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Portfolios under Different Methods and Scenarios: A Case of Fiji's South Pacific Stock Exchange

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Abstract: In this study, we analyze portfolio performance under different methods and scenarios for the small island economy of Fiji. In addition to documenting the historical performance and the smallness of the stock market, the study looks at the possibility of opting for an equally weighted (naïve) portfolio against market and minimum variance portfolios. To this end, we extract monthly stock price data of 17/19 listed companies from August 2019 to July 2022 and invoke different approaches to develop portfolios under different scenarios. We consider the mean-variance, minimum variance, semi-variance, utility maximization, and minimum turbulence portfolios, based on beta-adjusted (CAPM-based) returns. The different portfolios presented in the study should provide some insights on asset allocation in Fiji's stock market. Interestingly, unlike average returns, the beta-adjusted returns indicate that an equally weighted portfolio can yield relatively higher expected returns than market portfolios, although, with a relatively higher standard deviation and lower Sharpe ratio than the optimized results. In a semi-variance analysis (where we account for downside risk only), equally weighted portfolio yields superior returns, albeit with a relatively lower Sortino ratio. Given that Fiji's stock market is currently a small, with a relatively small number of listed companies, potential and less sophisticated investors and analysts considering portfolios based on beta-adjusted returns, may simply opt for 1/N (naïve) portfolios as a diversification strategy while realizing decent expected returns. The optimized portfolio under mean-variance, semi-variance, and utility are presented as alternative considerations for nuanced investors. Additionally, equally weighted turbulence-adjusted and minimum-turbulence portfolios are constructed to capture periods of unusualness and calmness in the market. The methodologies and the results presented can be adjusted and applied to other small markets and hence can influence investment decisions of investors in creating diversified portfolios under different scenarios.

Keywords: beta-adjusted portfolios; mean-variance; semi-variance; utility; turbulence-adjusted portfolios; equally weighted; South Pacific Stock Exchange; Fiji

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1. Introduction

Stock market development is an important part of financial development. Most studies have generally focused on stock markets in developed and emerging economies with highly liquid markets (Baumann and Trautmann 2013; Turcas et al. 2017; Chavalle and Chavez-Bedoya 2019; Becker et al. 2015; Sun et al. 2021; Zaimovic et al. 2021). However, stock markets in small and developing (island) countries largely remain unexplored. In this study, we analyze Fiji's (a small island economy) stock market. One of the early studies on Fiji's stock market goes back to Curnow (1992), which described the market at the time as lacking sophistication, small, and only accessible to just a few large institutions. Since the 1990s, some progress has been made in terms of the number of listed companies, which has grown from 4 to 19, the volume and frequency of trades, and the number of shareholders (Kumar et al. 2022a).

As a background, Fiji's financial sector includes the Reserve Bank of Fiji (RBF) as the overseer, the commercial banks, the development banks, the credit institutions, the superannuation fund, the insurance companies, the brokers, the agents and the capital markets (stock exchange and intermediaries), the foreign exchange dealers and money changes, and other payment service providers (Chand et al. 2021; Kumar et al. 2022b). The stock exchange in Fiji is known as the South Pacific Stock Exchange (SPSE and later re-branded as SPX). Initially, the exchange was known as the Suva Stock Exchange (SSE). SPX was established in 1979 as a wholly owned subsidiary of the Fiji Development Bank (FDB), as a trading post (i.e., with no sharebrokers) (Curnow 1992), and later it was converted into a double auction market in 1997 as SPSE (Mala and White 2009). Curnow (1992) documents that, in 1980, there were eight companies listed on SSE and, by 1991, the number of listed companies was only four, which included Fiji Sugar Corporation Ltd. (FSC with share price of FJD = 0.65), Burns Philip South Seas Co., Ltd. (BP with share price of FJD 0.70), Flour Mills of Fiji Ltd. (FMF with share price of FJD 1.75), and South Pacific Distilleries Ltd. (SPD with share price of FJD 1.15).

Moreover, the shareholding was largely concentrated with at least 83% of the shares held by 20% of the shareholders. Observing the market over a six-month period (June 1991), Curnow (1992) described the stock market as generally illiquid, because the stocks had no buyers and sellers and some had only buyers or only sellers. Additionally, it was observed that the share prices remained stable due to the lack of trade. The absence of efficient operation of the stock market, the lack of responses of share prices to changes in interest rates, the presence of three dominant long-term investors (Fiji National Provident Fund, FNPF—the national superannuation scheme), the Unit Trust of Fiji (then a subsidiary of FDB), and Fiji Holdings (a private company backed by the government with the aim to promote the participation of indigenous Fijians), and the absence of brokers in the market were some notable features of the time. However, since then, there have been attempts to promote and encourage the listings of new companies and increase liquidity in the market. Some notable initiatives included the provisions of 150% tax rebate on costs of listing and the establishment of the Kontiki Share Price Index (KPSX) in 2000 to track SPX market movements (Mala and White 2009). While the number of listings grew from 4 (in 1996) to 16 (in 2007), public offerings of shares remained a small proportion of total equity. The low uptake of companies to list on the exchange were generally due to their fear of losing control and their reluctance of disclosing financial performance to competitors (Chand and White 2007; Mala and White 2009).

As of 2022, there are 19 companies listed on SPX (SPX 2022; Kumar et al. 2022a). Although there has been a general progress in terms of accessibility of basic financial services in Fiji, participation in the stock market remains relatively low. From an investor's perspective, this lack of participation can be due to lack of confidence in the market, lack of familiarity with securities, trading, and the listed companies, and the low level of accessibility of the stock market to the wider population. Amidst these constraints, as part of financial inclusiveness, new efforts have been made to enhance stock market engagement. For instance, to support achieving the United Nations Sustainable Development Goals by 2030, the RBF has commissioned a report on Fiji National Financial Inclusion Strategy 2022–2030 (RBF 2022, ii), in which Objective 3 (O3) strives to see that "All Fijians have sufficient financial education and access to clear, transparent information that equips them to make informed financial decisions".

In this spirit, this paper explores the stock market of Fiji, with the aim to apply techniques of asset allocation, which can be of interest to current and potential investors. At a macro-level, studies on Fiji's stock market have examined the determinants of stock price (Puah and Jayaraman 2007; Saliya 2020). For instance, Puah and Jayaraman (2007) note that factors such as real GDP, M2, interest rate (measured by Treasury bill rate), and exchange rate are positively associated with the stock price and that the stock price is less sensitive to changes in the interest rate and money supply but more responsive to the exchange rate and real GDP. However, a similar finding regarding the interest rate was noted by

Curnow's (1992) study, which noted that the interest rates of the 1990s were sufficiently low to promote investment in the economy. Saliya (2020) notes a positive association of economic growth and a negative association of inflation with stock market development. While macro-level studies can be useful for broad policy implications, they provide very little information to individual investors and traders in terms of developing investment strategies.

Moreover, to support O3 of the RBF (2022) report, increasing greater participation in the stock market would require that investors are well-equipped with the basic tools and methods for investment analysis and asset allocations. It must be noted that economic performance can be captured by the risk–return perceptions of the market participants and this needs to be accounted for in a well-diversified portfolio. Additionally, with the given economic environment, it is vital that investors are able to produce sound investment analysis and decisions. At least on this basis, closer and regular examination of the stock market is warranted.

The current stock market has evolved with 19 companies listed on the exchange, witnessing a growth in the number of shareholders, in trading activities, and correlations among securities, all of which provides the possibility of investment analysis (Kumar et al. 2022a). Thus, we extend the study of Kumar et al. (2022a) in that, instead of using average return of assets, we compute and use the beta-adjusted (CAPM) returns and then develop portfolios using mean-variance, minimum-variance, utility, semi-variance, and minimum financial turbulence approaches. By constructing beta-adjusted returns, we are able to obtain returns of each asset, which are closer to the overall market performance. The beta-adjusted returns take into account the riskiness of each asset relative to the overall market performance. This is important for an investor who is concerned about how a specific asset reacts with respect to the up and down movements of the market performance. Additionally, we construct utility-optimized portfolios to illustrate the degree of risk-averseness, viz. portfolio returns, and provide alternative approaches to portfolio construction and turbulence-adjusted portfolios to detect periods of calmness and unusualness in the stock market. A caveat to our analysis is that we only analyze securities (equities) listed on SPX and that other asset classes such as fixed income securities (corporate bonds) or alternative investment options (such as superannuation or trust funds), which could influence the wealth allocation of an investor, are not part of the analysis. The study presents some useful insights into portfolio construction that can appeal to practitioners and financial analysts. A key finding is that, for less sophisticated investors, an equally weighted portfolio achieves diversification with decent returns. Moreover, for sophisticated investors, various portfolios are presented under different scenarios to consider. The findings can be used as the basis for further analysis and comparisons, especially in the context of small and developing island economies. The remaining sections are outlined as follows. In Section 2, we provide an intuitive explanation why and how stock exchanges can increase economic growth. In Section 3, the literature is presented, followed by the methodology in Section 4. The analysis and results are covered in Section 5 and the conclusion follows in Section 6.

2. Stock Exchanges and Growth in Developing Countries

Although it is common knowledge that financial markets play a crucial role for the development process of economies, it seems useful to explain in more detail why the establishment of a well-functioning stock exchange in developing countries can support economic growth. One economic challenge of developing countries is to mobilize financial capital for investments in capital equipment, but it is difficult for corporations in developing countries to gain access to the international capital markets, because financial investments in developing countries are recognized as relatively risky by international investors. In the case of Fiji, an additional obstacle is capital controls, which prevents capital flight in the case of economically unstable times. Additionally, international investors do not bear the risk of changing exchange rates, because of a fixed exchange rate system. Because of the assumed higher risk attached to investments in developing countries, the risk premium on the interest, which has to be paid by corporations, is accordingly higher than in the developed countries. A way to find alternative sources of finance is to mobilize national financial sources and, for this purpose, it is necessary that a well-functioning financial market is established. Beside banks, a stock exchange is an important part of a financial market. The underlying purpose of a stock exchange is to raise financial means to purchase capital investment. This is particularly true for promising but risky projects that cannot be financed by bank loans. Banks may refuse to finance a project because of legal reasons or if the risks in the view of bank managers are too high. Without a stock exchange, the only alternative way of funding for bigger projects would be government funding, however the government budget in developing countries is relatively small.

Another positive feature of a well-functioning stock exchange is that it increases the efficiency of corporations' managements. If the management of a corporation performs poorly, the price of the cooperation's share will fall, so that it becomes cheaper for new investors to buy these shares and to replace the bad management. Both characteristics improve the international competitiveness of corporations because they can finance their equipment at lower costs and the efficiency of management will be improved. From the view of households, the advantage of a stock exchange is that it increases the opportunities to invest their savings. In the case of Fiji, the stock exchange is also important because the compulsory Fijian retirement system is a capital-funded system, where the contributors transfer their contributions (a share of their income) to the FNPF. Accordingly, the FNPF has the duty to invest the accumulated funds in the most profitable way. Without a stock exchange, the only opportunities would be either to invest the pension funds in government bonds, to invest directly (setting up a firm), or to deposit the funds in a bank. Usually, direct investments are not recommended because of the constraints on the expertise of the pension fund's managers. To purchase many government bonds is also not recommended because this means to implicitly transform the capital-funded pension system into a pay-as-you-go system; the latter has the disadvantage that it will reduce the aggregated private savings and to deposit funds in banks leads mostly to low rates of return. Therefore, the existence of a stock exchange offers the opportunity to diversify risks and increase the rate of returns. For private households, the arguments are similar—the investors can diversify risks and increase the rates of return compared to a situation in which they can only deposit their money in bank accounts, government bonds, or direct investments.

