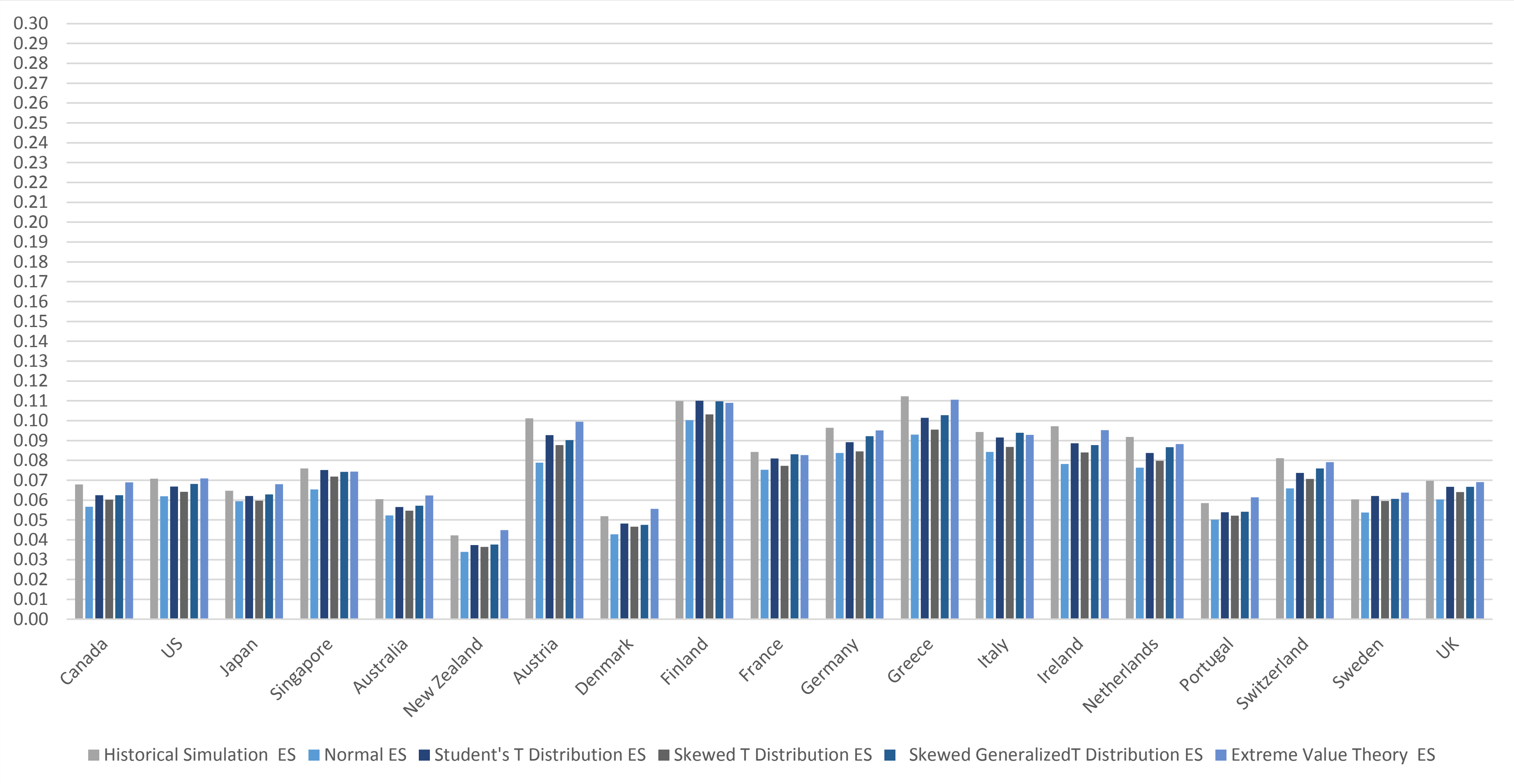
Panel B. 2.5% ESs



Note: Figure 95. Presents the developed stock exchanges high quarterly volatility period weekly ESs. The data source is DataStream.

Figure 95. Developed stock exchanges high quarterly volatility period weekly ESs

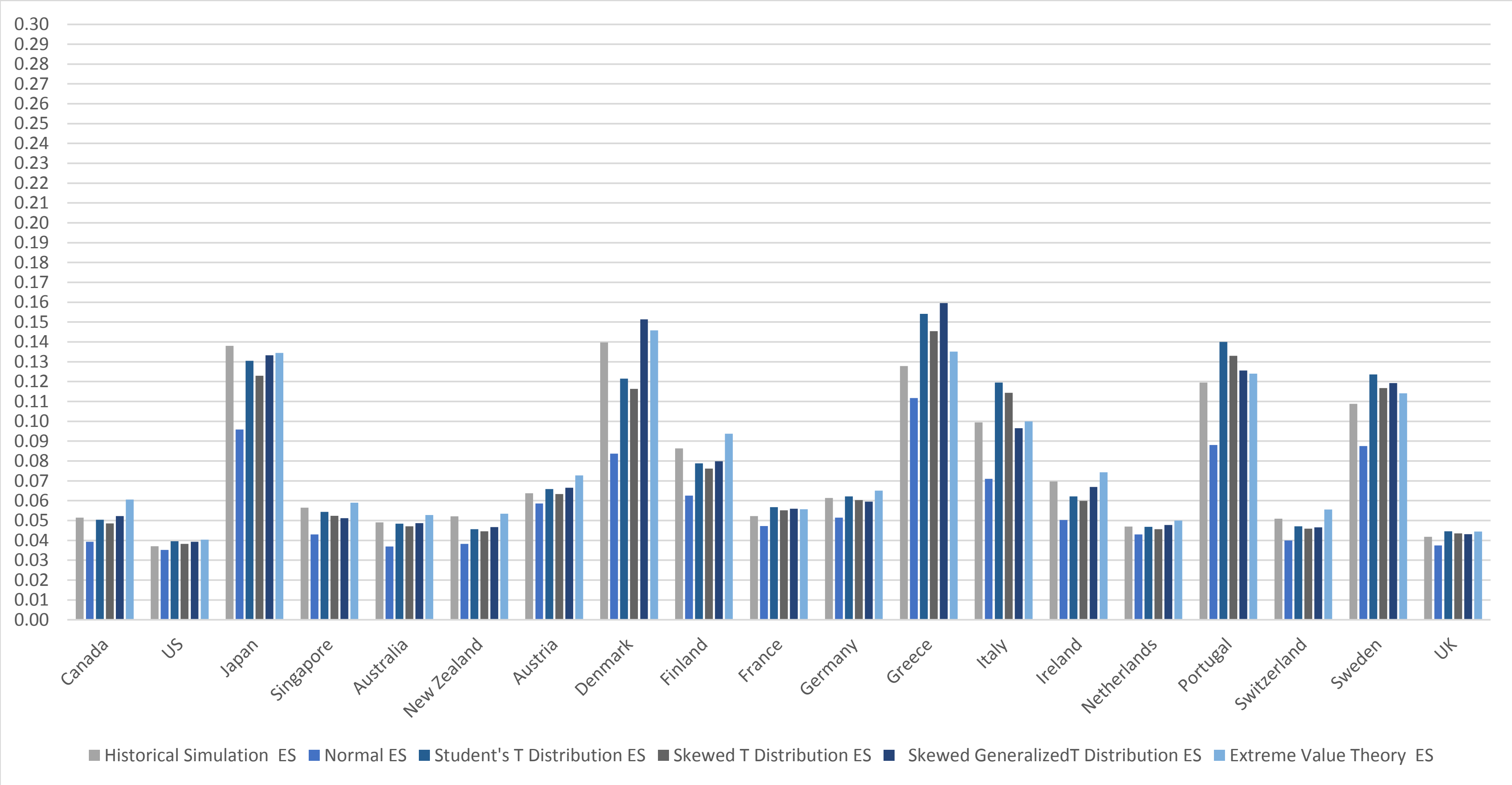
Panel C. 5% ESs



Note: Figure 95. Presents the developed stock exchanges high quarterly volatility period weekly ESs. The data source is DataStream.

Figure 96. Developed stock exchanges low quarterly volatility period weekly ESs

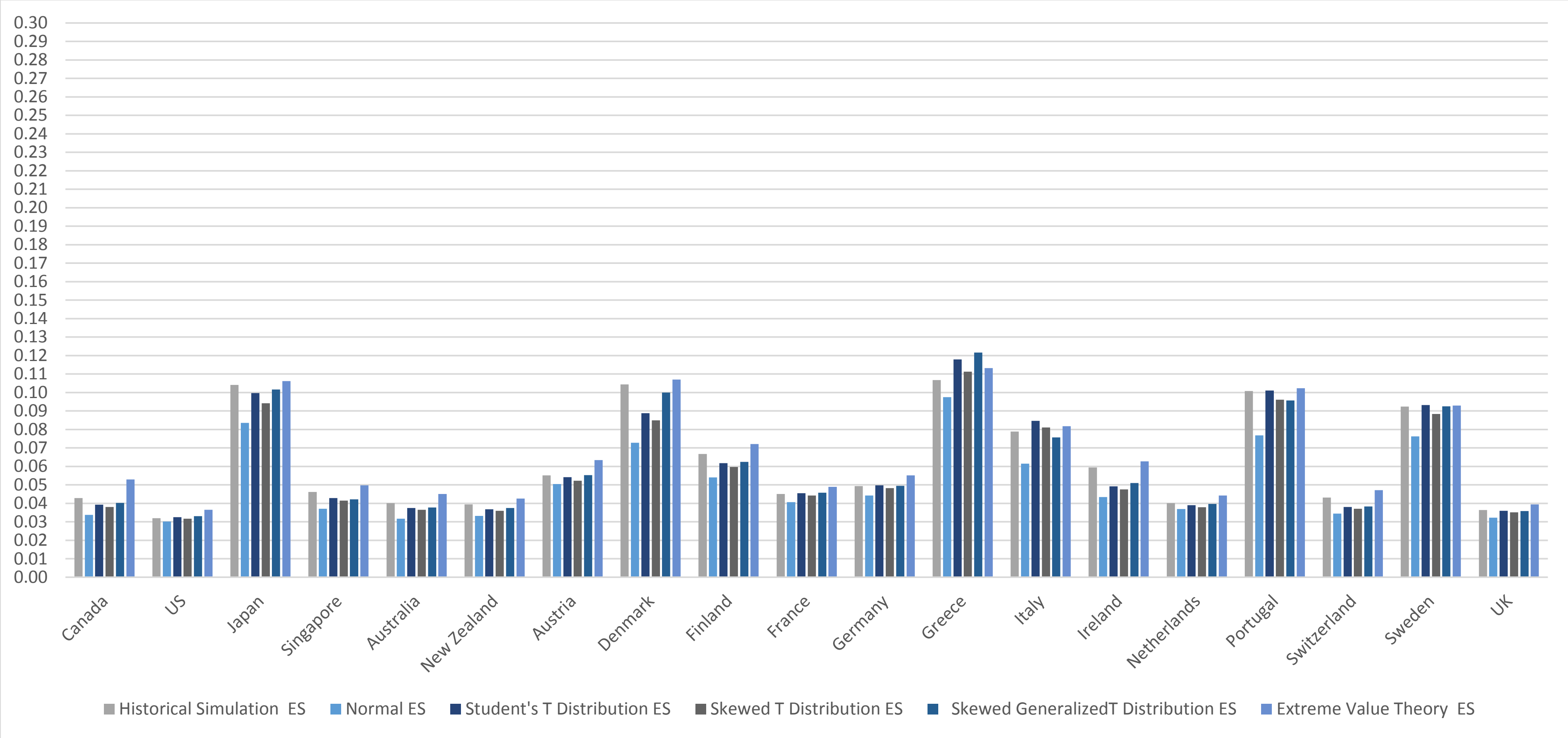
Panel A. 1% ESs



Note: Figure 96. Presents the developed stock exchanges low quarterly volatility period weekly ESs. The data source is DataStream.

Figure 96. Developed stock exchanges low quarterly volatility period weekly ESs

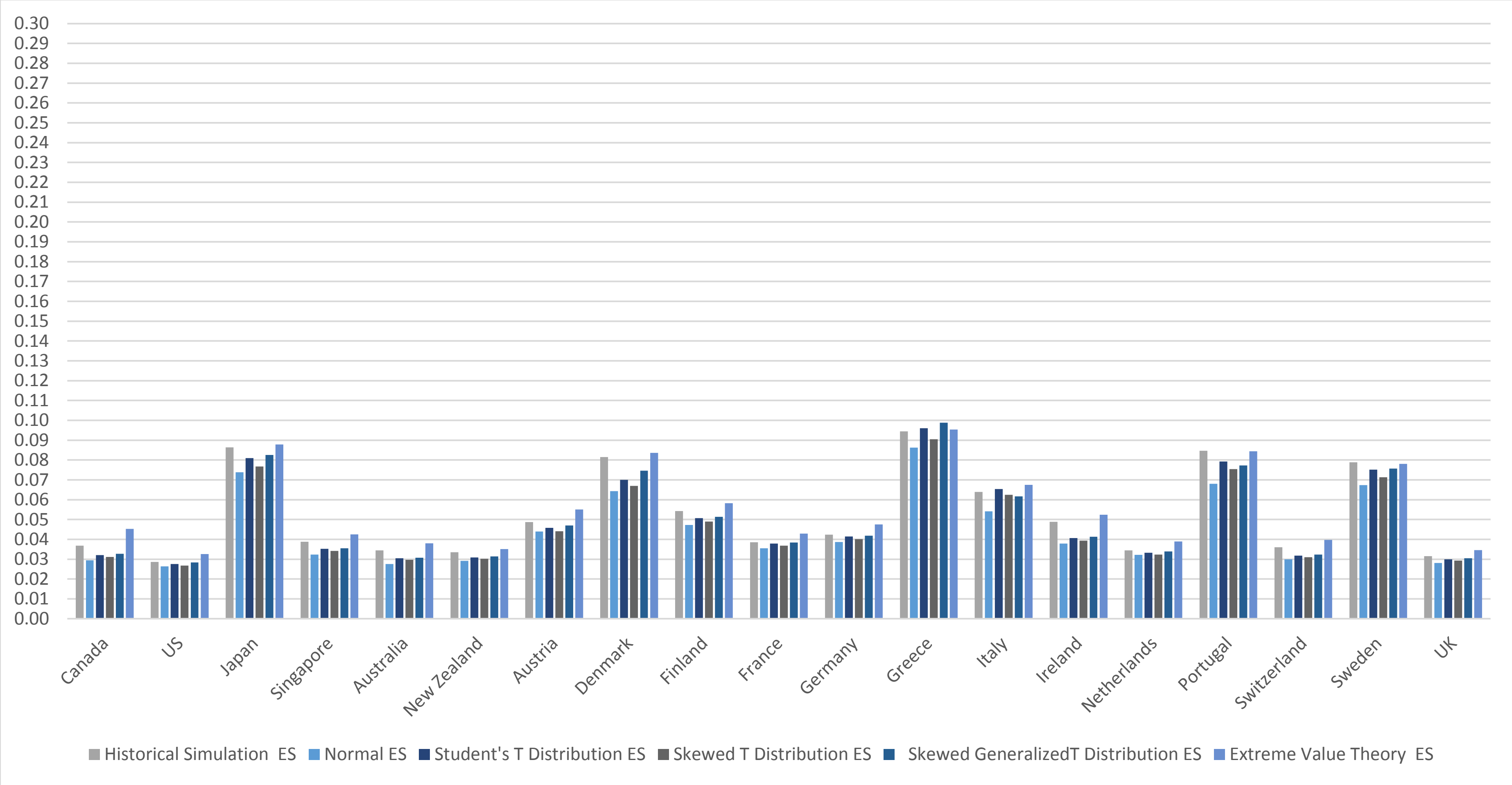
Panel B. 2.5% ESs



Note: Figure 96. Presents the developed stock exchanges low quarterly volatility period weekly ESs. The data source is DataStream.

