

# Is Human Capital Premium Price in Asset Pricing? Insights from South Africa During the COVID-19 Era

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## ABSTRACT

**Purpose** - In recent years, numerous asset pricing models have demonstrated superior performance over traditional approaches in explaining the variability of asset returns. In this study, we empirically evaluate the efficiency of the augmented human capital six-factor model in the South African stock market over the period from July 2010 to June 2023.

**Study Design/methodology/approach**- This study, constructs a set of thirty-two portfolios, using daily stock price data of non-financial firms. These portfolios are sorted based on size, value, profitability, investment, and labor income growth rate premium. Further, we employ Fama and Macbeth's (1973) time-series regression for the empirical analysis.

**Findings**- Findings indicate that small-size portfolios considerably earn higher returns than big-size portfolios. Additionally, we report that market, size, value, profitability, investment, and human capital premium significantly explain the time-series variability in excess portfolio returns. Further, the analysis also highlights that the COVID-19 pandemic induced substantial volatility in the South African stock market, which notably reduced the efficiency of the six-factor model during the pandemic period. To further assess model efficiency, we employ a Gibbons, Ross, and Shanken (GRS) test as part of the sub-sample analysis.

**Research Practical Implications**- The results provide valuable insights for policymakers, investors, and portfolio managers in constructing optimal portfolios for investment, particularly during the COVID-19 pandemic. Furthermore, the findings emphasize that investors should incorporate the human capital premium alongside other risk factors when valuing securities.

**Originality/value**- First, this study significantly contributes to the existing literature on asset pricing models. Second, this study is the first which extend the Fama and French five-factor model in the South African market. Third, this study examines the efficiency of the augmented six-factor model during the COVID-19 pandemic. Fourth, this study highlights the performance of the augmented six-factors model and provides helpful suggestions for improving investing strategies during turbulent times.

**Keywords:** Fama and MacBeth regression, Human capital, Asset pricing models, COVID-19

**JEL Classification Codes:** C22, C53, E24, G11

## 1 | INTRODUCTION

Over the past few decades, testing the efficiency and validity of asset pricing models has attracted the attention of many researchers to examine the risk-return relationship ([Aygoren & Balkan, 2020](#); [Khan et al., 2022](#); [Zada et al., 2021](#)). However, investing money in different assets is sometimes challenging for investors and portfolio managers to get the benefit of diversification. To address this concern, [Markowitz \(1952\)](#) document that investors have a particular view of portfolio selection. Further, the author argued that the ultimate aim of investors and portfolio managers is to get maximum return on investment with a desired level of risk.

The seminal work of [Sharpe \(1964\)](#), [Lintner \(1965\)](#), and [Mossin \(1966\)](#) who used the Tobin-Markowitz mean-variance approach and proposed the capital asset pricing model (hereafter, CAPM) which documents the relationship between the price of individual assets (stocks) and the associated risk. Later, [Merton \(1969\)](#) used the CAPM framework over time for the joint determination of consumption and selection of portfolios. Following this, many researchers criticized the limitation of CAPM ([Bhandari, 1988](#); [Friend et al., 1978](#); [Roll, 1977](#)), and identified many anomalies in asset pricing that explain variability in asset returns ([Banz, 1981](#); [Rosenberg et al., 1985](#)).

To address these limitations, [Ross \(1976\)](#) proposed the multi-factor model, commonly known as arbitrage pricing theory (APT). Further, [Cox et al. \(1985\)](#) extend the CAPM framework with savings and capital formation for optimal portfolio selection. On one hand, CAPM has attracted the attention of many researchers to examine the risk and return relationship ([Khan et al., 2023](#); [Mohanasundaram & Kasilingam, 2024](#)). On the other hand, multi-factor asset pricing models tend to perform better than CAPM in explaining the variability in excess portfolio returns ([Khan et al., 2023](#); [Khan et al., 2022](#)). However, recent multi-factor models can not accurately explain the variability in asset returns, therefore, it is necessary to add more anomalies in asset pricing models ([Kan et al., 2024](#)). As the CAPM is based on a single factor, researchers have progressively identified many anomalies to claim the success of asset pricing models ([Harvey et al., 2016](#)). In financial literature, many researchers identified various financial anomalies that have a long-term impact on asset pricing ([Hou et al., 2020](#); [Linnainmaa & Roberts, 2018](#)).

Over the past few decades, several asset pricing models have been proposed to explain the cross-sectional variability in expected asset returns. For instance, [Fama and French \(1993\)](#) extend the CAPM with two prominent factors, namely, size and value premium, thus proposing a three-factor model (henceforth, FF3FM). Following this, [Carhart \(1997\)](#) extended the FF3FM with a momentum factor and thus proposed the momentum-based four-factor model. Moreover, [Fama and French \(2015\)](#) proposed a five-factor model (henceforth, FF5FM) which includes two factors namely, investment and profitability to their traditional FF3FM. In a similar vein, [Fama and French \(2018\)](#) extend the five-factor model with momentum, thus proposing a momentum-based six-factor model (FF6FM). Additionally, they also proposed a non-nested six-factor model (hereafter, FF6CP), by substituting cash profitability with operating profitability.

The intertemporal consumption-based asset pricing model, introduced by [Lucas Jr \(1978\)](#) and [Breedon \(1979\)](#), has been extensively utilized to integrate asset valuation with consumption-investment decisions. As [Campbell \(1996\)](#) documented that human capital represents the true wealth of the economy and should therefore be integrated into the asset pricing models. Therefore, considering the impact of human capital on

asset and portfolio returns, [Roy and Shijin \(2018\)](#) extended the FF5FM with human capital as an additional factor thus proposing the human capital-based six-factor model (HC6FM). Later, several studies test the efficiency of HC6FM over FF5FM for explaining the cross-sectional and time series variability in excess portfolio returns ([Florensia & Susanti, 2020](#); [Maiti & Balakrishnan, 2018](#); [Maiti & Vuković, 2020](#); [Tambosi Filho et al., 2022](#); [Thalassinos et al., 2023](#)).

In recent years, the literature on asset pricing in the South African market has raised significant criticisms of the CAPM's ability to explain the cross-sectional variability in asset returns. For example, [Charteris et al. \(2018\)](#) explored the momentum factor, [Molele and Mukuddem-Petersen \(2020\)](#) incorporated global and exchange rate factors, and [Mpoha and Bonga-Bonga \(2020\)](#) examined exchange rate risk. Numerous studies have employed regression-based approaches to investigate the risk-return relationship, including traditional methods ([Charteris et al., 2018](#); [Steyn & Theart, 2019](#)), [Fama and MacBeth \(1973\)](#) regressions, and Ordinary Least Squares (OLS) with Newey-West adjustments ([Dwarika, 2023](#)). However, a critical gap remains, as these studies have largely overlooked the role of human capital in asset pricing models. Moreover, [Ren et al. \(2023\)](#) examine the efficiency of CAPM and FF3FM during COVID-19 pandemic. Their findings indicate that FF3FM surpasses CAPM in explaining the time series variability in asset returns. Additionally, they document those future studies should examine the efficiency of the multi-factor model and CAPM during these periods.

Additionally, the COVID-19 pandemic has created a significant influence on the world economy and financial markets, leading to industry collapse, business interruptions, job losses, and physical and economic lockdowns. On March 3, 2020, the first virus case was reported in South Africa ([Mkhize, 2020](#)). Moreover, when the World Health Organization (WHO) proclaimed the virus a pandemic on March 11, 2020, the South African economy was already experiencing significant strain, and economic growth in the years before COVID-19 had slowed to 1.5% from 3% in 2010, which caused the economy to enter a technical recession by the fourth quarter of 2019 (Statistics South Africa, 2020). In response to the growing number of coronavirus infections, the South African government implemented several emergency intervention measures including obligatory quarantines, travel restrictions, social distancing, complete lockdowns, and economic packages, even if these measures were judged essential for the pandemic, but still it heightened the uncertainty and impact the economy ([Ashraf, 2020](#)). According to a BBC report on March 31, 2020, the FTSE 100 and Dow Jones Industrial Average (DIJA) dropped by 25% and 23% respectively. Similarly, South Africa's All Share Index (ALSI) experienced a sharp decline, closing on March 16, 2020, with a 32.6% drop from the start of the year, including one of its largest single-day declines since 1997. These substantial losses are attributed to factors such as poor healthcare infrastructure, limited fiscal flexibility, underdeveloped financial sectors, and inadequate resources, particularly in emerging economies like South Africa ([Takyi & Bentum-Ennin, 2021](#)). Furthermore, the impact of the COVID-19 pandemic and its spillover effects on stock markets continue to be investigated across various financial asset classes and economies ([Chaudhary et al., 2020](#); [Dragomirescu-Gaina & Philippas, 2022](#); [Eachempati et al., 2021](#)).

Therefore, to bridge this gap, the current study proposes the following research question; Does an augmented human capital-based six-factor asset pricing model accurately predict time-series variability in excess portfolio returns? Does a multi-factor asset pricing model explain the risk exposure in excess portfolio

returns during the COVID-19 pandemic? Additionally, our studies contribute to the existing literature in four-fold. First, our study is the first which examine the role of human capital in the asset pricing model in the South African stock market. Second, we examine the efficiency of the human capital-based-six factors asset pricing model during the COVID-19 pandemic. Third, we take daily data to construct a set of thirty-two portfolios. Fourth, we use the [Fama and MacBeth \(1973\)](#) time series regression approach to examine the risk-return relationship. Employing, [Fama and MacBeth \(1973\)](#) regression has many advantages over other methodologies of asset pricing. First, this approach is widely used in empirical literature to capture the effect of different risks beyond market risk ([Jagannathan & Wang, 1996](#); [Zada et al., 2018](#)). Second, this approach provides a robust framework for testing whether anomalies persist after controlling for other risk factors ([Jegadeesh & Titman, 1993](#)).

The estimation reports some interesting insights using monthly data from July 2010 to July 2023. The main findings are summarized as follows. Our findings indicate that COVID-19 has created identical volatility in the South African stock market, and in response to that most of the portfolios show inefficient returns with higher risk. For instance, we report that among 32 portfolios small portfolios considerably report higher returns as compared to big portfolios. Furthermore, we find that market premium significantly explains the time series variability in all sets of portfolios. Where for size, value, profitability, investment, and human capital we find significant relationships of these factors with excess portfolio returns. Furthermore, we find that the six-factor model performs better in a full sample as compared to the pandemic periods. Interestingly, we report that the efficiency of the six-factor model significantly reduces during COVID-19 and after the pandemic period as compared to the full sample period, such findings indicate that six-factor asset pricing models significantly explain the variability in excess portfolio returns.

The remainder of the paper is structured as follows: Section 2 provides a review of the theoretical and empirical literature, focusing on the relationship between risk factors and returns. Section 3 outlines the data, portfolio construction process, and research methodology. Section 4 presents and analyzes the empirical findings. Finally, Section 5 concludes with a summary of key insights and policy implications.

## 2 | LITERATURE REVIEW

### 2.1 | Theoretical Nexus

[Markowitz \(1952\)](#) modern portfolio theory (MPT) has marked the beginning of asset pricing studies. This theory proposed the fundamental theorem for mean-variance portfolio theory, which documents that retaining constant variance will decrease the variance while maximizing the expected returns. Following this, [Sharpe \(1964\)](#), and [Mossin \(1966\)](#) used the Tobin-Markowitz mean-variance approach and proposed a capital asset pricing model (hereafter, CAPM) which determines a theoretical relationship between the price of individual assets (stocks) and its associated risk. Further, some of the extensions have been made to CAPM to test it for multi-period portfolio selection ([Mossin, 1966](#); [Samuelson, 1975](#)).