Undoubtedly, investments in stocks can be risky and it is absolutely important that investors understand the risks and that they have sufficient financial literacy, an area that remains an important focus for many developing countries including Fiji (RBF 2022). Furthermore, it is important that the stock exchange is efficiently regulated to avoid stock exchange crashes and fraudulent behavior (e.g., insider trade) of market participants. If the two latter conditions are fulfilled, the existence of a stock exchange increases the average rate return on savings, which may lead to an increasing savings rate of households and more that in turns can support higher growth rates via capital accumulation.

3. Literature Review

The Markowitz's (1952, 1959) approaches can be used to optimize small-scale portfolios (c.f. Konno and Yamazaki 1991), to derive the minimum-variance portfolios and the market portfolios by maximizing the Sharpe (1966, 1971a, 1971b) ratio, to construct a unique portfolio based on specific risk–return combinations, and to extend portfolios based on utility and semi-variance approaches. The conventional approaches of mean-variance equally penalize the gains and losses of each asset when computing the average return, standard deviations, and hence market-adjusted returns. Thus, accounting only for the downside risk requires the application of semi-variance procedure.

Another important aspect in portfolio analysis is to consider the periods of high volatility. Chow et al. (1999) highlight that "[i]n turbulent markets, asset returns tend to become more volatile and more highly correlated." During turbulent periods, diversification may not be substantial or even disappear completely, especially if the diversification is based on averages that do not differentiate between, or place equal importance on, the time-measured (noise-driven) and the event-measured (event-driven) observations. Subsequently, Chow et al. (1999) recommends a turbulence-adjusted portfolio, which can be constructed from the covariance matrix based on the outliers instead of the full sample. Because the standard asset allocation models are sensitive to the mean return assumptions provided by the investor (Black and Litterman 1992), and in the case of utility, they are sensitive to the level of risk-aversion specified by the investor, these models fail to reflect the attributes of turbulence or financial crisis. Turbulence-adjusted portfolios can be constructed using the distance measure proposed by Mahalanobis (1936). The distance statistic can be used to classify regimes with realizations in which the statistic exceeding a threshold is classified as turbulent or unusual and the remaining observations are classified as calm (c.f. Chow et al. 1999; Kritzman and Li 2010; Berger 2013; Vukovic 2015; Lee and Teng 2009; Kritzman and Li 2010; Stöckl and Hanke 2014).

From utility perspective, Khan et al. (2022) examine risk preferences in household portfolio decision-making in Australian housing and equity markets. Among various findings, they note that a risk-taking attitude matters in household portfolio allocations and that individual risk preferences vary with fluctuations in the equity and housing markets. In another study, Škrinjarić et al. (2021) examine the stock markets in Central, Eastern, and South-Eastern European countries. Their study highlights the importance of entropy transfers in portfolio construction and notes that rebalancing portfolios can yield superior outcomes than the benchmark strategies. For a comprehensive literature review on portfolio optimization, we refer readers to Zaimovic et al. (2021). The study (Zaimovic et al. 2021) conducts a bibliometric analysis of studies on portfolio and stock market analysis. Inter alia, they note that countries such as the US, South Korea, England, France, and Australia were among the most cited studies when it came to examining stock market related documents, highlighting the fact that previous studies largely focused on the developed and emerging markets due to their sophisticated financial sector in general. Among various interesting findings, the study underscores the challenges in identifying an appropriate number of assets to gain the maximum benefit of diversification. This is because a lot of factors influence portfolio construction, inter alia, the measure of systematic risk, the size and asset classes, the model applied for optimization and diversification strategies (market versus equally weighted portfolios), data frequency, and market conditions. At least, this is one of the recent studies that bring home the idea that portfolio analysis is not only scientific and of interest to both practitioners and academics, but also that the landscape of investment analysis is shaped by the investment environment, which in turn is influenced by various factors.

4. Data, Materials and Methods

In the following four subsections, we construct different portfolios based on the mean-variance approach, the utility maximization approach, the semi-variance approach, and the minimum-variance turbulence approach. The daily price data for most of the stocks begin from 30 May 2017, however, consistent data for all the stocks were available from 13 August 2019. Hence, we computed month-end return data using the sample from August 2019 to July 2022.

4.1. Mean-Variance

We apply the mean-variance approach to determine the optimum portfolio (Markowitz 1952, 1959). The basic framework is specified by the following objective function subject to the constraints as:

$$\max\left\{Z = \sum_{i=1}^{N} \overline{r}_i \omega_i \middle| \sum_{i=1}^{N} \sum_{j=1}^{N} \sigma_{ij} \omega_i \omega_j \leq \delta, \sum_{i=1}^{N} \omega_i = 1\right\} \quad (1)$$

where N is the number of stocks, σ_{ij} is the covariance between returns of stock i and stock j, $\overline{r}_i$ is the beta-adjusted annualized expected return of stock i, σ is the maximum risk level specified by the investor, and ω_i is the weight of stock i in the portfolio. We use the changes in equally weighted stock returns as the market return and compute the beta-adjusted annualized stock returns accordingly. The individual stock returns are computed as $r_t = \ln\left(\frac{p_t}{p_{t-1}}\right)$, where p_t and p_{t-1} are the individual stock prices for months t and $t-1$, respectively.

The individual asset beta, β_i represents the trade-off between the market return against the individual asset's return over the sample period. Hence, the beta-adjusted annualized (CAPM) return is computed as: $\mu_{\beta i} = r_f + \beta_i\left(\mu_{mkt} - r_f\right)$, where $r_f = 0.01$ is the risk-free rate, and μ_{mkt} = average returns of the equally weighted return index (EWRI) reported by SPX. Alternative approaches to optimize the portfolio include minimizing the variance subject to portfolio weights to derive a minimum-variance portfolio or maximizing the Sharpe (1966) ratio $SR = \left(\frac{\mu_p - r_f}{\sigma_p}\right)$ to determine the market portfolio, where μ_p, r_f, and σ_p are portfolio mean, risk-free rate, and portfolio standard deviation, respectively. Following Bai et al. (2011), the market portfolio is computed by solving:

$$\max\left\{SR = \frac{\mu_{p-r_f}}{\sigma_p}\middle|\mu_p = \sum_{i=1}^{N}\omega_i r_i, \sigma_p = \sqrt{\sum_{i,j}^{N}\sigma_{ij}\omega_i\omega_j}, \sum_{i=1}^{N}\omega_i = 1\right\} \tag{2}$$

Generally, the portfolio with the minimum variance can be computed by $\omega_{min} = \frac{\Sigma^{-1}}{1^T\Sigma^{-1}1}$, where Σ^{-1} is the inverse covariance matrix of the returns. A portfolio's beta-adjusted portfolio mean is provided by $\mu_p = \omega'\mu$ and the variance is provided by $\sigma_p = \omega'\Sigma\omega$, where Σ is the covariance matrix.

4.2. Utility Maximization

From the optimal portfolios, we can proceed to optimize utility (Bai et al. 2011; Fahrenwaldt and Sun 2020) as:

$$\max\left\{U(A) = E(\mu_p) - \frac{A}{2}\sigma_p^2\middle|SR = \frac{\mu_{p-r_f}}{\sigma_p}, \sigma_p = \sqrt{\sum_{i,j}^{N}\sigma_{ij}\omega_i\omega_j}, \sum_{i=1}^{N}\omega_i = 1\right\} \tag{3}$$

where U is the investor's utility function, which depends on A, is a measure of individual's risk aversion, and a higher value of A denotes greater risk-aversion. We note that for $A > 10$, there is no improvement in the utility, hence we restrict $A \in [2, 10]$, where $A = 2$ for the least risk-averse investor and $A = 10$ for the most risk-averse investor.

4.3. Semi-Variance

Next, we extend the analysis to examine downside risk only and hence invoke the semi-variance approach. We compute the monthly upside risk as: $UR_t = \max(\mu_{p_t} - \overline{\mu}, 0)$, where μ_{p_t} is the monthly portfolio return with respect to weight, ω_i, and $\overline{\mu}$ is the historical monthly returns. The monthly downside risk is provided by $DR_t = \max(\overline{\mu} - \mu_{p_t}, 0)$. Moreover, we compute the monthly downside volatility, as: $\sigma_D = \sqrt{\frac{\sum_{i=1}^{T}\max(\mu_T - \mu_i, 0)^2}{T-1}}$, with an annualized target return of $\mu_T = 0.06$. The target return is approximated by the interest earned on the funds deposited in the superannuation fund. Accordingly, we compute the Sortino Ratio as: $\frac{\overline{\mu} - T_g}{\overline{\sigma_D}}$, where $\overline{\sigma_D}$ is the annualized volatility. Finally, the volatility skewness is defined as $\sigma_v = \frac{\sigma_U^2}{\sigma_D^2}$, where σ_U^2 and σ_D^2 are the variances of upside risk and downside risk and $\sigma^2 = \sigma_U^2 + \sigma_D^2$. Hence, $0 < \sigma_v < 1$ implies a higher downside risk in the portfolio, whereas $\sigma_v > 1$ implies a greater upside risk in the portfolio. Finally, the optimization proceeds with the n-period sample as:

$$\max\left\{SV = \frac{\overline{\mu} - T_g}{\overline{\sigma_D}}\middle|\mu_p = \sum_{i=1}^{N}\omega_i r_i, \overline{\sigma_D} = \sqrt{12\left[\frac{\sum_{i=1}^{T}\max(\mu_T - \mu_i, 0)^2}{T-1}\right]}, \sum_{i=1}^{N}\omega_i = 1\right\} \tag{4}$$

4.4. Minimum-Variance Turbulence

To determine the turbulence-adjusted portfolio, we invoke the classic approach of the Mahalanobis (1936) distance (MD) measure, which was initially developed for the classification of human skulls based on various properties. De Maesschalck et al. (2000) note that in the original variable space, the MD takes into account correlations in the data since it is calculated using the inverse variance-covariance. The MD can be used for detecting outliers, selecting calibration samples from a large set of measurements, and investigating the representativity between the two data sets.

To compute the MD, the first step is to construct the variance–covariance matrix $C_x = (\boldsymbol{X}_c)^T \boldsymbol{X}_c$ where $\boldsymbol{X}$ is the data matrix containing n objects in the rows measured for p variables, X_c is the column-centered data matrix $(X - \overline{X})$. The MD for each object x_i is then: $MD_i = \sqrt{(x_i - \overline{x})C_x^{-1}(x_i - \overline{x})^T}$. Generalizing for X, we have: $MD_i^2 = (x_i - \boldsymbol{\mu})\boldsymbol{\Sigma}^{-1}(x_i - \overline{x})^T$ and the (Euclidian distance) ED is computed as $ED_i^2 = (x_i - \boldsymbol{\mu})(x_i - \overline{x})^T$. For the investment analysis, we write as: $d_t = (\boldsymbol{r_t} - \boldsymbol{\mu})\Sigma^{-1}(\boldsymbol{r_t} - \boldsymbol{\mu})^T$, where r_t is the vector of financial variables during the period t, μ is the vector of sample average returns and sigma represents the sample covariance matrix for these elements. Given the time-series of realizations of d_t, each period t may be classified as "turbulent", if the distance statistic exceeds a given threshold, and it may be classified as "calm" if it does not exceed the threshold (De Maesschalck et al. 2000; Cho et al. 2010; Kritzman and Li 2010; Geyer et al. 2014). From the financial analysis point, such properties can be the moments of assets in a portfolio, which can be explored for turbulence or unusualness in financial markets (Chow et al. 1999; Stöckl and Hanke 2014). Accordingly, Stöckl and Hanke (2014) provide an extension, which is called the financial turbulence portfolio (FTP) provided by:

$$FTP^2 = \sum_{i=1}^{n} \frac{1}{\omega_i^2}(\boldsymbol{\omega_D}(\boldsymbol{r_t} - \boldsymbol{\mu}))\Sigma^{-1}(\boldsymbol{\omega_D}(\boldsymbol{r_t} - \boldsymbol{\mu}))' \tag{5}$$

where $\boldsymbol{\omega_D}$ is the diagonal matrix of weights ω_i. Hence, we minimize the average $\overline{FTP}$ as for n months:

$$\min\left\{\overline{FTP} = \frac{1}{T}\sqrt{\sum_{i=1}^{n} \frac{1}{\omega_i^2}(\boldsymbol{\omega_D}(\boldsymbol{r_t} - \boldsymbol{\mu_\beta}))\Sigma^{-1}(\boldsymbol{\omega_D}(\boldsymbol{r_t} - \boldsymbol{\mu_\beta}))'}\,\middle|\,\sum_{i=1}^{N} \omega_i = 1\right\} \tag{6}$$

where $\boldsymbol{\omega_D}$ = matrix of diagonal weights, $\boldsymbol{r_t} - \boldsymbol{\mu}$ is the difference between monthly actual returns and the beta-adjusted returns.