Figure 96. Developed stock exchanges low quarterly volatility period weekly ESs

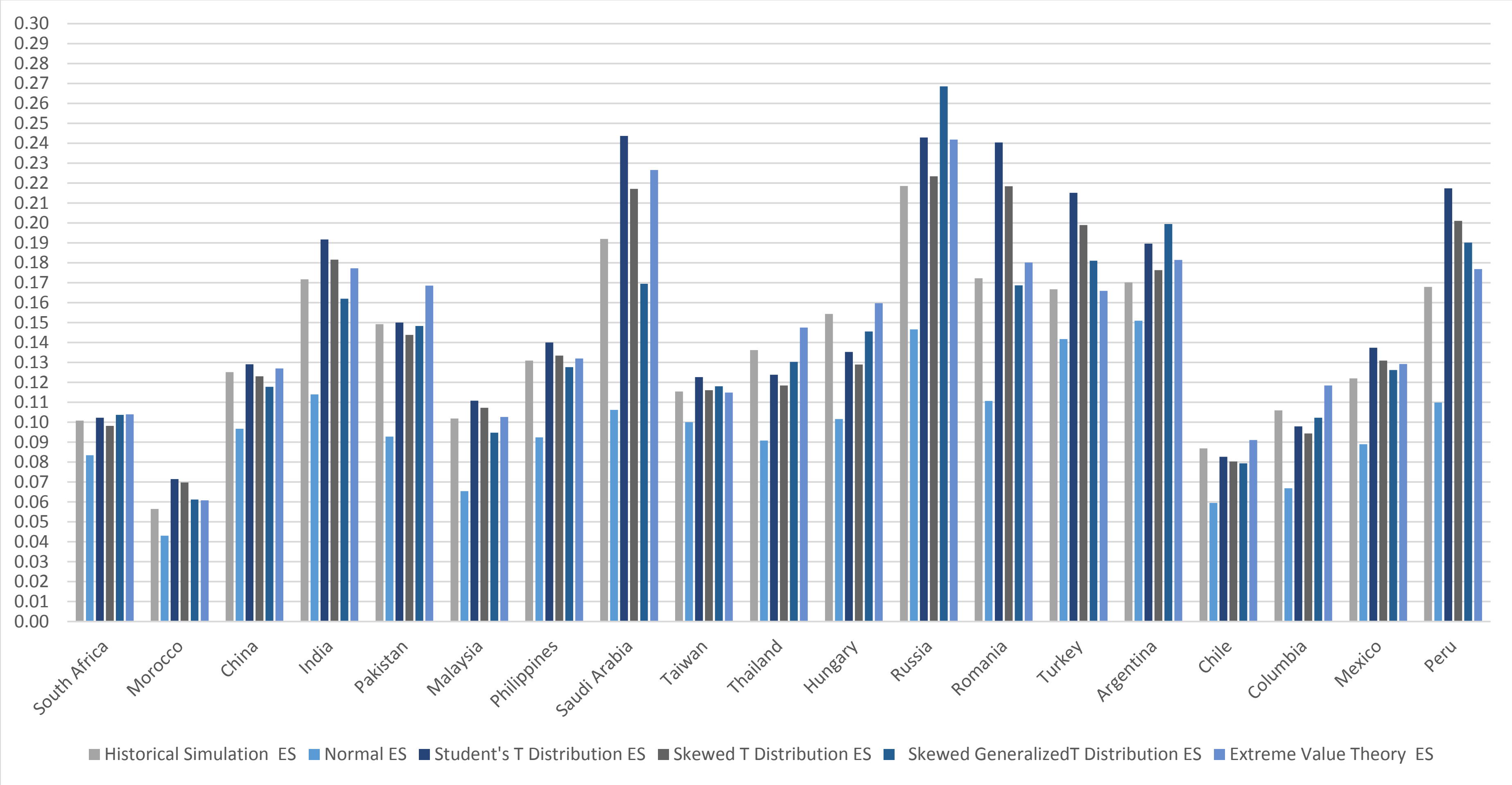
Panel C. 5% ESs



Note: Figure 96. Presents the developed stock exchanges low quarterly volatility period weekly ESs. The data source is DataStream.

Figure 97. Emerging stock exchanges high quarterly volatility period weekly ESs

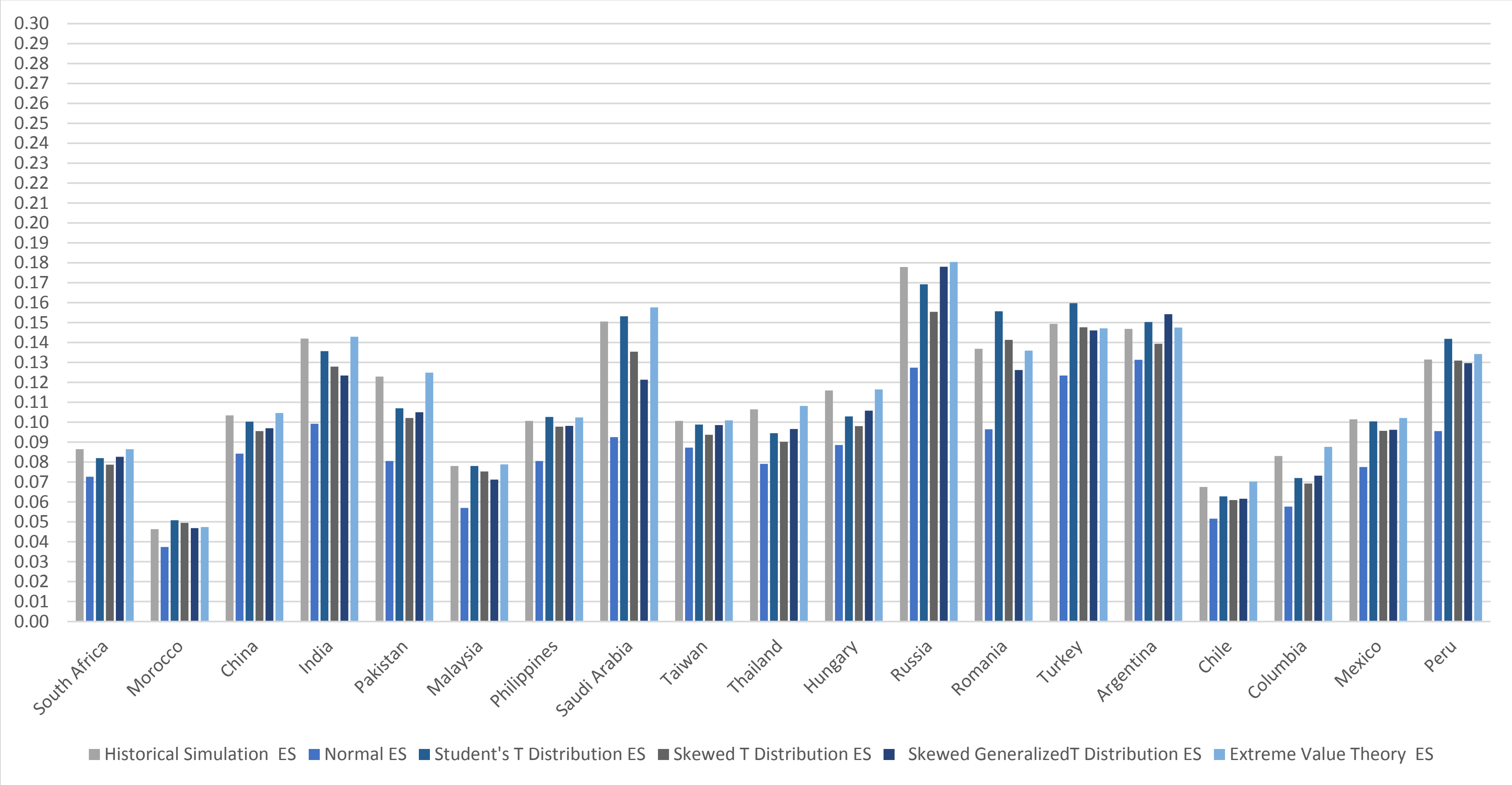
Panel A. 1% ESs



Note: Figure 97. Presents the emerging stock exchanges high quarterly volatility period weekly ESs. The data source is DataStream.

Figure 97. Emerging stock exchanges high quarterly volatility period weekly ESs

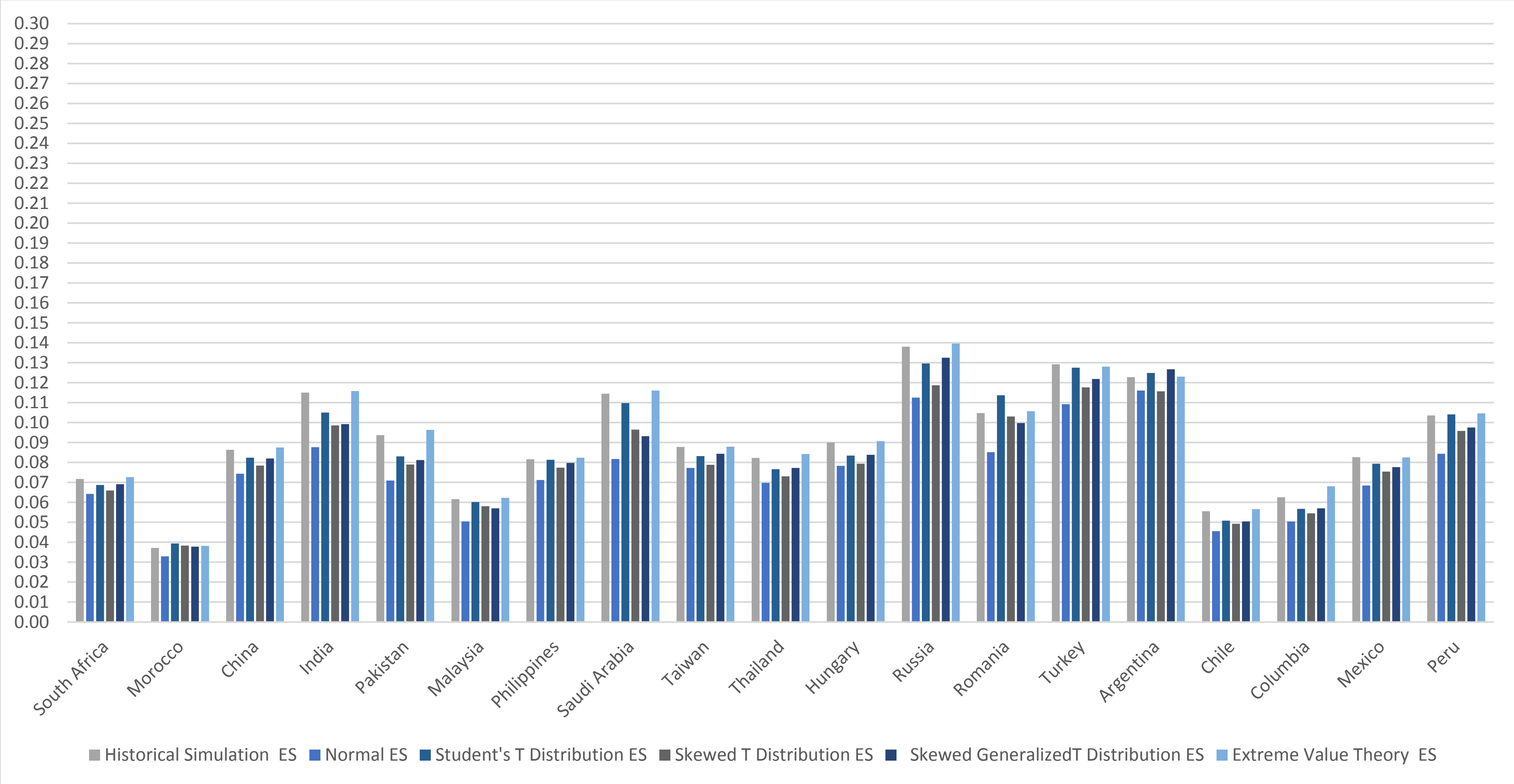
Panel B. 2.5% ESs



Note: Figure 97. Presents the emerging stock exchanges high quarterly volatility period weekly ESs. The data source is DataStream.

Figure 97. Emerging stock exchanges high quarterly volatility period weekly ESs

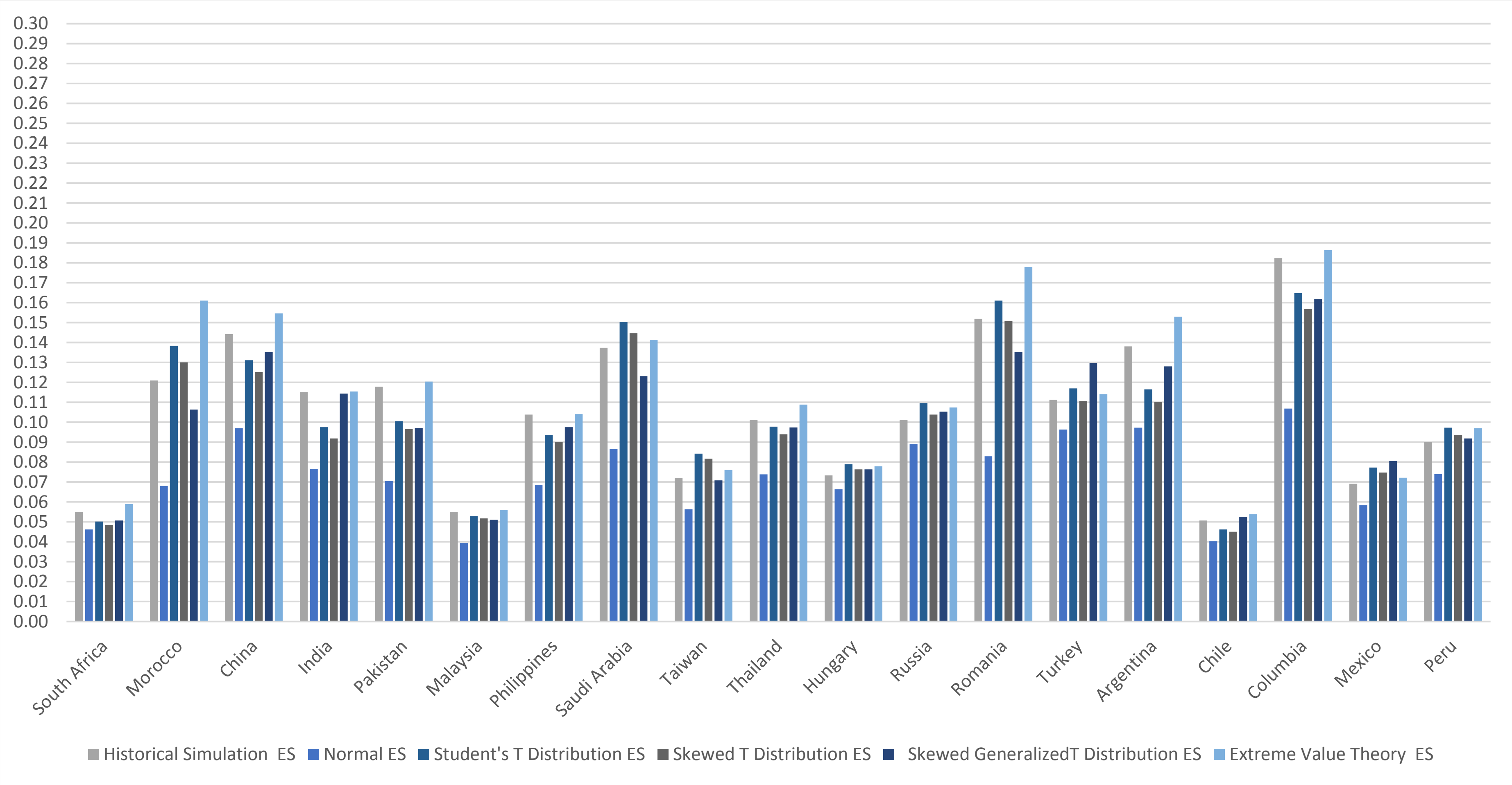
Panel C. 5% ESs



Note: Figure 97. Presents the emerging stock exchanges high quarterly volatility period weekly ESs. The data source is DataStream.