A large number of studies identified several anomalies that explain the variation in asset returns, for instance, price to-earning anomaly of [Basu \(1977\)](#) size anomaly of [Banz \(1981\)](#), the debt-to-equity anomaly of [Bhandari \(1988\)](#), and book to the market value of equity of [Rosenberg et al. \(1985\)](#). Similar to this, [Connor and Korajczyk \(1989\)](#) proposed a new equilibrium version of APT. The authors find that APT and the new

proposed version of APT which includes equilibrium are found similar in predicting the variability in stock prices and portfolio returns. [Fama and French \(1992\)](#) examine the joint influence of market beta, size, leverage, earnings-to-price ratio, and book-to-market ratio on stock returns. Their study demonstrates that these anomalies are the significant determinants that explain the cross-sectional variation in expected stock returns. [Jegadeesh and Titman \(1993\)](#) explore the phenomena of stock market efficiency. The authors find that stocks that performed well in the past (buy option) and stocks that performed poorly in the past significantly earned positive returns. Similarly, some of the studies report the persistence of mutual funds' performance in common investment strategies over short and long-term horizons ([Brown et al., 1992](#); [Elton et al., 1996a](#); [Elton et al., 1993](#); [Goetzmann & Ibbotson, 1994](#); [Grinblatt & Titman, 1992](#); [Wermers, 1997](#)).

## 2.2 | Empirical Nexus of Asset Pricing

[Horváth and Wang \(2021\)](#) evaluate the efficiency of Fama-French models during the financial crisis and COVID-19 pandemic. Their findings indicate that the performance of portfolios significantly reduced during the financial crisis and COVID-19 pandemic. [González-Sánchez \(2022\)](#) evaluates the efficiency of factorial versus information stochastic discount factor (SDF) models, using the data of 28 emerging counties. The author finds that portfolios in SDF models show better goodness of fit, as compared to the factorial model. Furthermore, they document that value and growth stocks perform well in emerging markets. [Carrasco and Hansen \(2022\)](#) investigate the role of uncertainty in asset pricing models and its effect on portfolio choice. Using the Bayesian mean-variance the authors reported that uncertainty in the model significantly improves the portfolio performance. [Son and Lee \(2022\)](#) proposed the latent assets pricing models to estimate the risk exposure based on the characteristics of firms. Using the graph convolutional newton (GCN) their findings indicate that the GCN model outperforms the traditional assets pricing models in terms of explanatory power. ([Kolari et al., 2022](#)) compare the efficiency of ZCAPM with traditional assets pricing models (CAPM, FF3FM, C4FM). Using the global sample, the authors find that out of the sample, the ZCAPM outperforms the three and four-factor models in terms of returns dispersion.

[Alessi et al. \(2023\)](#) examine the role of greenium (carbon emission and environmental transparency) in asset returns. The authors find that investors in Europe hold geranium stock with low equity returns. Examined the efficiency of the augmented-q factor model, Fama and French six factors model (FF6FM) during full, bear, and bullish markets. The authors find that the q-factor model performs well during overall and bull markets, while FF6FM performs well during bear markets. Further, [Zhou et al. \(2024\)](#) examined the efficiency of six-factor models in the Chinese stock market, using a profit-income trading behavior proxy, their findings indicate that the Chinese stock market is structurally efficient. Moreover, they reported that big-size and high-volume portfolios performed well in terms of liquidity and trading premiums. Examined the determinants of idiosyncratic risk (IR) in BRICS economies. Using the panel data models, the authors documented that higher IR firms report lower returns as compared to lower IR firms. [Mohanasundaram and Kasilingam \(2024\)](#) investigate the performance of sustainability factors in assets pricing models, using the Fama and MacBeth two-pass series regression and Fama and French methodology, the authors conclude that the sustainability factor (environmental, social, and governance (ESG), hereafter) has a positive and significant impact on portfolio returns.

### 2.3 | Role of Human Capital in the Asset Pricing Model

According to, a sizable amount of an individual wealth may be held in non-marketable assets (HC), which is difficult to trade on financial markets. As a result, the presence of these non-marketable assets influences people's investment methods and portfolio choices. Moreover, [Campbell \(1996\)](#) argued that HC represents the actual wealth of the economy, and this factor plays a vital role in asset pricing. Further, a growing number of studies confirm that human capital-based assets pricing models successfully predict the time series variability in assets returns ([Belo et al., 2017](#); [Jagannathan & Wang, 1996](#); [Kim et al., 2011](#); [Kuehn et al., 2017](#); [Lettau et al., 2019](#)). Similarly, considering the effect of human capital on stock returns, [Roy and Shijin \(2018\)](#) extend the FF5FM with human capital as an additional factor thus proposing a human capital six-factor model (HC6FM). Later, a growing number of studies confirmed the supremacy of HC6FM over FF5FM for explaining the cross-sectional and time series variability in excess portfolio returns ([Khan et al., 2023](#); [Khan et al., 2022](#); [Prasad et al., 2024](#); [Thalassinos et al., 2023](#)).

## 3 | METHODOLOGY & DESIGN

To examine the efficiency of human capital based on the six-factor model during the full sample and the COVID-19 pandemic, we collect the data of non-financial companies in multiple ways. First, we take daily data on stock prices for the period spanning from June 2010 to July 2023. Second, for portfolio construction, we take yearly balance sheet data from 2010 to 2022. Third, we take daily data of the Jakarta Stock Exchange index and treasury bill rates, further all the data is taken from Thompson Reuters DataStream. In this study, we followed a rigorous methodology for data collection of non-financial firms listed on the Johannesburg Stock Exchange (JSE), ensuring that only firms with complete and consistent data across all factors were included in the final sample. Moreover, we removed the companies whose market capitalization (MC), book-to-market ratio, profitability, investment, and HC (growth in salaries and wages) for the sample period were inadequate or missing. Likewise, companies with irregularities in their closing prices were removed from the sample. Furthermore, companies with negative book-to-market ratios were excluded from the sample. Further, we acknowledge that the data-cleaning process may inadvertently introduce survivorship bias. Therefore, excluding firms that face financial distress, may be omitting valuable information that could provide insights into market inefficiencies and risk, particularly in South Africa, where market dynamics are significantly different from developed economies. However, given our focus on companies with complete data, the analysis maintains consistency and reliability in the results. To address the survivorship bias, we recommend that future studies in the South African market incorporate techniques such as survival analysis or multiple imputation to handle missing or incomplete data, ensuring a more representative sample. Such methods would provide a more comprehensive view of the market's behavior, including firms that faced financial problems. As highlighted by ([Bekaert & Harvey, 2000](#)), survivorship bias is a significant concern in such markets due to factors like mergers, acquisitions, and financial distress, which can lead to missing or incomplete data for struggling firms. To mitigate this issue, we followed ([Elton et al., 1996b](#)), who recommend that reducing the sample size to an optimal level helps minimize the effects of survivorship bias. Consequently, our final sample

consists of 90 non-financial companies for portfolio construction, ensuring the inclusion of firms with consistent and complete data.

**Table 1**

*Variable Explanations*

| Variable              | Proxy | Computation                                 | References                                                                |
|-----------------------|-------|---------------------------------------------|---------------------------------------------------------------------------|
| Market Premium        | MKT   | RM-RF                                       | Sharpe (1964)                                                             |
| Size Premium          | SMB   | Market Capitalization                       | Fama and French (1993)                                                    |
| Value Premium         | HML   | Book value of equity/Market value of Equity | Fama and French (1993)                                                    |
| Profitability Premium | RMW   | EBIT/Book Value of Equity                   | Fama and French (2015)                                                    |
| Investment Premium    | CMA   | Growth in Total assets                      | Fama and French (2015)<br>Roy and Shijin (2018),                          |
| Human Capital         | LBR   | Growth in Salaries and Wages                | Khan et al. (2022),<br>Thalassinios et al., 2023;<br>Prasad et al. (2024) |

*Note: This table shows the variable explanation and its computation. Additionally, in financial literature, numerous studies use growth in salary and wages as a reasonable proxy due to its practical and observable nature. Moreover, this proxy reflects the monetary returns to individual income, skills, and productivity, which are key components of human capital (Roy & Shijin, 2018; Khan et al., 2022; Thalassinios et al., 2023; Prasad et al., 2024).*

### 3.1 | Fama and MacBeth (1973) Regression

In recent years, numerous studies have used the Fama and MacBeth regression (FMB) to explain the cross-sectional variability in asset returns ([Khan et al., 2023](#); [Khan et al., 2022](#); [Zada et al., 2018](#)). The FMB regression was theoretically based on the Sharpe-Lintner model (CAPM) which states that Betas ( $\beta$ ) significantly explains the cross-sectional variability in stock returns at a certain time.

Further, the standardized form of Fama-Macbeth regression is summarized as follows, which assumes that asset or portfolio returns are governed by a multi-factor model ([Bai & Zhou, 2015](#)).

$$R_{it} = \alpha_i + \beta_{i1}f_{1t} + \dots + \beta_{iK}f_{Kt} + \epsilon_{it}, i = 1, \dots, N, t = 1, \dots, T, \quad (1)$$

where in Equation (1),  $R_{it}$  is the asset or excess portfolio returns for  $i$  in period  $t$  ( $1 \leq i \leq N$ ), and  $f_{jt}$  is the real  $j$ th factor in period  $t$  ( $1 \leq j \leq K$ ),  $\epsilon_{it}$  is the disturbance term. Moreover,  $N$  shows the number of assets or portfolios, while  $T$  shows a number of time series observations.

### 3.2 | Model Specification

$$R_{it} = \alpha + \beta_1 RM - RF_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 RMW_t + \beta_5 CMA_t + \beta_6 LBR_t + \epsilon_{it} \quad (4)$$

where in Equation (4)  $R_{it}$  Represent the excess portfolio returns, while  $RM - RF_t$ ,  $SMB_t$ ,  $HML_t$ ,  $RMW_t$ ,  $CMA_t$ ,  $LBR_t$ , shows the premium of risk factors.  $\epsilon_{it}$  shows the error term for portfolio  $i$ , with time  $t$ .

### 3.3 | Gibbons, Ross, and Shanken (GRS) Test

In the recent past, the GRS-Wald test statistics have been widely used by many asset pricing studies for portfolio efficiency. [Gibbons et al. \(1989\)](#) proposed this test to measure the mean-variance efficiency of a portfolio. The authors proposed this test, to measure the efficiency of CAPM, further, they investigate the

sensitivity of stocks, number of assets, and choice of portfolio to derive the efficient frontier ([Azam & Arif; Merton, 1972](#)).

The following equation shows the estimation of the GRS test:

$$GRS = \left(\frac{T}{N}\right) \left(\frac{T}{T} \frac{-N-L}{-L-1}\right) \left[ \frac{\hat{a}' \hat{\Sigma}_{-1}^{-1} \hat{a}}{1 + \bar{\mu}' \hat{\varphi}^{-1} \bar{\mu}} \right] \sim F(N, T - N - L) \quad (5)$$

Where, in Equation (5) the term,  $\hat{a} = N \times 1$  compute the error term vector (constant). Where,  $\hat{\Sigma}$  Shows the stochastic term of the unbiased covariance matrix. Where,  $\bar{\mu} = L \times 1$  shows the average portfolio matrix. Where,  $\hat{\varphi}$  Shows the portfolio/factor unbiased covariance matrix. Similarly, T shows the no of observations, where N shows the no of regression equations, while L shows the number of factors included in the model.

#### 4 | RESULTS and ANALYSIS

Table 2 shows the summary statistics of 32 portfolios. Among the small portfolios, SLRAL exhibits the highest mean return of 0.0011, with the highest standard deviation (SD) value of 0.0222. Similarly, SLWAH reports the second-highest mean return of 0.0007 with an SD of 0.0216. For the big portfolios, BLRCH shows the highest mean return with an SD of 0.0187, while BHRAH records the lowest positive mean return with an SD of 0.0202. These findings align with the principle that "higher risk yields higher returns." Additionally, the findings reveal that small portfolios consistently outperformed big portfolios, as evidenced by their higher mean returns and SD.