5. Analysis and Results

Table 1 provides descriptive statistics of monthly returns, which were extracted from an individual company's daily price data available on the SPX website. The annualized expected returns, standard deviations, and beta-adjusted expected returns are based on an equally weighted total return index (EWTRI). Table 2 presents a covariance matrix. As noted from Table 1, the stocks that are highly sensitive to overall market performance (i.e., $\beta > 1$) are BCN ($\beta = 1.37$), FHL ($\beta = 3.41$), FMF ($\beta = 1.10$), FTV ($\beta = 2.10$), TTS ($\beta = 1.71$), and VIL ($\beta = 1.15$), whereas the stocks that are somewhat less sensitive to market movements ($0 < \beta < 1$) are APP ($\beta = 0.61$), ATH ($\beta = 0.78$), CFL ($\beta = 0.49$), FBL ($\beta = 0.50$), FIL ($\beta = 0.33$), KFL ($\beta = 0.90$), PBP ($\beta = 0.69$), PDM ($\beta = 0.95$), RCF ($\beta = 0.63$), and VBH ($\beta = 0.51$). However, we note the RBG to move contrary to the market ($\beta = -0.54$). Based on the asset betas, the respective beta-adjusted returns are computed.

The plots of each stock return (in decimal) over the sample period and the changes in EWTRI are provided in Figure 1a–r, respectively. It can be noted from the monthly stock returns that some stock returns have been stable with just a few episodes of volatility (CFL, FMF, FBL, PBP, RCF, and VBH), with more upside movements than downside. On the other hand, the stocks that revealed more downside movements include FTV, PDM, and RBG and the stocks that experienced more upside movements include APP and FIL. Somewhat erratic movements are noted for ATH, BCN, FHL, KFL, TTS, and VIL. Using EWTRI as an index to track the overall market performance, a high volatility in general is noted from the changes in EWTRI, although the movements are mostly in the positive rather than negative direction. We also observe that the periods with below-zero movements are noted in September 2019, April 2020, June 2020, August 2020, January 2021, March 2021, May 2021, January 2022, and June 2022, while the remaining months generally have positive changes. Interesting to note is that prior to January 2020, the movements generally oscillated within a higher positive band and then lowered thereafter, indicating some decline in the market performance, which can be attributed to exogenous shocks such as the pandemic (COVID-19) that has affected the key sectors of the economy. The stocks that appeared more responsive (negatively) to the decline included ATH, FHL, FTV, KFL, PDM, RBG, and VIL, whereas those somewhat opposite to the market decline were noted by APP, BCN, FBL, FIL, PBP, RCF, TTS, and VBH. However, the stocks that appeared to be indifferent to the market movements with share prices generally unchanging were CFL and FMF.

The beta-adjusted (CAPM) returns for each asset are based on an equally weighted return index (EWRI). From the mean-variance analysis, (see Table 3, panel (a)), it can be noted that a higher portfolio return is achieved from the equally weighted (1/N) portfolio (MV1) ($\mu_p = 19.35\%$, $\sigma_p = 7.06\%$, $SR = 2.5976$) than from the market portfolios (MV3 and MV4). Figure 2 shows the performance of an equally weighted portfolio, which appears to be relatively more volatile than the market portfolio (Figure 3). However, maximizing the return–risk trade-off, that is the Sharpe ratio, we note the highest Sharpe ratio for MV3 (SR = 4.2366) and MV4 (SR = 4.8725), with $\mu_{p_{MV3}} = 15.7\%$, $\sigma_{p_{MV3}} = 3.50\%$ and $\mu_{p_{MV4}} = 14.3\%$, $\sigma_{p_{MV4}} = 2.70\%$. From Figure 2, it is apparent that there are more episodes of positive returns then negative returns, hence indicating the possibility of gaining from diversification through semi-variance analysis. Moreover, considering the performance of the minimum-variance portfolio (see Figure 4), the returns with a long-only constraint is 13.57% ($\mu_{p_{MV5}} = 13.57\%$, $\sigma_{p_{MV5}} = 3.20\%$) and with a short-selling constraint is 11.82% ($\mu_{p_{MV6}} = 11.82\%$, $\sigma_{p_{MV5}} = 2.46\%$). Given that Fiji's stock market is less sophisticated, it is practical to focus on long-only portfolios.

In the utility maximizing portfolios (Table 3, panel (b)), we only consider long-only portfolios. Within the mean-variance analysis, we maximize the utility (see Equation (3)). The results show relatively higher and different expected returns at different levels of risk aversion. For instance, with $A = 10$, and hence a relatively more risk-averse investor, the portfolio return is 37.2% ($\mu_{p_{U1}} = 37.2\%, \sigma_{p_{U1}} = 14.4\%$, $SR = 2.5141$) (see Figure 5), Comparing $A = 5$ (Figure 6), with $A = 2$ (for a relatively less risk-averse) investor (Figure 7), the expected return is 54.9% with higher risk ($\mu_{p_{U3}} = 54.9\%, \sigma_{p_{U3}} = 33.8\%$, $SR = 1.5959$). Therefore, it can be observed from the portfolio performances at different levels of risk-aversion, a lower risk-version is associated with higher volatility. In terms of skewness (see Table 4, panels (a) and (b)) as noted from $\sigma_v \to 1$, both mean-variance and utility-maximization portfolios generally have closer to equal proportions of up and down movements.

Moving on to the semi-variance analysis (Table 3, panel (c)), we note that accounting for downside risk only (which is what an investor would mostly care about), an equally weighted portfolio achieves a lower risk with the same expected return $\mu_{p_{SV1}} = 19.35\%$, $\sigma_{p_{SV1}} = 5.50\%, SR = 2.4277$), as in the mean-variance 1/N portfolio. Moreover, in the optimized portfolio (see Equation (4)), the market portfolio has a higher expected return ($\mu_{p_{SV2}} = 18.89\%, \sigma_{p_{SV2}} = 6.89\%, SR = 4.5965$), compared to the returns in the mean-variance analysis (see Figure 8). The semi-variance market portfolio performance (Figure 8) clearly shows more episodes of up-movement (positive returns) than down-movements. Moreover, the minimum-variance portfolio yields a slightly higher return ($\mu_{p_{SV3}} = 13.83\%, \sigma_{p_{SV3}} = 3.67\%, SR = 3.2549$) than that in the mean-variance minimum-variance portfolio. In terms of skewness, it is noted that most portfolios (see Table 4, panel (c)) have at least twice the upside variance than the downside variance.

In terms of turbulent-adjusted portfolio (Table 3, panel (d)), we note that an equally weighted portfolio (T1) encompasses high turbulence ($\overline{FTP} = 94.9\%$) (see Figure 9), arising from all the stocks. Noting from the performance of the turbulence-adjusted 1/N portfolio, we can link important events associated with turbulent periods over the sample period. A careful observation shows high turbulence in periods of COVID-19, with turbulence abating in months where COVID-19 precautionary measures were put in place. For example, we note high turbulence from December 2019 to February 2020 and calmness from March 2021 to July 2021; then the high turbulence from August 2021 to March 2022, with April 2022 as another period of calmness, followed by a period of turbulence from May 2022. The periods of high-turbulence coincide with COVID-19 restrictions and their impact on most businesses, in addition to changes in management for some of the companies listed on the stock exchange. The periods of turbulence were mainly marked by COVID-19 restrictions on business operations and resignations and subsequent appointments of directors, CEOs, and managers (as noted from the various announcements on the SPX website (SPX 2022)). For example, considering some of the announcements released by SPX on behalf of the listed companies, the following events are noted. The period from December 2019 to January 2021 includes the resignation of the director of FIL (20 December 2019), the resignation of the group CEO (20 December 2019), the subsequent appointment of an acting group CEO for FHL (23 December 2019), the resignation of the FHL director, the resignation of the director for BSP-PNG (13 December 2019), the appointment of an acting chairman for FHL (8 January 2020), the resignation of the director FTV (7 January 2020), the appointment of a director for FTV (11 March 2020), the resignation of the CEO and finance manager for FTV (11 September 2020), the resignation and appointment of an independent director for VIL (28 February 2020), the resignation of a director for PDM (5 November 2020), the resignation of directors for APP, FMF, and RCF (25 November 2022), the resignation of the director and the subsequent appointment of the new director for VIL (25 November 2020), and the travel restrictions due to COVID-19 and the COVID-19 case announced by FIL (23 March 2020), respectively.

At the height of the first wave of COVID-19 and the lockdown measures in Fiji, many companies were impacted and this was noted from the company announcements (FHL 26 March 2020, BCN 31 March 2020, PDM 2 April 2020, TTS 23 April 2020, PBP 21 April 2020, FMF 24 April 2020, VIL 24 April 2020, FTV 24 April 2020, VBH 21 April 2020, and KFL 28 July 2020) issued via the SPX website on specific days. However, RBG issued a somewhat optimistic update (RBG 24 April 2020) as it remained operational in some key areas of the country and FHL posted positive news in terms of the appointment of the group CEO (FHL 8 March 2021). However, from May 2021, which marked the second wave of COVID-19, all the businesses were affected—as noted from the companies' announcements on various risk management strategies being undertaken amidst lockdown restrictions for their businesses.

As can be noted, while equally weighted turbulent portfolio yields relatively high expected returns (considering the market performance), it is highly susceptible to exogenous shocks (Figure 9 and Table 3d—T1). However, that does not mean that market portfolios are immune to shocks because even market portfolios have exposures in more than one company. In any case, by minimizing the average turbulence (see Equation (6)), the turbulence ratio is reduced to 43.46% (Table 3, rows T2 and T3, and Figure 10), with a relatively high exposure (concentration) in a single stock (RBG, supermarket grocery chain), which is consistent with the fact that during the pandemic, the company's reports were relatively optimistic and they released fewer announcements, and it remained generally operational. As noted from the skewness (Table 4, panel (d)) and Figure 10, the minimum-variance turbulence-adjusted portfolios have a relatively higher downside risk than upside due to huge exposure in a single stock.

Table 1. Descriptive statistics (monthly data: September 2019–July 2022).