Figure 98. Emerging stock exchanges low quarterly volatility period weekly ESs

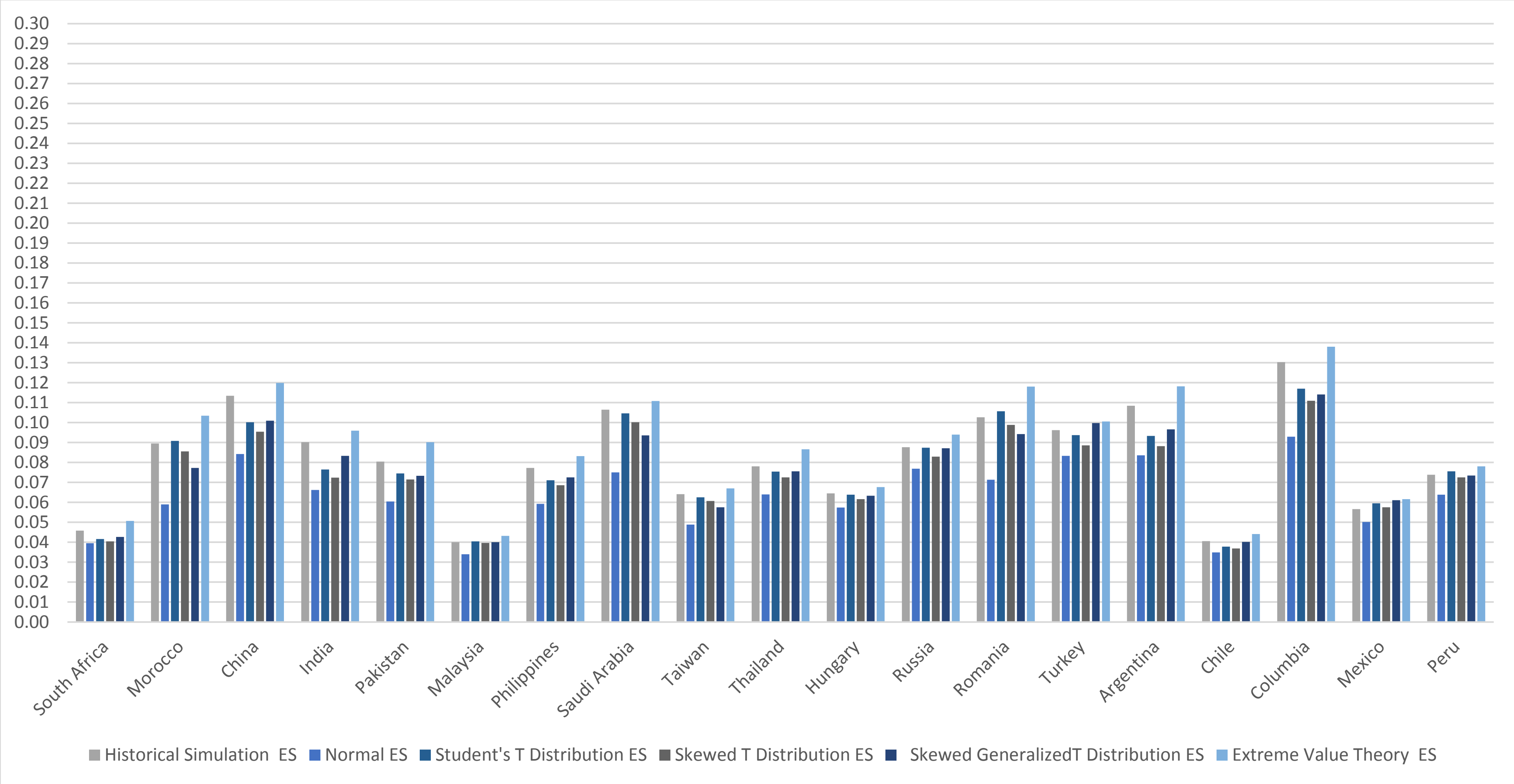
Panel A. 1% ESs



Note: Figure 98. Presents the emerging stock exchanges low quarterly volatility period weekly ESs. The data source is DataStream.

Figure 98. Emerging stock exchanges low quarterly volatility period weekly ESs

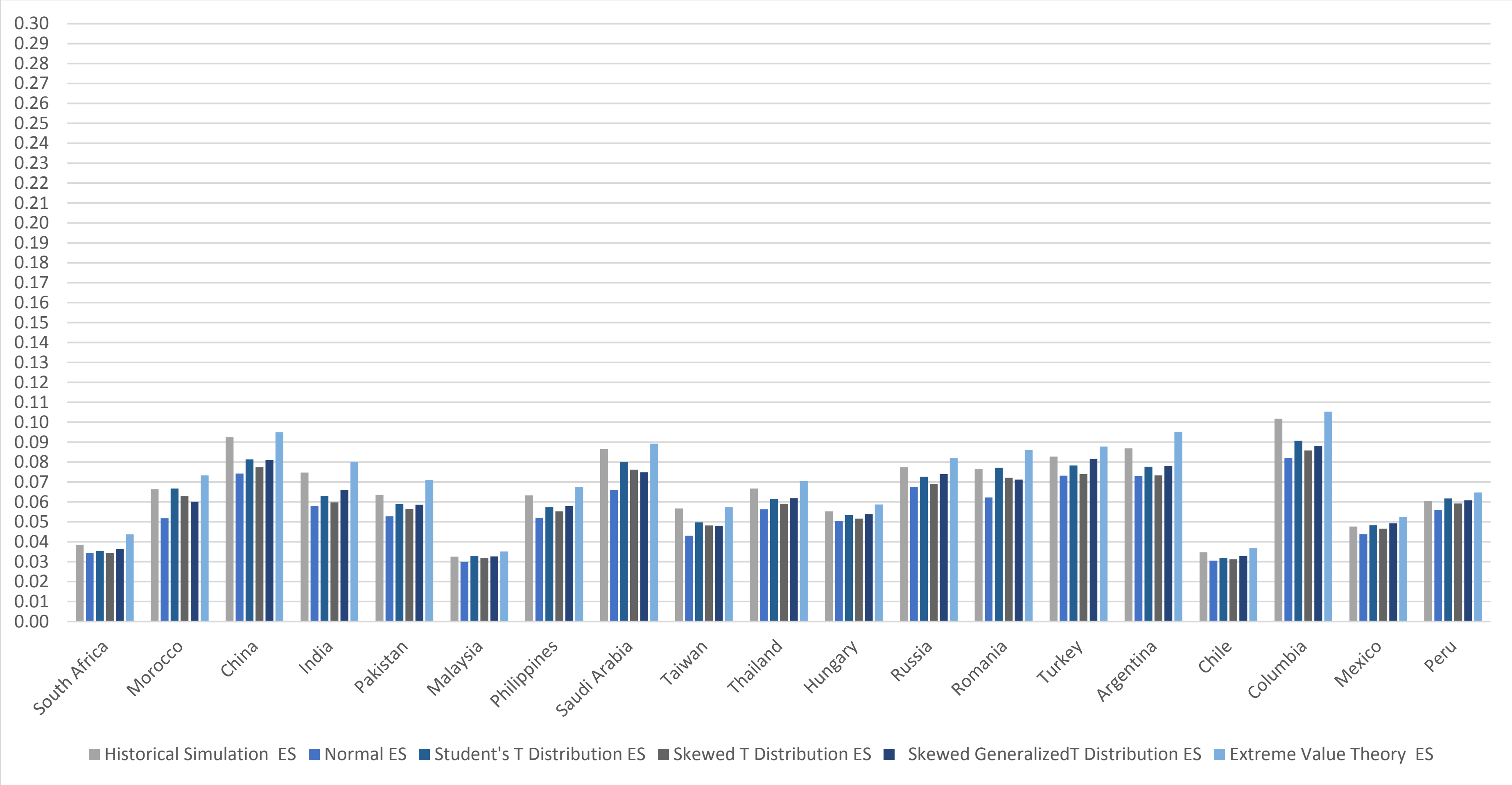
Panel B. 2.5% ESs



Note: Figure 98. Presents the emerging stock exchanges low quarterly volatility period weekly ESs. The data source is DataStream.

Figure 98. Emerging stock exchanges low quarterly volatility period weekly ESs

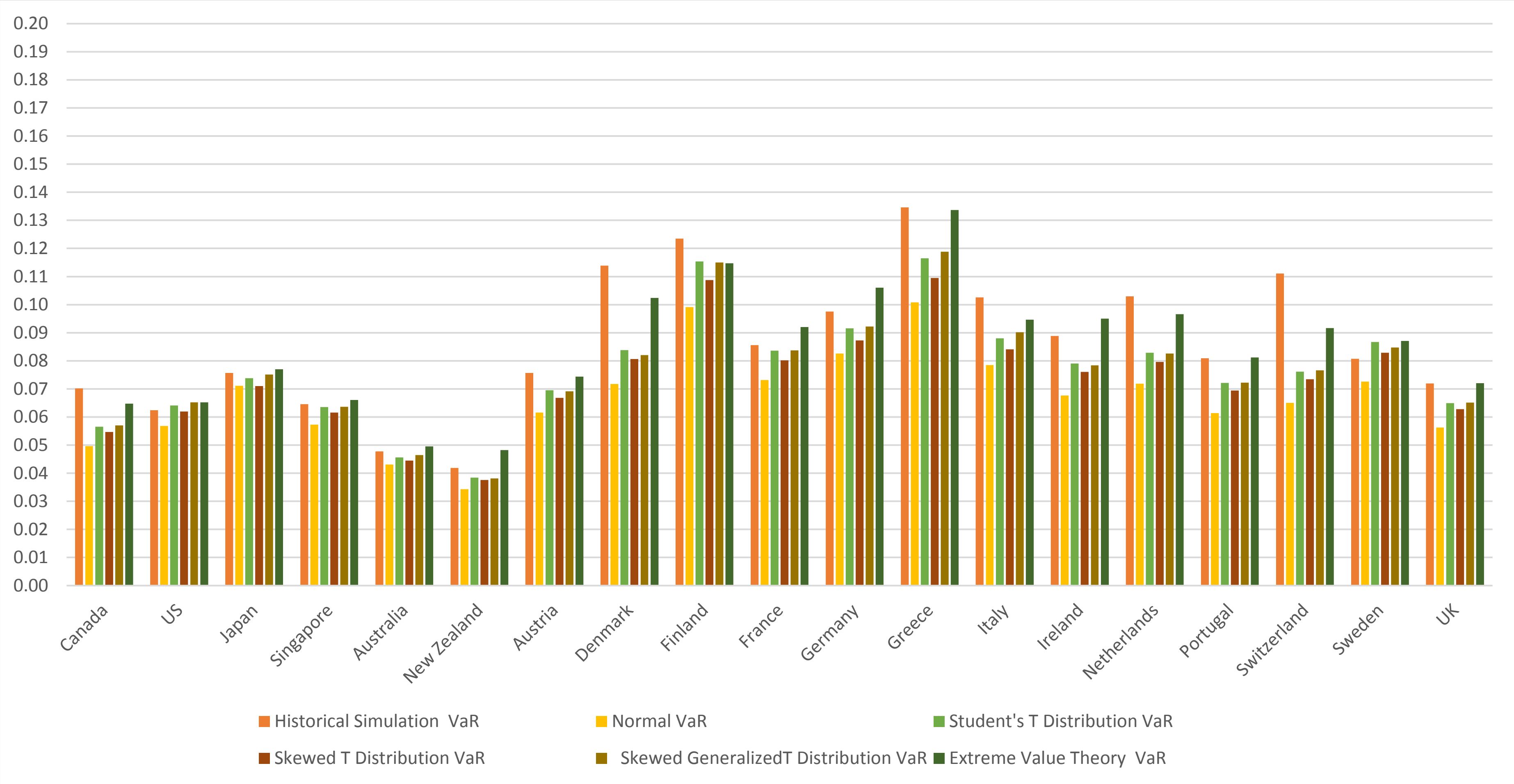
Panel C. 5% ESs



Note: Figure 98. presents presents the emerging stock exchanges low quarterly volatility period weekly ESs. The data source is DataStream.

Figure 99. Developed stock exchanges high quarterly skewness period weekly VaRs

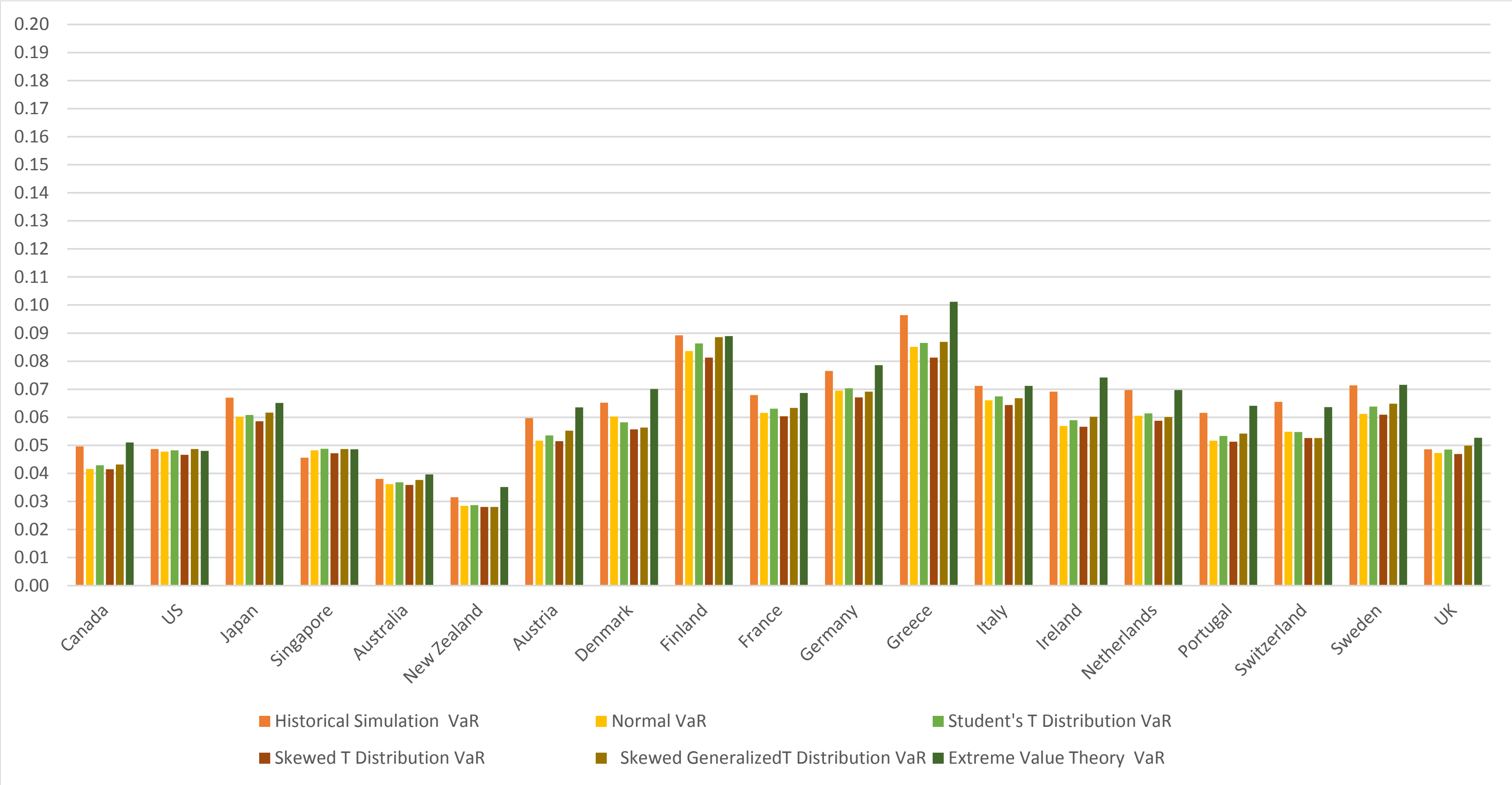
Panel A. 1% VaRs



Note: Figure 99. presents presents the developed stock exchanges high quarterly skewness period weekly VaRs . The data source is DataStream.