**Table 2**

*Summary Statistics of Portfolio for the Period of 2010-2023*

|       | Mean    | SD     | Kurt    | Skew    | Min     | Max     | Obs  |
|-------|---------|--------|---------|---------|---------|---------|------|
| SLWCL | 0.0001  | 0.0236 | 15.4730 | 0.8038  | -0.2058 | 0.3340  | 3422 |
| SLWCH | 0.0006  | 0.0211 | 5.6511  | 0.4609  | -0.1213 | 0.1570  | 3422 |
| SLWAL | 0.0005  | 0.0129 | 10.0387 | 0.4446  | -0.0768 | 0.0876  | 3422 |
| SLWAH | 0.0007  | 0.0216 | 9.2667  | 0.0698  | -0.1757 | 0.1666  | 3422 |
| SLRCL | -0.0001 | 0.0214 | 4.7043  | 0.2823  | -0.1168 | 0.1775  | 3422 |
| SLRCH | -0.0003 | 0.0169 | 5.7528  | -0.4068 | -0.1445 | 0.0885  | 3422 |
| SLRAL | 0.0011  | 0.0222 | 29.4605 | 1.7745  | -0.1440 | 0.3787  | 3422 |
| SLRAH | -0.0007 | 0.0151 | 9.0340  | -0.2744 | -0.1282 | 0.1284  | 3422 |
| SHWCL | -0.0001 | 0.0175 | 7.7114  | 0.4418  | -0.1239 | 0.1693  | 3422 |
| SHWCH | 0.0003  | 0.0174 | 22.4499 | 0.1163  | -0.2089 | 0.1960  | 3422 |
| SHWAL | 0.0002  | 0.0181 | 8.6773  | 0.2922  | -0.1305 | 0.1555  | 3422 |
| SHWAH | 0.0003  | 0.0201 | 12.6260 | 0.5422  | -0.1600 | 0.2594  | 3422 |
| SHRCL | 0.0006  | 0.0159 | 6.583   | -0.2603 | -0.1336 | 0.10195 | 3422 |
| SHRCH | 0.0002  | 0.0220 | 7.6686  | 0.4458  | -0.1577 | 0.2201  | 3422 |
| SHRAL | 0.0005  | 0.0164 | 3.7032  | 0.2329  | -0.0769 | 0.1020  | 3422 |
| SHRAH | 0.0003  | 0.0172 | 7.2835  | 0.0665  | -0.1252 | 0.1229  | 3422 |
| BLWCL | 0.0005  | 0.0204 | 7.1896  | -0.1765 | -0.1708 | 0.1433  | 3422 |
| BLWCH | -0.0002 | 0.0185 | 3.9352  | -0.2395 | -0.1330 | 0.1024  | 3422 |
| BLWAL | -0.0008 | 0.0225 | 82.5169 | -4.5038 | -0.4851 | 0.1411  | 3422 |

|       |         |        |         |         |          |        |      |
|-------|---------|--------|---------|---------|----------|--------|------|
| BLWAH | -0.0004 | 0.0214 | 26.7721 | -0.6701 | -0.2758  | 0.2166 | 3422 |
| BLRCL | -0.0002 | 0.0153 | 10.3765 | -0.5033 | -0.1424  | 0.1145 | 3422 |
| BLRCH | 0.0008  | 0.0187 | 5.7068  | -0.0891 | -0.1346  | 0.1201 | 3422 |
| BLRAL | -0.0001 | 0.0163 | 7.3887  | -0.3769 | -0.13001 | 0.1160 | 3422 |
| BLRAH | 0.0004  | 0.0191 | 6.3804  | -0.2582 | -0.1295  | 0.1571 | 3422 |
| BHWCL | 0.0005  | 0.0185 | 5.9555  | -0.0635 | -0.1674  | 0.1267 | 3422 |
| BHWCH | 0.0005  | 0.0195 | 5.9058  | -0.0416 | -0.1415  | 0.1498 | 3422 |
| BHWAL | 0.0002  | 0.0224 | 7.9521  | 0.1933  | -0.1818  | 0.1756 | 3422 |
| BHWAH | -0.0002 | 0.0246 | 24.9018 | 0.0959  | -0.2541  | 0.3163 | 3422 |
| BHRCL | -0.0009 | 0.0198 | 5.0327  | -0.0718 | -0.1367  | 0.1339 | 3422 |
| BHRCH | 0.0003  | 0.0183 | 8.8474  | -0.1924 | -0.1753  | 0.1583 | 3422 |
| BHRAL | -0.0006 | 0.0170 | 5.2222  | -0.2678 | -0.1284  | 0.0894 | 3422 |
| BHRAH | 0.0001  | 0.0202 | 4.3934  | -0.0056 | -0.1465  | 0.1152 | 3422 |

Note: SD shows the standard deviation, while max and min show the maximum and minimum values of the data and Obs shows now of observation. Where S and B stand for small and big companies, respectively. L and H denote a company with low and high book-to-market ratio. R and W represent companies with weak and robust profitability. C and A refer to companies with Conservative and Aggressive investment strategies. L and H show companies with low and higher labor income growth rates, respectively.

Table 3 shows the summary statistics of the risk factors. Among these six factors market and value premium report a negative mean value, while size, investment, and human capital premium report a positive mean value. Further, the market premium remains the highest volatile risk factor.

**Table 3**

*Summary Statistics for Premium for the Period of 2010-2023*

|      | MKT     | SMB     | HML     | RMW     | CMA     | LBR     |
|------|---------|---------|---------|---------|---------|---------|
| Mean | -0.0856 | 0.0002  | -0.0002 | -0.0002 | 0.0001  | 0.0000  |
| SD   | 0.1597  | 0.0073  | 0.0046  | 0.0034  | 0.0022  | 0.0017  |
| Kurt | 13.1180 | 4.6539  | 4.8081  | 7.4487  | 4.6659  | 10.3334 |
| Skew | -3.4354 | 0.1459  | -0.4035 | -0.4724 | 0.3254  | 0.2277  |
| Min  | -1.0318 | -0.0490 | -0.0340 | -0.0324 | -0.0147 | -0.0145 |
| Max  | 0.0750  | 0.0518  | 0.0258  | 0.0259  | 0.0183  | 0.0193  |

Note: SD shows the standard deviation, while max and min show the maximum and minimum values of the data. Skew and Kurt show Skewness and Kurtosis of the data.

Table 4 shows the correlation matrix of the study. It is observed that value and profitability premiums show a negative correlation with market premiums, while size and human capital show a positive correlation. Further, to address the problem of multicollinearity, we employ the VIF test, and the findings indicate that the value of all explanatory variables is less than 10, suggesting that the problem of multicollinearity does not exist ([Khan et al., 2022](#)).

**Table 4***Correlation Matrix of Risk Factors*

|              | <b>MKT</b> | <b>SMB</b> | <b>HML</b> | <b>RMW</b> | <b>CMA</b> | <b>LBR</b> | <b>VIF</b> |
|--------------|------------|------------|------------|------------|------------|------------|------------|
| <b>RM-RF</b> | 1          |            |            |            |            |            |            |
| <b>SMB</b>   | 0.0142     | 1          |            |            |            |            | 2.99       |
| <b>HML</b>   | -0.0162    | -0.8118    | 1          |            |            |            | 4.58       |
| <b>RMW</b>   | -0.0234    | -0.6845    | 0.8080     | 1          |            |            | 4.01       |
| <b>CMA</b>   | 0.0122     | 0.4796     | -0.6000    | -0.7307    | 1          |            | 2.96       |
| <b>LBR</b>   | 0.0007     | 0.3399     | -0.4697    | -0.5506    | 0.7014     | 1          | 2.00       |

**4.1 | Human Capital Base Six-Factor Model**

Table 5 reports the estimation output of the human capital-based six-factor model. It is observed that the market premium is statistically significant at 1% for all of the portfolios (small and big), findings suggest that market premium has a positive and significant association with excess portfolio returns in the South Africa stock market. Further, we observe that the coefficient for size premium is positive, negative, and significant for all small portfolios (except SHWCL, SHWAL, SHWAH, and SHRAL) at 1 and 5% levels of significance, respectively. The SMB coefficient for big portfolios is negative and statistically significant at 1, 5, and 10% levels, respectively. Such findings reveal that size premium has a positive, negative, and significant association with excess portfolio returns in the South African stock market. Furthermore, we observe a positive and significant coefficient for the value premium across small and large portfolios (SHWCL, BLRCL, BLRCH, and BLRAL). These findings suggest that the value premium has a meaningful influence on excess portfolio returns. In the case of profitability portfolios, we find that small and large portfolios (SLWCL, SLWCH, SLRCL, SLRCH, SLRAL, SLRAH, SHWCL, SHWCH, SHWAL, SHWAH, SHRCL, SHRCH, SHRAL, SHRAL, BLWCL, BLWCH, BLWAL, BLWAH, BHWCL, BHWCH, BLWAL, BLWAH, BLRAH, BHWCL, BHWCH, BHWAL, BHWAH, BHRCL, BHRCH) exhibit a positive and significant relationship with excess portfolio returns. For investment portfolios, we find that the coefficients for small and large portfolios (SLWCL, SLWCH, SLRCL, SLRAL, SHWCL, SHWCH, SHWAL, SHWAH, SHRCH, SHRAL, BLWCL, BLWAL, BLWAH, BLRCL, BLRCH, BHWCL, BHWCH, BHWAH, BHRCL, BHRCH, and BHRAH) exhibit a positive and significant relationship with excess portfolio returns. Similarly, for human capital portfolios, small and large portfolios (SLWCL, BLWCH) also demonstrate a positive and significant association with excess portfolio returns.