	APP	ATH	BCN	CFL	FBL	FHL	FIL	FMF	FTV	KFL	PBP	PDM	RBG	RCF	TTS	VBH	VIL
Mean	0.019	−0.017	0.009	0.003	0.002	−0.017	0.034	−0.003	−0.005	0.003	0.005	0.007	−0.026	0.009	0.007	0.001	−0.004
Standard Error	0.010	0.010	0.009	0.003	0.011	0.025	0.010	0.005	0.017	0.012	0.003	0.010	0.034	0.009	0.010	0.005	0.016
Median	0.000	0.000	0.000	0.000	0.000	−0.041	0.000	0.000	0.000	−0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Standard Deviation	0.057	0.058	0.056	0.016	0.065	0.150	0.057	0.031	0.101	0.071	0.020	0.058	0.199	0.051	0.060	0.031	0.096
Sample Variance	0.003	0.003	0.003	0.000	0.004	0.023	0.003	0.001	0.010	0.005	0.000	0.003	0.040	0.003	0.004	0.001	0.009
Kurtosis	9.074	3.233	1.923	28.620	12.821	1.213	2.366	16.446	8.460	1.637	7.416	5.133	30.531	16.512	7.789	7.183	4.561
Skewness	2.060	−1.329	0.141	5.028	−1.352	0.034	1.481	−1.551	1.129	0.283	1.808	1.996	−5.325	3.314	1.938	−0.593	0.482
Range	0.354	0.291	0.293	0.113	0.489	0.738	0.280	0.247	0.679	0.351	0.132	0.300	1.329	0.353	0.361	0.198	0.557
Minimum	−0.092	−0.196	−0.146	−0.022	−0.279	−0.389	−0.066	−0.142	−0.284	−0.184	−0.048	−0.090	−1.136	−0.100	−0.110	−0.118	−0.281
Maximum	0.262	0.095	0.147	0.091	0.210	0.349	0.214	0.105	0.395	0.167	0.084	0.210	0.193	0.254	0.251	0.080	0.276
Annualized Exp. Ret.	22.7%	−20.0%	10.9%	3.7%	2.5%	−20.8%	40.4%	−3.6%	−6.3%	3.3%	5.5%	9.0%	−31.5%	11.2%	8.8%	0.9%	−4.7%
Annualized Std. dev.	19.9%	20.0%	19.2%	5.6%	22.5%	52.0%	19.8%	10.7%	34.9%	24.7%	7.1%	20.2%	69.0%	17.6%	20.8%	10.9%	33.3%
Beta-STRI	0.05	1.10	0.56	0.11	−0.01	2.04	−0.22	0.70	0.71	0.29	0.22	−0.21	−1.06	0.05	0.21	0.21	1.08
Beta-EWPI	0.68	0.76	1.38	0.51	0.57	3.57	0.36	1.18	2.26	0.98	0.73	1.01	−0.65	0.68	1.66	0.55	1.21
Beta-MCWPI	0.07	1.11	0.58	0.11	−0.01	2.03	−0.22	0.71	0.72	0.30	0.23	−0.21	−1.09	0.04	0.21	0.23	1.09
Beta-EWTRI	0.61	0.78	1.37	0.49	0.50	3.41	0.33	1.10	2.10	0.90	0.69	0.95	−0.54	0.63	1.71	0.51	1.15
Beta-adj. Return	12.4%	15.5%	26.7%	10.1%	10.4%	64.8%	7.2%	21.6%	40.3%	17.9%	13.8%	18.7%	−9.1%	12.7%	32.9%	10.5%	22.5%
DS Beta-EWTRI	0.23	0.08	0.16	N/A	0.16	0.00	0.15	0.18	0.14	0.14	−0.02	0.47	−0.04	0.03	0.25	0.15	0.07
DS Beta-adj. Ret	5.3%	2.6%	3.9%	N/A	3.9%	0.9%	3.9%	4.3%	3.6%	3.6%	0.7%	9.7%	0.2%	1.5%	5.6%	3.9%	2.3%

Note: STRI = SPX total return index; EWPI = Equally weighted price index; MCWPI = market-capitalization weighted price index; and EWTRI = equally weighted total return index. Beta-adjusted return is based on EWTRI. DS-Beta = downside beta. Source: Author's estimation based on data from SPX (2022).

Table 2. Covariance matrix (annualized).

Ticker	APP	ATH	BCN	CFL	FBL	FHL	FIL	FMF	FTV	KFL	PBP	PDM	RBG	RCF	TTS	VBH	VIL
APP	0.0395	0.0003	0.0043	0.0076	0.0163	0.0096	0.0015	−0.0011	−0.0085	0.0007	0.0082	0.0024	0.0046	0.0014	0.0045	−0.0011	0.0019
ATH	0.0003	0.0402	0.0036	0.0006	−0.0071	0.0111	−0.0083	0.0060	−0.0013	0.0082	−0.0041	−0.0163	−0.0458	−0.0026	−0.0021	0.0002	0.0043
BCN	0.0043	0.0036	0.0370	−0.0016	−0.0008	0.0107	−0.0003	0.0092	0.0056	0.0129	0.0014	0.0007	−0.0232	−0.0001	0.0007	−0.0009	0.0037
CFL	0.0076	0.0006	−0.0016	0.0031	0.0000	0.0090	0.0009	0.0001	0.0005	0.0002	0.0025	−0.0001	−0.0026	−0.0003	0.0003	0.0004	0.0003
FBL	0.0163	−0.0071	−0.0008	0.0000	0.0508	−0.0313	0.0019	−0.0044	0.0105	0.0057	0.0008	0.0066	0.0107	−0.0009	0.0102	0.0004	0.0039
FHL	0.0096	0.0111	0.0107	0.0090	−0.0313	0.2704	0.0139	0.0334	−0.0026	0.0241	0.0047	−0.0009	−0.0271	−0.0003	0.0011	−0.0046	0.0065
FIL	0.0015	−0.0083	−0.0003	0.0009	0.0019	0.0139	0.0393	0.0016	−0.0130	−0.0093	0.0026	−0.0103	−0.0076	0.0062	−0.0055	−0.0020	−0.0032
FMF	−0.0011	0.0060	0.0092	0.0001	−0.0044	0.0334	0.0016	0.0114	0.0018	0.0064	0.0002	−0.0039	−0.0066	0.0003	0.0008	−0.0017	0.0044
FTV	−0.0085	−0.0013	0.0056	0.0005	0.0105	−0.0026	−0.0130	0.0018	0.1215	0.0200	0.0003	0.0109	−0.0582	0.0029	0.0048	0.0044	0.0220
KFL	0.0007	0.0082	0.0129	0.0002	0.0057	0.0241	−0.0093	0.0064	0.0200	0.0610	−0.0008	0.0129	−0.0022	0.0030	0.0139	0.0046	−0.0288
PBP	0.0082	−0.0041	0.0014	0.0025	0.0008	0.0047	0.0026	0.0002	0.0003	−0.0008	0.0050	0.0017	0.0012	0.0003	0.0031	−0.0004	0.0002
PDM	0.0024	−0.0163	0.0007	−0.0001	0.0066	−0.0009	−0.0103	−0.0039	0.0109	0.0129	0.0017	0.0409	0.0162	0.0012	0.0074	−0.0010	−0.0052
RBG	0.0046	−0.0458	−0.0232	−0.0026	0.0107	−0.0271	−0.0076	−0.0066	−0.0582	−0.0022	0.0012	0.0162	0.4767	0.0090	−0.0059	−0.0022	−0.0186
RCF	0.0014	−0.0026	−0.0001	−0.0003	−0.0009	−0.0003	0.0062	0.0003	0.0029	0.0030	0.0003	0.0012	0.0090	0.0310	0.0063	−0.0114	−0.0086
TTS	0.0045	−0.0021	0.0007	0.0003	0.0102	0.0011	−0.0055	0.0008	0.0048	0.0139	0.0031	0.0074	−0.0059	0.0063	0.0433	−0.0039	−0.0260
VBH	−0.0011	0.0002	−0.0009	0.0004	0.0004	−0.0046	−0.0020	−0.0017	0.0044	0.0046	−0.0004	−0.0010	−0.0022	−0.0114	−0.0039	0.0119	−0.0008
VIL	0.0019	0.0043	0.0037	0.0003	0.0039	0.0065	−0.0032	0.0044	0.0220	−0.0288	0.0002	−0.0052	−0.0186	−0.0086	−0.0260	−0.0008	0.1106

Source: Author's estimation based on data from SPX (2022).

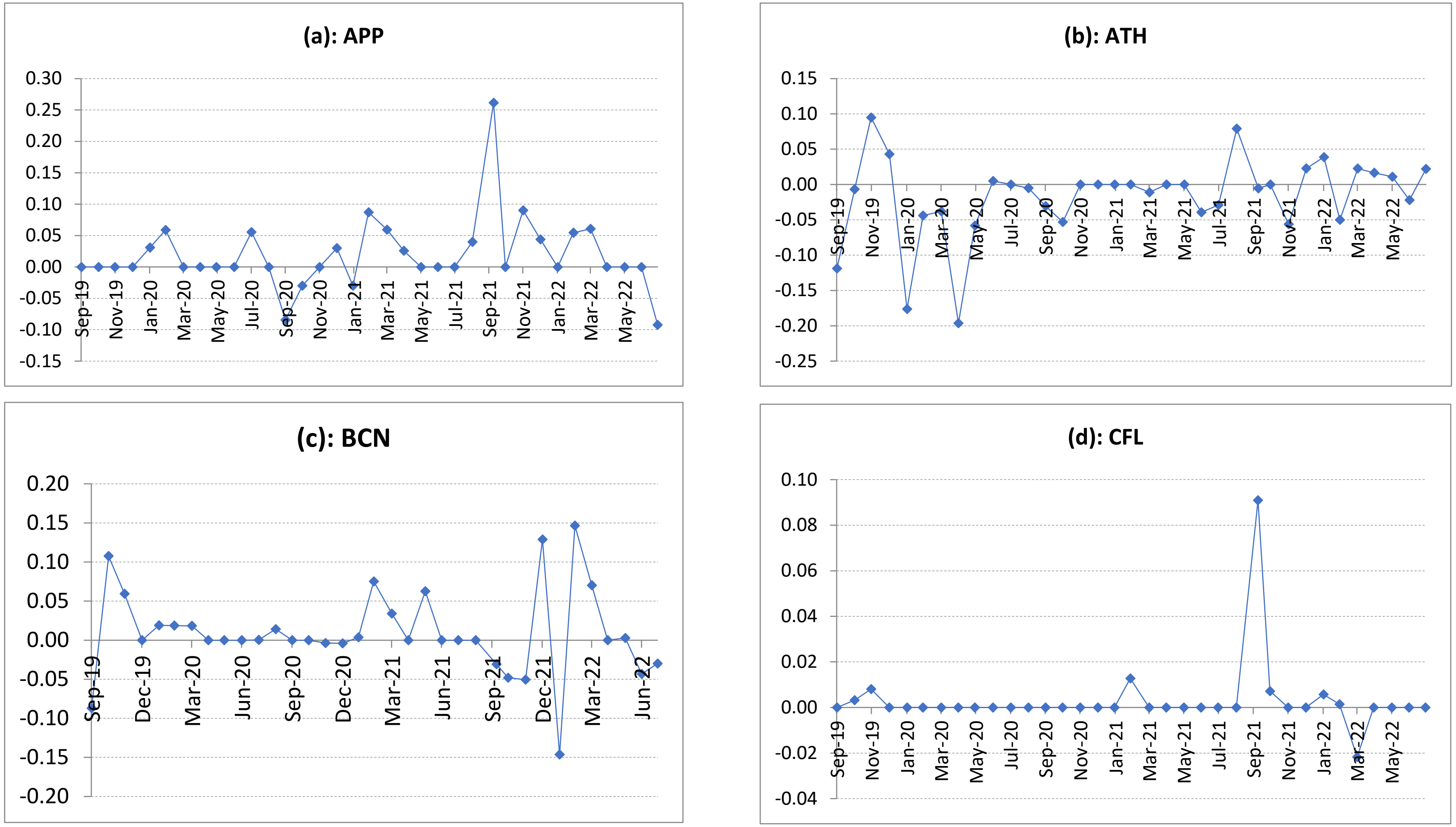
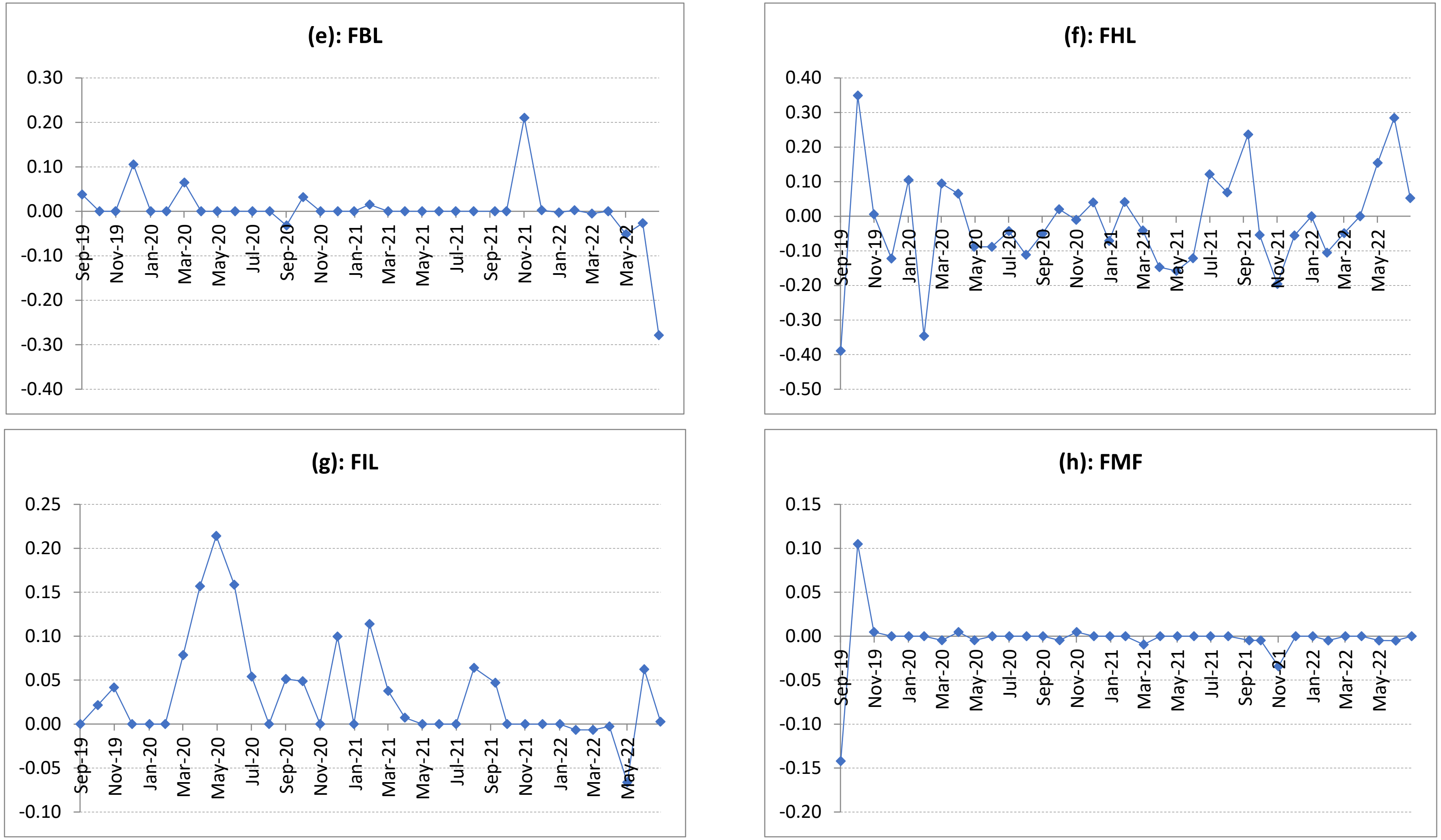


