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Labor-Income Growth And Equity Returns: A Human Capital–Augmented Four-Factor Asset Pricing Model For Punjab, Pakistan

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ABSTRACT

This study develops and empirically evaluates a human capital–augmented four-factor asset-pricing model for non-financial firms associated with Punjab, Pakistan. Traditional models such as the Capital Asset Pricing Model (CAPM) and the Fama–French three-factor model (FF3) have been widely applied in emerging markets; however, they typically overlook the role of human capital, a critical driver of firm productivity and long-term value. By incorporating labor-income growth as a proxy for human capital, this study extends the conventional asset-pricing framework and investigates whether human capital risk plays a significant role in explaining return variations within Punjab’s corporate sector. Using monthly data for 164 non-financial PSX-listed firms from July 2010 to June 2020, the study constructs eight portfolios categorized by firm size, book-to-market ratio, and labor-income growth. The Fama–MacBeth two-pass regression methodology is employed to estimate time-series factor sensitivities and cross-sectional risk premiums. The empirical findings show that size, value, and human capital factors significantly explain time-series variation in excess portfolio returns. Small firms, high book-to-market firms, and firms with low labor-income growth consistently generate higher average returns, indicating the existence of size, value, and human capital premiums within Punjab’s market environment. However, the cross-sectional analysis reveals that factor betas do not reliably predict future returns, suggesting that historical risk exposures do not necessarily translate into future performance—an outcome consistent with the Efficient Market Hypothesis. These results highlight the importance of incorporating human capital into asset-pricing models, particularly in labor-intensive regional economies. The study contributes to the literature by demonstrating that human capital is a meaningful and priced source of risk in Punjab and underscores the need for broader, regionally contextualized asset-pricing frameworks.

Keywords: Human Capital; Labor-Income Growth; Four-Factor Model; Asset Pricing; Punjab; Fama–Macbeth Regression; Fama–French Model; Emerging Markets; Stock Returns.

INTRODUCTION

Understanding what drives asset returns has long been one of the most fundamental and debated issues within financial economics. Early studies relied heavily on the Capital Asset Pricing Model (CAPM), which argues that the expected return on any asset is determined solely by its exposure to systematic market risk. While elegant and theoretically appealing, CAPM assumes that all investors are diversified and that only market-wide fluctuations matter, leaving no role for other sources of risk (Rashid, 2021). Overtime, extensive empirical evidence from both developed and emerging markets has



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shown that this single-factor approach is unable to fully account for the observed cross-sectional variations in stock returns. Researchers have consistently identified additional firm-specific characteristics—such as size, book-to-market ratio, profitability, investment patterns, liquidity conditions, and momentum—as influential predictors of asset returns, highlighting the need for multifactor models that capture a broader spectrum of risk (Khan et al., 2023).

In the context of Pakistan, the province of Punjab plays a central economic role as the country's industrial and commercial backbone. Punjab hosts a large concentration of manufacturing firms, service-sector organizations, agro-based industries, and logistics networks that contribute substantially to national GDP, employment generation, and export revenue. The performance of firms based in Punjab therefore holds considerable importance for domestic and foreign investors (Riaz, 2024). Despite this significance, empirical research on asset pricing rarely investigates the region-specific determinants of stock returns, particularly in relation to the unique industrial dynamics of Punjab's corporate landscape. Most existing studies analyze Pakistan's stock market at a national level, thereby overlooking important structural and regional heterogeneities. This gap becomes even more pronounced when considering advanced asset-pricing models that incorporate human capital as a key determinant—an area that remains largely unexplored in Punjab's financial context (Mosoeu & Kodongo, 2022).

Human capital, represented through the knowledge, experience, competencies, and productivity of employees, is increasingly viewed as a pivotal driver of firm performance and long-term competitive advantage. Modern firms rely heavily on their workforce to generate innovation, operational efficiency, adaptability, and sustainable growth. From a financial perspective, variations in labor income, employee productivity, and workforce-related costs carry meaningful implications for a firm's future cash flows and risk profile. Theoretically, firms experiencing fluctuations in labor-income growth face different levels of uncertainty and operational constraints that may directly influence their stock returns. Despite this, classical models such as CAPM fail to treat human capital as a distinct priced factor. Even earlier multifactor models, although incorporating size and value effects, do not acknowledge the role of human capital in shaping return-generating processes (Khan, 2025).