Table 5

*Human Capital-Based Six-Factor Model (Full Sample)*

|       | Intercept               | MKT                   | SMB                    | HML                       | RMW                    | CMA                    | LBR                    | Adj-R2 | F-stat      |
|-------|-------------------------|-----------------------|------------------------|---------------------------|------------------------|------------------------|------------------------|--------|-------------|
| SLWCL | -0.005<br>(-1.382)      | 0.995<br>(458.261)*** | -0.942<br>(-11.437)*** | -1.208<br>(-7.428)***     | 1.854<br>(8.995)***    | 2.426<br>(9.042)***    | 8.572<br>(28.868)***   | 0.984  | 35347.83*** |
| SLWCH | -0.027<br>(-0.702)      | 0.995<br>(471.472)*** | -0.943<br>(-11.787)*** | -1.508<br>(-9.541)***     | 1.361<br>(6.794)***    | 9.130<br>(35.006)***   | -8.748<br>(-30.309)*** | 0.984  | 37415.86*** |
| SLWAL | -0.004<br>(-1.342)      | 0.995<br>(564.635)*** | -0.165<br>(-2.483)**   | -0.262<br>(-1.988)**      | -1.127<br>(-6.740)***  | -0.705<br>(-3.239)***  | -0.608<br>(-2.526)**   | 0.989  | 53241.33*** |
| SLWAH | (-0.001)<br>(-2.550)*** | 0.994<br>(407.407)*** | -0.720<br>(-7.783)***  | -0.944<br>(-5.165)***     | -3.197<br>(-13.795)*** | -3.481<br>(-11.538)*** | -1.625<br>(-4.869)***  | 0.979  | 27806.84*** |
| SLRCL | -0.074<br>(-1.746)*     | 0.994<br>(427.167)*** | -0.995<br>(-11.276)*** | -4.164<br>(-23.876)***    | 4.703<br>(21.274)***   | 0.550<br>(1.911)*      | -0.395<br>(-1.240)     | 0.981  | 30506.16*** |
| SLRCH | -0.001<br>(-2.806)***   | 0.994<br>(479.608)*** | -0.535<br>(-6.816)***  | -2.238<br>(-14.416)***    | 2.661<br>(13.525)***   | 0.412<br>(1.611)       | -0.753<br>(-2.657)**   | 0.985  | 38377.79*** |
| SLRAL | 0.004<br>(1.109)        | 0.995<br>(412.400)*** | -0.786<br>(-8.585)***  | -3.903<br>(-21.585)***    | 4.430<br>(19.332)***   | 2.492<br>(8.355)***    | -1.172<br>(-3.553)***  | 0.980  | 28439.57*** |
| SLRAH | -0.006<br>(-1.895)*     | 0.994<br>(535.702)*** | -0.444<br>(-6.312)***  | -1.719<br>(-12.360)***    | 2.578<br>(14.627)***   | 0.054<br>(0.237)       | -0.255<br>(-1.006)     | 0.988  | 47861.86*** |
| SHWCL | -0.007<br>(-1.856)*     | 0.994<br>(454.533)*** | 0.282<br>(3.406)***    | 0.324<br>(1.979)**        | 1.215<br>(5.853)***    | 1.613<br>(5.972)***    | -0.707<br>(-2.367)**   | 0.983  | 34452.39*** |
| SHWCH | -0.036<br>(-0.915)      | 0.994<br>(456.738)*** | 0.086<br>(1.045)       | -0.398<br>(-2.442)**      | 1.297<br>(6.275)***    | 1.289<br>(4.793)***    | -1.134<br>(-3.810)***  | 0.983  | 34791.68*** |
| SHWAL | -0.003<br>(-0.873)      | 0.995<br>(447.804)*** | 0.222<br>(2.643)**     | -0.371<br>(-2.231)**      | 1.963<br>(9.309)***    | 0.747<br>(2.720)**     | -0.931<br>(-3.066)**   | 0.983  | 33437.49*** |
| SHWAH | -0.038<br>(-0.864)      | 0.993<br>(411.263)*** | 0.263<br>(2.875)***    | -0.487<br>(-2.692)**      | 2.393<br>(10.437)***   | 1.251<br>(4.192)***    | -0.459<br>(-1.392)     | 0.980  | 28200.99*** |
| SHRCL | -0.067<br>(-1.783)*     | 0.994<br>(483.068)*** | -0.052<br>(-0.679)     | -0.456<br>(-2.965)***     | 1.138<br>(5.830)***    | -0.160<br>(-0.631)     | -0.658<br>(-2.339)**   | 0.985  | 38909.95*** |
| SHRCH | -0.004<br>(-0.905)      | 0.994<br>(386.195)*** | -0.074<br>(-0.759)     | -1.042<br>(-5.407)***     | 2.428<br>(9.935)***    | 1.345<br>(4.229)***    | 0.309<br>(0.878)       | 0.977  | 24867.74*** |
| SHRAL | -0.074<br>(-1.937)*     | 0.994<br>(472.31)***  | 0.397<br>(4.979)***    | -0.066<br>(-0.421)        | 1.124<br>(5.622)***    | 1.111<br>(4.270)***    | -0.538<br>(-1.868)*    | 0.984  | 37212.63*** |
| SHRAH | -0.002<br>(-0.515)      | 0.995<br>(465.696)*** | -0.130<br>(-1.612)     | -0.480<br>(-3.004)**      | 1.497<br>(7.382)***    | 0.384<br>(1.457)       | 0.139<br>(0.477)       | 0.984  | 36151.6***  |
| BLWCL | -0.00031<br>-0.7977     | 0.995<br>(472.458)*** | -1.044<br>(-13.073)*** | -1.179<br>(-7.471)***     | 1.860<br>(9.299)***    | 0.593<br>(2.280)**     | -3.935<br>(-13.657)*** | 0.984  | 37357.15*** |
| BLWCH | -0.061<br>(-1.650)      | 0.995<br>(487.115)*** | -1.080<br>(-13.944)*** | -1.353<br>(-8.843)***     | 1.505<br>(7.761)***    | -2.535<br>(-10.040)*** | 2.270<br>(8.123)***    | 0.985  | 39621.33*** |
| BLWAL | -0.093<br>(-2.323)**    | 0.994<br>(448.646)*** | -0.1753<br>(-2.085)**  | 0.225<br>(1.358)          | 5.577<br>(26.517)***   | 5.959<br>(21.767)***   | -0.330<br>(-1.089)     | 0.983  | 33712.1***  |
| BLWAH | -0.062<br>(-1.540)      | 0.995<br>(451.697)*** | -0.650<br>(-7.789)***  | -1.223<br>(-7.416)***     | 4.931<br>(23.584)***   | 3.427<br>(12.591)***   | -0.893<br>(-2.964)**   | 0.983  | 34109.1***  |
| BLRCL | -0.096<br>(-2.754)***   | 0.993<br>(516.781)*** | -0.428<br>(-5.881)***  | 0.596<br>(4.143)***       | 0.347<br>(1.901)*      | 2.008<br>(8.456)***    | -1.063<br>(-4.046)***  | 0.987  | 44561.82*** |
| BLRCH | -0.002<br>(-0.664)      | 0.995<br>(472.661)*** | -0.482<br>(-6.042)***  | 1.486<br>(9.416)***       | -0.073<br>(-0.368)     | 0.943<br>(3.625)***    | -0.605<br>(-2.103)**   | 0.984  | 37322.01*** |
| BLRAL | -0.006<br>(-1.848)*     | 0.994<br>(509.218)*** | -0.655<br>(-8.849)***  | 0.845<br>(5.784)***       | -0.557<br>(-3.007)**   | 0.274<br>(1.139)       | -0.203<br>(-0.763)     | 0.986  | 43284.61*** |
| BLRAH | 0.009<br>(0.023)        | 0.995<br>(451.889)*** | -1.002<br>(-12.002)*** | -0.134<br>(-0.813)        | 0.477<br>(2.280)**     | -0.234<br>(-0.862)     | 0.101<br>(0.337)       | 0.983  | 34090.4***  |
| BHWCL | -0.001<br>(-0.454)      | 0.993<br>(483.566)*** | -1.867<br>(-23.960)*** | (-2.531)**<br>(-16.44)*** | 1.274<br>(6.530)***    | 0.823<br>(3.242)***    | -0.562<br>(-2.003)**   | 0.985  | 39079.39*** |
| BHWCH | -0.004<br>(-1.189)      | 0.994<br>(468.962)*** | -1.719<br>(-21.375)*** | -1.852<br>(-11.659)***    | 1.601<br>(7.954)***    | 0.689<br>(2.630)**     | -0.592<br>(-2.042)**   | 0.984  | 36754.79*** |
| BHWAL | -0.003<br>(-0.787)      | 0.994<br>(419.428)*** | -2.258<br>(-25.109)*** | -3.055<br>(-17.200)***    | 1.527<br>(6.786)***    | 0.352<br>(1.201)       | 0.723<br>(2.232)**     | 0.980  | 29430.3***  |
| BHWAH | -0.088<br>(-1.933)*     | 0.993<br>(398.193)*** | -2.391<br>(-25.280)*** | -2.782<br>(-14.892)***    | 1.716<br>(7.249)***    | 1.001<br>(3.249)***    | -1.269<br>(-3.721)**   | 0.978  | 26556.23*** |
| BHRCL | -0.066                  | 0.994                 | -1.857                 | -2.311                    | 2.090                  | 1.882                  | -1.065                 | 0.984  | 36481.67*** |

|              |           |              |              |              |             |            |             |       |             |
|--------------|-----------|--------------|--------------|--------------|-------------|------------|-------------|-------|-------------|
|              | (-1.707)  | (467.142)*** | (-23.009)*** | (-14.499)*** | (10.342)*** | (7.157)*** | (-3.662)*** |       |             |
| <b>BHRCH</b> | -0.023    | 0.994        | -1.526       | -1.184       | 0.913       | 1.675      | -0.777      | 0.985 | 38314.03*** |
|              | (-0.611)  | (478.919)*** | (-19.384)*** | (-7.616)***  | (4.637)***  | (6.530)*** | (-2.739)**  |       |             |
| <b>BHRAL</b> | -0.066    | 0.994        | -1.500       | -2.025       | 1.724       | 0.385      | -0.009      | 0.986 | 43108.45*** |
|              | (-1.854)* | (508.106)*** | (-20.211)*** | (-13.817)*** | (9.281)***  | (1.593)    | (-0.035)    |       |             |
| <b>BHRAH</b> | -0.046    | 0.995        | -1.896       | -2.448       | 1.404       | 1.215      | -0.753      | 0.983 | 34276.71*** |
|              | (-1.156)  | (452.850)*** | (-22.756)*** | (-14.873)*** | (6.733)***  | (4.475)*** | (-2.507)**  |       |             |

Note: The value in parentheses shows the *t* statistics, and \*\*\* \*\* \* shows the level of significance at 10, 5, and 1%, respectively. For portfolios description refer to Table 2.

#### 4.2 | Performance of Human Capital-Based Six Factor Model During COVID-19 Pandemic

Tables 6 and 7 present the performance of the six-factor model during and post-COVID-19 pandemic period. The results indicate that the model's effectiveness in explaining the variability in excess portfolio returns significantly declined during and after the pandemic. Additionally, the market premium consistently shows a positive and significant impact on portfolio returns across both periods (during and post-COVID-19 pandemic). Moreover, the coefficient values of all five factors (SMB, HML, RMW, CMA, and LBR) slightly declined during the pandemic period. Table 8 provides an overview of the model's explanatory power over the sample periods. The findings reveal a substantial reduction in the predictive power of the six-factor model, as evidenced by a significant decrease in the Adjusted R<sup>2</sup> (Adj-R<sup>2</sup>) during and post-pandemic period. These findings suggest that the predictive power of the risk factors for explaining the variability in excess portfolio returns significantly weakened during these periods.

**Table 6**

*Model Performance During COVID-19 Period*

|              | Intercept   | MKT          | SMB          | HML          | RMW         | CMA         | LBR          | Adj-R2 | F-stat       |
|--------------|-------------|--------------|--------------|--------------|-------------|-------------|--------------|--------|--------------|
| <b>SLWCL</b> | -0.005      | 0.995        | -0.942       | -1.208       | 1.854       | 2.426       | 8.572        | 0.984  | 35347.831*** |
|              | (-1.382)    | (458.267)*** | (-11.437)*** | (-7.428)***  | (8.995)***  | (9.042)***  | (28.868)***  |        |              |
| <b>SLWCH</b> | -0.003      | 0.239        | -0.916       | -1.825       | 2.029       | 14.354      | -14.606      | 0.569  | 153.352***   |
|              | (-3.648)*** | (4.976)***   | (-5.636)***  | (-5.606)***  | (5.298)***  | (26.460)*** | (-22.966)*** |        |              |
| <b>SLWAL</b> | -0.001      | 0.326        | 0.117        | 0.593        | -1.084      | -0.197      | -1.657       | 0.106  | 14.761***    |
|              | (-2.848)*** | (8.332)***   | (0.887)      | (2.244)**    | (-3.484)*** | (-0.448)    | (-3.206)***  |        |              |
| <b>SLWAH</b> | -0.003      | 0.369        | -1.111       | -1.025       | -2.721      | -1.495      | -2.326       | 0.124  | 11.237***    |
|              | (-3.032)*** | (5.270)***   | (-4.044)***  | (-1.938)*    | (-4.075)*** | (-1.487)    | (-2.108)**   |        |              |
| <b>SLRCL</b> | 0.000       | 0.028        | -0.916       | -3.519       | 4.666       | 2.025       | -1.882       | 0.217  | 20.989***    |
|              | (0.718)     | (0.388)      | (-4.361)***  | (-8.256)***  | (9.285)***  | (2.989)***  | (-2.266)**   |        |              |
| <b>SLRCH</b> | -0.000      | -0.000       | -0.736       | -2.378       | 3.193       | 2.202       | -2.097       | 0.155  | 14.275***    |
|              | (-0.354)    | (-0.006)     | (-3.899)***  | (-6.213)***  | (7.074)***  | (3.618)***  | (-2.810)**   |        |              |
| <b>SLRAL</b> | 0.001       | 0.005        | -1.082       | -6.994       | 8.423       | 4.456       | -4.814       | 0.340  | 38.116***    |
|              | (0.679)     | (0.058)      | (-3.890)***  | (-12.394)*** | (12.660)*** | (4.968)***  | (-4.376)***  |        |              |
| <b>SLRAH</b> | -0.003      | 0.437        | -0.215       | -3.211       | 4.756       | 1.616       | -0.354       | 0.267  | 27.232***    |
|              | (-3.418)*** | (7.598)***   | (-0.961)     | (-7.404)***  | (8.680)***  | (1.969)**   | (-0.393)     |        |              |
| <b>SHWCL</b> | -0.004      | 0.338        | 0.887        | 1.509        | 1.480       | 2.190       | 0.404        | 0.095  | 8.540***     |
|              | (-3.566)*** | (4.957)***   | (3.332)***   | (2.932)**    | (2.277)**   | (2.250)**   | (0.378)      |        |              |
| <b>SHWCH</b> | 0.000       | 0.191        | 0.040        | -2.278       | 4.506       | 2.435       | -4.325       | 0.135  | 12.233***    |