Figure 1. *Cont.*



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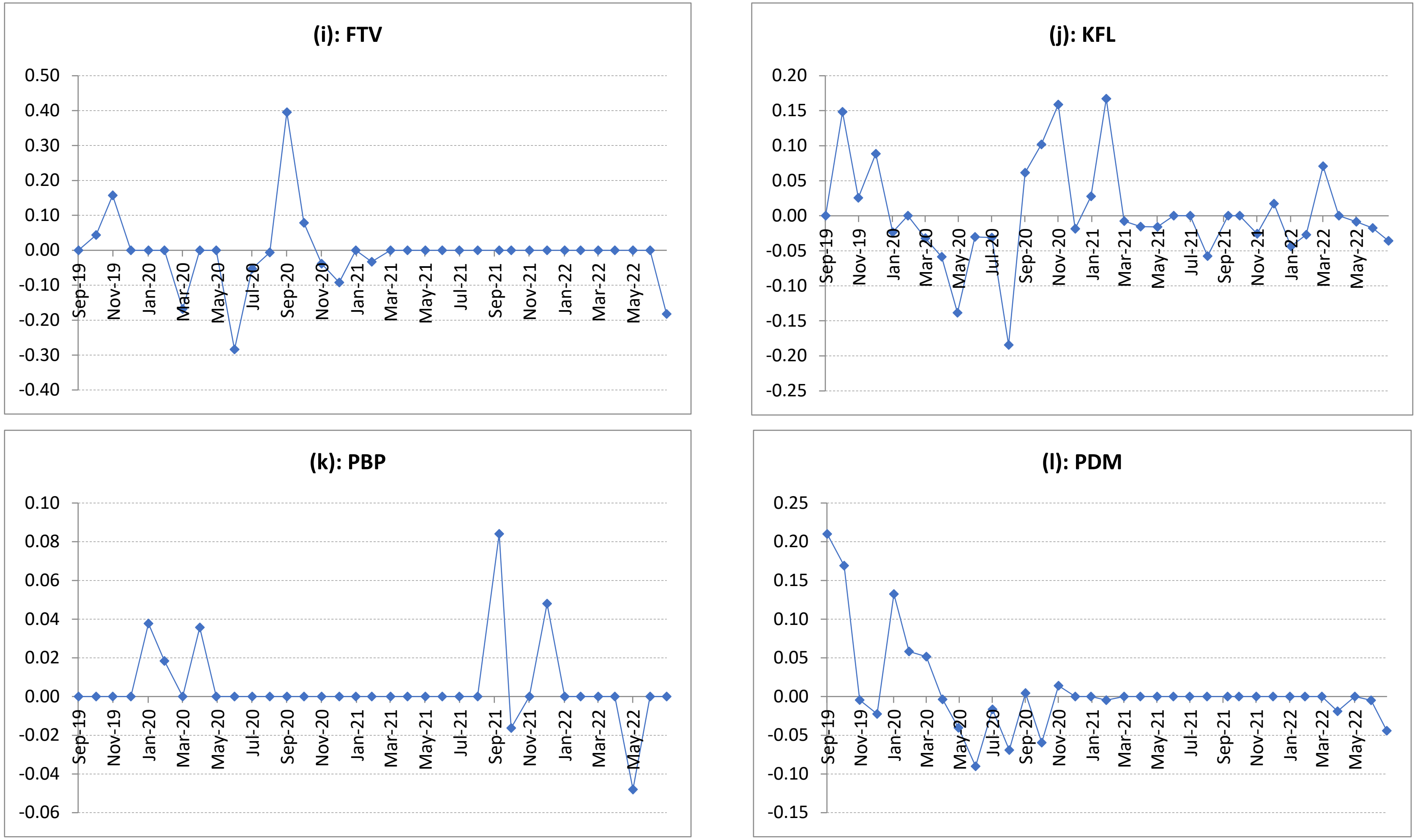

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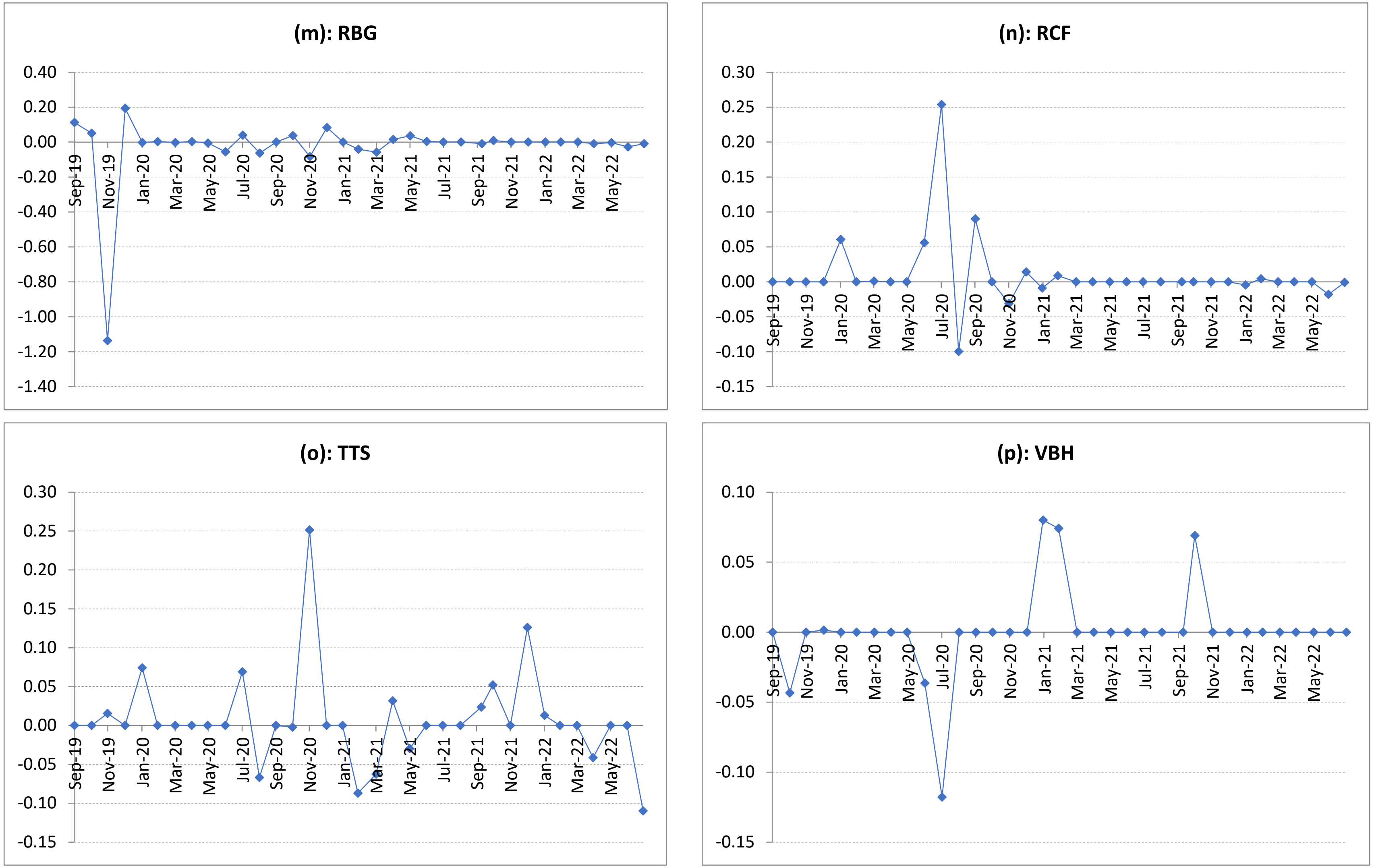