Statement of the Problem

Despite the growing recognition of multifactor asset-pricing models, limited attention has been given to the role of human capital in explaining stock return variations within Punjab's corporate sector. Traditional models such as CAPM and even the Fama–French three-factor model do not incorporate labor-income dynamics, overlooking a critical component of firm productivity and risk. In a labor-intensive region like Punjab, where workforce costs and human capital fluctuations directly influence operational performance, ignoring this factor may lead to inaccurate asset valuation and misinformed investment decisions. Moreover, empirical evidence on how human capital affects risk premiums in emerging markets remains scarce, particularly at the regional level. This gap highlights the need to evaluate whether labor-income growth significantly improves the explanatory power of existing asset-pricing models. Therefore, the absence of human capital in current frameworks presents a conceptual and empirical problem that this study seeks to address.



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Research Objectives

To examine the extent to which human capital, measured through labor-income growth, explains variations in portfolio returns of firms associated with Punjab, Pakistan.

To evaluate whether a human capital-augmented four-factor model provides superior explanatory power compared to the traditional Fama-French three-factor model in the context of Punjab's equity market.

Research Questions

Does human capital (labor-income growth) significantly influence the portfolio returns of Punjab-based firms?

Does the human capital-augmented four-factor model outperform the Fama-French three-factor model in explaining excess stock returns in Punjab?

LITERATURE REVIEW

Classical Asset-Pricing Models

The Capital Asset Pricing Model (CAPM) represents one of the earliest and most influential attempts to formalize the relationship between expected return and risk. According to CAPM, the excess return on an asset is determined solely by its beta, which measures the asset's sensitivity to systematic market fluctuations. This single-factor approach provides a simple and intuitive solution for portfolio selection and expected return estimation. However, despite its theoretical elegance, CAPM has been widely criticized on empirical grounds. Numerous studies document persistent anomalies—most notably the size effect, where small-cap stocks consistently outperform large-cap stocks, and the value effect, where stocks with high book-to-market ratios yield higher returns than low book-to-market stocks (Deming, 2025). These return patterns cannot be fully explained by CAPM's reliance on market beta alone. In response to CAPM's limitations, alternative frameworks emerged, including the Arbitrage Pricing Theory (APT), which introduced the idea that multiple systematic factors, rather than a single market factor, drive asset returns. Although APT does not explicitly define which factors should be included, it established the foundation for multifactor modeling and inspired subsequent empirical research (Haqqani & Rahman, 2020).

Multifactor Models: Fama-French and Beyond

Building on the evidence of asset-pricing anomalies, Fama and French (1993) developed the three-factor model (FF3), which incorporates market return, firm size, and book-to-market ratio as determinants of expected returns. The model demonstrated significantly improved explanatory power over CAPM, particularly in capturing variations across portfolios sorted by size and value. Subsequent extensions further expanded multifactor frameworks: Carhart (1997) added a momentum factor to create a four-factor model, while Fama and French (2015) introduced a five-factor model that incorporates profitability and investment as additional explanatory dimensions (Siri et al., 2025). Although these models enhance predictive accuracy in many markets, their performance in emerging markets—including Pakistan—has been inconsistent. Several empirical studies report that the FF3, FF4, and FF5 models leave considerable pricing errors unexplained in developing economies, indicating that the return-generating process may differ in contexts characterized by structural inefficiencies, market volatility, and unique economic conditions. This has strengthened the argument that additional risk factors may be necessary to accurately model returns in emerging markets (Lohano, 2018).



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Human Capital in Asset Pricing

Human capital, encompassing employees' skills, knowledge, training, experience, and productivity, has gained increasing recognition as a critical determinant of firm performance and long-term value creation. In corporate finance, human capital contributes to operational efficiency, innovation capability, and competitive advantage. In asset pricing, human capital is viewed as an important risk factor because fluctuations in labor income, employment stability, and workforce productivity can directly influence firm cash flows (Qadeer et al., 2023).