Figure 99. Developed stock exchanges high quarterly skewness period weekly VaRs

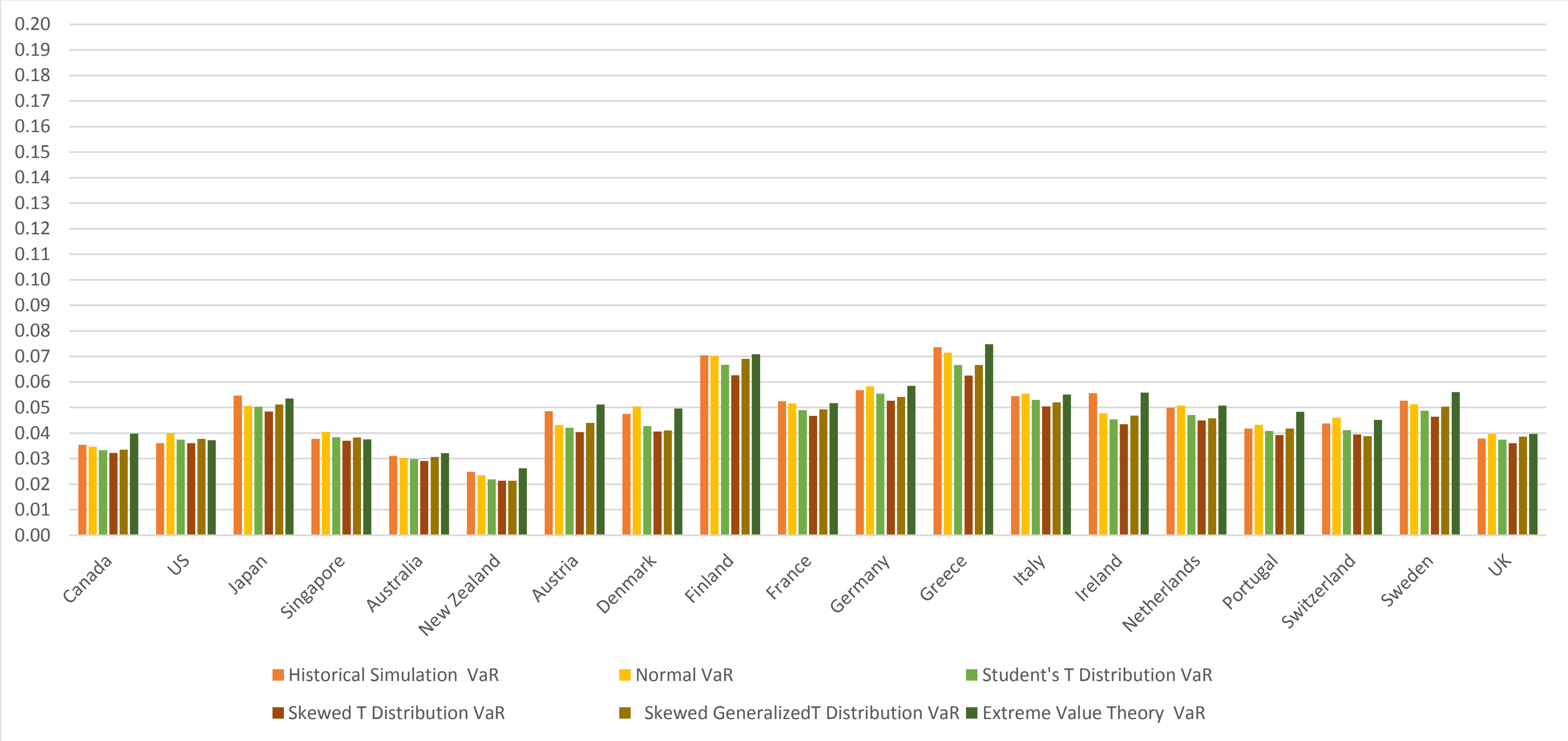
Panel B. 2.5% VaRs



Note: Figure 99. presents presents the developed stock exchanges high quarterly skewness period weekly VaRs . The data source is DataStream.

Figure 92. Developed stock exchanges high quarterly skewness period weekly VaRs

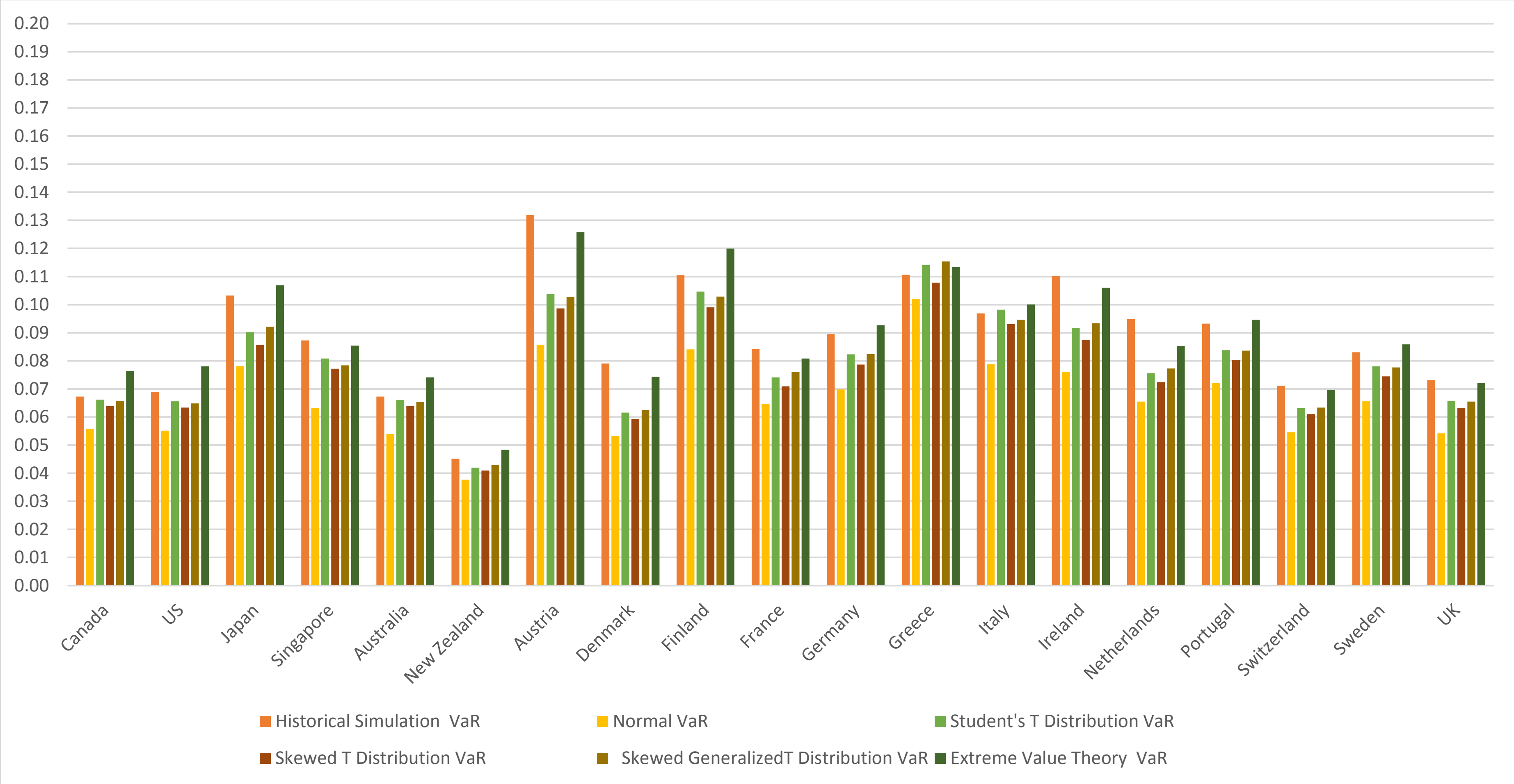
Panel C. 5% VaRs



Note: Figure 99. presents presents the developed stock exchanges high quarterly skewness period weekly VaRs . The data source is DataStream.

Figure 100. Developed stock exchanges low quarterly skewness period weekly VaRs

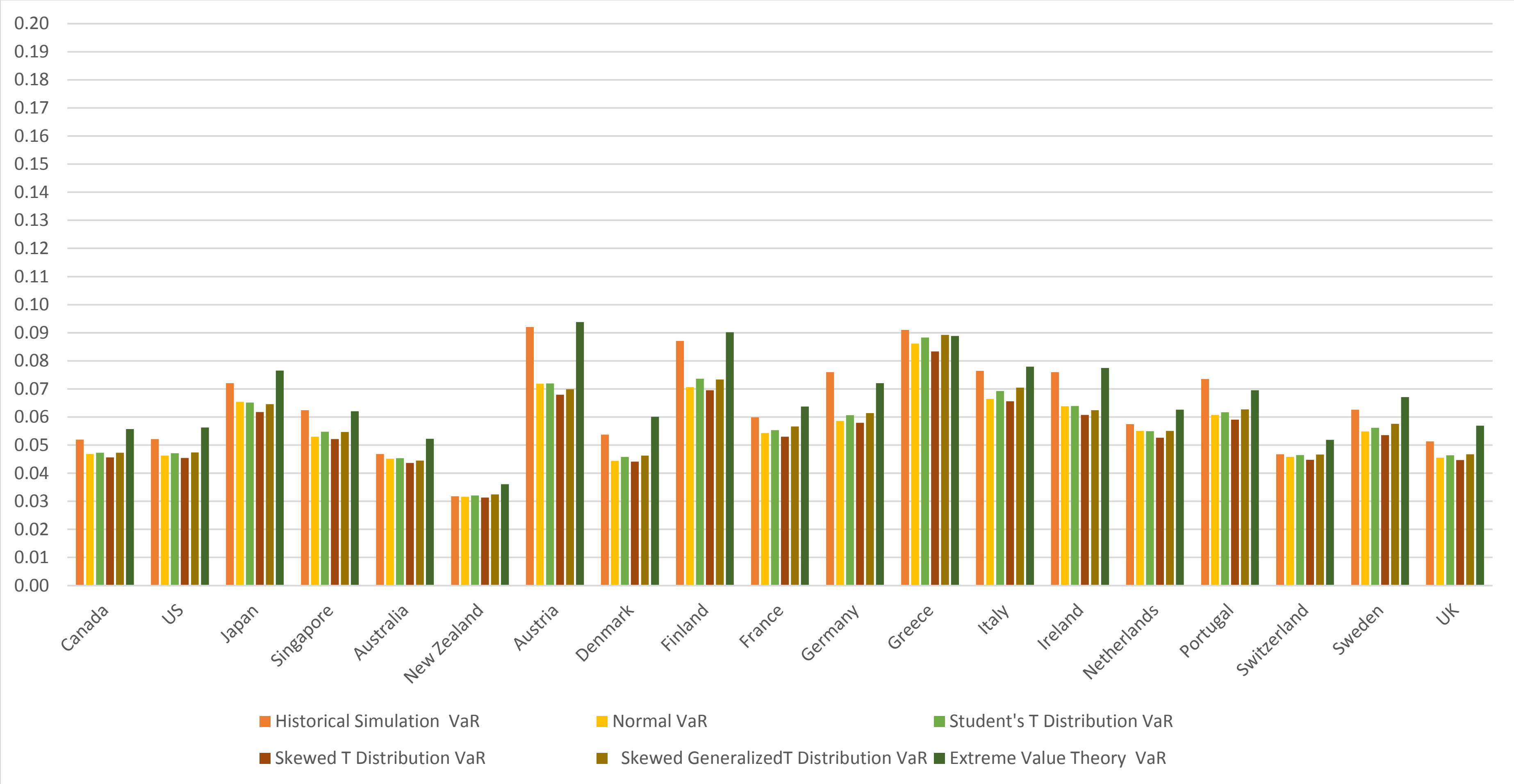
Panel A. 1% VaRs



Note: Figure 100. presents the developed stock exchanges low quarterly skewness period weekly VaRs. The data source is DataStream.

Figure 100. Developed stock exchanges low quarterly skewness period weekly VaRs

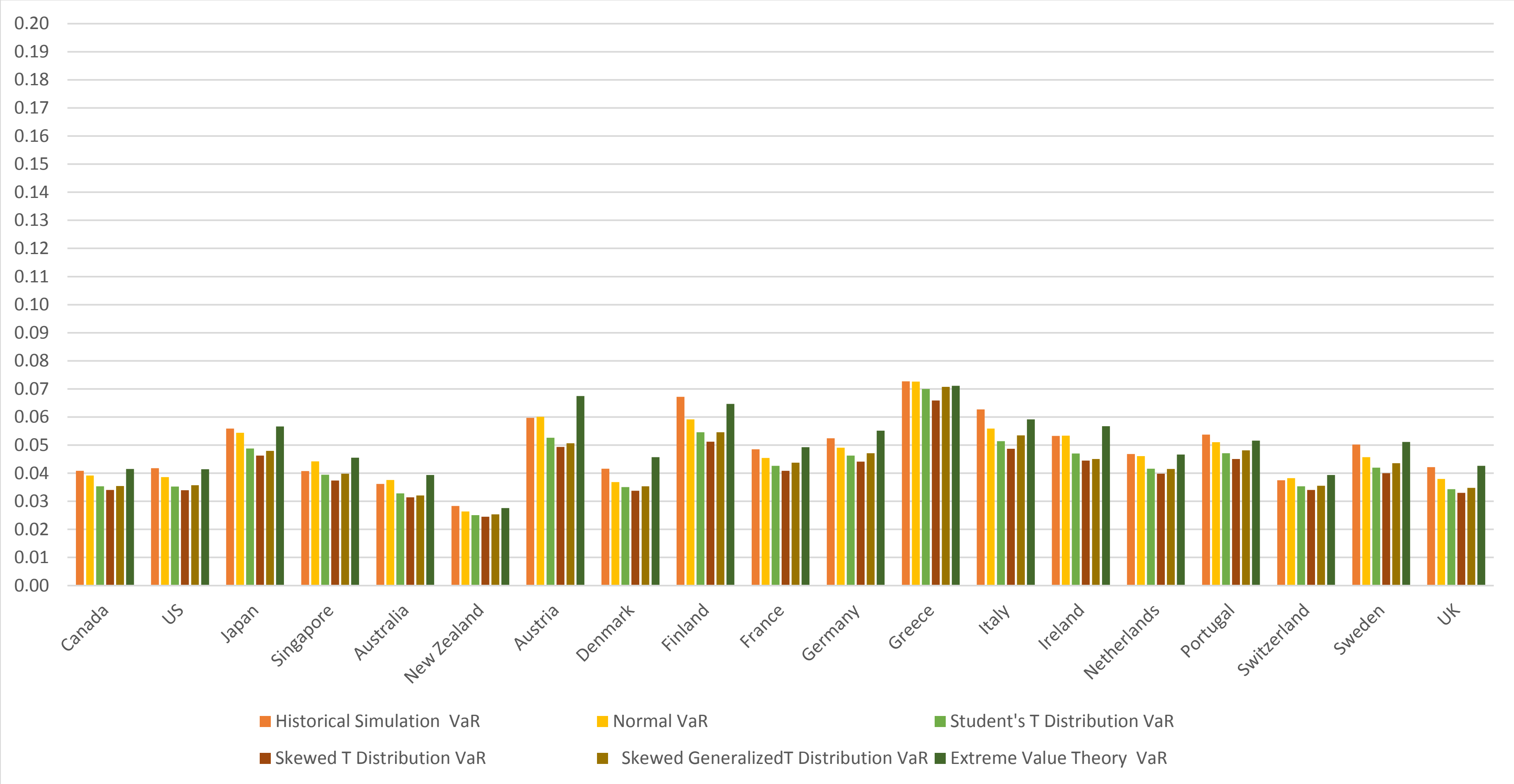
Panel B. 2.5% VaRs



Note: Figure 100. presents presents the developed stock exchanges low quarterly skewness period weekly VaRs. The data source is DataStream.

Figure 100. Developed stock exchanges low quarterly skewness period weekly VaRs

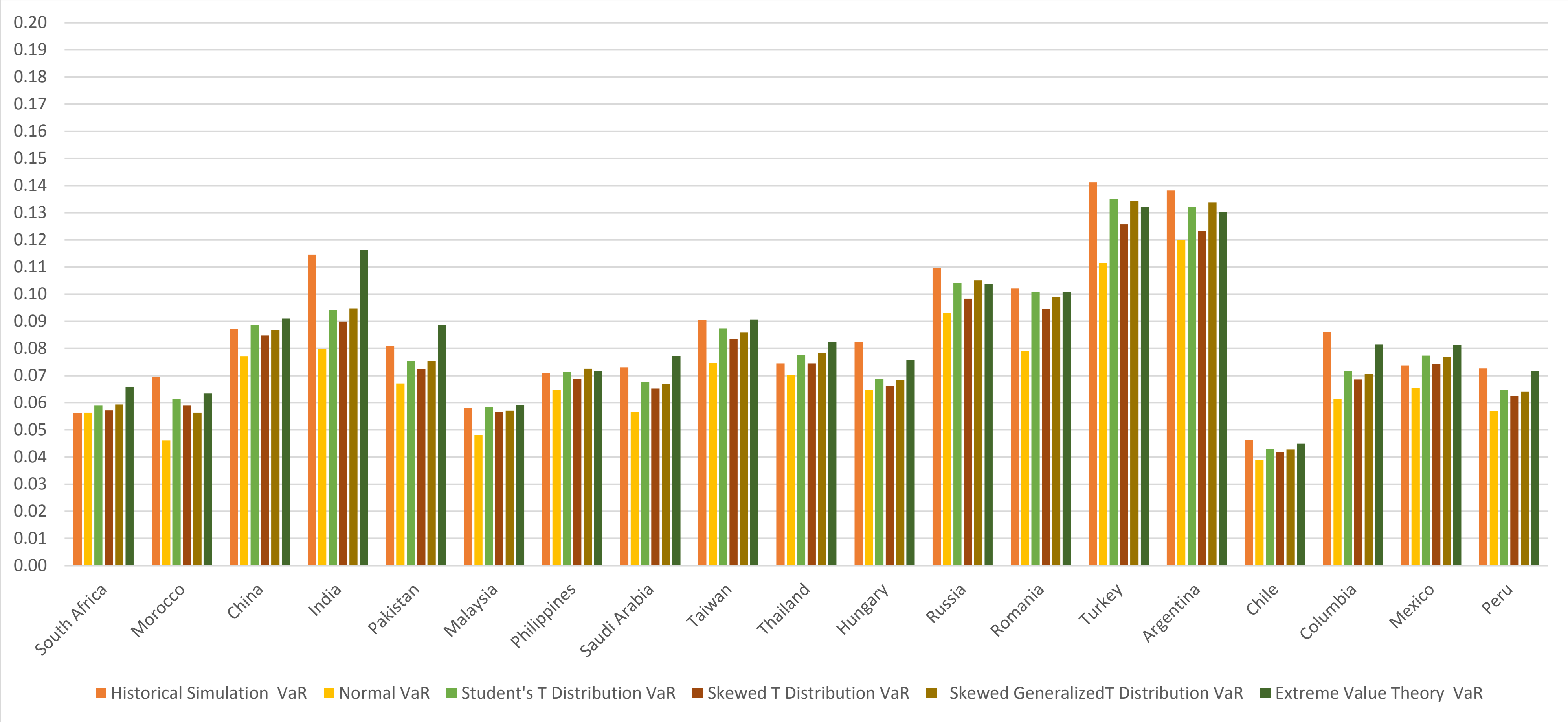
Panel C. 5% VaRs



Note: Figure 100. presents the developed stock exchanges low quarterly skewness period weekly VaRs. The data source is DataStream.