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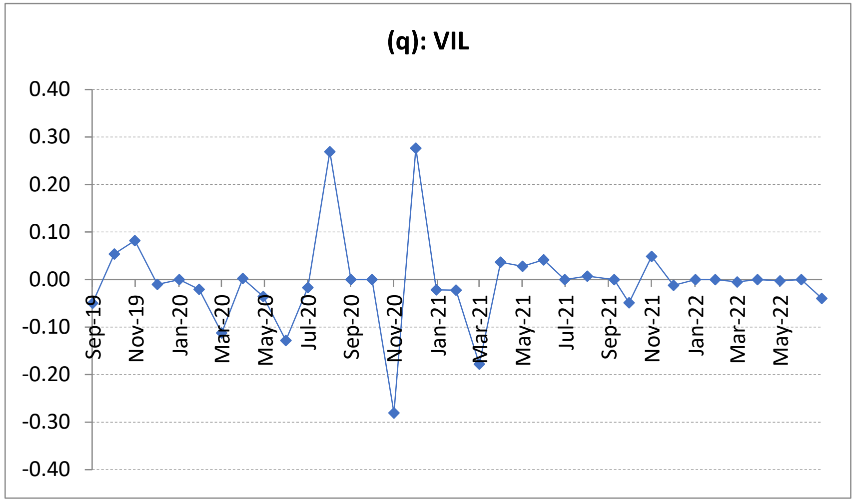

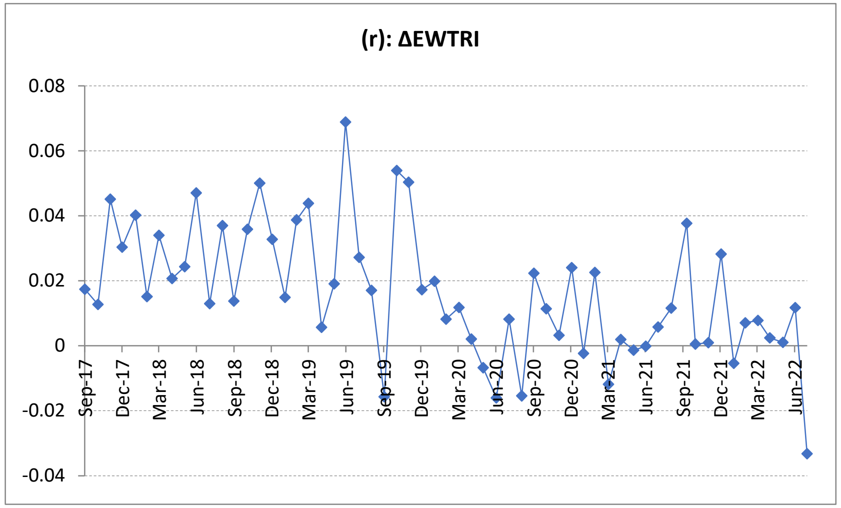

Figure 1. Changes in stock prices and EWTRI.

Table 3. (**a**) 1/N and mean-variance portfolios. (**b**) Utility maximizing portfolio. (**c**) Semi-variance portfolio. (**d**) Turbulence adjusted portfolio.

(a)

Portfolio	APP	ATH	BCN	CFL	FBL	FHL	FIL	FMF	FTV	KFL	PBP	PDM	RBG	RCF	TTS	VBH	VIL	Portfolio Mean (CAPM)	Portfolio Std.	Sharpe Ratio
MV1 (1/N)	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	19.35%	7.06%	2.5976
MV2	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	64.78%	52.0%	1.2266
MV3	0.000	0.075	0.024	0.103	0.002	0.000	0.045	0.118	0.007	0.000	0.124	0.071	0.009	0.095	0.074	0.214	0.038	15.7%	3.50%	4.2366
MV4	−0.111	0.080	0.059	0.331	0.047	0.001	0.017	0.084	−0.003	−0.053	0.134	0.070	0.010	0.091	0.052	0.178	0.014	14.3%	2.70%	4.8725
MV5	0.000	0.072	0.015	0.226	0.016	0.000	0.044	0.083	0.000	0.000	0.089	0.063	0.010	0.108	0.029	0.221	0.024	13.57%	3.20%	3.9242
MV6	−0.135	0.062	0.050	0.506	0.056	−0.015	0.014	0.089	−0.019	−0.037	0.094	0.059	0.008	0.089	0.019	0.152	0.009	11.82%	2.46%	4.3925

Notes: (MV1) 1/N—Evenly weighted portfolio, (MV2) Maximizing μ, (MV3) Maximizing Sharpe ratio—market portfolio without short-selling, (MV4) Maximizing Sharpe ratio—market portfolio with short-selling, (MV5) Minimum-variance portfolio—without short-selling, (MV6) Minimum-variance portfolio—with short-selling; RF = 1%.

Table 3. *Cont.*

(b)

Portfolio	APP	ATH	BCN	CFL	FBL	FHL	FIL	FMF	FTV	KFL	PBP	PDM	RBG	RCF	TTS	VBH	VIL	Portfolio Mean (CAPM)	Portfolio Std.	Sharpe Ratio
U1	0.000	0.000	0.234	0.000	0.000	0.174	0.000	0.000	0.174	0.000	0.000	0.010	0.001	0.000	0.312	0.000	0.094	37.2%	14.4%	2.5141
U2	0.000	0.000	0.032	0.000	0.000	0.304	0.000	0.000	0.265	0.000	0.000	0.000	0.000	0.000	0.396	0.000	0.003	44.4%	20.4%	2.1260
U3	0.000	0.000	0.000	0.000	0.000	0.608	0.000	0.000	0.351	0.000	0.000	0.000	0.000	0.000	0.041	0.000	0.000	54.9%	33.8%	1.5959

Notes: U1 = UMax portfolio—no short-selling: $(A = 10)$, U2 = UMax portfolio—no short-selling $A = 5)$, U3 = UMax portfolio—no short-selling $(A = 2)$.

(c)

Portfolio	APP	ATH	BCN	CFL	FBL	FHL	FIL	FMF	FTV	KFL	PBP	PDM	RBG	RCF	TTS	VBH	VIL	Portfolio Mean (CAPM)	Portfolio Std.	Sortino Ratio
SV1	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	19.35%	5.50%	2.4277
SV2	0.036	0.016	0.058	0.000	0.000	0.034	0.227	0.169	0.000	0.000	0.000	0.215	0.000	0.003	0.075	0.094	0.072	18.89%	6.89%	4.5965
SV3	0.000	0.034	0.032	0.421	0.015	0.000	0.066	0.112	0.000	0.000	0.000	0.067	0.012	0.004	0.053	0.161	0.024	13.83%	3.67%	3.2549
SV4	0.059	0.007	0.019	0.667	0.000	0.000	0.082	0.000	0.000	0.027	0.000	0.018	0.004	0.021	0.000	0.078	0.018	10.96%	5.08%	3.1285
SV5	0.046	0.008	0.004	0.830	0.000	0.004	0.002	0.000	0.000	0.012	0.072	0.000	0.006	0.003	0.000	0.011	0.003	10.81%	5.70%	2.4498
SV6	0.000	0.000	0.097	0.000	0.000	0.227	0.000	0.000	0.182	0.000	0.000	0.000	0.000	0.000	0.494	0.000	0.000	40.91%	17.48%	2.6985

Notes: SV1—1/N—Evenly weighted portfolio, SV2—Maximizing Sortino ratio—market without short-selling, SV3—Minimum-variance portfolio—without short-selling, SV4—Minimizing downside volatility without short-selling, SV5—Maximizing upside variance without short-selling. SV6—Maximizing utility without short selling.

(d)

Portfolio	APP	ATH	BCN	CFL	FBL	FHL	FIL	FMF	FTV	KFL	PBP	PDM	RBG	RCF	TTS	VBH	VIL	Average Turbulence
T1 (1/N)	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	94.94%
T2	0.001	0.010	0.002	0.001	0.000	0.001	0.005	0.000	0.000	0.000	0.001	0.000	0.975	0.003	0.000	0.000	0.000	43.46%
T3	0.001	0.010	0.002	0.001	0.000	0.001	0.005	−0.001	−0.004	−0.001	0.001	0.000	0.983	0.003	0.000	0.000	0.000	43.45%

Notes: T1 = Equally weighted portfolio, T2 = minimum turbulence portfolio without short selling, T3 = minimum turbulence portfolio with short-selling. Source: Author's own estimation.

Table 4. Upside/downside variance analysis.

Approach	Portfolio	Upside Var. (%)	Downside Var. (%)	Skewness (σ_v)
(a) Mean-Variance	MV1 = SV1	53.1%	46.9%	1.13
	MV2	51.5%	48.5%	1.06
	MV3	56.0%	44.0%	1.27
	MV4	54.9%	45.1%	1.22
	MV5	64.3%	35.7%	1.80
	MV6	49.2%	50.8%	0.97
(b) Utility	U1 (A =10)	50.4%	49.6%	1.02
	U2 (A = 5)	52.8%	47.2%	1.12
	U3 (A = 2)	52.5%	47.5%	1.11
(c) Semi-variance	SV2	68.4%	31.6%	2.17
	SV3	66.8%	33.2%	2.02
	SV4	86.0%	14.0%	6.16
	SV5	92.0%	8.0%	11.54
	SV6	59.4%	40.6%	1.46
(d) Turbulence-adjusted	T2	8.3%	91.7%	0.09
	T3	8.3%	91.7%	0.09

Source: Author's own estimation.

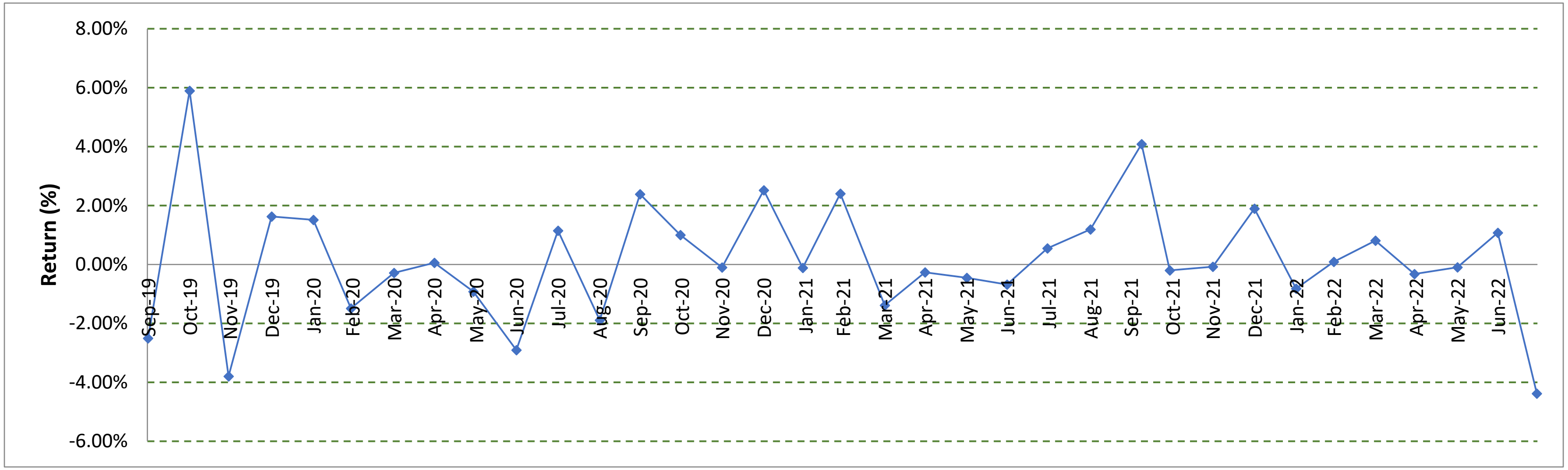

Figure 2. Equally-weighted portfolio.