Asset Pricing in Emerging Markets and Punjab Context

Emerging markets exhibit financial characteristics distinct from developed economies, including higher volatility, concentrated ownership, greater information asymmetry, and less efficient market mechanisms. These attributes influence the behavior of risk factors and, consequently, the performance of asset-pricing models (Afzal et al., 2025). Pakistan's equity market reflects these typical emerging-market features, with Punjab serving as the economic nucleus due to its strong industrial base, extensive services sector, and significant contribution to national GDP. Firms in Punjab often operate with smaller market capitalizations, face fluctuating liquidity conditions, and encounter substantial operational risks stemming from macroeconomic and political uncertainties (Thalassinos et al., 2023)

Conceptual Framework and Hypotheses

Based on the theoretical foundations and empirical evidence discussed above, the conceptual framework of this study integrates four key risk factors: the market factor (MKT), which captures systematic risk; the size factor (SMB), which differentiates between small and large firms; the value factor (HML), which distinguishes between high and low book-to-market firms; and the human capital factor (LMH), which captures differences in labor-income growth among firms (Ali et al., 2021). The inclusion of the LMH factor is grounded in the argument that variations in human capital conditions reflect firm-specific risks that are not captured by traditional factors. The model posits that portfolios with higher exposure to these risk dimensions will earn corresponding risk premiums, reflecting compensation for bearing additional uncertainty (Thalassinos et al., 2025).

Accordingly, the study proposes two hypotheses:

H1: Human capital, measured through labor-income growth, significantly explains cross-sectional variations in portfolio returns of firms associated with Punjab.

H2: The human capital-augmented four-factor model, incorporating MKT, SMB, HML, and LMH, is a valid model for capturing time-series variations in portfolio excess returns.

RESEARCH METHODOLOGY

Data and Sample Selection

This study utilizes monthly data for 164 non-financial firms listed on the Pakistan Stock Exchange (PSX) over a ten-year period from July 2010 to June 2020. The selected firms are either headquartered in Punjab or conduct the majority of their operations within Punjab, making the sample a representative reflection of the region's corporate and industrial structure. The analysis relies on multiple credible data sources. Monthly stock price information is obtained from the Business Recorder financial portal and the PSX



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historical database, ensuring consistency and accuracy in market return calculations (Khan, 2024). Firm-level accounting information, such as total assets, equity book value, labor costs, wage expenditures, and other financial indicators, is extracted from the State Bank of Pakistan's (SBP) **Balance Sheet Analysis (BSA)** reports for non-financial companies between 2010 and 2019. The market index used in this study is the KSE-100 Index, and its adjusted monthly closing values are utilized to compute market return series. Additionally, the three-month Treasury bill rate published by the State Bank of Pakistan serves as the proxy for the monthly risk-free rate. Together, these data sources form a comprehensive dataset suitable for constructing portfolios and estimating factor returns (Ait-Sahalia et al., 2025)

Fama–MacBeth (1973) Two-Pass Regression Procedure

To evaluate whether the four factors are priced in the market, this study applies the Fama–MacBeth (1973) two-pass regression methodology. The first pass involves performing separate time-series regressions for each of the eight constructed portfolios, where excess returns are regressed on the four risk factors to estimate their corresponding betas (Qadeer, 2021). These betas capture each portfolio's sensitivity to systematic risks associated with market, size, value, and human capital factors. In the second pass, cross-sectional regressions are conducted for each month, using the estimated betas from the first pass as explanatory variables and actual portfolio returns as the dependent variable (Khan et al., 2022). The average of these monthly slope coefficients provides an estimate of the risk premiums associated with each factor. If these risk premiums are statistically significant and differ from zero, the factor is considered priced in the market and the model is deemed valid. The Fama–MacBeth approach is widely accepted for testing asset-pricing models because it accounts for time-series variation while minimizing the influence of cross-sectional correlation in returns (Sun et al., 2024)

