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RESEARCH ARTICLE

Understanding Mutual Funds Performance with mediation of Human Capital and GDP-Growth in Pakistan Mutual Funds: Demonstration of Structural Equation Model

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Abstract
This work sheds light on the complex interplay between mutual fund performance, using human capital, and GDP growth as mediating variables in Pakistan through the lens of Structural Equation Modeling. By employing this sophisticated analytical approach, the findings uncovered nuanced nexus that traditional methods might have overlooked. The findings underscore the critical role of GDP-Growth and human capital as a mediating factor, suggesting that investments in mutual funds could have far-reaching effects on the financial performance on individual investors. Moreover, the demonstrated link between GDP-growth and mutual fund outcomes highlights the intricate web of economic factors influencing investment landscapes. Our findings thus reveal that the impact of the market factor and GDP growth on portfolio returns shows statistically significant estimates both mediation models. However, size-factor shows two portfolios significant while two portfolios insignificant results using both mediating variables. However, the value factor shows highly significant in both mediating models but reveal insignificant nexus with HC-Growth as mediating variable using only FF3FM. Moreover, momentum factor shows insignificant results for both mediating models. As Pakistan continues to develop its mutual fund market, policymakers and fund managers alike would do well to consider these interconnections in their decision-making processes.

Keywords: Mediation of GDP-Growth and Human-Capital; Multifactor asset pricing models; Structural Equation Modelling; Mutual Funds of Pakistan

Introduction

In financial markets and a country's economy, mutual funds industry (MFI) has always played an ambivalent role. Hence, it is the most trusted and reliable source for individual investors who are hyperconscious about their investments in the economy closed to defaulters like Pakistan. However, MFI in Pakistan has shown progressive growth since their inception in 1962, as there are 323 open-ended registered units in Mutual Funds of Pakistan (Iraj, Gul, & Khan, 2020). In addition, academics are increasingly scrutinizing the performance of mutual funds using various methods to measure real performance compared to equity markets, which support higher returns while bearing higher risk by charging specific management fee. Mutual fund managers mitigate or diversify the

risk by using various investment and portfolio techniques to cope with the investments of individual investors with limited funds or pensions. In evaluating the performance of mutual funds, the asset pricing models have also played an ambivalent role in the decision-making process of mutual funds and, in particular, portfolio investment around the world. Therefore, the selection of the appropriate factor for pre-investment decision making is ambivalent for investors and for an academic or researcher in a model in finance. According to literature, the empirical performance of mutual funds is thoroughly investigated based on various techniques such as Sharpe Ratio, Information Ratio, Treynor ratio and Jensen alpha (Afridi, et al., 2020; Tripathy, 2017) as well as on various asset pricing models such as Fama and French (2015) five-factor model (Iraj, Gul, & Khan, 2020; Mateus, Mateus, & Todorovic, 2019; Sha, & Gao, 2019). In the performance evaluation of MFI, various studies employed the most sophisticated advanced measurement techniques and models but besides ignore the mediating effect of GDP-growth which significantly influence the relationship between risk-factors and portfolio returns. Similarly, human-capital which also significantly impact the consumption and saving patterns of individual investors in the lower level investors who are the major contributors of mutual funds. Both the determinants mediating micro and macro aspects of the nexus between risk-premiums and portfolio returns which are ignored in the literature as mediating variables. There is a plethora of studies that have empirically evaluated the performance of mutual funds using various traditional and sophisticated techniques such as Asset Pricing Models (APMs) using different datasets from emerging and developed economies worldwide. Scholars used different unconditional or traditional APMs and observed different estimates for Pakistan's mutual fund industry, but there is no study that used mediation of human capital and GDP growth as mediating variables with standard APMs. To fill the gap, we employ mediating effect of both determinants in this study, intends to empirically investigate various APMs including CAPM, FF3FM and C4FM. Furthermore, this paper contributes to the body of knowledge in three directions. With the best of our knowledge, no one investigated the performance of mutual funds using Structural Equation Modeling (SEM) with the mediation of GDP-growth and Income-growth (Human-capital) using CAPM, Fama and French (1993) three-factor model (FF3FM) and Carhart (1997) four-factor model (C4FM) in developing economy such as Pakistan. Azam (2022a) examines the performance of Pakistan Stock Exchange (PSX) through CAPM using SEM with GDP-growth as mediating variable and reveal statistically significant nexus between market risk premium and portfolio stock returns and suggests investigating further studies using more advanced and sophisticated models for further robustness in estimation. More recently, Azam (2022b) examines the selectivity skills and market-timing ability performance of mutual funds of Pakistan using various augmented asset pricing model in which the human-capital (income-growth) also assumed to be the more efficient determinant as sixth factor augmented with CAPM, FF3FM and C4FM but surprisingly the findings reveal statistically insignificant nexus with portfolio mutual funds returns as independent variable in Pakistan.

This study combines both the studies major determinants such as GDP-growth and Income-growth while using as mediating variables by employing SEM to examine CAPM, FF3FM and C4FM in mutual funds of Pakistan. Furthermore, we also employ the Gibbons, Ross and Shanken (1989) F-test for examining the valid model for the market. There are inconclusive findings concerning the relationship of human-capital and funds returns such as Azam (2022b) though using multivariate approach may produce more valid justification in terms of statistical significance, hence we investigate and compare the GDP-growth and Income-growth (human-capital) as mediating variables using CAPM, FF3FM and C4FM with a view to examining robustness in estimation. Although, the Income-growth revealed insignificant nexus with funds returns as independent variable (Azam, 2022b) though, it is unobservable as mediating variable in previous literature therefore, this study intends to examine novel aspect of study for further investigation in the context of Pakistan. After reviewing the relevant literature, we construct the following hypotheses to be tested in Pakistani mutual funds:

H_1: Human capital mediates the nexus between market, size, value premium and momentum and portfolio fund returns.
H_2: GDP growth mediates the nexus between market, size, value premium and momentum and portfolio fund returns.
The rest of the study is further categorized as part two deals with literature review, part three data and methodology, then empirical analysis and finally the conclusion of the study.