Figure 101. Emerging stock exchanges high quarterly skewness period weekly VaRs

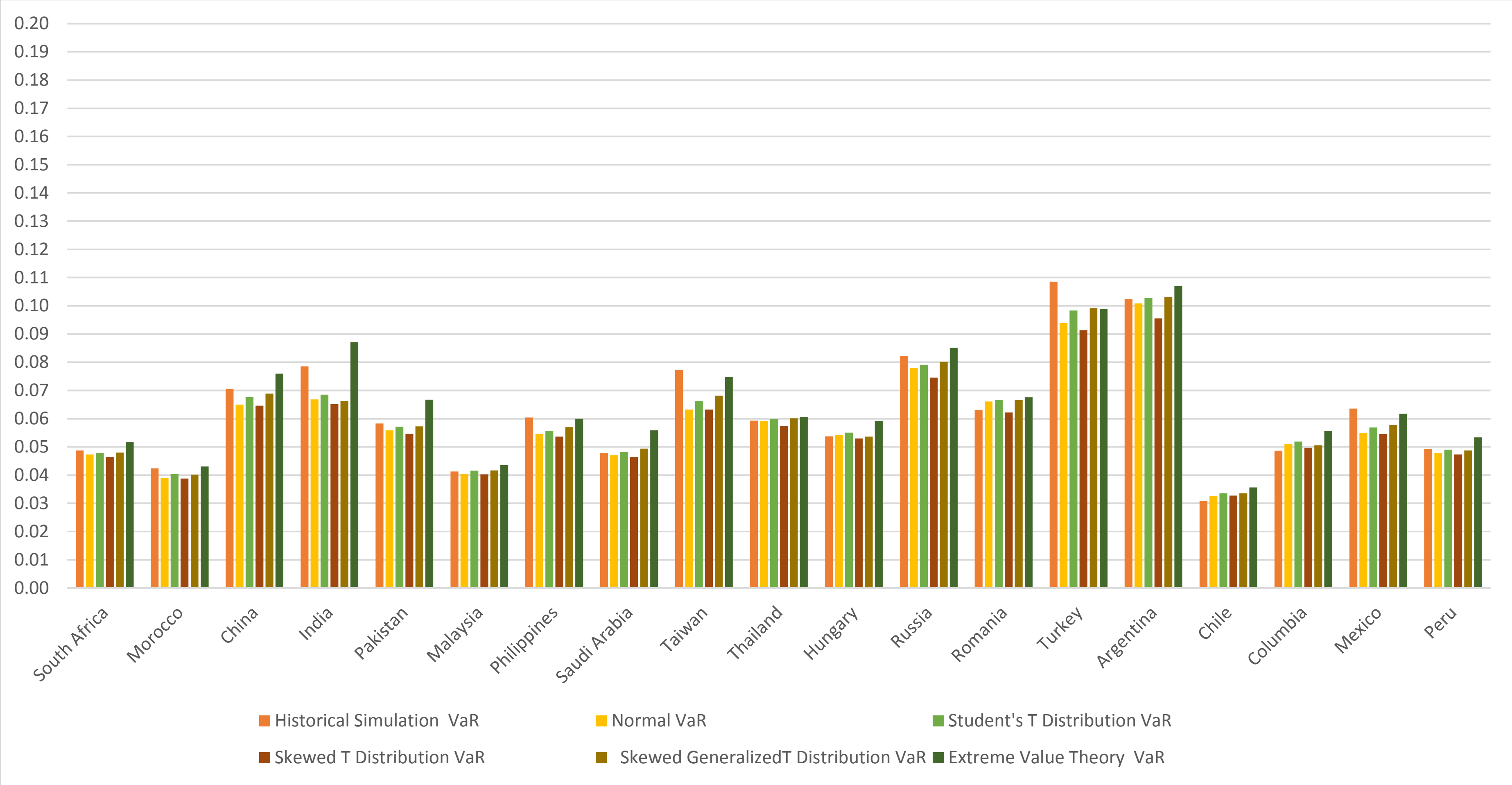
Panel A. 1% VaRs



Note: Figure 101. presents the emerging stock exchanges high quarterly skewness period weekly VaRs. The data source is DataStream.

Figure 101. Emerging stock exchanges high quarterly skewness period weekly VaRs

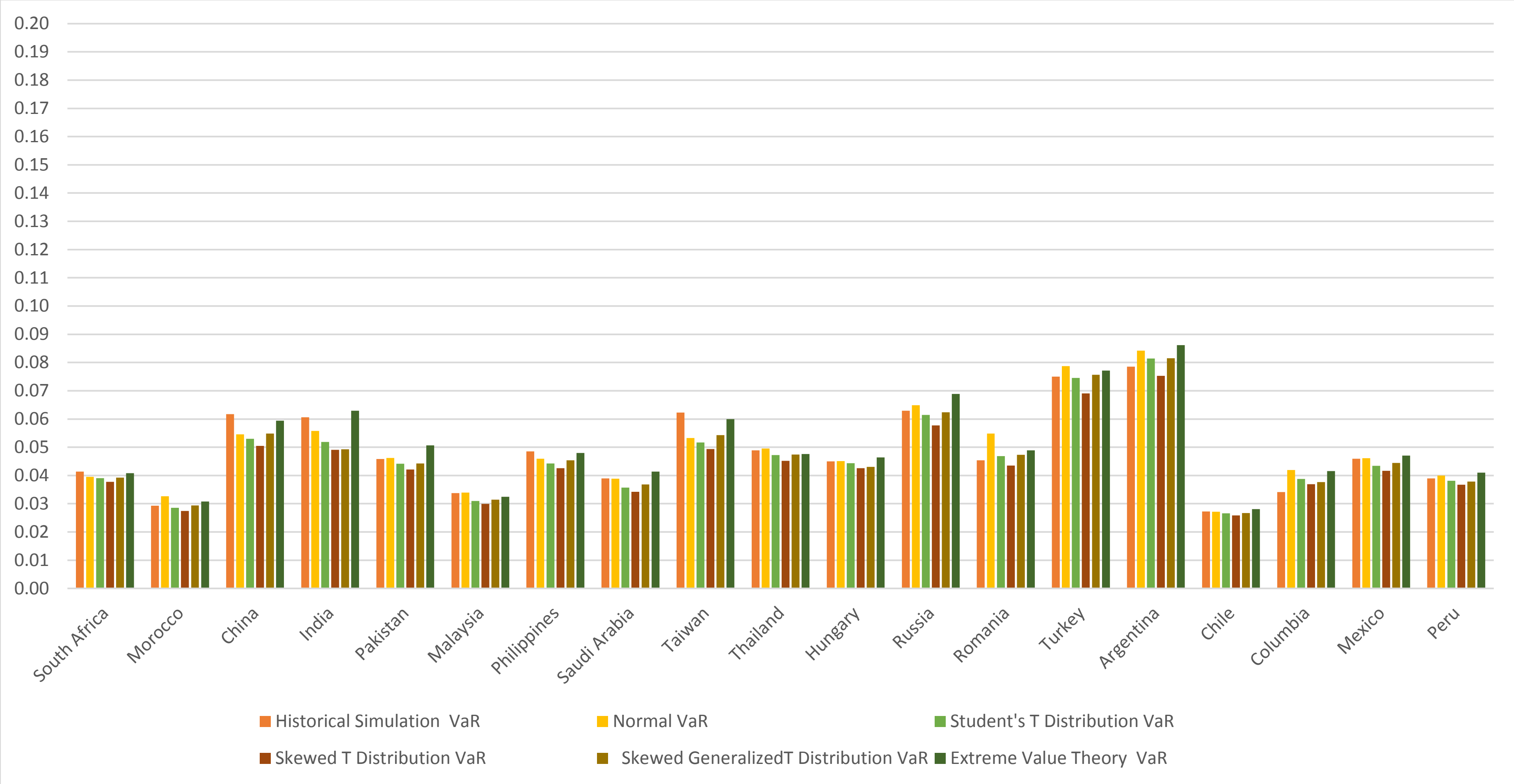
Panel B. 2.5% VaRs



Note: Figure 101. presents the emerging stock exchanges high quarterly skewness period weekly VaRs. The data source is DataStream.

Figure 101. Emerging stock exchanges high quarterly skewness period weekly VaRs

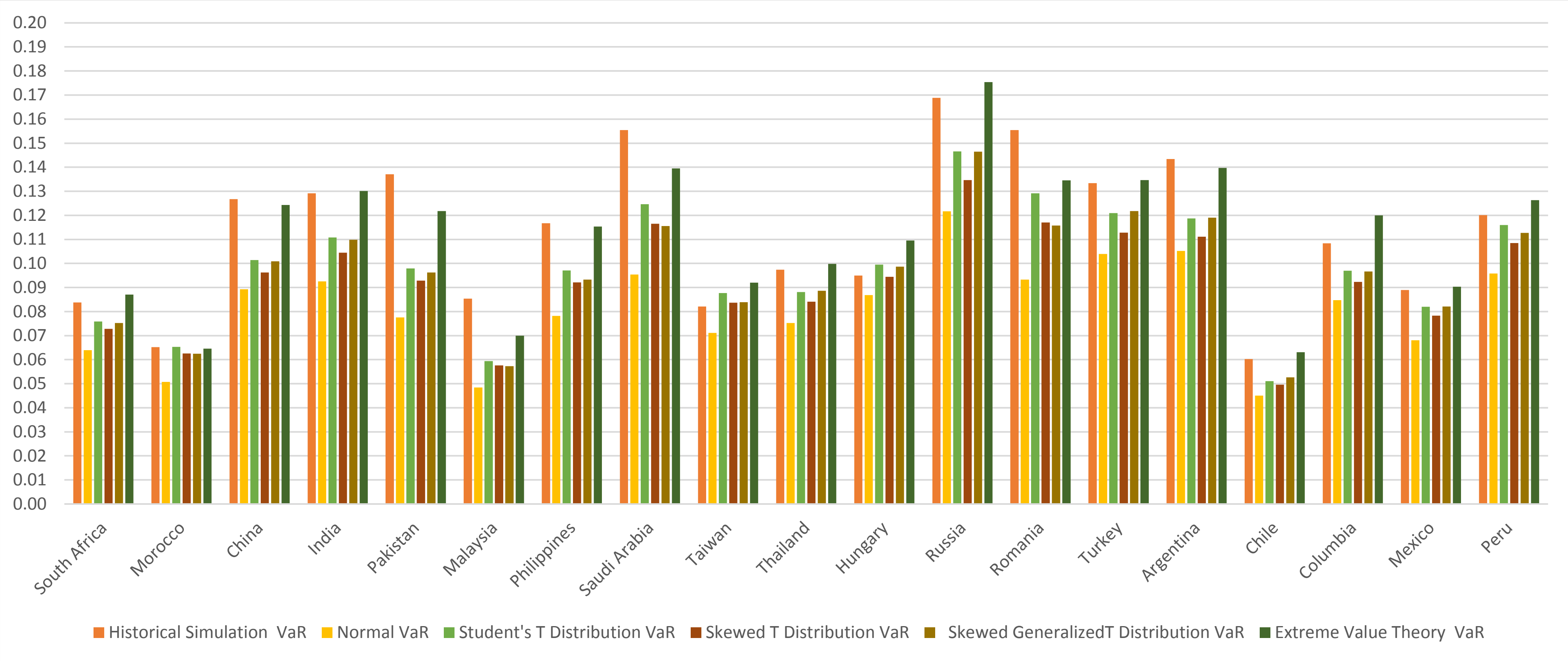
Panel C. 5% VaRs



Note: Figure 101. presents the emerging stock exchanges high quarterly skewness period weekly VaRs. The data source is DataStream.

Figure 102. Emerging stock exchanges low quarterly skewness period weekly VaRs

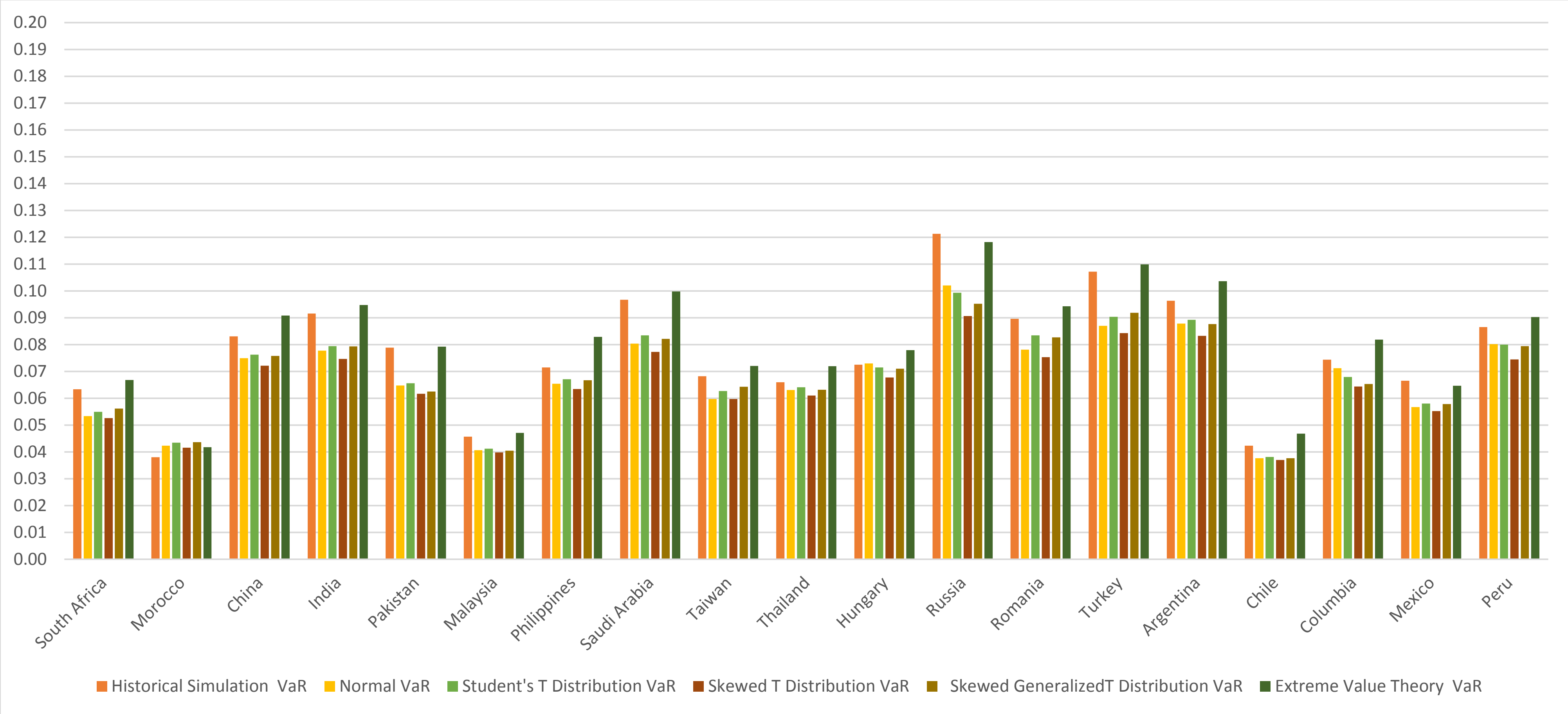
Panel A. 1% VaRs



Note: Figure 102. presents the emerging stock exchanges low quarterly skewness period weekly VaRs. The data source is DataStream.