|              |             |            |              |             |            |             |              |       |           |
|--------------|-------------|------------|--------------|-------------|------------|-------------|--------------|-------|-----------|
|              | (0.129)     | (1.933)*   | (0.141)      | (-3.956)*** | (6.647)*** | (2.657)**   | (-3.859)***  |       |           |
| <b>SHWAL</b> | 0.000       | 0.072      | -0.041       | -1.100      | 3.251      | 2.952       | -3.517       | 0.122 | 10.977*** |
|              | (0.081)     | (0.870)    | (-0.174)     | (-2.262)**  | (5.678)*** | (3.815)***  | (-3.715)***  |       |           |
| <b>SHWAH</b> | 0.000       | -0.052     | 0.829        | -0.081      | 3.464      | 3.271       | -3.924       | 0.134 | 12.161*** |
|              | (0.578)     | (-0.591)   | (3.263)***   | (-0.158)    | (5.715)*** | (3.994)***  | (-3.916)***  |       |           |
| <b>SHRCL</b> | -0.000      | -0.010     | -0.567       | -1.006      | 1.880      | 2.164       | -2.651       | 0.119 | 10.683*** |
|              | (-0.875)    | (-0.149)   | (-2.792)**   | (-2.444)**  | (3.879)*** | (3.304)***  | (-3.308)***  |       |           |
| <b>SHRCH</b> | 0.001       | 0.176      | 0.431        | -0.470      | 2.621      | 2.841       | -2.873       | 0.067 | 6.226***  |
|              | (0.766)     | (2.090)**  | (1.777)*     | (-0.957)    | (4.530)*** | (3.633)***  | (-3.003)***  |       |           |
| <b>SHRAL</b> | 0.000       | 0.026      | 0.287        | -0.440      | 1.242      | 2.616       | -2.529       | 0.055 | 5.222***  |
|              | (0.184)     | (0.391)    | (1.502)      | (-1.138)    | (2.726)**  | (4.247)***  | (-3.357)***  |       |           |
| <b>SHRAH</b> | 0.000       | 0.117      | -0.762       | -1.665      | 2.589      | 1.483       | -0.328       | 0.196 | 18.473*** |
|              | (0.951)     | (2.171)**  | (-4.901)***  | (-5.281)*** | (6.977)*** | (2.956)***  | (-0.535)     |       |           |
| <b>BLWCL</b> | 0.001       | 0.010      | -0.403       | -0.320      | 2.722      | 4.513       | -10.159      | 0.532 | 82.645*** |
|              | (1.043)     | (0.149)    | (-2.062)**   | (-0.810)    | (5.840)**  | (7.162)***  | (-13.181)*** |       |           |
| <b>BLWCH</b> | -0.003      | 0.419      | -0.462       | -0.260      | 0.866      | -2.348      | 2.771        | 0.202 | 19.202*** |
|              | (-4.012)*** | (7.667)*** | (-2.172)**   | (-0.633)    | (1.665)*   | (-3.014)*** | (3.240)***   |       |           |
| <b>BLWAL</b> | 0.001       | 0.058      | -0.696       | -0.231      | 4.456      | 7.026       | -2.314       | 0.405 | 49.897*** |
|              | (1.418)     | (0.779)    | (-3.216)***  | (-0.528)    | (8.634)*** | (10.072)*** | -2.712       |       |           |
| <b>BLWAH</b> | 0.000       | 0.205      | -0.154       | 0.262       | 5.911      | 6.858       | (-5.938)***  | 0.474 | 65.752*** |
|              | (0.252)     | (2.191)**  | (-0.574)     | (0.479)     | (9.193)*** | (7.891)***  | -5.585       |       |           |
| <b>BLRCL</b> | -0.001      | -0.047     | -0.807       | -0.986      | 2.055      | 2.972       | (-3.025)***  | 0.181 | 16.879*** |
|              | (-1.495)    | (-0.646)   | (-3.856)***  | (-2.323)**  | (4.113)*** | (4.402)***  | (-3.663)***  |       |           |
| <b>BLRCH</b> | 0.001       | 0.188      | -0.092       | 3.195       | -0.751     | 3.237       | -4.158       | 0.428 | 54.732*** |
|              | (1.449)     | (2.533)**  | (-0.432)     | (7.367)***  | (-1.472)   | (4.692)***  | (-4.927)***  |       |           |
| <b>BLRAL</b> | -0.002      | 0.015      | -0.927       | 0.118       | 0.184      | 0.906       | -1.074       | 0.198 | 18.745*** |
|              | (-0.020)    | (0.215)    | (-4.533)***  | (0.287)     | (0.378)    | (1.374)     | (-1.332)     |       |           |
| <b>BLRAH</b> | 0.001       | 0.025      | -1.612       | -1.005      | 1.064      | 2.268       | -1.751       | 0.255 | 25.639*** |
|              | (1.507)     | (0.337)    | (-7.282)***  | (-2.245)*** | (2.019)**  | (3.183)***  | (-2.009)**   |       |           |
| <b>BHWCL</b> | 0.001       | 0.065      | -1.151       | -1.441      | 1.440      | 1.212       | -0.533       | 0.222 | 21.553*** |
|              | (1.438)     | (1.249)    | (-7.636)***  | (-4.717)*** | (4.006)*** | (2.495)**   | (-0.897)     |       |           |
| <b>BHWCH</b> | 0.000       | 0.001      | -1.872       | -2.730      | 2.224      | 2.105       | -2.897       | 0.300 | 31.762*** |
|              | (0.387)     | (0.020)    | (-9.466)***  | (-6.812)*** | (4.714)*** | (3.301)***  | (-3.714)***  |       |           |
| <b>BHWAL</b> | 0.000       | 0.012      | -2.710       | -4.283      | 3.129      | 1.739       | -1.870       | 0.348 | 39.354*** |
|              | (0.456)     | (0.153)    | (-11.890)*** | (-9.272)*** | (5.756)*** | (2.367)**   | (-2.081)**   |       |           |
| <b>BHWAH</b> | -0.000      | 0.422      | -3.396       | -4.685      | 3.168      | 4.556       | -6.647       | 0.321 | 35.029*** |
|              | (-0.196)    | (3.545)*** | (-9.935)***  | (-6.763)*** | (3.886)*** | (4.134)***  | (-4.931)***  |       |           |
| <b>BHRCL</b> | 0.000       | 0.099      | -1.228       | -1.789      | 3.219      | 4.181       | -3.531       | 0.288 | 30.023*** |
|              | (0.611)     | (1.353)    | (-5.829)***  | (-4.191)*** | (6.403)*** | (6.154)***  | (-4.249)***  |       |           |
| <b>BHRCH</b> | 0.000       | 0.010      | -1.901       | -2.687      | 2.677      | 1.465       | -0.840       | 0.426 | 54.353*** |
|              | (0.847)     | (0.195)    | (-12.034)*** | (-8.397)*** | (7.106)*** | (2.878)**   | (-1.350)     |       |           |
| <b>BHRAL</b> | -0.000      | -0.027     | -1.631       | -3.018      | 2.690      | 1.545       | -2.152       | 0.259 | 26.177*** |
|              | (-0.460)    | (-0.411)   | (-8.544)***  | (-7.800)*** | (5.907)*** | (2.510)**   | (-2.858)**   |       |           |
| <b>BHRAH</b> | 0.000       | 0.042      | -1.489       | -2.297      | 2.804      | 2.577       | -2.477       | 0.251 | 25.062*** |
|              | (0.157)     | (0.566)    | (-6.989)***  | (-5.318)*** | (5.515)*** | (3.751)***  | (-2.947)***  |       |           |

Note: Refer to Table 5

Table 7

*Model Performance After COVID-19 Period*

|       | Intercept              | MKT                 | SMB                   | HML                   | RMW                   | CMA                   | LBR                    | Adj-R2 | F-stat    |
|-------|------------------------|---------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|--------|-----------|
| SLWCL | -0.031<br>(-6.183)***  | 0.308<br>(2.815)*** | -2.423<br>(-9.059)*** | -1.789<br>(-3.402)*** | -1.646<br>(-2.677)*** | -0.408<br>(-0.395)    | 11.087<br>(9.787)***   | 0.716  | 83.221*** |
| SLWCH | -0.042<br>(-9.626)***  | 0.100<br>(1.074)    | -1.555<br>(-6.827)*** | 0.815<br>(1.819)      | -3.339<br>(-6.379)*** | 12.589<br>(14.299)*** | -12.133<br>(12.580)*** | 0.695  | 75.211*** |
| SLWAL | -0.038<br>(-7.022)***  | 0.173<br>(1.470)    | -0.896<br>(-3.114)*** | -0.076<br>(-0.134)    | -5.188<br>(-7.845)*** | -2.631<br>(-2.367)**  | -1.287<br>(-1.057)     | 0.274  | 13.310*** |
| SLWAH | -0.048<br>(-7.270)***  | -0.028<br>(-0.202)  | -1.213<br>(-3.506)*** | -0.374<br>(-0.550)    | -7.528<br>(-9.464)*** | -6.360<br>(-4.757)*** | 0.721<br>(0.492)       | 0.375  | 20.527*** |
| SLRCL | -0.040<br>(-7.534)***  | 0.139<br>(1.221)    | -1.379<br>(-4.941)*** | -1.862<br>(-3.393)*** | -0.436<br>(-0.679)    | -2.470<br>(-2.289)**  | 2.610<br>(2.208)**     | 0.117  | 5.312***  |
| SLRCH | -0.045<br>(-7.302)***  | 0.024<br>(0.183)    | -1.433<br>(-4.392)*** | -1.830<br>(-2.853)**  | -0.225<br>(-0.300)    | -0.846<br>(-0.671)    | 2.493<br>(1.805)       | 0.107  | 4.899***  |
| SLRAL | -0.031<br>(-4.806)***  | 0.316<br>(2.306)**  | -2.400<br>(-7.174)*** | -3.431<br>(-5.219)*** | -0.117<br>(-0.152)    | 0.767<br>(0.593)      | -1.615<br>(-1.140)     | 0.217  | 10.015*** |
| SLRAH | -0.036<br>(23.242)***  | 0.239<br>(7.126)*** | -0.001<br>(-0.018)    | 0.165<br>(1.023)      | -0.259<br>(-1.374)    | -0.163<br>(-0.515)    | -0.016<br>(-0.047)     | 0.188  | 8.525***  |
| SHWCL | -0.044<br>(-6.808)***  | 0.063<br>(0.453)    | -0.374<br>(-1.099)    | 2.058<br>(3.074)***   | -3.774<br>(-4.811)*** | -0.074<br>(-0.056)    | -0.062<br>(-0.043)     | 0.169  | 7.623***  |
| SHWCH | -0.042<br>(-7.596)***  | 0.075<br>(0.641)    | -0.826<br>(-2.867)*** | 1.037<br>(1.830)      | -3.216<br>(-4.853)*** | -1.112<br>(-0.998)    | 1.137<br>(0.932)       | 0.206  | 9.449***  |
| SHWAL | -0.038<br>(-24.563)*** | 0.232<br>(7.064)*** | -0.014<br>(-0.175)    | 0.103<br>(0.657)      | -0.223<br>(-1.210)    | 0.007<br>(0.023)      | -0.204<br>(-0.602)     | 0.185  | 8.391***  |
| SHWAH | -0.045<br>(-6.417)***  | 0.043<br>(0.288)    | 0.101<br>(0.277)      | 0.766<br>(1.067)      | -0.991<br>(-1.181)    | 0.370<br>(0.262)      | 1.137<br>(0.736)       | 0.010  | 1.330***  |
| SHRCL | -0.036<br>(-7.198)***  | 0.206<br>(1.894)*   | (-0.640)              | 0.241<br>(0.462)      | -2.466<br>(-4.034)*** | -1.497<br>(-1.457)    | 0.444<br>(0.394)       | 0.102  | 4.718***  |
| SHRCH | -0.037<br>(-8.591)***  | 0.223<br>(2.430)**  | -1.025<br>(-4.559)*** | 0.569<br>(1.290)      | -2.554<br>(-4.943)*** | -1.092<br>(-1.257)    | 0.998<br>(1.048)       | 0.277  | 13.491*** |
| SHRAL | -0.041<br>(-7.839)***  | 0.109<br>(0.967)    | -0.549<br>(-1.996)*   | 0.778<br>(1.437)      | -1.948<br>(-3.078)*** | -0.650<br>(-0.611)    | 1.561<br>(1.340)       | 0.122  | 5.542***  |
| SHRAH | -0.039<br>(-7.490)***  | 0.118<br>(1.049)    | -0.815<br>(-2.946)*** | 1.397<br>(2.568)**    | -2.463<br>(-3.871)*** | -0.349<br>(-0.326)    | 1.697<br>(1.448)       | 0.249  | 11.782*** |
| BLWCL | -0.031<br>(-6.183)***  | 0.308<br>(2.815)*** | -2.424<br>(-9.059)*** | -1.789<br>(-3.402)*** | -1.646<br>(-2.677)*** | -0.408<br>(-0.395)    | -4.912<br>(-4.337)***  | 0.423  | 24.870*** |
| BLWCH | -0.042<br>(-9.626)***  | 0.100<br>(1.074)    | -1.555<br>(-6.827)*** | 0.815<br>(1.819)*     | -3.339<br>(-6.375)*** | -3.410<br>(-3.873)*** | 3.866<br>(4.008)***    | 0.475  | 30.504*** |
| BLWAL | -0.049<br>(-7.447)***  | -0.046<br>(-0.328)  | -2.608<br>(-7.496)*** | -1.554<br>(-2.27)**   | 0.996<br>(1.245)      | 3.089<br>(2.298)**    | -0.366<br>(-0.249)     | 0.331  | 17.134*** |
| BLWAH | -0.037<br>(-7.127)***  | 0.191<br>(1.712)*   | 0.498<br>(1.826)*     | 1.104<br>(2.059)**    | 2.287<br>(3.646)***   | 3.918<br>(3.715)***   | -0.199<br>(-0.172)     | 0.147  | 6.607***  |
| BLRCL | -0.039                 | 0.163               | -0.993                | 2.614                 | -4.519                | -0.678                | 0.826                  | 0.488  | 31.997*** |