Literature Review

There is a burgeoning literature on the relationship between risk premia and portfolio returns worldwide, estimating direct or indirect relationships in the discipline of mutual fund performance. To understand both aspects of the study, the literature of the study can be easily divided into two groups as the performance of mutual funds through the application of multiple APMs globally. The second part of the literature uses income growth (human capital) and GDP growth as a factor or determinant in mutual funds in both developed and emerging economies worldwide. However, both aspects consolidate the theoretical background of the study as follows:

Asset Pricing Models (Factors and portfolio returns nexus) Performance

The most investigated research area in finance is asset pricing models, which contribute to investors, portfolio managers and academics a new approach of hyperconsciousness in allocating and constructing portfolios in dynamic and volatile markets. Prior to conducting novel studies, previous studies help to understand the background of the area and methodologies employed in the area is an important process. The APMs discipline began with the independent contribution of Markowitz (1952), Sharpe (1964), Treynor (1961), Lintner (1965), Mossin (1966), single-factor model (Capital Asset Pricing Model-CAPM). This school of thought explored the relationship between market risk premium and cross-sectional stock returns, which has been thoroughly investigated and is still helpful for investors and portfolio managers to calculate cost of capital and asset valuation. Researchers continue to demonstrate the significant contribution of the CAPM to the body of knowledge, such as Azam (2022). Later, various researchers added a plethora of anomalies based on firm characteristics to the single factor model, such as price-to-earnings (P|E) ratios by Basu, (1977), Liu (2006) two-factor model of liquidity, Fama and French (1993) three-factor model of size and value, Carhart (1997) four-factor model of momentum, Fama and French (2015) five-factor model of profitability and investment, and Azam (2022c) six-factor model of Tobin Q. However, Carhart (1997) pioneered the study of several APMs in the mutual fund industry and introduced the momentum and contrarian factors to the discipline of APMs, adding another sophisticated theory to the mutual fund literature for analysing the performance of the industry. Afridi, Rehman, Mubashir and Zeeshan (2020) used Pakistani fund data to compare the performance of Islamic and conventional mutual funds. They analyzed data of 40 Islamic and 45 conventional funds from 2011 to 2016. Sharpe ratio, Treynor ratio and Jensen alpha are used in conjunction with the TM model to examine the funds. The results showed that conventional funds outperform Islamic funds based on Sharpe ratio, while Islamic funds outperform conventional funds based on Jensen alpha and Treynor ratio. They concluded that the selection and timing skills of conventional fund managers are superior to those of Islamic fund managers.

Human-Capital and GDP-Growth with portfolio returns Performance

Recently, Evans, Prado, Rizzo and Zambrana (2024) examined the US mutual funds, analyzing the political diverse aspect of the team performance (human-capital) using time span from January 1992 through December 2020. The findings reveal that the diversified political convictions generate higher yields than homogenous teams

in the US market. Similarly, Zhang et al. (2024) examine the impact of human-capital on fund performance with the moderating variable of investment ambition. The results suggest that leading investment and entrepreneurial experience is associated with better market performance. However, Khan, Zada and Yousaf (2022); Maiti, and Balakrishnan (2018) use human capital (HC) as a risk factor and find it to be a significant determinant in explaining stock returns. HC is also a significant determinant of economic development (Lim, et al., 2018). In addition, GDP growth measures real economic growth and contributes to the development of an economy (Jung, 1986). Both income growth and GDP growth determine the micro-level performance and macro-level performance of an economic progress, thus mediating the individual investors from the micro perspective and the economic progress from the macro perspective. However, the asset pricing models focus on individual firm as well as the market factor similar to micro and macro perspective, it must be considered as a mediating determinant in the model. However, Azam (2022b) examined Human-capital adjusted numerous APMs in Pakistani MFI using 120 open ended units' data from Jan-2005 to Dec-2020. He used Human-capital (Income-growth) as independent variable and revealed insignificant results using various asset pricing models (APMs) through OLS regression approach. The study included an alleged factor for novelty whereas using a macroeconomic determinant may not directly impact the fund returns therefore a novel approach is employ in this study to utilize it as mediating variable and comparatively investigate with another macroeconomic determinant like GDP-growth using new approach of SEM in mutual funds returns. The findings reveal that income-capital demonstrates insignificant premium in all the models. As, Azam (2021) observe highly statistically significant findings of GDP-growth as mediating variable, this study examines both the growth macroeconomic factors as mediating variables with CAPM, FF3FM and C4FM for further novel contribution to the body of knowledge. The SEM is a contemporary technique which is widely used in management sciences studies investigating the mediation between indigenous and exogenous determinants where later is equivalent to independent variable. It scrutinizes multivariate nexus by establishing direct and indirect relationship in an established causal association (Fan, et al., 2016). It is the amalgamation of factor analysis and multiple regression techniques in single analysis (Baillie, Calonaci, & Kapetanios, 2022). Therefore, researchers prefer this technique to be investigated in management studies. The study uses Structural Equation Modeling (SEM) with mediating variable of GDP-Growth and Income-Growth to scrutinize the robust estimates using CAPM, Fama and French (1993) three-factor model (FF-3FM) and Carhart (1997) four-factor model (C-4FM) where the data of emerging markets contain a lot of noise and outliers.