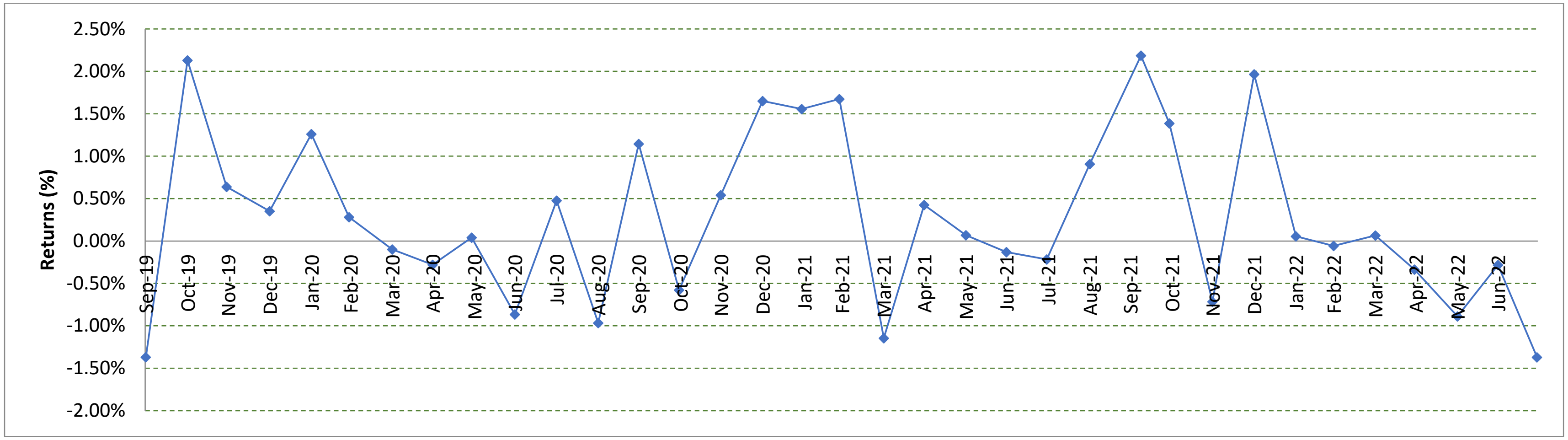

Figure 3. Mean-variance portfolio: long-only.

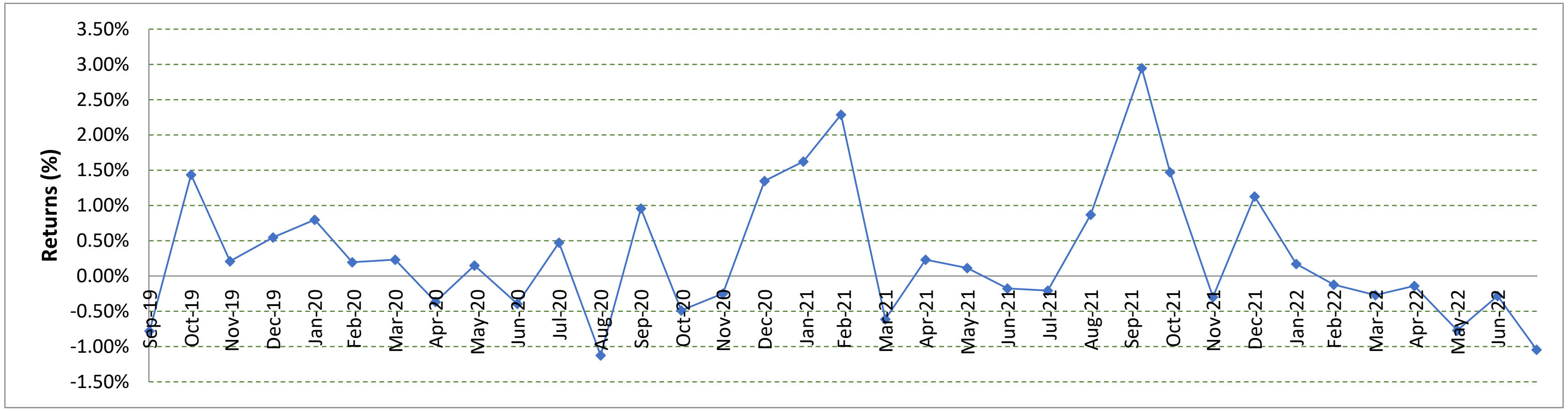

Figure 4. Minimum-variance portfolio: long-only.

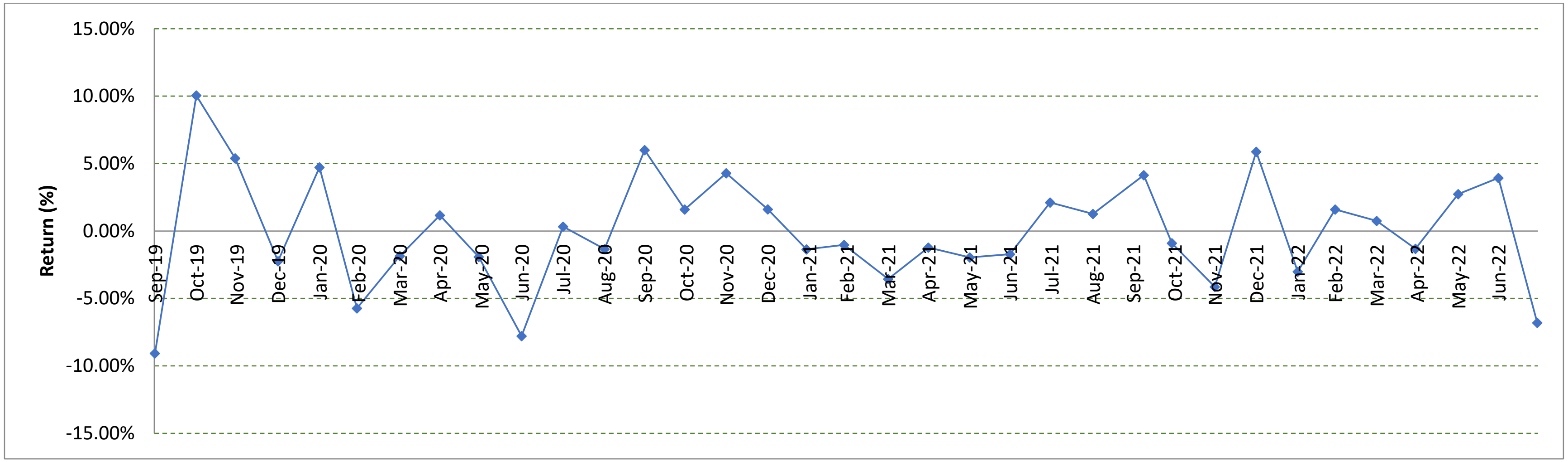

Figure 5. Utility-maximized portfolio (A = 10): long-only.

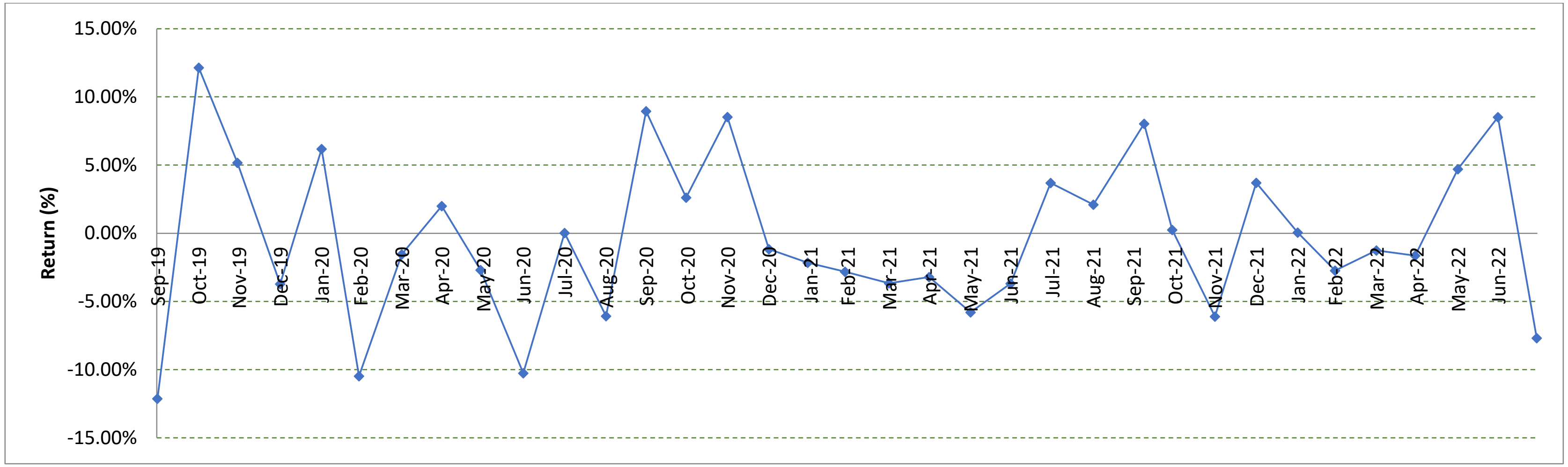

Figure 6. Utility-maximization portfolio (A = 5): long-only.

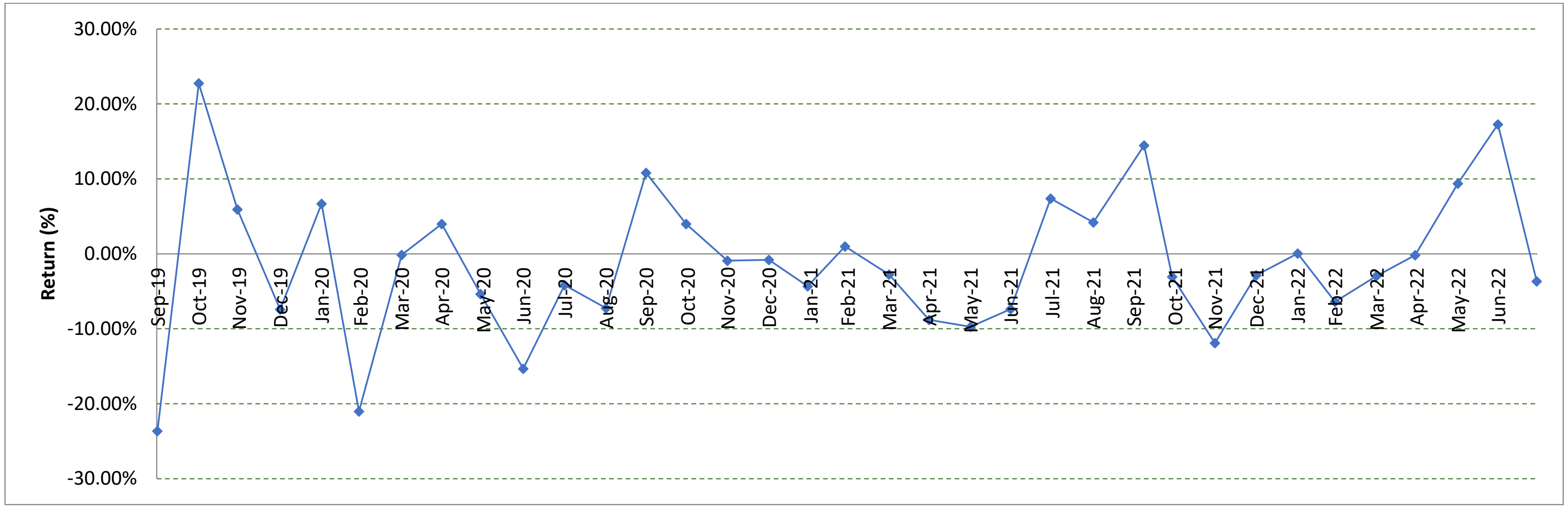

Figure 7. Utility maximizing portfolio (A = 2): long-only.