|              |              |          |              |             |             |           |          |       |           |
|--------------|--------------|----------|--------------|-------------|-------------|-----------|----------|-------|-----------|
|              | (-8.464)***  | (1.637)  | (-4.069)***  | (5.447)***  | (-8.050)*** | (-0.718)  | (0.799)  |       |           |
| <b>BLRCH</b> | -0.036       | 0.209    | -2.354       | 1.012       | -3.069      | -0.488    | 1.180    | 0.547 | 40.351*** |
|              | (-7.089)***  | (1.892)* | (-8.727)***  | (1.910)*    | (-4.950)*** | (-0.468)  | (1.033)  |       |           |
| <b>BLRAL</b> | -0.040       | 0.155    | -0.988       | 2.410       | -4.576      | -0.256    | -0.150   | 0.548 | 40.474*** |
|              | (-10.048)*** | (1.837)* | (-4.780)***  | (5.928)***  | (-9.624)*** | (-0.320)  | (-0.171) |       |           |
| <b>BLRAH</b> | -0.037       | 0.191    | -0.878       | 3.002       | -4.872      | -1.289    | 1.615    | 0.497 | 33.123*** |
|              | (-7.709)***  | (1.852)* | (-3.481)***  | (6.054)***  | (-8.400)*** | (-1.322)  | (1.512)  |       |           |
| <b>BHWCL</b> | -0.039       | 0.150    | -2.548       | -2.090      | -1.166      | -0.785    | 1.324    | 0.311 | 15.727*** |
|              | (-6.854)***  | (1.218)  | (-8.469)***  | (-3.533)*** | (-1.686)    | (-0.675)  | (1.039)  |       |           |
| <b>BHWCH</b> | -0.042       | 0.111    | -2.171       | -0.033      | -2.808      | 0.054     | 1.075    | 0.493 | 32.723*** |
|              | (-9.039)***  | (1.125)  | (-8.939)***  | (-0.069)    | (-5.030)*** | (0.057)   | (1.046)  |       |           |
| <b>BHWAL</b> | -0.037       | 0.188    | -1.749       | 0.310       | -3.176      | -1.672    | 2.115    | 0.392 | 21.999*** |
|              | (-7.575)***  | (1.767)* | (-6.733)***  | (0.608)     | (-5.319)*** | (-1.666)* | (1.924)* |       |           |
| <b>BHWAH</b> | -0.041       | 0.145    | -3.381       | -2.670      | -1.117      | 1.297     | 0.120    | 0.497 | 33.231*** |
|              | (-7.568)***  | (1.263)  | (-12.009)*** | (-4.826)*** | (-1.726)*   | (1.193)   | (0.101)  |       |           |
| <b>BHRCL</b> | -0.041       | 0.131    | -3.423       | -1.968      | -1.937      | -0.411    | 1.555    | 0.547 | 40.328*** |
|              | (-7.909)***  | (1.174)  | (-12.531)*** | (-3.666)*** | (-3.085)*** | (-0.390)  | (1.345)  |       |           |
| <b>BHRCH</b> | -0.045       | 0.040    | -2.206       | -0.348      | -2.855      | -0.571    | 1.285    | 0.400 | 22.730*** |
|              | (-8.325)***  | (0.348)  | (-7.848)***  | (-0.630)    | (-4.418)*** | (-0.526)  | (1.080)  |       |           |
| <b>BHRAL</b> | -0.042       | 0.091    | -1.564       | -0.066      | -2.591      | -1.196    | 1.136    | 0.354 | 18.861*** |
|              | (-9.589)***  | (0.978)  | (-6.868)***  | (-0.149)    | (-4.947)*** | (-1.359)  | (1.178)  |       |           |
| <b>BHRAH</b> | -0.035       | 0.214    | -3.099       | -2.181      | -1.985      | -1.112    | -1.903   | 0.454 | 28.025*** |
|              | (-6.643)***  | (1.866)* | (-11.066)*** | (-3.962)*** | (-3.084)*** | (-1.027)  | (-1.605) |       |           |

Note: Refer to Table 5

**Table 8**

*Model Comparison Based on Adj-R<sup>2</sup>*

| Portfolio | Full Sample | During COVID-19 | After-COVID-19 |
|-----------|-------------|-----------------|----------------|
| SLWCL     | 98.41%      | 98.41%          | 71.67%         |
| SLWCH     | 98.50%      | 56.99%          | 69.54%         |
| SLWAL     | 98.94%      | 10.69%          | 27.47%         |
| SLWAH     | 97.99%      | 12.47%          | 37.53%         |
| SLRCL     | 98.17%      | 21.77%          | 11.72%         |
| SLRCH     | 98.54%      | 15.60%          | 10.71%         |
| SLRAL     | 98.03%      | 34.07%          | 21.72%         |
| SLRAH     | 98.82%      | 26.80%          | 18.80%         |
| SHWCL     | 98.37%      | 9.52%           | 16.93%         |
| SHWCH     | 98.39%      | 13.55%          | 20.63%         |
| SHWAL     | 98.32%      | 12.22%          | 18.53%         |
| SHWAH     | 98.02%      | 13.48%          | 1.01%          |
| SHRCL     | 98.56%      | 11.90%          | 10.27%         |
| SHRCH     | 97.76%      | 6.80%           | 27.76%         |
| SHRAL     | 98.49%      | 5.56%           | 12.26%         |
| SHRAH     | 98.45%      | 19.60%          | 24.91%         |
| BLWCL     | 98.50%      | 53.25%          | 42.35%         |
| BLWCH     | 98.58%      | 20.25%          | 47.58%         |
| BLWAL     | 98.34%      | 40.56%          | 33.17%         |
| BLWAH     | 98.36%      | 47.47%          | 14.71%         |

|       |        |        |        |
|-------|--------|--------|--------|
| BLRCL | 98.74% | 18.14% | 48.82% |
| BLRCH | 98.50% | 42.85% | 54.77% |
| BLRAL | 98.70% | 19.85% | 54.85% |
| BLRAH | 98.35% | 25.58% | 49.71% |
| BHWCL | 98.56% | 22.29% | 31.18% |
| BHWCH | 98.47% | 30.03% | 49.40% |
| BHWAL | 98.10% | 34.86% | 39.25% |
| BHWAH | 97.90% | 32.20% | 49.79% |
| BHRCL | 98.46% | 28.82% | 54.75% |
| BHRCH | 98.53% | 42.68% | 40.07% |
| BHRAL | 98.69% | 26.00% | 35.47% |
| BHRAH | 98.36% | 25.14% | 45.40% |

Notes: Refer to Table 5

Table 9 shows the efficiency of the human-based six-factor model across the sample period (full sample, during and after COVID-19), wherein the full sample the six-factor model remains the most effective for explaining the variability in excess portfolio returns.

**Table 9**

*GRS Test for HC6F Model Efficiency during Crisis Period Based on Absolute Average Alpha*

| Period                 | GRS Wald test | GRS F test |
|------------------------|---------------|------------|
| <b>Full sample</b>     | 1.5525019**   | 1.617235** |
| <b>During COVID-19</b> | 1.5449955*    | 1.084265   |
| <b>Post COVID-19</b>   | 18.566603***  | 0.899979   |

Note: Table 8 \*\*\*\*\* shows the level of significance at 10, 5, and 1%, respectively.

### 4.3 | Robustness Check: Quantile Regression (QR)

As a further robustness check, we estimated the quantile regression to examine the relationship between risk factors and excess portfolio returns across different quantiles. The results, presented in Table 1C (see appendix), were derived by applying the regression in three stages: first for the lower quantile (0.10), then for the median quantile (0.50), and finally for the higher quantile (0.90). Findings reveal that the market premium significantly and positively influences excess portfolio returns, while the size factor significantly and negatively impacts excess portfolio returns. The findings from the quantile regression are in line with earlier results reported in Tables 5, 6, and 7.

## 6 | DISCUSSION

The findings of our study are in line with previous studies. First, the findings support the theoretical notion of [Markowitz \(1952\)](#) who documented that a portfolio with a maximum level of returns and minimum level of variance is considered to be efficient. Following the CAPM of [Sharpe \(1964\)](#), [Lintner \(1965\)](#), and [Mossin \(1966\)](#) we report that market premium significantly priced the time series variability in assets portfolio returns. Furthermore, we also document that FF3FM and FF5FM factors significantly capture the risk exposure in excess portfolio returns. Similarly, [González-Sánchez \(2022\)](#) concluded that portfolios in SDF

models show better goodness of fit, as compared to the factorial model. Furthermore, they document that value and growth stocks perform well in emerging markets. Moreover, compare the efficiency of ZCAPM with traditional assets pricing models (CAPM, FF3FM, C4FM). Using the global sample, the authors find that out of the sample, the ZCAPM outperforms the three and four-factor models in terms of returns dispersion. [Nettayanun \(2023\)](#) reported that the q-factor model performs well during overall and bull markets, while FF6FM performs well during bear markets. [Liu \(2023\)](#) documents that CAPM, FF3FM, and FF5FM significantly explain the variability in portfolio returns during COVID-19. [Sitanggang and Rizkianto \(2024\)](#) reported that market, size, value, and profitability premium have insignificant effects on excess portfolio returns during COVID-19. [Zhou et al. \(2024\)](#) document that COVID-19 has significantly affected the stock return, while the efficiency of the Fama and French models during COVID-19 was decreased to explain the variability in portfolio returns. [Kausar et al. \(2024\)](#) documented that higher IR firms report lower returns as compared to lower IR firms. Similarly, for human capital, the findings of our study are in line with some of the earlier studies. A growing body of literature documents that human capital successfully predicts the time series variability in asset returns ([Prasad et al., 2024](#); [Roy & Shijin, 2018](#)).

## 5 | CONCLUSION

The Modern Portfolio Theory (MPT) proposed by [Markowitz \(1952\)](#) gained widespread attention by emphasizing the relationship between risk and return. Building on this foundation, the seminal works of [Sharpe \(1964\)](#), [Mossin \(1966\)](#), and [Lintner \(1965\)](#) laid the groundwork for asset pricing models. Over the years, the CAPM has been extensively used to study the relationship between risk and return. However, numerous studies have questioned the CAPM's assumptions and its ability to fully explain the variability in asset returns. In response to these limitations, researchers have developed multifactor asset pricing models to enhance predictive accuracy. Despite these advancements, such models often struggle to consistently explain asset return variation across different financial markets.

Therefore, this study examines the applicability and validity of the human capital-based six-factor asset pricing model in the South African stock market. To do this, we take daily data of stock prices, listed on the Johannesburg stock exchange for the period spanning from July 2010 to July 2023. Second, we take companies' financial data for portfolio construction from 2010 to 2022. Third, we construct a set of thirty-two portfolios following [Fama and French \(2015\)](#) methodology. Fourth, to test the efficiency of asset pricing models, we split the sample data into the following sections; full sample, during the COVID-19, and post-COVID-19 period.