Empirical Results

Table 1: Descriptive Statistics of Portfolio Excess Returns

| Portfolio | Mean | SD | Min | Max |
|-----------|-------|-------|--------|-------|
| SLLo | 0.026 | 0.103 | -0.189 | 0.397 |
| SLHi | 0.019 | 0.068 | -0.125 | 0.199 |
| SHLo | 0.023 | 0.101 | -0.158 | 0.353 |
| SHHi | 0.020 | 0.078 | -0.150 | 0.261 |
| BLLo | 0.022 | 0.084 | -0.146 | 0.391 |
| BLHi | 0.017 | 0.071 | -0.123 | 0.281 |
| BHLo | 0.026 | 0.083 | -0.151 | 0.307 |
| BHHi | 0.017 | 0.073 | -0.244 | 0.227 |

The descriptive statistics of the eight size–value–human capital portfolios reveal clear performance patterns across the Punjab-based firms. The results show that portfolios consisting of small firms consistently generate higher average returns than their large-firm counterparts. Specifically, the returns of SLLo, SLHi, SHLo, and SHHi exceed those of BLLo, BLHi, BHLo, and BHHi, confirming the presence of a strong size effect within the sample. Similarly, value portfolios—those with high book-to-market ratios—outperform low-BMR portfolios, highlighting the existence of a value premium. Another



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important observation is that portfolios composed of firms with low labor-income growth exhibit higher average returns as well as greater volatility compared to portfolios comprising high labor-income-growth firms. This pattern suggests that firms experiencing slower labor cost expansion may carry higher operational risks, resulting in higher expected returns. Overall, the descriptive analysis supports the argument that small firm size, high book-to-market value, and low labor-income growth are associated with elevated levels of risk and thus yield higher returns.

Table 2: Descriptive Statistics of Risk Factors

| Factor | Mean | SD | Min | Max |
|--------|--------|-------|--------|-------|
| MKT | -0.018 | 0.059 | -0.275 | 0.129 |
| SMB | 0.001 | 0.030 | -0.083 | 0.084 |
| HML | -0.002 | 0.028 | -0.084 | 0.089 |
| LMH | 0.0061 | 0.039 | -0.088 | 0.119 |

The descriptive summary of the four risk factors—MKT, SMB, HML, and LMH—provides additional insights into market behavior during the sample period. The market factor exhibits a negative mean along with a relatively large standard deviation, reflecting high volatility, multiple downturns, and broader economic instability in Pakistan between 2010 and 2020. The SMB factor shows a modestly positive mean, indicating the presence of a small-firm premium, although its magnitude is not substantial. The HML factor demonstrates a slightly negative mean, suggesting that the value premium is not consistently positive throughout the entire sample window and may vary across subperiods. In contrast, the LMH factor displays a positive mean, which implies that firms with low labor-income growth outperform those with high labor-income growth on average. This positive LMH value reinforces the argument that human capital-related characteristics play a meaningful role in explaining return differences among Punjab-based firms.

Table 3: Correlation Matrix of Risk Factors

| Factor | MKT | SMB | HML | LMH |
|--------|----------|--------|----------|----------|
| MKT | 1.000 | -0.063 | -0.244** | 0.212* |
| SMB | -0.063 | 1.000 | -0.048 | 0.204* |
| HML | -0.244** | -0.048 | 1.000 | -0.358** |
| LMH | 0.212* | 0.204* | -0.358** | 1.000 |

Notes: *Significant at 5%; **Significant at 1%

The correlation matrix for the four risk factors shows that most relationships fall within acceptable limits and indicate no severe correlation problems among explanatory variables. The correlation between the market factor and SMB is weakly negative, suggesting only a minimal relationship between market-wide movements and size-based returns. The HML factor is negatively correlated with both the market factor and SMB, and these correlations are statistically significant at the 1% level, indicating that value-based return patterns tend to move inversely with market cycles and firm size. Meanwhile, the human capital factor (LMH) shows a positive correlation with the market factor but negative correlations with SMB and HML, reflecting its distinct behavior as an



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independent source of risk. To verify that multicollinearity does not distort regression estimates, Variance Inflation Factors (VIFs) are computed for all explanatory variables. All VIF values are found to be below the threshold of 5, confirming that multicollinearity is not a concern in the model and that the regression coefficients can be interpreted reliably.