Figure 102. Emerging stock exchanges low quarterly skewness period weekly VaRs

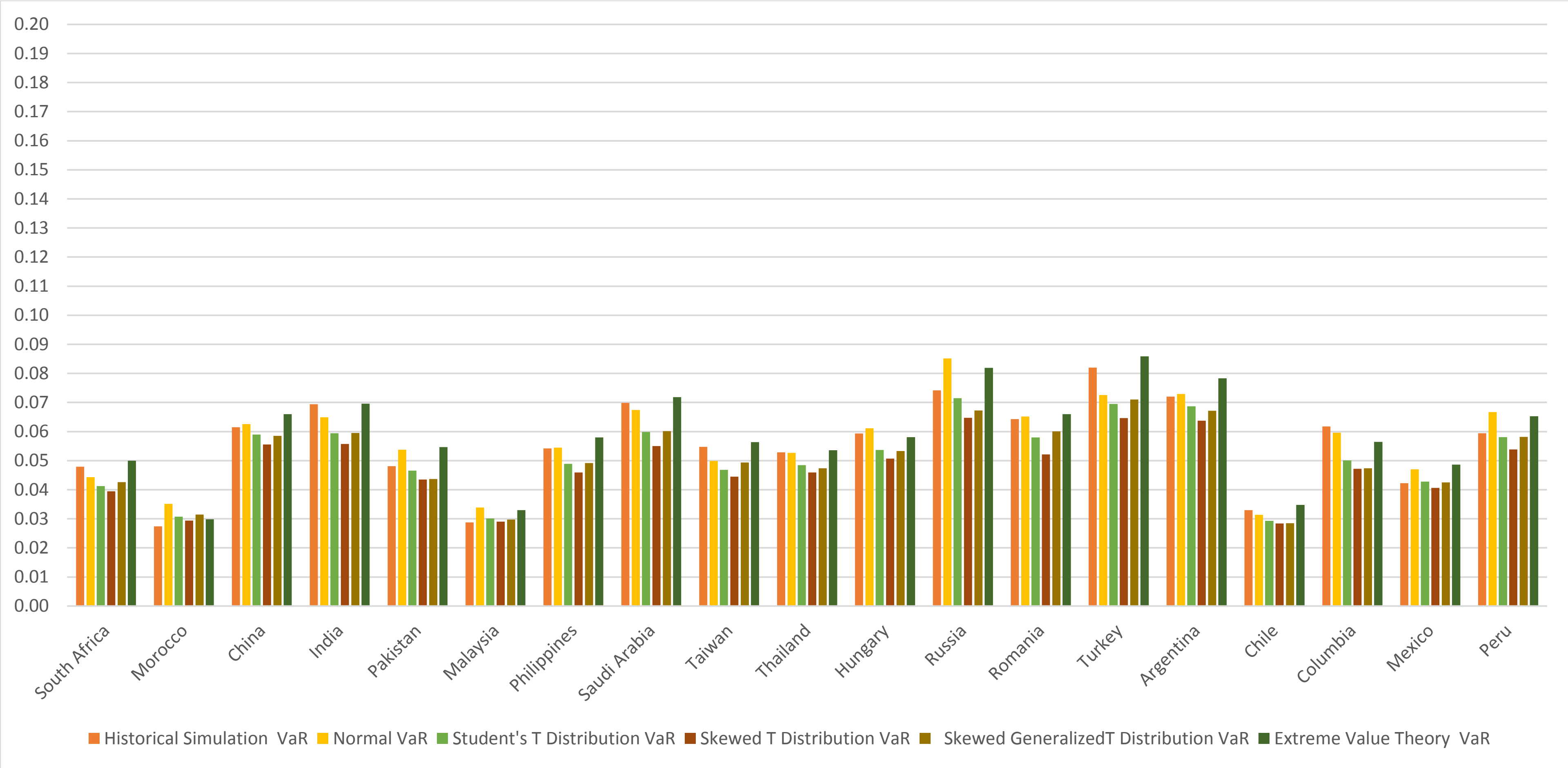
Panel B. 2.5% VaRs



Note: Figure 102. presents the emerging stock exchanges low quarterly skewness period weekly VaRs. The data source is DataStream.

Figure 102. Emerging stock exchanges low quarterly skewness period weekly VaRs

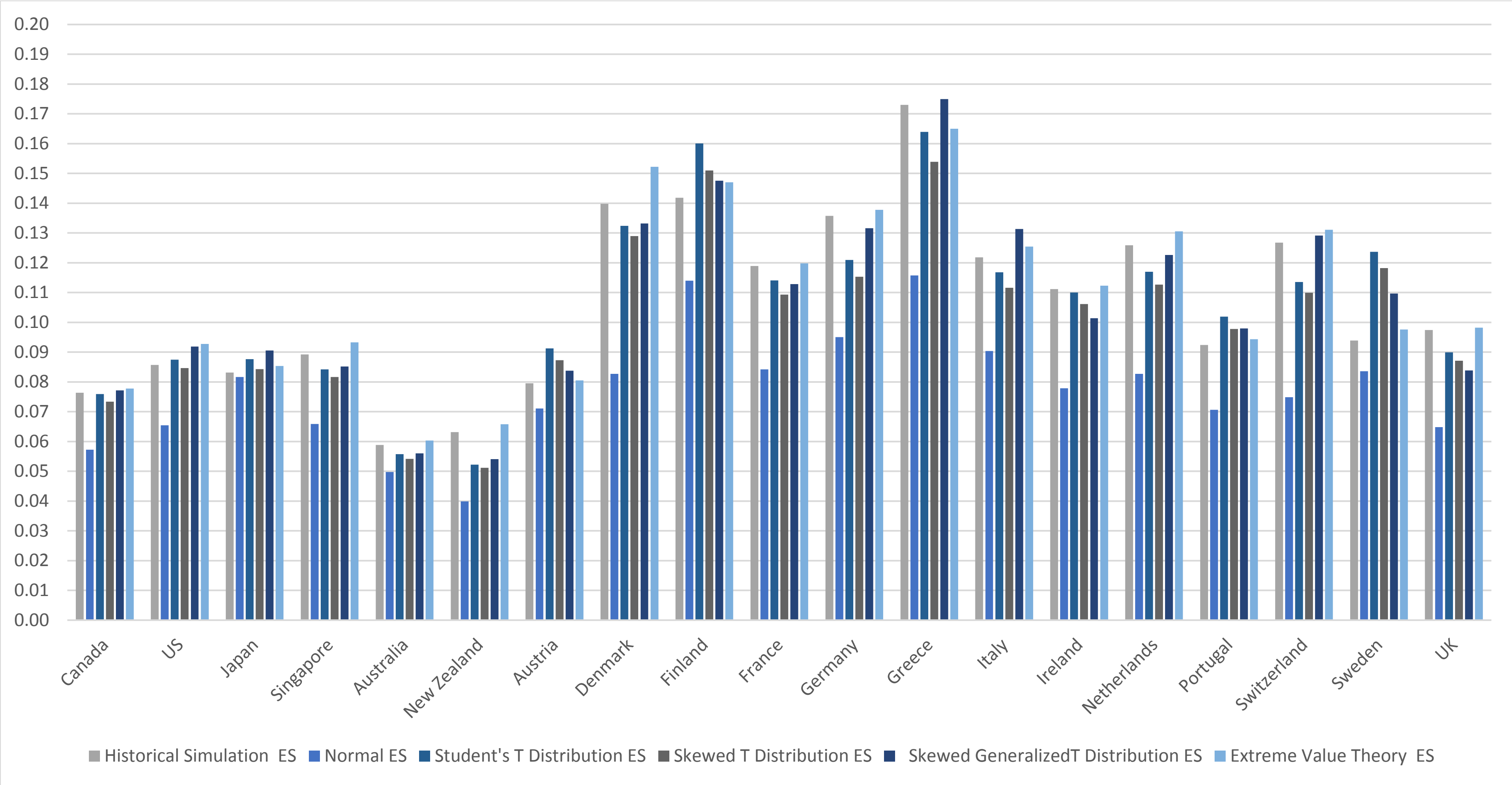
Panel C. 5% VaRs



Note: Figure 102. presents the emerging stock exchanges low quarterly skewness period weekly VaRs. The data source is DataStream.

Figure 103. Developed stock exchanges high quarterly skewness period weekly ESs

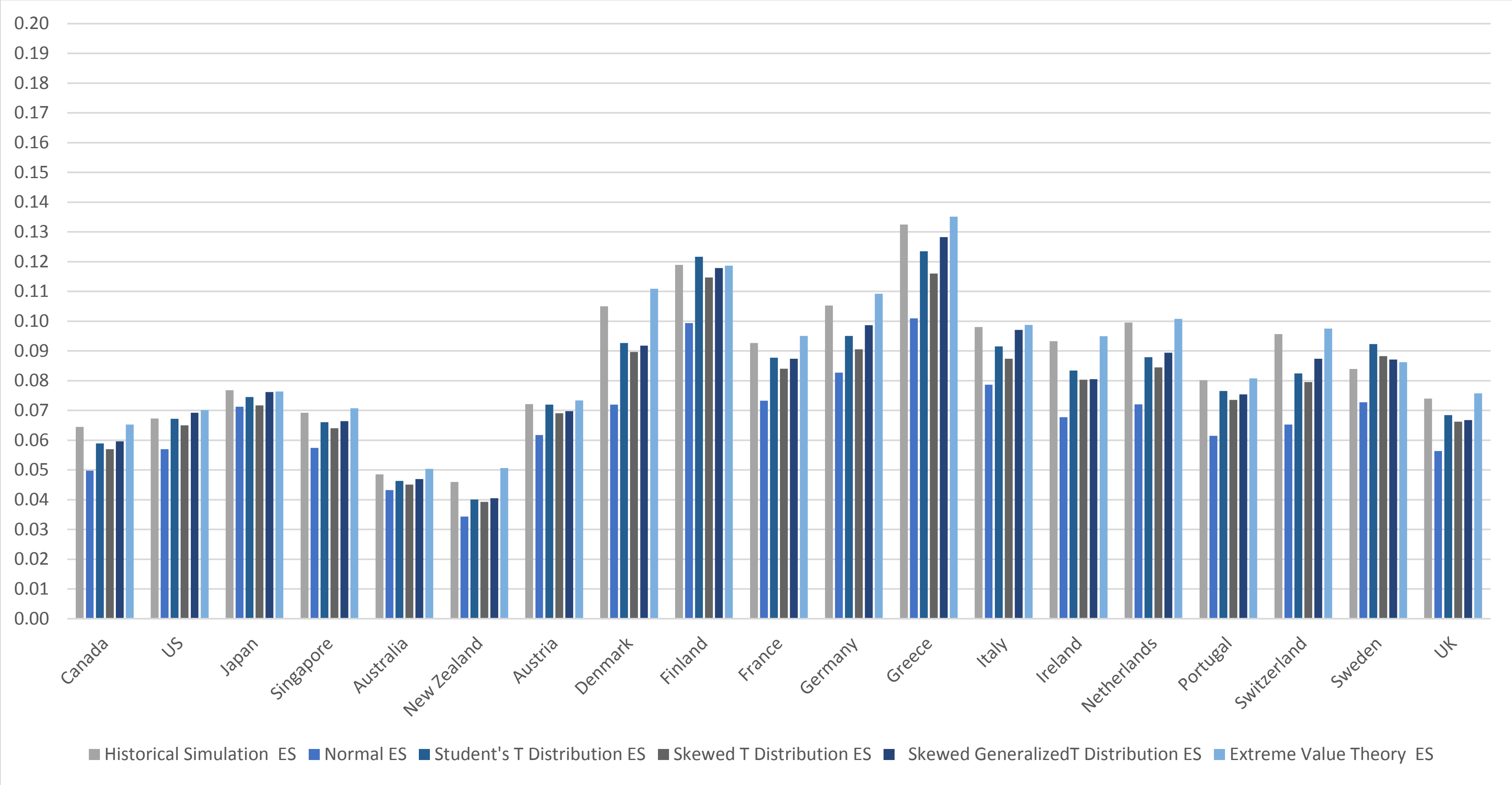
Panel A. 1% ESs



Note: Figure 103. presents the developed stock exchanges high quarterly skewness period weekly ESs. The data source is DataStream.

Figure 103. Developed stock exchanges high quarterly skewness period weekly ESs

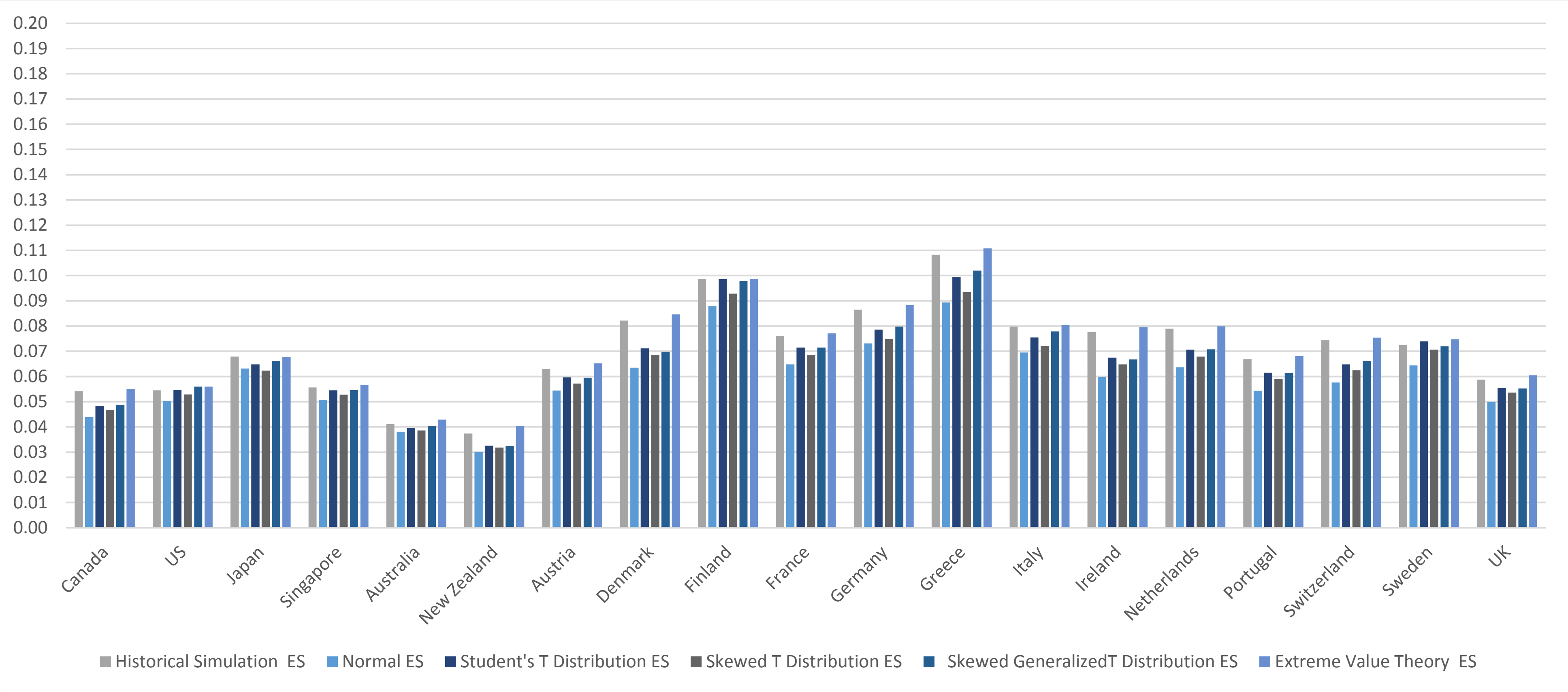
Panel B. 2.5% ESs



Note: Figure 103. presents the developed stock exchanges high quarterly skewness period weekly ESs. The data source is DataStream.