Methodology

The study works under the domain of quantitative and positivist paradigm. Though, there are 323 open-ended registered units in Mutual Funds of Pakistan (Iraj, Gul, & Khan, 2020). This study conducts an analysis on 180 open-ended mutual funds as sample from Pakistani mutual funds using a time span of 246 months between January 2004 and June 2024. The data has been obtained from the official website of Mutual Funds Association of Pakistan (MUFAP) for the purpose of calculating the market risk premium, while the PSX-100 index from the official website of Pakistan Stock Exchange and the six-month treasury bill rate from the official website of State Bank of Pakistan have been used for the same purpose.

Construction of Portfolios

The primary objective of portfolio design is to eliminate volatility or reduce risk (Urooj & Aamir, 2016). Therefore, this study constructs four equally weighted portfolios based on Size-B|M ratios by following Azam (2021). To introduce novelty, this paper first constructs six portfolios by following Fama & French (1993; 2015), but these portfolios are aggregated as an average of small and large size funds such as (SH + SM + SL/3) and (BH + BM + BL/3), respectively. Similarly, funds with a high B|M ratio and funds with a low B|M ratio are

constructed as (SH + BH/2) and (SL + BL/2), respectively, to form four equal-weighted portfolios called small size fund portfolio, large size fund portfolio, value fund portfolio and growth fund portfolio, symbolized as (sRi, bRi, vRi and gRi), respectively. For a better understanding, the following figure shows the mechanism of portfolio construction:

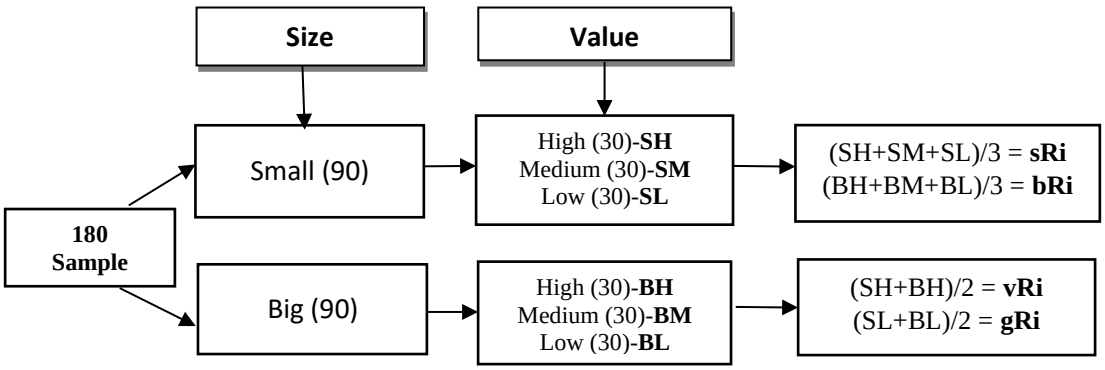

Figure 1: Portfolio Construction

Source: Author's construction

Variable measurement

The market risk premium, which is regarded as an independent variable, is measured in accordance with the methodology set forth by Fama and French (1993). It is assumed that the risk-free rate can be calculated using the yield on six-month Treasury bills, which are then deducted from the market returns (using the PSX 100-Index as a proxy) to obtain the excess market returns (Rm-Rf). The size (SMB) anomaly is calculated by multiplying the outstanding shares of an individual fund by its market price. The value anomaly (HML) is calculated by multiplying the book value (BV) of the fund by the market value (MV) of the fund. Similarly, the momentum anomaly (WML) is calculated as the mean returns of winning funds over the past year, minus the mean returns of losing funds over the same period.

Model Specification

The following econometric models are used in this study to analyse the performance of different risk factors in relation to the mutual returns of the portfolios. In addition, GDP growth and human capital (income-growth) as mediating determinants are shown in the graph to understand the mechanism of analysis of the study.

The Capital Asset Pricing Model (CAPM) Specification:

$$R_{i,t} - R_f = \alpha_i + \beta_{i,M}(R_{m,t} - R_f) + \varepsilon_{i,t} \quad (1)$$

The left-hand side refers portfolio excess returns (portfolio-returns minus risk-free rates) and the market-factor is the outcome of excess-market returns (market-returns minus risk-free rates) also known as market risk premium. However, beta-m refers to market risk coefficient.

The Fama and French (1993) three-factor model (FF3FM) Specification

$$R_{i,t} - R_f = \alpha_i + \beta_{i,M}(R_{m,t} - R_f) + \beta_{i,S}(SMB_t) + \beta_{i,V}(HML_t) + \varepsilon_{i,t} \quad (2)$$

The size-factor is the outcome of small firms' average returns minus big firms' average returns (small minus big). Similarly, high Book-to-market ratio minus low Book-to-market ratio (HML). The beta-s and beta-v refers to size and value factor coefficients.

The Carhart (1997) four-factor model (C4FM) Specification

$$R_{i,t} - R_f = \alpha_i + \beta_{i,M}(R_{m,t} - R_f) + \beta_{i,S}(SMB_t) + \beta_{i,V}(HML_t) + \beta_{i,W}(WML_t) + \varepsilon_{i,t} \quad (3)$$

The momentum-factor is the outcome of average 12-months winners portfolio returns minus average 12-months losers portfolio returns. The beta-w refers to momentum factor coefficient.