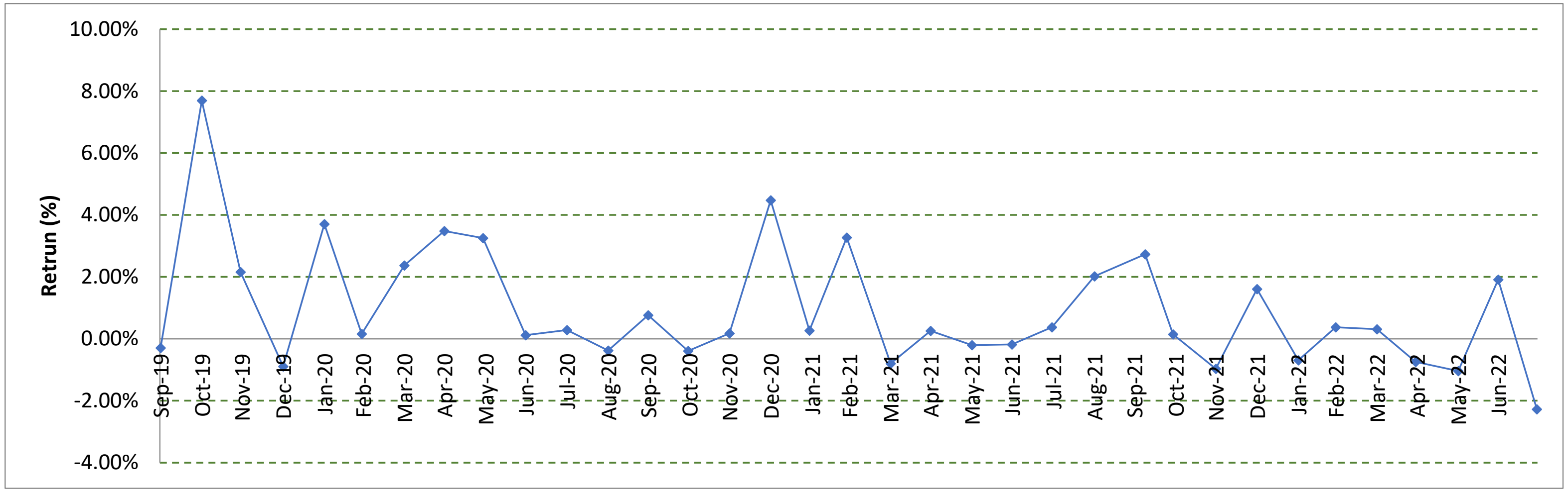

Figure 8. Semi-variance portfolio: long only.

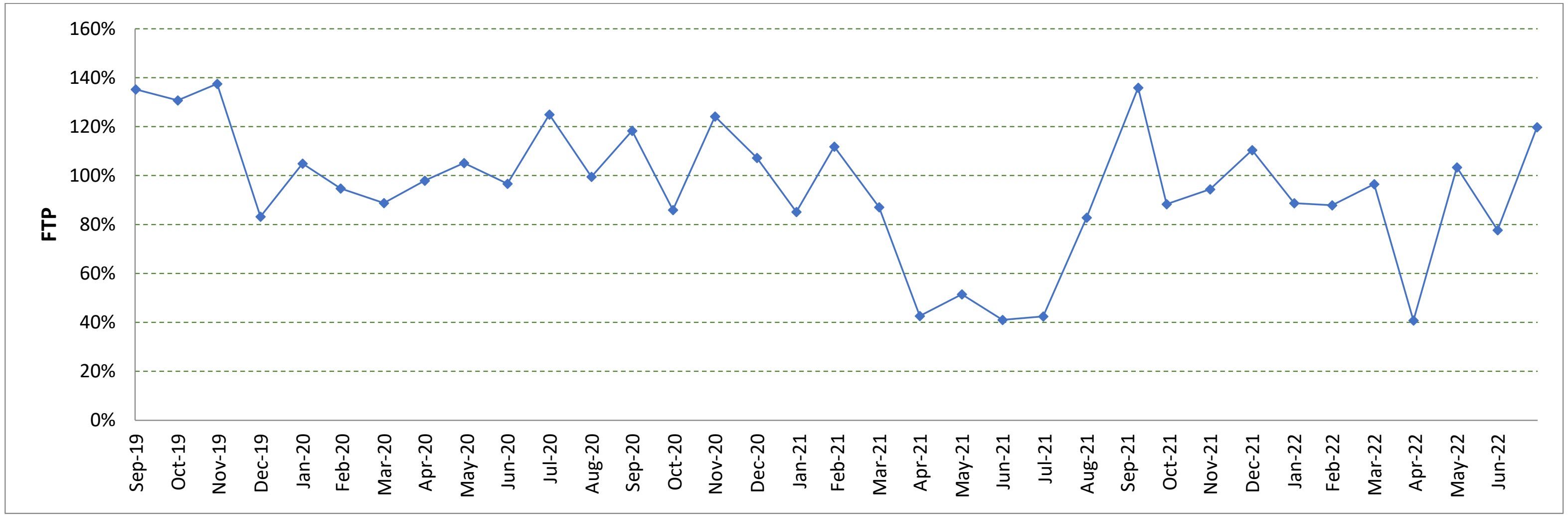

Figure 9. Equally-weighted turbulence-adjusted portfolio.

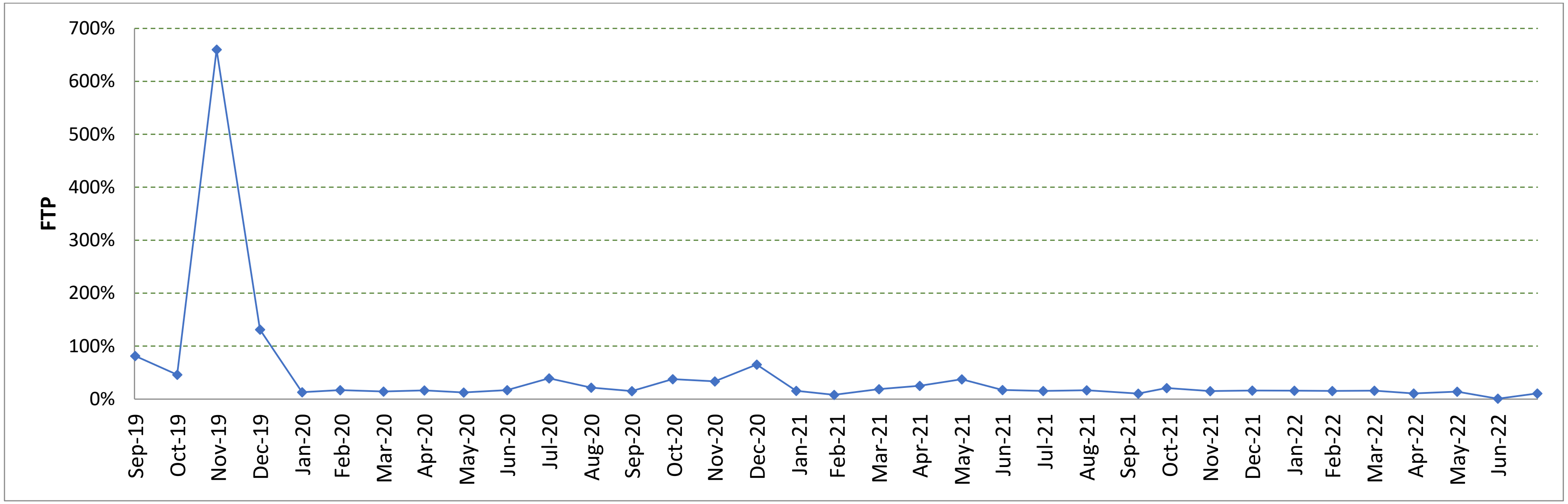

Figure 10. Minimum-turbulence-adjusted portfolio.

6. Conclusions

In this paper, we presented beta-adjusted portfolios under different scenarios. In our analysis, we computed beta for each stock based on the equally weighted return index. It is noted that stocks in general move with the market, however, some are more sensitive than others. Using the beta-adjusted individual asset's returns, we construct 1/N (naïve) portfolios, which happen to yield superior returns, although with relatively higher risk than under some of the optimized portfolios. Our analysis shows that even without optimization, (for a less sophisticated investor) an equally weighted (naïve) portfolio provides reasonable diversification and expected returns, thus reducing the burden of regular re-balancing (Edirisinghe and Jaehwan 2022). This outcome holds when the portfolio is compared against the mean-variance and the semi-variance portfolios. However, Kumar et al. (2022a) show that when using average returns of the assets (and not the beta-adjusted returns), market portfolios provide superior returns. However, we argue that using beta-adjusted returns to construct a portfolio provides greater insights for investment decisions because it reflects not only the individual stock's performance (mean and standard deviation) but also accounts for the overall market movements, i.e., how each asset responds with the overall market performance. Hence, for a nuanced investor, we present various portfolios under different optimization scenarios based on beta-adjusted returns, which can be compared with portfolios based on average returns. Finally, our analysis of the turbulence-adjusted portfolios shows that most of the market announcements coincide with stock performance and that various announcements coincide with the overall market performance. The results indicate that investors could have minimized the risk if they would have had a relatively high exposure in RBG than all the other companies. However, in must be noted that in a normal scenario, depending on the risk appetite of an investor, either an equally weighted, a market, or a minimum-variance portfolio is preferable.

While our analysis may offer useful insights on stock investments in Fiji, we place some caveats to our findings. First, although the method can be easily replicated to and compared with other small stock markets, the findings in terms of the type of portfolio (naïve, full-variance, semi-variance utility, turbulence) can be methodology-dependent and hence should not be generalized (c.f. Zaimovic et al. 2021; Sun et al. 2021). Second, as noted from the kurtosis values in the descriptive data, the monthly data do not exhibit strict symmetry and hence at best weakly support normal distribution. Future studies could look into alternative methods of portfolio optimization, which relaxes the assumption of normality and hence allows higher frequency data to be considered (Karandikar and Sinha 2012; Ding 2006). Third, our beta-adjusted returns are based on an equally weighted return index, which could have some influence on the exclusiveness of the naïve portfolio against the market portfolios under different scenarios. It remains to be seen if beta based on alternative measures such as a price-weighted or market-weighted index can offer different outcomes. Fourth, while a turbulence-adjusted portfolio coincides with various announcements, future research could analyze the announcements in more detail to examine its impact on liquidity and the possibility of herd behavior. In addition, other consideration can be accounted for, especially in the context of climate finance. For instance, it has been noted from studies on emerging markets that companies complying with socially responsible (sustainable) investment, or companies operating within the framework of Sustainable Development Goals (SDGs), are preferred by investors (Azmi et al. 2019; Miralles-Quirós et al. 2019). To what extend this holds for Fiji and similar countries is yet to be explored. Finally, with larger datasets, the outcomes may change in the favor of unique optimization approaches and portfolios (see David et al. 2019a, 2019b; Michaud et al. 2020 for an interesting debate).

On policy implications, we recommend that efforts are initiated to improve financial education in the Pacific, especially in the small island countries. One of the ways we can achieve this would be to build core financial literacy skills and knowledge of basic investment tools and products in the education curriculum at different levels in the education system. Higher education institutions should consider offering programs such as applied financial mathematics to support robust investment analysis and financial inclusivity (c.f.

Castellano and Ferrari 2019). Moreover, alternative approaches in portfolio construction may account for climate related factors including socially and environmentally responsible investment activities. From a trading cost perspective, it is important to keep the transaction costs (which includes trading fees) low or at a reasonable level. During the COVID-19 periods, and even at the time of writing this paper, the trading fees were reduced to 2.5 percent of the funds allocated per trade (this include 1% paid to the exchange and RBF and 1.5% to the broker) with minimum broker fees set FJD 5. Future studies can investigate the implications of trading cost on trade volume and potential investors' willingness to participate, especially where investors intend to buy small quantities of shares on a regular basis. It is equally important that stock exchange is efficiently regulated to gain and secure confidence in the stock exchange and hence the roles of SPX and RBF are pivotal. Stock trading can become easier and better with the use of financial technology such as an online trading system that is linked to electronic payment services.

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