Figure 103. Developed stock exchanges high quarterly skewness period weekly ESs

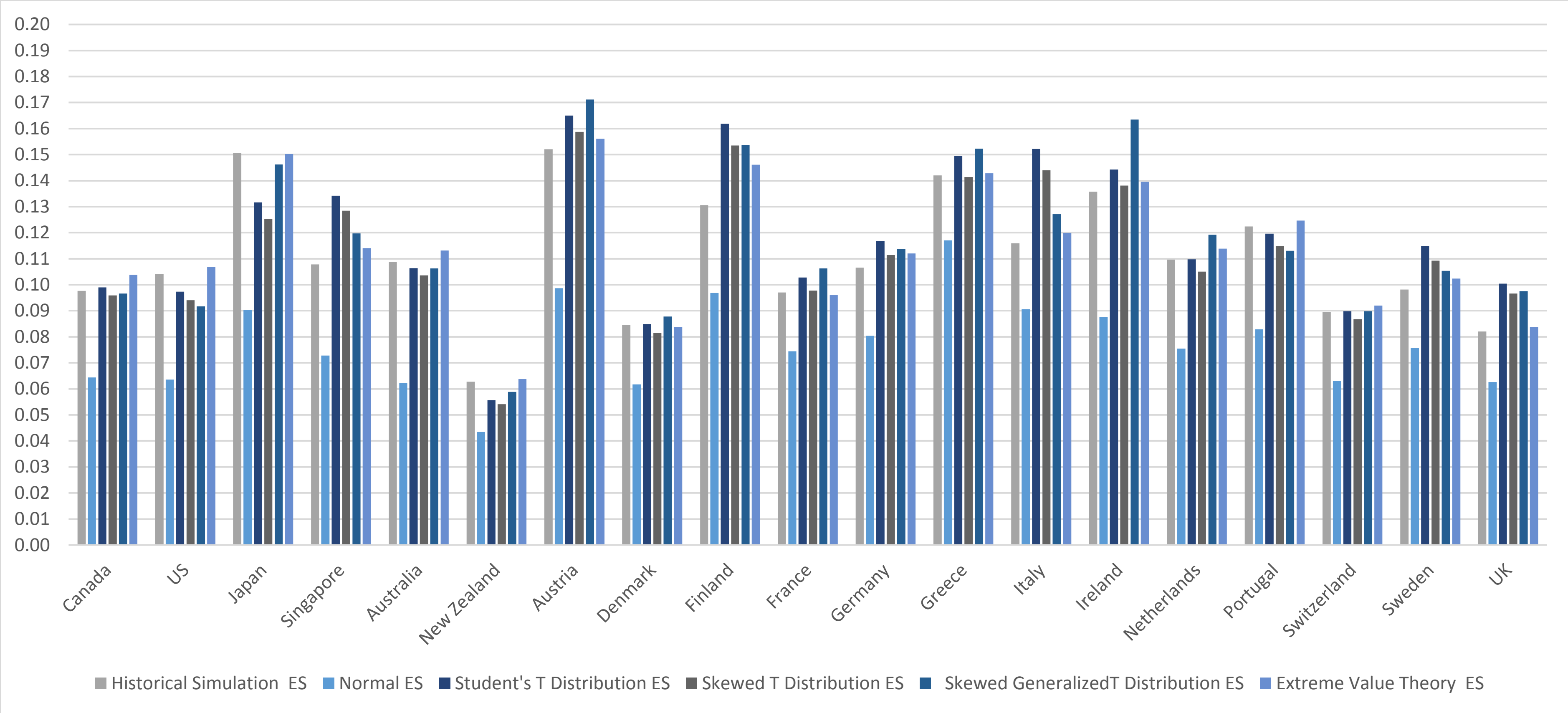
Panel C. 5% ESs



Note: Figure 103. presents the developed stock exchanges high quarterly skewness period weekly ESs. The data source is DataStream.

Figure 104. Developed stock exchanges low quarterly skewness period weekly ESs

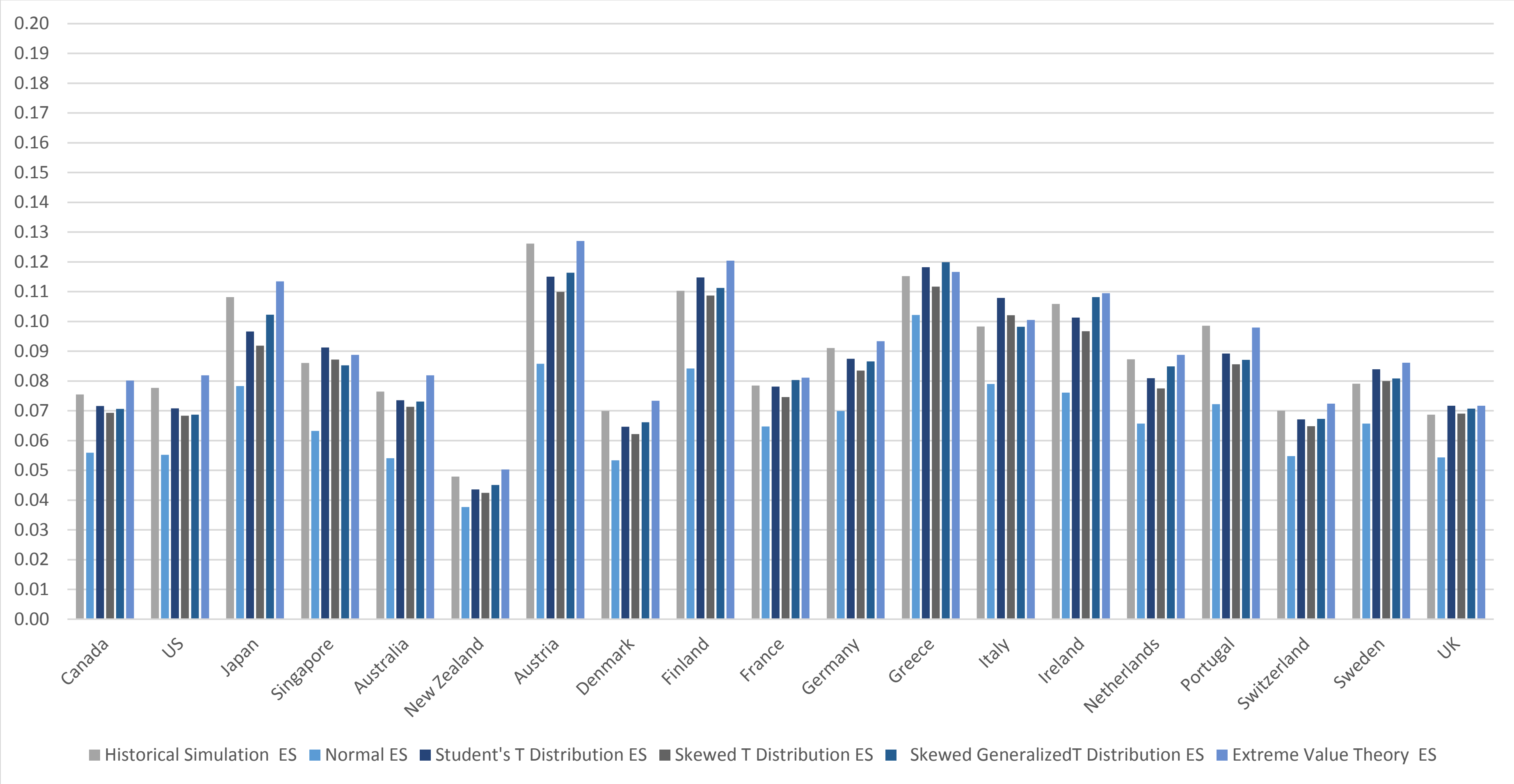
Panel A. 1% ESs



Note: Figure 104. presents the developed stock exchanges low quarterly skewness period weekly ESs. The data source is DataStream.

Figure 104. Developed stock exchanges low quarterly skewness period weekly ESs

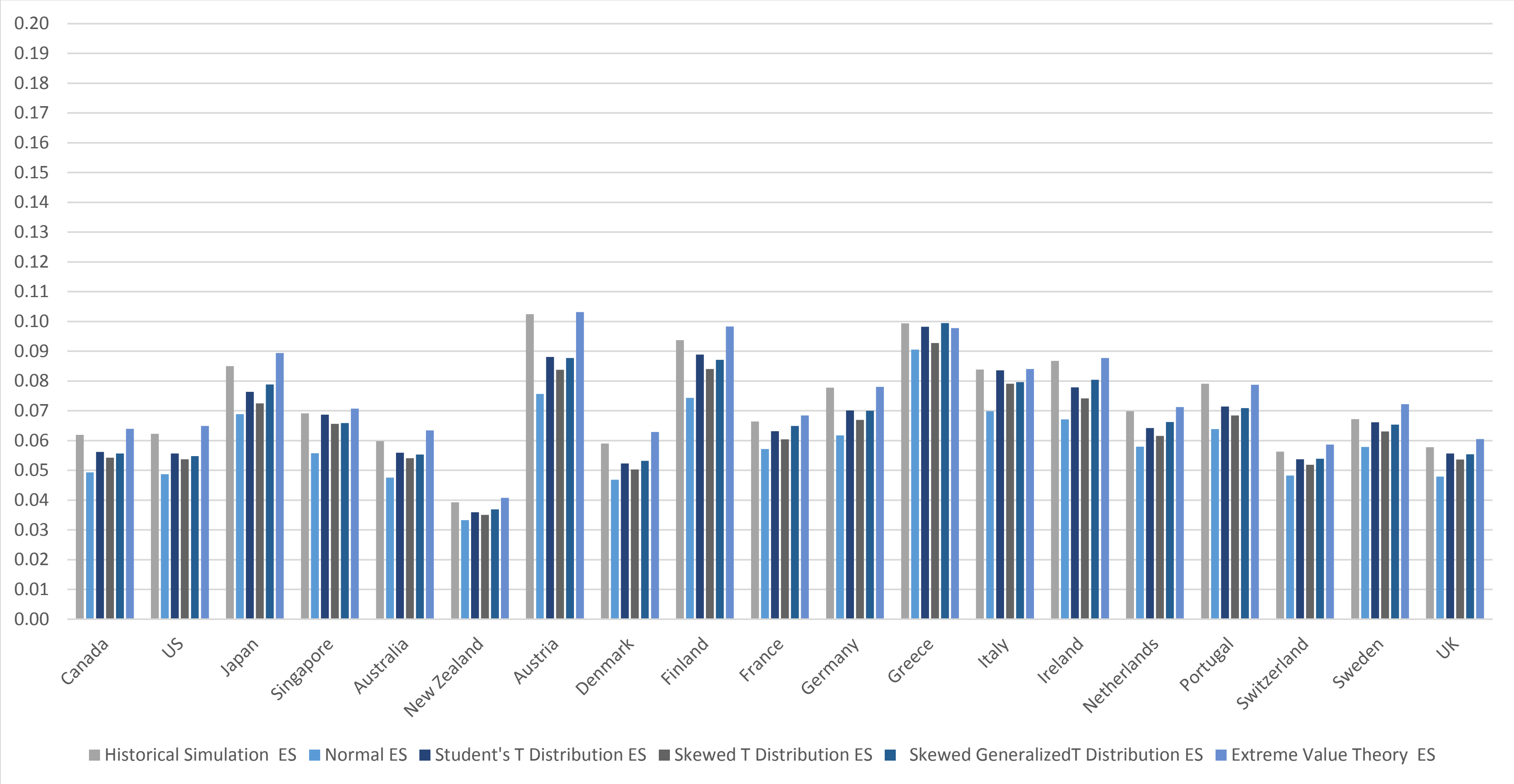
Panel B. 2.5% ESs



Note: Figure 104. presents the developed stock exchanges low quarterly skewness period weekly ESs. The data source is DataStream.

Figure 104. Developed stock exchanges low quarterly skewness period weekly ESs

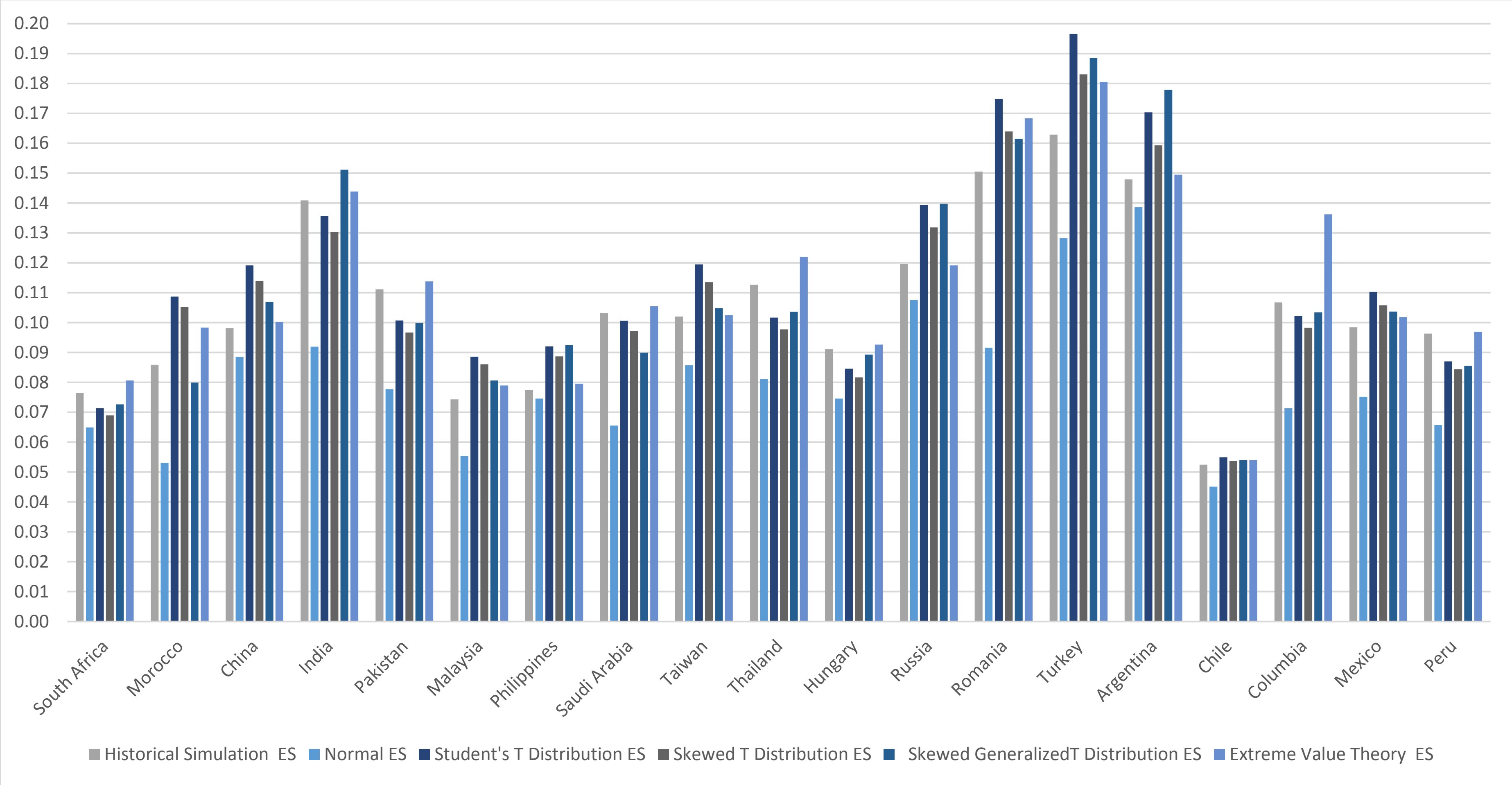
Panel C. 5% ESs



Note: Figure 104. presents the developed stock exchanges low quarterly skewness period weekly ESs. The data source is DataStream.

Figure 105. Emerging stock exchanges high quarterly skewness period weekly ESs

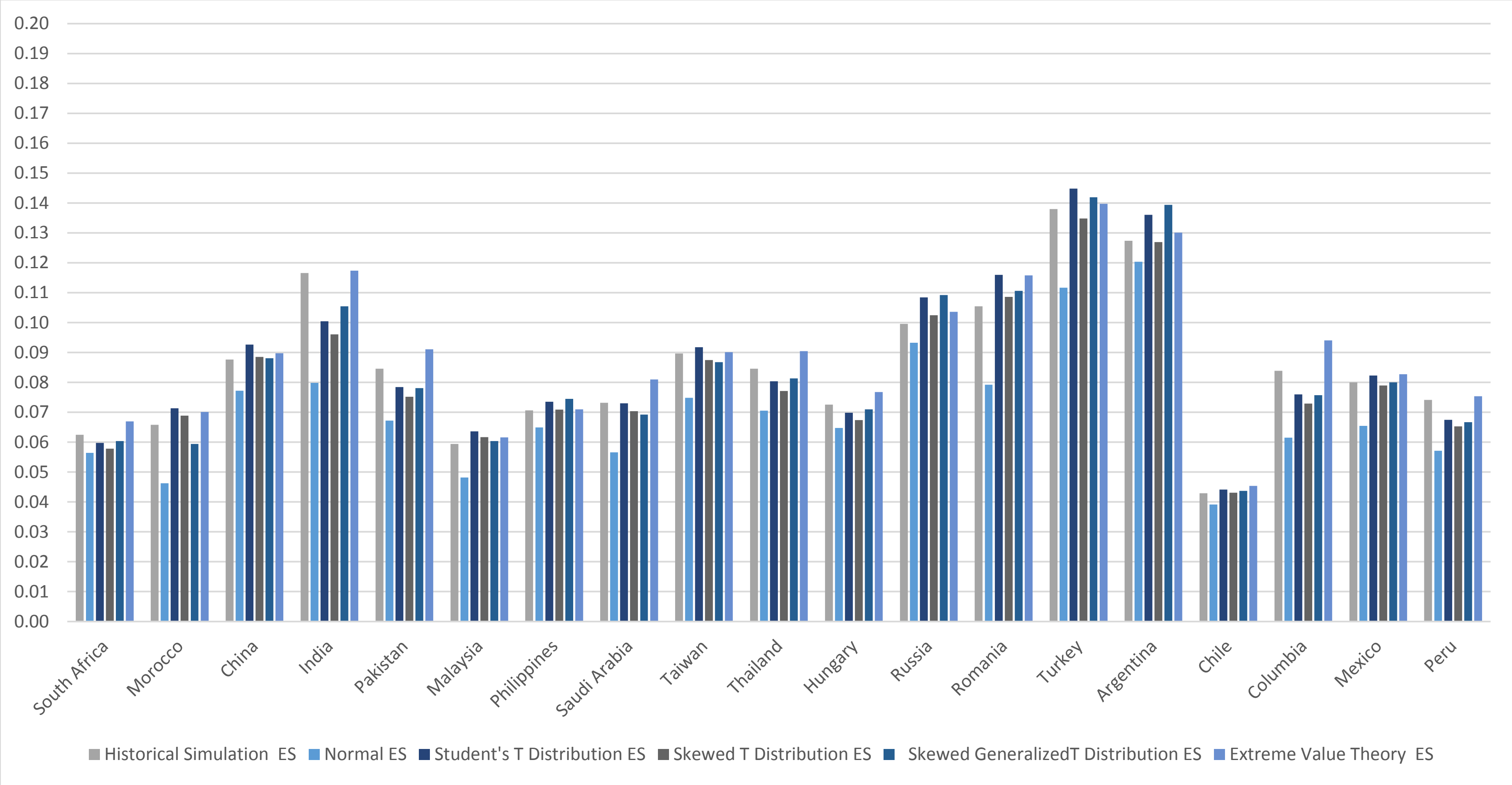
Panel A. 1% ESs



Note: Figure 105. presents the emerging stock exchanges high quarterly skewness period weekly ESs. The data source is DataStream.