Gibbons, Ross and Shanken (GRS) test

$$GRS = \left(\frac{T}{N}\right)\left(\frac{T}{T}\ \frac{-N-L}{-L-1}\right)\ \left[\frac{\hat{\alpha}'\,\hat{\sum}^{-1}\,\hat{\alpha}}{1+\bar{\mu}!\,\hat{\Omega}^{-1}\hat{\mu}}\right]\ \sim F(N,\ T-N-L) \quad (4)$$

where, $\hat{\alpha}$ = N x 1 estimated constant term vector. $\hat{\sum}$ = Stochastic terms unbiased covariance matrix. $\bar{\mu}$ = L x 1 factor portfolio average matrix. $\hat{\Omega}$ = Factor portfolio unbiased covariance matrix. T = No. of observations. N = No. of regression equations. L = No. of factors in the regression.

Utilizing the equation (4), this study analyzes the GRS-F test using the following hypothesis:
H_0: $\alpha_i = 0$, here i = 1, 2, 3, …, N. where, all alpha coefficients are equal to zero (α=0)
H_1: $\alpha_i \neq 0$, here i = 1, 2, 3, …, N. where, all alpha coefficients are not equal to zero ($\alpha \neq 0$)

Results and Discussion

This study is an attempt to evaluate the performance of mutual funds using CAPM, FF3FM and C4FM. The study employs structural equation modelling (SEM) to evaluate the role of GDP growth and income growth (human capital) as mediating variables in the context of Pakistan's mutual funds. The analysis utilises the CAPM, FF-3FM and C4FM to examine the potential influence of these variables on the performance of mutual funds. In other words, the validity of CAPM, FF3FM and C4FM is examined using SEM with GDP-growth and income-growth (human capital) as mediating variables for mutual funds in Pakistan. The following section presents the empirical findings and interpretations of each model and factor.

Descriptive Statistics and Correlation Analysis

Table 1. Descriptive Statistics and Correlation Matrix

Variable	RmRf	SMB	HML	WML	GDP-G	Income-G
Mean	0.00633	-0.00833	-0.02296	0.05911	3.71174	0.87249
Std. Dev.	0.07258	0.04047	0.04019	0.05723	2.17837	1.76285
Min	-0.45966	-0.15260	-0.27753	-0.14013	-0.38100	-3.37900
Max	0.23542	0.12892	0.10350	0.42918	7.54686	4.78600
Variance	0.00526	0.00163	0.001615	0.003275	4.74529	3.10763
Skewness	-1.23938	-0.62607	-1.67653	1.07241	-0.36153	0.44609
Kurtosis	10.2695	4.91114	11.1038	10.5642	2.11333	2.42389
Obs.	246	246	246	246	246	246
Variable	RmRf	SMB	HML	WML	GDP-G	Income-G
RmRf	1					
SMB	-0.160	1				
HML	0.296	-0.120	1			
WML	-0.226	0.267	-0.438	1		
GDP-G	0.191	-0.064	-0.104	0.067	1	
Income-G	0.151	0.022	0.114	0.060	0.456	1

Table 1 depicts the descriptive statistics and correlation matrix for independent factors (market, size, value and momentum) and mediating variables (GDP Growth and Income Growth) of the study.

Table 1 presents the descriptive statistics of six variables, including the independent variables market risk-premium, size, value and momentum factor, and the mediating variables GDP-growth and income-growth. As evidenced in the table, the highest value of GDP-growth is 3.712. However, among the factors, momentum exhibits the highest value (0.0591), with a standard deviation of 0.0572 and a maximum value of 0.429. The next highest value is that of the market risk premium, which has a standard deviation of 0.0726 and a maximum value of 0.2354, though it also has a minimum value of -0.460. It is noteworthy that there is a negative relationship between the size and momentum factor and the mean returns of portfolios. Similarly, there is an inverse correlation between GDP growth and the mean portfolio returns.

A correlation analysis is a statistical method used to examine the association among independent variables. As illustrated in Table 1, the correlation matrix reveals that the highest correlation value is between Income-Growth and GDP-Growth (0.456). This is not a cause for concern, as in one model, we do not utilise both variables simultaneously. The second-highest correlation value between WML and HML is -44%, which is also not problematic given the inverse relationship and the relatively low correlations between factors. The correlation matrix table indicates that there is no evidence of multicollinearity in the dataset, which could otherwise have a detrimental impact on the estimation results. The mean returns of portfolios (Ri) demonstrate a positive correlation with the market and value risk premiums (0.397 and 0.559, respectively).

Table 2. CAPM using SEM with mediating variable of GDP-Growth and Income-Growth

Variable		Robust			Variable		Robust		
GDP Growth	Coef.	Std. Err.	z	P>z	Income Growth	Coef.	Std. Err.	z	P>z
sRi <-					sRi <-				
GDP-Growth	-0.00578	0.00148	-3.90	0.000	Income-Growth	0.00197	0.00176	1.12	0.263
RmRf	0.37257	0.07254	5.14	0.000	RmRf	0.33212	0.07425	4.47	0.000
_cons	0.02849	0.00600	4.75	0.000	_cons	0.00556	0.00400	1.39	0.165
GDP-Growth <-					Income-Growth <-				
RmRf	5.73847	1.83671	3.12	0.002	RmRf	3.67610	1.45193	2.53	0.011
_cons	3.67541	0.13731	26.77	0.000	_cons	0.84922	0.10904	7.79	0.000
bRi <-					bRi <-				
GDP-Growth	-0.00529	0.00130	-4.06	0.000	Income-Growth	0.00183	0.00176	1.04	0.297
RmRf	0.30910	0.05495	5.63	0.000	RmRf	0.27199	0.05635	4.83	0.000
_cons	0.02987	0.00521	5.73	0.000	_cons	0.00885	0.00391	2.26	0.024
GDP-Growth <-					Income-Growth <-				
RmRf	5.73847	1.83671	3.12	0.002	RmRf	3.67610	1.45193	2.53	0.011
_cons	3.67541	0.13731	26.77	0.000	_cons	0.84922	0.10904	7.79	0.000
gRi <-					gRi <-				
GDP-Growth	-0.00594	0.00145	-4.10	0.000	Income-Growth	0.00062	0.00177	0.35	0.728
RmRf	0.41086	0.07370	5.57	0.000	RmRf	0.37448	0.07530	4.97	0.000
_cons	0.03313	0.00567	5.85	0.000	_cons	0.01076	0.00402	2.67	0.007
GDP-Growth <-					Income-Growth <-				
RmRf	5.73847	1.83671	3.12	0.002	RmRf	3.67610	1.45193	2.53	0.011
_cons	3.67541	0.13731	26.77	0.000	_cons	0.84922	0.10904	7.79	0.000
vRi <-					vRi <-				
GDP-Growth	-0.00544	0.00149	-3.66	0.000	Income-Growth	0.00326	0.00186	1.75	0.079
RmRf	0.27609	0.05562	4.96	0.000	RmRf	0.23290	0.05780	4.03	0.000
_cons	0.02730	0.00597	4.57	0.000	_cons	0.00453	0.00403	1.12	0.261
GDP-Growth <-					Income-Growth <-				
RmRf	5.73847	1.83671	3.12	0.002	RmRf	3.67610	1.45193	2.53	0.011
_cons	3.67541	0.13731	26.77	0.000	_cons	0.84922	0.10904	7.79	0.000