After employing the [Fama and MacBeth \(1973\)](#) time series regression, findings indicate that COVID-19 heightened volatility across the South African stock market. In response, most portfolios demonstrated lower returns relative to the increased risk levels. For instance, we observe that among 32 portfolios small portfolios considerably report higher returns along with a high value of risk as compared to big portfolios. Furthermore, we find that market premium significantly explains the time series variability in all sets of portfolios. Where for size, value, profitability, investment, and human capital, we find significant relationships of these factors with excess portfolio returns. Such findings indicate that these factors are significantly priced in South African stock markets. Furthermore, we also report that the factors model performs better in the full sample as

compared to pandemic periods. Additionally, we report that the efficiency of the six-factor model significantly reduces during COVID-19 and after the pandemic period as compared to the full and post-COVID-19 period. Findings, therefore, highlight that the six-factors asset pricing model significantly explains the variability in excess portfolio returns.

Moreover, the varying performance of portfolios, particularly small portfolios, attributed to their distinct risk exposures and sensitivities to market conditions during the COVID-19 pandemic. Small portfolios, such as SLWCL and SLWCH, generally exhibited stronger performance, as explained by their greater responsiveness to factors like MKT and SMB factors, as well as profitability and investment factors. In times of crisis, smaller stocks experience higher volatility, but they also benefit from opportunities for rapid growth, which might explain their higher performance in some cases. In contrast, larger portfolios, such as BLWCL and BHWCL, often demonstrated more stability but weaker performance. Big companies tend to be more established and may have less flexibility in adapting to rapidly changing global conditions. The crisis could have disproportionately affected sectors or industries in these portfolios, especially those with high exposure to global supply chain disruptions and lower profitability.

The findings report some practical implications for investors, policymakers, and model developers. For investors, the declining performance of the six-factor model during and after the COVID-19 pandemic suggests that traditional risk factors may be insufficient to capture the complexities of market behavior in times of crisis. This highlights the need to consider alternative factors, such as macroeconomic uncertainty or behavioral influences, to improve the understanding and prediction of portfolio returns. For policymakers, the reduced explanatory power of the model underscores the heightened uncertainty in financial markets during crises. This calls for measures to enhance market stability, such as providing timely economic support and ensuring transparent communication to reduce market volatility. Lastly, for model developers, these findings emphasize the importance of adapting asset pricing models to account for changing market dynamics. Incorporating additional factors, such as pandemic-specific risks or global economic shocks, could improve the model's predictive accuracy in turbulent periods. Moreover, this study extends the FF5FM with an additional factor which is human capital, and findings report that labor income growth rate significantly prices the variability in asset returns. Further, this study recommends that investors should consider investments in human capital in South African companies.

Moreover, our study opens several avenues for future research based on these findings. First, future studies could employ the Fama and MacBeth two-pass time series regression, which would enhance the robustness and reliability of the results. Additionally, incorporating more anomalies, such as environmental, social, and governance (ESG) factors, could provide a deeper understanding of how these non-traditional determinants affect portfolio performance. Second, including the uncertainty premium as a factor could help capture the influence of economic and financial uncertainty on asset returns. By incorporating these factors, future research could significantly improve the explanatory power of asset pricing models, offering more precise insights for investors and policymakers. Additionally, we employ numerous robustness checks. First, we examine the efficiency of the augmented six-factor model, during a full sample, during the COVID-19 pandemic and post-COVID-19 pandemic. Second, we employ quantile regression for robustness checks. Third, the findings are consistent across these checks providing confidence in the reliability of the findings.

Moreover, diagnostic tests for multicollinearity and model misspecification are performed to ensure the validity of the regression estimates.

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## REFERENCE

- Alessi, L., Ossola, E., & Panzica, R. (2023). When do investors go green? Evidence from a time-varying asset-pricing model. *International Review of Financial Analysis*, 90, 102898.
- Ashraf, B. N. (2020). Economic impact of government interventions during the COVID-19 pandemic: International evidence from financial markets. *Journal of behavioral and experimental finance*, 27, 100371.
- Aygoren, H., & Balkan, E. (2020). The role of efficiency in capital asset pricing: a research on Nasdaq technology sector. *Managerial Finance*, 46(11), 1479-1493.
- Azam, M., & Arif, M. Understanding Mutual Funds Performance with mediation of Human Capital and GDP-Growth in Pakistan Mutual Funds: Demonstration of Structural Equation Model.
- Bai, J., & Zhou, G. (2015). Fama–MacBeth two-pass regressions: Improving risk premia estimates. *Finance Research Letters*, 15, 31-40.
- Banz, R. W. (1981). The relationship between return and market value of common stocks. *Journal of Financial Economics*, 9(1), 3-18.
- Basu, S. (1977). Investment performance of common stocks in relation to their price-earnings ratios: A test of the efficient market hypothesis. *the Journal of Finance*, 32(3), 663-682.
- Bekaert, G., & Harvey, C. R. (2000). Foreign speculators and emerging equity markets. *the Journal of Finance*, 55(2), 565-613.
- Belo, F., Li, J., Lin, X., & Zhao, X. (2017). Labor-force heterogeneity and asset prices: The importance of skilled labor. *The Review of Financial Studies*, 30(10), 3669-3709.

- Bhandari, L. C. (1988). Debt/equity ratio and expected common stock returns: Empirical evidence. *the Journal of Finance*, 43(2), 507-528.
- Breeden, D. T. (1979). An intertemporal asset pricing model with stochastic consumption and investment opportunities. *Journal of Financial Economics*, 7(3), 265-296.
- Brown, S. J., Goetzmann, W., Ibbotson, R. G., & Ross, S. A. (1992). Survivorship bias in performance studies. *The Review of Financial Studies*, 5(4), 553-580.
- Campbell, J. Y. (1996). Understanding risk and return. *Journal of political Economy*, 104(2), 298-345.
- Carhart, M. M. (1997). On persistence in mutual fund performance. *the Journal of Finance*, 52(1), 57-82.
- Carrasco, I., & Hansen, E. (2022). Asset pricing model uncertainty and portfolio choice. *Finance Research Letters*, 45, 102144.
- Charteris, A., Rwisema, M., & Chidede, T.-H. (2018). Asset pricing and momentum: A South African perspective. *Journal of African Business*, 19(1), 62-85.
- Chaudhary, R., Bakhshi, P., & Gupta, H. (2020). Volatility in international stock markets: An empirical study during COVID-19. *Journal of Risk and Financial Management*, 13(9), 208.
- Connor, G., & Korajczyk, R. A. (1989). An intertemporal equilibrium beta pricing model. *The Review of Financial Studies*, 2(3), 373-392.
- Cox, J. C., Ingersoll Jr, J. E., & Ross, S. A. (1985). An intertemporal general equilibrium model of asset prices. *Econometrica: Journal of the Econometric Society*, 363-384.
- Dragomirescu-Gaina, C., & Philippas, D. (2022). Local versus global factors weighing on stock market returns during the COVID-19 pandemic. *Finance Research Letters*, 46, 102270.
- Dwarika, N. (2023). Asset pricing models in South Africa: A comparative of regression analysis and the Bayesian approach. *Data Science in Finance and Economics*, 3(1), 55-75.
- Eachempati, P., Srivastava, P. R., & Panigrahi, P. K. (2021). Sentiment analysis of COVID-19 pandemic on the stock market. *American Business Review*, 24(1), 8.
- Elton, E. J., Gruber, M. J., & Blake, C. R. (1996a). The persistence of risk-adjusted mutual fund performance. *Journal of business*, 133-157.
- Elton, E. J., Gruber, M. J., & Blake, C. R. (1996b). Survivor bias and mutual fund performance. *The Review of Financial Studies*, 9(4), 1097-1120.
- Elton, E. J., Gruber, M. J., Das, S., & Hlavka, M. (1993). Efficiency with costly information: A reinterpretation of evidence from managed portfolios. *The Review of Financial Studies*, 6(1), 1-22.
- Fama, E. F., & French, K. R. (1992). The cross-section of expected stock returns. *the Journal of Finance*, 47(2), 427-465.
- Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, 33(1), 3-56.
- Fama, E. F., & French, K. R. (2015). A five-factor asset pricing model. *Journal of Financial Economics*, 116(1), 1-22.
- Fama, E. F., & French, K. R. (2018). Choosing factors. *Journal of Financial Economics*, 128(2), 234-252.
- Fama, E. F., & MacBeth, J. D. (1973). Risk, return, and equilibrium: Empirical tests. *Journal of political Economy*, 81(3), 607-636.
- Floresia, C., & Susanti, N. (2020). How does the six-factor model do in explaining the relationship between return and risk on the Indonesia stock exchange? *International Journal of Research in Business and Social Science*, 9(7), 93-107.
- Friend, I., Westerfield, R., & Granito, M. (1978). New evidence on the capital asset pricing model. *the Journal of Finance*, 33(3), 903-917.
- Gibbons, M. R., Ross, S. A., & Shanken, J. (1989). A test of the efficiency of a given portfolio. *Econometrica: Journal of the Econometric Society*, 1121-1152.
- Goetzmann, W. N., & Ibbotson, R. G. (1994). Do winners repeat? *Journal of portfolio Management*, 20(2), 9-18.
- González-Sánchez, M. (2022). Asset pricing models in emerging markets: Factorial approaches vs. information stochastic discount factor. *Finance Research Letters*, 46, 102394.
- Grinblatt, M., & Titman, S. (1992). The persistence of mutual fund performance. *the Journal of Finance*, 47(5), 1977-1984.
- Harvey, C. R., Liu, Y., & Zhu, H. (2016). ... and the cross-section of expected returns. *The Review of Financial Studies*, 29(1), 5-68.
- Horváth, D., & Wang, Y.-L. (2021). The examination of Fama-French model during the COVID-19. *Finance Research Letters*, 41, 101848.
- Hou, K., Xue, C., & Zhang, L. (2020). Replicating anomalies. *The Review of Financial Studies*, 33(5), 2019-2133.
- Jagannathan, R., & Wang, Z. (1996). The conditional CAPM and the cross-section of expected returns. *the Journal of Finance*, 51(1), 3-53.
- Jegadeesh, N., & Titman, S. (1993). Returns to buying winners and selling losers: Implications for stock market efficiency. *the Journal of Finance*, 48(1), 65-91.
- Kan, R., Wang, X., & Zheng, X. (2024). In-sample and out-of-sample Sharpe ratios of multi-factor asset pricing models. *Journal of Financial Economics*, 155, 103837.