Figure 105. Emerging stock exchanges high quarterly skewness period weekly ESs

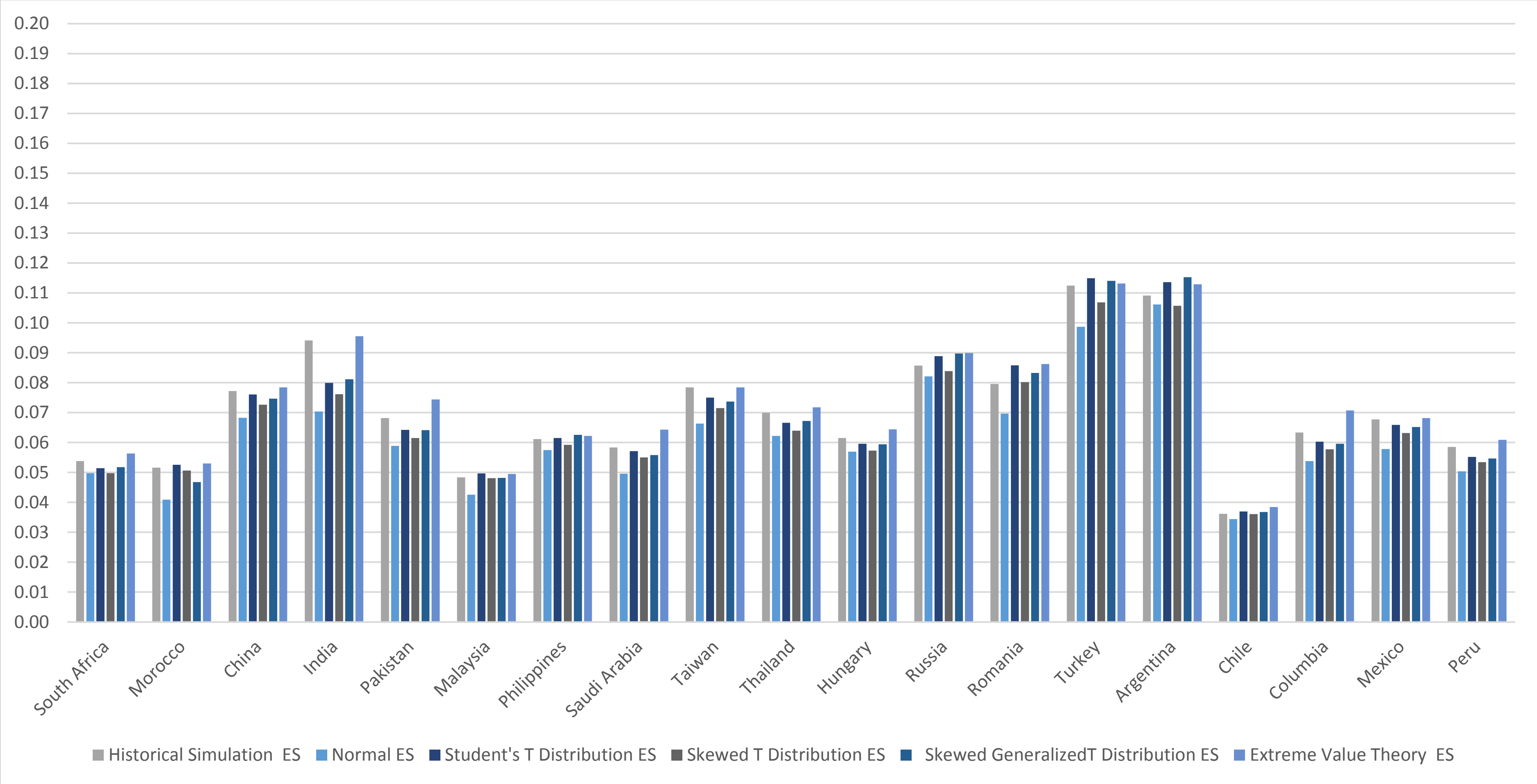
Panel B. 2.5% ESs



Note: Figure 105. presents the emerging stock exchanges high quarterly skewness period weekly ESs. The data source is DataStream.

Figure 105. Emerging stock exchanges high quarterly skewness period weekly ESs

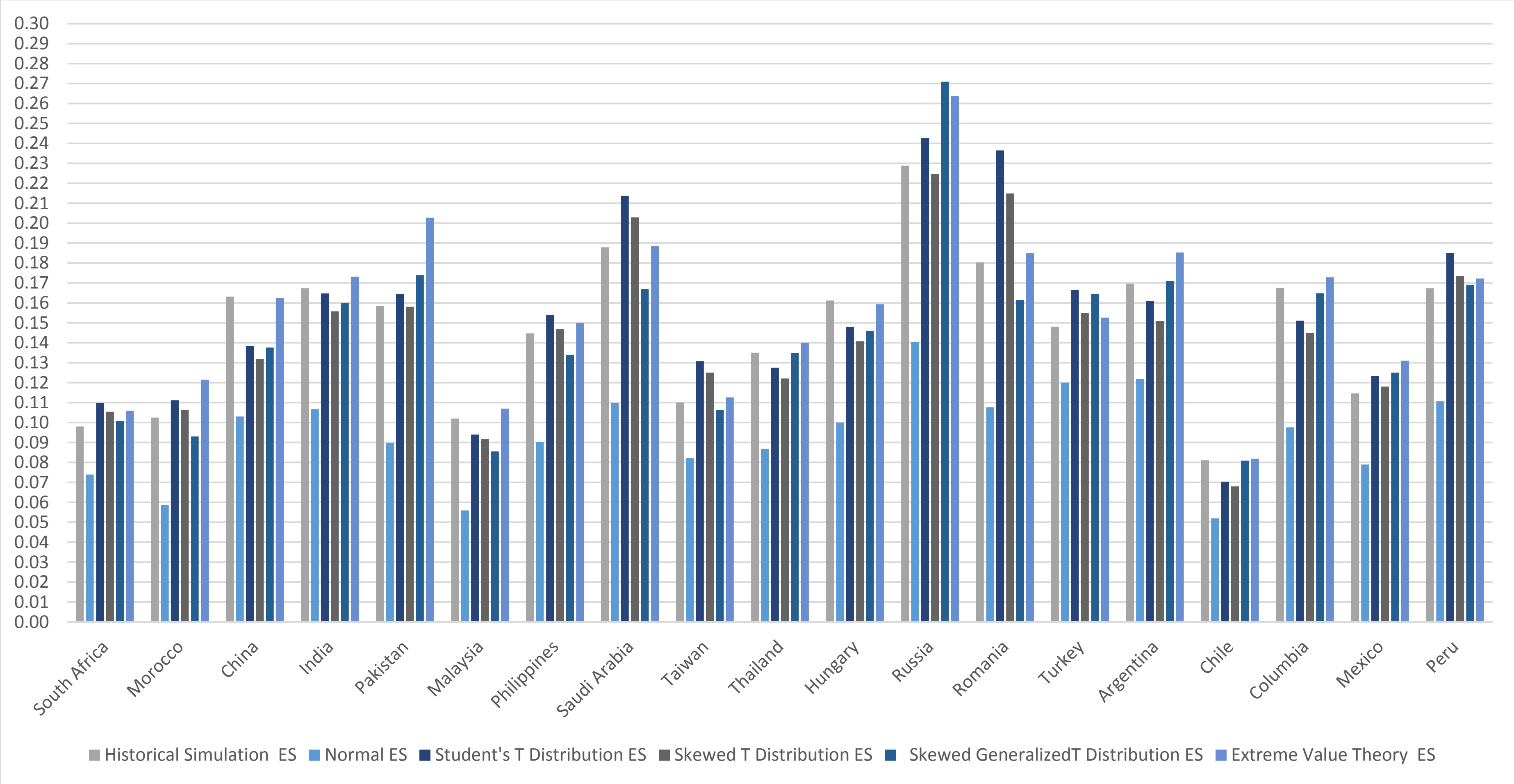
Panel C. 5% ESs



Note: Figure 105. presents the emerging stock exchanges high quarterly skewness period weekly ESs. The data source is DataStream.

Figure 106. Emerging stock exchanges low quarterly skewness period weekly ESs

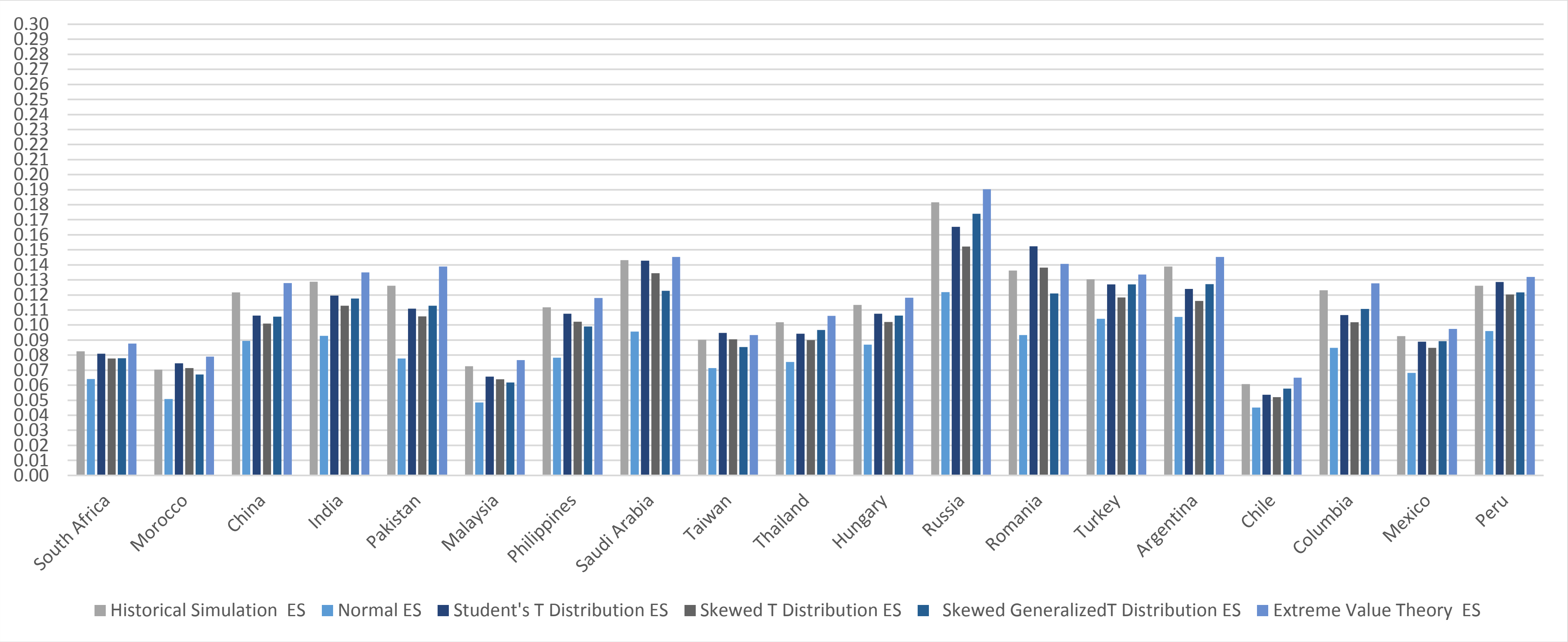
Panel A. 1% ESs



Note: Figure 106. presents the emerging stock exchanges low quarterly skewness period weekly ESs. The data source is DataStream.

Figure 106. Emerging stock exchanges low quarterly skewness period weekly ESs

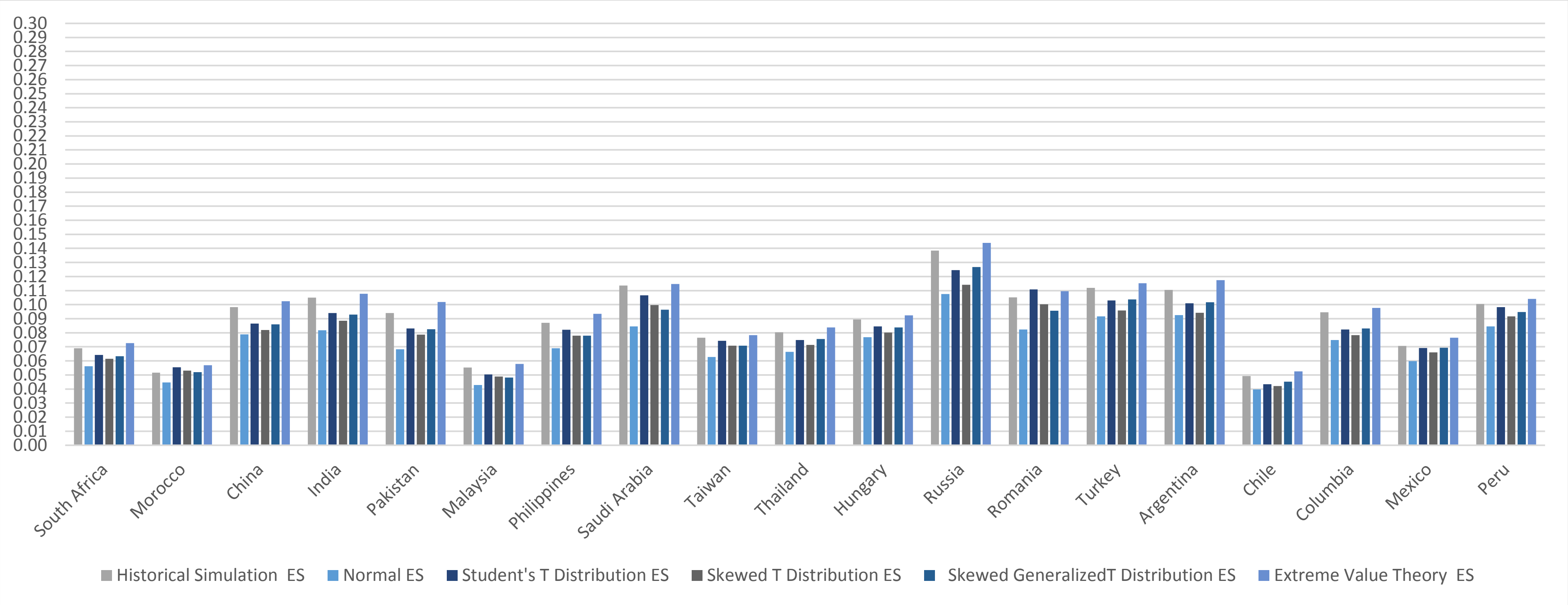
Panel B. 2.5% ESs



Note: Figure 106. presents the emerging stock exchanges low quarterly skewness period weekly ESs. The data source is DataStream.

Figure 106. Emerging stock exchanges low quarterly skewness period weekly ESs

Panel C. 5% ESs



Note: Figure 106. presents the emerging stock exchanges low quarterly skewness period weekly ESs. The data source is DataStream.