Table 2 shows the estimates of CAPM using SEM approach with mediating variable of GDP-growth and Income-growth (human capital). The results demonstrate the relationship between market risk-premium and portfolio returns based on coefficients, robust standard errors, z-value and probability of the model using four value-weighted portfolios returns.

The CAPM Estimations

Table 2 demonstrates strong evidence that supports the CAPM as the coefficients of RmRf shows positive and statistically significant nexus with portfolio returns as forecasted by CAPM as well as both mediating variable based on probability value less than 0.05. The results demonstrate that as a mediating variable GDP-Growth has inverse nexus with portfolio returns which is also presented in correlation matrix (-0.132) though statistically highly significant nexus is shown. The market risk-premium has a positive and statistically significant association with GDP-growth in all the cases which confirms that as mediating variable GDP-growth contributes to the economy in the positive context. Conversely, the results of Income-Growth present statistically insignificant mediating relationship with all four portfolio returns though the market risk-premium shows again highly statistically significant nexus with all portfolio returns. The results also show that market risk-premium has positive and statistically significant association with Income-Growth. Comparatively, GDP-Growth represents inverse but significant contribution to the portfolio mutual funds returns but mediating a highly significant role in the market though Income-Growth as mediating variable does not produce desirable contribution in the market. As a result, GDP-growth is valid mediating variable to be assumed whereas Income-growth is redundant for mutual funds of Pakistan.

Table 3. FF3FM using SEM model with mediating variable of GDP-Growth and Income-Growth

Variable		Robust			Variable		Robust		
GDP Growth	Coef.	Std. Err.	z	P>z	Income Growth	Coef.	Std. Err.	z	P>z
sRi <-					sRi <-				
GDP-Growth	-0.0035	0.0014	-2.58	0.010	Income-Growth	0.0006	0.0017	0.37	0.710
RmRf	0.2531	0.0504	5.02	0.000	RmRf	0.2258	0.0505	4.47	0.000
SMB	0.1097	0.0803	1.37	0.172	SMB	0.1171	0.0761	1.54	0.124
HML	0.7111	0.0999	7.12	0.000	HML	0.7432	0.0996	7.46	0.000
_cons	0.0381	0.0054	7.04	0.000	_cons	0.0254	0.0040	6.3	0.000
GDP-Growth <-					Income-Growth <-				
RmRf	7.1044	1.9060	3.73	0.000	RmRf	3.3084	1.5474	2.14	0.033
SMB	-2.5475	3.3678	-0.76	0.449	SMB	2.3209	2.8488	0.81	0.415
HML	-9.7356	3.0220	-3.22	0.001	HML	3.5115	2.3208	1.51	0.130
_cons	3.4220	0.1804	18.97	0.000	_cons	0.9515	0.1227	7.76	0.000
bRi <-					bRi <-				
GDP-Growth	-0.0034	0.0012	-2.74	0.006	Income-Growth	0.0007	0.0017	0.43	0.666
RmRf	0.1980	0.0513	3.86	0.000	RmRf	0.1717	0.0519	3.31	0.001
SMB	0.0245	0.0894	0.27	0.784	SMB	0.0313	0.0878	0.36	0.721
HML	0.6243	0.1031	6.06	0.000	HML	0.6544	0.1027	6.37	0.000
_cons	0.0379	0.0048	7.86	0.000	_cons	0.0257	0.0037	7.03	0.000
GDP-Growth <-					Income-Growth <-				
RmRf	7.1044	1.9060	3.73	0.000	RmRf	3.3084	1.5474	2.14	0.033
SMB	-2.5475	3.3678	-0.76	0.449	SMB	2.3209	2.8488	0.81	0.415
HML	-9.7356	3.0220	-3.22	0.001	HML	3.5115	2.3208	1.51	0.130
_cons	3.4220	0.1804	18.97	0.000	_cons	0.9515	0.1227	7.76	0.000
gRi <-					gRi <-				
GDP-Growth	-0.0041	0.0013	-3.18	0.001	Income-Growth	-0.0002	0.0017	-0.11	0.914
RmRf	0.2678	0.0510	5.25	0.000	RmRf	0.2390	0.0514	4.65	0.000
SMB	-0.2974	0.0761	-3.91	0.000	SMB	-0.2864	0.0723	-3.96	0.000
HML	0.6491	0.0985	6.59	0.000	HML	0.6901	0.0995	6.94	0.000
_cons	0.0398	0.0052	7.64	0.000	_cons	0.0258	0.0040	6.42	0.000
GDP-Growth <-					Income-Growth <-				
RmRf	7.1044	1.9060	3.73	0.000	RmRf	3.3084	1.5474	2.14	0.033
SMB	-2.5475	3.3678	-0.76	0.449	SMB	2.3209	2.8488	0.81	0.415
HML	-9.7356	3.0220	-3.22	0.001	HML	3.5115	2.3208	1.51	0.130
_cons	3.4220	0.1804	18.97	0.000	_cons	0.9515	0.1227	7.76	0.000
vRi <-					vRi <-				
GDP-Growth	-0.0032	0.0013	-2.47	0.014	Income-Growth	0.0017	0.0017	1.01	0.314
RmRf	0.1981	0.0514	3.85	0.000	RmRf	0.1695	0.0521	3.26	0.001
SMB	0.4292	0.0880	4.88	0.000	SMB	0.4334	0.0840	5.16	0.000
HML	0.6326	0.1049	6.03	0.000	HML	0.6579	0.1047	6.28	0.000
_cons	0.0377	0.0052	7.27	0.000	_cons	0.0250	0.0039	6.37	0.000
GDP-Growth <-					Income-Growth <-				
RmRf	7.1044	1.9060	3.73	0.000	RmRf	3.3084	1.5474	2.14	0.033
SMB	-2.5475	3.3678	-0.76	0.449	SMB	2.3209	2.8488	0.81	0.415
HML	-9.7356	3.0220	-3.22	0.001	HML	3.5115	2.3208	1.51	0.130
_cons	3.4220	0.1804	18.97	0.000	_cons	0.9515	0.1227	7.76	0.000