- Kausar, S., Shah, S. Z. A., & Rashid, A. (2024). Determinants of idiosyncratic risk: evidence from BRICS countries. *Asia-Pacific Journal of Business Administration*, 16(3), 553-574.
- Khan, N., Zada, H., Ahmed, S., Shah, F. A., & Jan, S. (2023). Human capital-based four-factor asset pricing model: An empirical study from Pakistan. *Heliyon*, 9(5).
- Khan, N., Zada, H., & Yousaf, I. (2022). Does premium exist in the stock market for labor income growth rate? A six-factor-asset-pricing model: Evidence from Pakistan. *Annals of Financial Economics*, 17(03), 2250017.
- Kim, D., Kim, T. S., & Min, B.-K. (2011). Future labor income growth and the cross-section of equity returns. *Journal of Banking & Finance*, 35(1), 67-81.
- Kolari, J. W., Huang, J. Z., Butt, H. A., & Liao, H. (2022). International tests of the ZCAPM asset pricing model. *Journal of International Financial Markets, Institutions and Money*, 79, 101607.
- Kuehn, L. A., Simutin, M., & Wang, J. J. (2017). A labor capital asset pricing model. *the Journal of Finance*, 72(5), 2131-2178.
- Lettau, M., Ludvigson, S. C., & Ma, S. (2019). Capital share risk in US asset pricing. *the Journal of Finance*, 74(4), 1753-1792.
- Linnainmaa, J. T., & Roberts, M. R. (2018). The history of the cross-section of stock returns. *The Review of Financial Studies*, 31(7), 2606-2649.
- Lintner, J. (1965). Security prices, risk, and maximal gains from diversification. *the Journal of Finance*, 20(4), 587-615.
- Liu, Y. (2023). A Comparison of Three Asset-pricing Models During COVID-19. *Highlights in Business, Economics and Management*, Volume 7(3rd International Conference on Financial Economics and Investment Management (FEIM 2023)), 144-149. <https://doi.org/https://doi.org/10.54097/hbem.v7i.6935>
- Lucas Jr, R. E. (1978). Asset prices in an exchange economy. *Econometrica: Journal of the Econometric Society*, 1429-1445.
- Maiti, M., & Balakrishnan, A. (2018). Is human capital the sixth factor? *Journal of Economic Studies*, 45(4), 710-737.
- Maiti, M., & Vuković, D. (2020). Role of human assets in measuring firm performance and its implication for firm valuation. *Journal of Economic Structures*, 9(1), 47.
- Markowitz, H. (1952). Portfolio selection. *the Journal of Finance*, 7 (1), 77-91. In: DOI.
- Mayers, D. (1972). Nonmarketable assets and capital market equilibrium under uncertainty. *Studies in the theory of capital markets*, 1, 223-248.
- Merton, R. C. (1969). Lifetime portfolio selection under uncertainty: The continuous-time case. *The review of Economics and Statistics*, 247-257.
- Merton, R. C. (1972). An analytic derivation of the efficient portfolio frontier. *Journal of Financial and Quantitative Analysis*, 7(4), 1851-1872.
- Mkhize, Z. (2020). *FIRST CASE OF COVID-19 CORONAVIRUS REPORTED IN SA*. National Institute for Communicable Diseases. <https://www.nicd.ac.za/first-case-of-covid-19-coronavirus-reported-in-sa/>
- Mohanasundaram, S., & Kasilingam, R. (2024). The sustainability factor in asset pricing: Empirical evidence from the Indian market. *The Quarterly Review of Economics and Finance*, 94, 206-213.
- Molele, M. H., & Mukuddem-Petersen, J. (2020). Emerging market currency risk exposure: evidence from South Africa. *The Journal of Risk Finance*, 21(2), 159-179.
- Mossin, J. (1966). Equilibrium in a capital asset market. *Econometrica: Journal of the Econometric Society*, 768-783.
- Mpoha, S., & Bonga-Bonga, L. (2020). Assessing the extent of exchange rate risk pricing in equity markets: emerging versus developed economies.
- Nettayanun, S. (2023). Asset pricing in bull and bear markets. *Journal of International Financial Markets, Institutions and Money*, 83, 101734.
- Peerbhai, F., & Strydom, B. (2018). Testing the International capital asset pricing model's relevance for South Africa. *Journal of Contemporary Management*, 15(1), 525-550.
- Prasad, S. S., Verma, A., Bakhshi, P., & Prasad, S. (2024). Superiority of six factor model in Indian stock market. *Cogent Economics & Finance*, 12(1), 2411567.
- Ren, T., Wang, H., & Zhang, Y. (2023). Evaluation of CAPM and Three-factor Model During the COVID-19: Evidence from Chinese Catering Industry. 2023 2nd International Conference on Economics, Smart Finance and Contemporary Trade (ESFCT 2023),
- Roll, R. (1977). A critique of the asset pricing theory's tests Part I: On past and potential testability of the theory. *Journal of Financial Economics*, 4(2), 129-176.
- Rosenberg, B., Reid, K., & Lanstein, R. (1985). Persuasive evidence of market inefficiency. *Journal of portfolio Management*, 11(3), 9-16.
- Ross, S. (1976). The arbitrage pricing theory. *Journal of Economic Theory*, 13(3), 341-360.
- Roy, R., & Shijin, S. (2018). A six-factor asset pricing model. *Borsa istanbul review*, 18(3), 205-217.

- Samuelson, P. A. (1975). Lifetime portfolio selection by dynamic stochastic programming. *Stochastic optimization models in finance*, 517-524.
- Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *the Journal of Finance*, 19(3), 425-442.
- Sitanggang, O. M., & Rizkianto, E. (2024). Empirical Testing of Fama-French Asset Pricing Model in Indonesia Stock Exchange During Covid-19 Pandemic. *Dynamic Management Journal*, 8(1), 155-177.
- Son, B., & Lee, J. (2022). Graph-based multi-factor asset pricing model. *Finance Research Letters*, 44, 102032.
- Steyn, J. P., & Theart, L. (2019). Are South African equity investors rewarded for taking on more risk? *Journal of Economic and Financial Sciences*, 12(1), 1-10.
- Takyi, P. O., & Bentum-Ennin, I. (2021). The impact of COVID-19 on stock market performance in Africa: A Bayesian structural time series approach. *Journal of Economics and Business*, 115, 105968.
- Tambosi Filho, E., Viera, A. M., & Garcia, F. G. (2022). Testing conditional CAPM with the inclusion of human capital. *Academy of Accounting and Financial Studies Journal*, 26, 1-8.
- Thalassinos, E., Khan, N., Ahmed, S., Zada, H., & Ihsan, A. (2023). A Comparison of Competing Asset Pricing Models: Empirical Evidence from Pakistan. *Risks*, 11(4), 65.
- Uddin, M., Chowdhury, A., Anderson, K., & Chaudhuri, K. (2021). The effect of COVID-19 pandemic on global stock market volatility: Can economic strength help to manage the uncertainty? *Journal of Business Research*, 128, 31.
- Wermers, R. (1997). *Momentum investment strategies of mutual funds, performance persistence, and survivorship bias*.
- Zada, H., Hassan, A., & Wong, W.-K. (2021). Do jumps matter in both equity market returns and integrated volatility: a comparison of Asian developed and emerging markets. *Economies*, 9(2), 92.
- Zada, H., Rehman, M. U., & Khwaja, M. G. (2018). Application of Fama and French five factor model of asset pricing: Evidence from Pakistan stock market. *International Journal of Economics, Management and Accounting*, 26(1), 1-23.
- Zhou, X., Lin, Y., & Zhong, J. (2024). A six-factor asset pricing model of China's stock market from the perspective of institutional investors' dominance. *International Journal of Emerging Markets*, 19(7), 1940-1958.

## Appendix

### Appendix 1A Heteroskedasticity Tests

|                      | Statistic | P     |
|----------------------|-----------|-------|
| <b>Breusch-Pagan</b> | 5.16      | 0.397 |

### Appendix 1B

#### Durbin–Watson Test for Autocorrelation

| Autocorrelation | DW Statistic | P     |
|-----------------|--------------|-------|
| -0.044          | 2.09         | 0.004 |

### Appendix 1C Ramsey RESET Test

Specification:  $ER_i \sim MKT\ HML\ CMA\ LBR\ SMB\ RMW\ C$

Omitted Variables: Squares of fitted values

|                  | Value    | df        | Probability |
|------------------|----------|-----------|-------------|
| t-statistic      | 1.493427 | 3414      | 0.1354      |
| F-statistic      | 2.230325 | (1, 3414) | 0.1354      |
| Likelihood ratio | 2.234821 | 1         | 0.1349      |

## Appendix 1D

### Robustness Check-Quantile Regression

| 0.1 (Lower Quantiles) |         |            |         |              |         |             |         |             |
|-----------------------|---------|------------|---------|--------------|---------|-------------|---------|-------------|
|                       | SLWCL   | T-Stat     | SLWCH   | T-Stat       | BLWCL   | T-Stat      | BLWCH   | T-Stat      |
| <b>C</b>              | -0.0202 | -28.925*** | -0.0180 | -27.98004*** | -0.0192 | -30.0118*** | -0.0179 | -28.8382*** |
| <b>MKT</b>            | 0.0058  | 1.7970*    | 0.0005  | 0.235142     | 0.0088  | 4.8061***   | 0.0020  | 1.0501      |
| <b>SMB</b>            | -1.1416 | -7.9822*** | -1.3004 | -9.2064***   | -1.1917 | -11.4546*** | -1.2635 | -10.5963*** |
| <b>HML</b>            | -1.4051 | -5.1567*** | -1.5470 | -6.1869***   | -1.3241 | -7.4501***  | -1.1464 | -4.2960***  |
| <b>RMW</b>            | 1.8733  | 5.4490***  | 1.0661  | 3.5458***    | 1.9204  | 5.9680***   | 1.6003  | 5.5819***   |
| <b>CMA</b>            | 1.6616  | 2.9901***  | 9.1579  | 27.195***    | -0.5108 | -1.2323     | -2.3420 | -5.5230***  |
| <b>LBR</b>            | 8.8828  | 16.1996*** | -8.568  | -16.79205*** | -2.8435 | -10.1066*** | 2.1816  | 4.7052***   |

  

| 0.5 (Median Quantile) |         |            |         |             |         |            |         |            |
|-----------------------|---------|------------|---------|-------------|---------|------------|---------|------------|
|                       | SLWCL   | T-Stat     | SLWCH   | T-Stat      | BLWCL   | T-Stat     | BLWCH   | T-Stat     |
| <b>C</b>              | 0.0003  | 0.0867     | 0.0003  | 1.6388*     | 0.0004  | 0.1832     | 0.0001  | 0.4407     |
| <b>MKT</b>            | 0.0004  | 0.28178    | 0.0002  | 0.2317      | 0.0001  | 0.0710     | 0.0008  | 0.5988     |
| <b>SMB</b>            | -0.9788 | -12.681*** | -1.0376 | -11.9193*** | -1.1855 | -15.479*** | -1.1889 | -13.916*** |
| <b>HML</b>            | -1.0211 | -6.2211*** | -1.4774 | -10.3846*** | -1.0851 | -6.8857*** | -1.3591 | -8.9884*** |
| <b>RMW</b>            | 1.2145  | 4.7434***  | 1.5347  | 6.1930***   | 1.0746  | 4.9140***  | 1.4431  | 6.0209***  |
| <b>CMA</b>            | 1.3700  | 3.8235***  | 8.7099  | 20.826***   | 0.1142  | 0.4110     | -2.896  | -6.9973*** |
| <b>LBR</b>            | 10.074  | 21.1894*** | -7.9922 | -22.745***  | -3.0381 | -8.5918*** | 3.177   | 6.5522***  |

| 0.9 (Higher Quantiles) |         |            |         |             |         |             |         |             |
|------------------------|---------|------------|---------|-------------|---------|-------------|---------|-------------|
|                        | SLWCL   | T-Stat     | SLWCH   | T-Stat      | BLWCL   | T-Stat      | BLWCH   | T-Stat      |
| <b>C</b>               | 0.0210  | 28.120***  | 0.0182  | 29.634***   | 0.0207  | 27.751***   | 0.0175  | 29.559***   |
| <b>MKT</b>             | 0.0064  | 2.4808***  | 0.0001  | 0.0554      | 0.0102  | 5.2248***   | 0.0012  | 0.4854      |
| <b>SMB</b>             | -1.2817 | -8.6814*** | -1.2826 | -15.288***  | -1.4700 | -10.7034*** | -1.3487 | -13.7173*** |
| <b>HML</b>             | -1.7956 | -6.1569*** | -1.7421 | -10.1324*** | -1.5622 | -6.5348***  | -1.6186 | -6.36251*** |
| <b>RMW</b>             | 1.9289  | 5.9638***  | 1.022   | 3.9640***   | 1.6641  | 5.4832***   | 1.5141  | 4.9745***   |
| <b>CMA</b>             | 3.0076  | 5.4884***  | 9.5601  | 29.0552***  | 0.6060  | 1.6411*     | -2.4094 | -6.4269***  |
| <b>LBR</b>             | 7.7901  | 12.611***  | -9.254  | -34.6203*** | -4.2667 | -7.8817***  | 2.4497  | 5.4864***   |

## Appendix 1E

### *Small and Big Portfolio (Group Comparison)*

| Group    | Cohen's d |
|----------|-----------|
| Group 1  | 0.0029    |
| Group 2  | 0.0058    |
| Group 3  | 0.0088    |
| Group 4  | 0.0034    |
| Group 5  | 0.005     |
| Group 6  | 0.0028    |
| Group 7  | 0.0028    |
| Group 8  | 0.0013    |
| Group 9  | 0.0013    |
| Group 10 | 0.001     |
| Group 11 | 0.004     |
| Group 12 | 0.003     |
| Group 13 | 0.0093    |
| Group 14 | 0.0099    |
| Group 15 | 0.004     |
| Group 16 | 0.0014    |

A Cohen's value of 0.2 or less indicate a small effect Medium effect, while a value between 0.5 and 0.8 indicate a medium effect and a value of 0.8 or more indicate a large effect.