Table 3 shows the estimates of FF3FM using GMM approach with mediating variable of GDP-growth and Income-growth (human capital). The results demonstrate the relationship between market, size and value risk-premium and portfolio returns based on coefficients, robust standard errors, z-value and probability of the model using four value-weighted portfolios returns.

The FF3FM Estimations

Table 3 presents the FF3FM results using SEM with mediating variable of GDP-growth and Income-growth (denotes the Human Capital-growth). Based on FF3FM estimations, we observe that similar to CAPM, the GDP-growth demonstrates statistically significant though inverse nexus with all portfolio fund returns. The results reveal that nexus between size-factor and portfolio returns is insignificant for both size-based portfolios such as 0.1097 and 0.0245 for sRi and bRi portfolios respectively though the value-based portfolios show statistically significant nexus with portfolio fund returns. Conversely, the value-factor indicates statistically highly significant relationship with portfolio fund returns for all portfolios. As far as the impact of factors on GDP-growth show diversified results such as market and value factors have statistically significant but negative impact on GDP-growth while size-factor shows statistically insignificant but negative nexus with GDP-growth using FF3FM with mediating effect of GDP-growth in the study.

On the contrary, Income-growth exhibits spurious and insignificant association with portfolio fund returns for all portfolios. Similar to GDP-growth model, the results reveal insignificant nexus between size-factor and portfolio returns for both size-based portfolios such as 0.1171 and 0.0313 for sRi and bRi portfolios respectively whereas the value-based portfolios show statistically significant nexus with portfolio fund returns. Similar to GDP-growth model, the coefficients of value-factor indicate statistically significant relationship with portfolio fund returns for all portfolios. Opposite to GDP-growth model, the size and value show positive and insignificant nexus with Income-growth but the market risk-premium is seen to be positive and statistically significant. As a result, we can conclude that GDP-growth is determined to be valid as a mediating variable for Pakistan mutual funds. Similar to CAPM, FF3FM symbolizes same results for GDP-growth and Income-growth in terms of validation of the mediating variable.

The C4FM Estimations

Table 4 demonstrates the outcomes of SEM with mediating variable of GDP-growth and Income-growth using Carhart (1997) four-factor model for Mutual funds of Pakistan. The results shown in the table 2 validate the existence of CAPM for both the models whether the impact on mediating variables or portfolio fund returns. Similar to FF3FM, the size factor represents statistically insignificant but positive results for both size-based portfolios (sRi and vRi) in both the models. The value-factor, similar to FF3FM, demonstrates statistically significant results for all the models including portfolio fund returns as well as mediating variables in the study. Unexpectedly, the momentum-factor demonstrates statistically insignificant results for both the models when its association is checked with portfolio fund returns. Furthermore, the impact of momentum factor on GDP-growth also reveals statistically insignificant effect though the impact on Income-growth has shown statistically significant. Consequently, the impact of GDP-growth as mediating variable on portfolio fund returns shows statistically significant and positive while conversely the Income-growth represents insignificant nexus with portfolio fund returns. Moreover, the size-factor impact on GDP-growth and Income-growth as mediating variables also displays statistically insignificant results. As a result, the momentum anomaly shows redundancy in the mutual fund of Pakistan whereas, similar to CAPM and FF3FM, the results unveil the GDP-growth significant mediating effect while Income-growth (Human-capital) insignificant mediating effect in the market.

Table 4. C4FM using SEM model with mediating variable of GDP-Growth and Income-Growth

Variable		**Robust**			**Variable**		**Robust**		
GDP-Growth	**Coef.**	**Std. Err.**	**z**	**P>z**	**Income-Growth**	**Coef.**	**Std. Err.**	**z**	**P>z**
sRi <-					sRi <-				
GDP-Growth	-0.0036	0.0014	-2.63	0.009	Income-Growth	0.0006	0.0018	0.33	0.740
RmRf	0.2552	0.0508	5.02	0.000	RmRf	0.2271	0.0508	4.47	0.000
SMB	0.1008	0.0825	1.22	0.222	SMB	0.1122	0.0783	1.43	0.152
HML	0.7271	0.1064	6.83	0.000	HML	0.7530	0.1069	7.04	0.000
WML	0.0297	0.0612	0.48	0.628	WML	0.0173	0.0621	0.28	0.781
_cons	0.0368	0.0059	6.23	0.000	_cons	0.0246	0.0045	5.44	0.000
GDP-Growth <-					Income-Growth <-				
RmRf	7.2725	1.9316	3.77	0.000	RmRf	3.5866	1.5729	2.28	0.023
SMB	-3.3526	3.3285	-1.01	0.314	SMB	0.9891	2.8006	0.35	0.724
HML	-8.2173	3.4056	-2.41	0.016	HML	6.0229	2.5857	2.33	0.020
WML	2.7359	2.2307	1.23	0.220	WML	4.5254	1.6690	2.71	0.007
_cons	3.2874	0.2022	16.26	0.000	_cons	0.7288	0.1376	5.30	0.000
bRi <-					bRi <-				
GDP-Growth	-0.0034	0.0012	-2.78	0.005	Income-Growth	0.0007	0.0017	0.43	0.667
RmRf	0.1990	0.0510	3.9	0.000	RmRf	0.1718	0.0517	3.32	0.001
SMB	0.0204	0.0962	0.21	0.832	SMB	0.0310	0.0938	0.33	0.741
HML	0.6318	0.1090	5.8	0.000	HML	0.6552	0.1084	6.04	0.000
WML	0.0139	0.0701	0.2	0.843	WML	0.0013	0.0707	0.02	0.985
_cons	0.0373	0.0061	6.09	0.000	_cons	0.0257	0.0052	4.98	0.000
GDP-Growth <-					Income-Growth <-				
RmRf	7.2725	1.9316	3.77	0.000	RmRf	3.5866	1.5729	2.28	0.023
SMB	-3.3526	3.3285	-1.01	0.314	SMB	0.9891	2.8006	0.35	0.724
HML	-8.2173	3.4056	-2.41	0.016	HML	6.0229	2.5857	2.33	0.020
WML	2.7359	2.2307	1.23	0.220	WML	4.5254	1.6690	2.71	0.007
_cons	3.2874	0.2022	16.26	0.000	_cons	0.7288	0.1376	5.30	0.000
gRi <-					gRi <-				
GDP-Growth	-0.0041	0.0013	-3.15	0.002	Income-Growth	0.0000	0.0018	-0.02	0.982
RmRf	0.2657	0.0509	5.22	0.000	RmRf	0.2361	0.0512	4.61	0.000
SMB	-0.2889	0.0817	-3.53	0.000	SMB	-0.2751	0.0777	-3.54	0.000
HML	0.6337	0.1022	6.2	0.000	HML	0.6676	0.1039	6.42	0.000
WML	-0.0285	0.0623	-0.46	0.647	WML	-0.0395	0.0635	-0.62	0.533
_cons	0.0410	0.0059	6.99	0.000	_cons	0.0276	0.0046	5.96	0.000
GDP-Growth <-					Income-Growth <-				
RmRf	7.2725	1.9316	3.77	0.000	RmRf	3.5866	1.5729	2.28	0.023
SMB	-3.3526	3.3285	-1.01	0.314	SMB	0.9891	2.8006	0.35	0.724
HML	-8.2173	3.4056	-2.41	0.016	HML	6.0229	2.5857	2.33	0.020
WML	2.7359	2.2307	1.23	0.220	WML	4.5254	1.6690	2.71	0.007
_cons	3.2874	0.2022	16.26	0.000	_cons	0.7288	0.1376	5.30	0.000
vRi <-					vRi <-				
GDP-Growth	-0.0033	0.0013	-2.58	0.010	Income-Growth	0.0015	0.0017	0.87	0.382
RmRf	0.2037	0.0508	4.01	0.000	RmRf	0.1741	0.0514	3.39	0.001
SMB	0.4061	0.0918	4.43	0.000	SMB	0.4158	0.0875	4.75	0.000
HML	0.6744	0.1111	6.07	0.000	HML	0.6929	0.1112	6.23	0.000
WML	0.0775	0.0676	1.15	0.252	WML	0.0616	0.0679	0.91	0.364
_cons	0.0342	0.0060	5.73	0.000	_cons	0.0222	0.0049	4.50	0.000
GDP-Growth <-					Income-Growth <-				
RmRf	7.2725	1.9316	3.77	0.000	RmRf	3.5866	1.5729	2.28	0.023
SMB	-3.3526	3.3285	-1.01	0.314	SMB	0.9891	2.8006	0.35	0.724
HML	-8.2173	3.4056	-2.41	0.016	HML	6.0229	2.5857	2.33	0.020
WML	2.7359	2.2307	1.23	0.220	WML	4.5254	1.6690	2.71	0.007
_cons	3.2874	0.2022	16.26	0.000	_cons	0.7288	0.1376	5.30	0.000

Table 4. shows the estimates of FF3FM using SEM approach with mediating variable of GDP-growth and Income-growth (human capital). The results demonstrate the relationship between market, size and value risk-premium and portfolio returns based on coefficients, robust standard errors, z-value and probability of the model using four value-weighted portfolios returns.

Alpha based Validation using Gibbons Ross Shanken (Wald) test

The GRS test specifies the better estimated APM and hypotheses that all intercepts are equal to zero. As a result, the findings indicate that all the models have successfully passed the GRS F-test to be the valid model in explaining portfolio fund returns for mutual funds of Pakistan but based on results given in Table 5, H_0 hypotheses are accepted for all models.

Table 5. GRS test for appropriate model based on Absolute Average Alpha

Model	GRS test (Wald)	P-value	GRS F-test	P-value
CAPM	19.507143	0.00063	91.31	0.0000
FF3FM	59.333066	0.00000	27.78	0.0000
C4FM	40.037417	0.00000	14.63	0.0000

Table 5. illustrates the GRS (Wald) test and F-test values for all the three models, including CAPM, FF3FM and C4FM for mutual funds of Pakistan based on the sample of the study.

In a nutshell, the results demonstrate that all models meet the GRS test of validation based on absolute average alpha. Furthermore, the CAPM remains the most effective model for explaining portfolio returns in the context of the emerging mutual fund market in Pakistan, as evidenced by the GRS-F test.

Conclusion

This study empirically analyzed the CAPM, Fama and French (1993) three-factor model and Carhart (1997) four-factor model using Structural Equation Modeling (SEM) frameworks with mediating variables of GDP-Growth and Income-Growth (Human-capital) in mutual funds of Pakistan. The empirical results demonstrate that the positive sign of beta-coefficient in all models validates that CAPM is still alive in explaining the portfolio fund returns and similar results show consistency with the CAPM theory. The results show that GDP-G has a significant impact on all portfolio returns, observing a direct relationship using the GDP-G mediating effect model. However, Human-cap has insignificant relationship with all portfolio returns using Human-cap mediating model. Though, SMB has a significant relationship with portfolio returns for (small and large) portfolios but an insignificant impact on portfolio returns for portfolios (growth and value) using both GDP-G and Income-G models for FF3FM and C4FM. Conversely, RmRf and HML have significant impact on all portfolio returns in both the models. In addition, WML has an insignificant relationship with all portfolio returns using both models. The results further show that the indirect impact of risk factors on GDP-G and HC-G show different results, as the impact of RmRf on GDP-G and HC-G is highly significant for both sides using CAPM. However, using FF3FM, RmRf and HML show a highly significant impact on GDP-G, while only RmRf shows a significant impact on HC-G. In addition, SMB and HML in FF3FM show an insignificant impact on HC-G for all portfolios. Similarly, using C4FM results, RmRf and HML show highly significant impact on GDP-G, while SMB and WML are insignificant for all portfolios. Using HC-G C4FM, the impact of RmRf, SMB, HML and WML show a significant relationship with HC-G for all portfolios.

In summary, the impact of the market factor and GDP-growth on portfolio returns shows statistically significant estimates using both mediation models in the market. However, size-factor shows two portfolios significant while two portfolios insignificant results using both mediating variables. However, the value factor shows highly

significant in both mediating models but reveal insignificant nexus with HC-Growth as mediating variable using only FF3FM. Moreover, momentum factor shows insignificant results for both mediating models. Compared to multi-factor models, the GRS test also confirms the overall significant estimates of the market factor (CAPM) in the market, confirming previous findings that the CAPM is still alive to explain mutual fund returns in emerging markets like Pakistan. In conclusion, GDP growth significantly mediates between risk factors and portfolio returns in Pakistani mutual funds while human capital has no mediation between risk factors and portfolio returns using CAPM, FF3FM and C4FM in the market.

Future research could explore how these relationships evolve over time or how they compare to other emerging economies. Ultimately, this study serves as a stepping stone towards a more holistic understanding of financial market dynamics, inviting us to reconsider the traditional boundaries between human capital development, economic growth, and investment performance. The similar study could be replicated using several developed market funds to see the broad perspective of the methodologies. In addition, the emerging market funds could also be studied using GDP growth and human capital growth as moderating variables for a robust analysis worldwide. Azam (2023) in a study compared two Asian competitors and found that the Indian stock market outperformed the PSX and liquidity was found to be significant for both markets. There is potential to consider liquidity as a factor in the mutual fund industry.

Declaration

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Appendices

Appendix-1

Model	(GDP-G)	Findings	(Income-G)	Findings
CAPM	GDPG-> Ri	Significant (All)	Income-G-> Ri	Insignificant (All)
	RmRf-> Ri	Significant (All)	RmRf-> Ri	Significant (All)
	RmRf -> GDPG	Significant (All)	RmRf -> Income-G	Significant (All)
FF3FM	GDPG-> Ri	Significant (All)	Income-G -> Ri	Insignificant (All)
	RmRf-> Ri	Significant (All)	RmRf-> Ri	Significant (All)
	SMB -> Ri	Sig./Insig. (2/2)	SMB -> Ri	Sig./Insig. (2/2)
	HML -> Ri	Significant (All)	HML -> Ri	Significant (All)
	RmRf-> GDPG	Significant (All)	RmRf-> Income-G	Significant (All)
	SMB-> GDPG	Insignificant (All)	SMB-> Income-G	Insignificant (All)
	HML -> GDPG	Significant (All)	HML -> Income-G	Insignificant (All)
C4FM	GDPG-> Ri	Significant (All)	Income-G -> Ri	Insignificant (All)
	RmRf-> Ri	Significant (All)	RmRf-> Ri	Significant (All)
	SMB -> Ri	Sig./Insig. (2/2)	SMB -> Ri	Sig./Insig. (2/2)
	HML -> Ri	Significant (All)	HML -> Ri	Significant (All)
	WML -> Ri	Insignificant (All)	WML -> Ri	Insignificant (All)
	RmRf-> GDPG	Significant (All)	RmRf-> Income-G	Significant (All)
	SMB-> GDPG	Insignificant (All)	SMB-> Income-G	Significant (All)
	HML -> GDPG	Significant (All)	HML -> Income-G	Significant (All)
	WML -> GDPG	Insignificant (All)	WML -> Income-G	Significant (All)

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