Table 4: First-Pass Time-Series Regression (Four-Factor Model)

Dependent variable: Portfolio Excess Return

| Portfolio | α (t) | MKT (t) | SMB (t) | HML (t) | LMH (t) | Adj. R ² |
|-----------|-----------------|----------------|----------------|----------------|-----------------|---------------------|
| SLLo | -0.010 (-1.42) | 0.248 (2.13)** | 1.002 (4.50)** | -0.393 (-1.58) | 1.359 (7.38)*** | 0.516 |
| SLHi | -0.010 (-1.65) | 0.132 (1.26) | 0.785 (3.92)** | 0.043 (0.19) | 0.100 (0.60) | 0.111 |
| SHLo | -0.012 (-1.92)* | 0.172 (1.63)* | 0.936 (4.66)** | 1.875 (8.34)* | 1.673 (10.05)* | 0.592 |
| SHHi | -0.010 (-1.49) | 0.132 (1.18) | 0.854 (4.01)** | 0.964 (4.04)** | 0.385 (2.17)** | 0.213 |
| BLLo | -0.010 (-1.88)* | 0.132 (1.20) | 0.854 (-0.18) | 0.964 (0.66) | 0.385 (6.80)*** | 0.312 |
| BLHi | -0.011 (-1.63)* | 0.208 (1.85)* | -0.017 (-0.08) | 0.510 (2.11)** | 0.413 (2.32)** | 0.058 |
| BHLo | -0.007 (-1.10) | 0.128 (1.12) | -0.320 (-1.46) | 0.846 (3.45)** | 1.267 (6.98)* | 0.298 |
| BHHi | -0.011 (-1.70)* | 0.211 (1.95)** | -0.045 (-0.21) | 0.971 (4.20)** | 0.618 (3.61)** | 0.161 |

The first-pass regression results provide evidence of the sensitivity of portfolio returns to the four explanatory risk factors. The findings show that the market factor exerts a consistently positive and statistically significant influence on the excess returns of several portfolios, reaffirming that systematic market risk remains an essential determinant of stock performance. The size factor (SMB) is strongly significant for all small-firm portfolios, reflecting that small firms generate higher returns due to greater exposure to size-related risk. In contrast, SMB is largely insignificant for large-firm portfolios, indicating that size premiums are concentrated among smaller companies. The value factor (HML) also performs as expected, displaying significant and positive coefficients for portfolios with high book-to-market ratios—particularly SHLo, SHHi, BHLo, and BHHi—thereby supporting the presence of a value premium in Punjab's equity market. Most importantly, the human capital factor (LMH) is positive and statistically significant for the majority of portfolios, except in isolated cases such as SLHi. This underscores the importance of labor-income growth as a meaningful source of risk affecting time-series variations in excess returns. The adjusted R-squared values range from moderate to relatively high (approximately 6% to nearly 60%), demonstrating that the four-factor model explains a substantial portion of the variation in portfolio returns, especially for portfolios with stronger risk exposures.



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Table 5: Second-Pass Fama–MacBeth Regression

| Portfolio | Intercept | MKT | SMB | HML | LMH | Adj. R ² |
|-----------|----------------|----------------|----------------|--------------|----------------|---------------------|
| SLLo | -0.189 (-1.07) | 0.126 (1.09) | 0.034 (0.51) | 0.023 (0.71) | 0.106 (1.12) | -0.017 |
| SLHi | -0.073 (-1.43) | -0.097 (-1.49) | 0.139 (1.98) | 0.125 (2.96) | 0.081 (0.99) | 0.073 |
| SHLo | -0.454 (-1.76) | -0.078 (-0.87) | 0.158 (1.44) | 0.112 (2.24) | 0.104 (0.99) | 0.069 |
| SHHi | 0.488 (0.29) | -0.012 (-0.13) | -0.064 (-1.36) | 0.035 (0.94) | -0.073 (-0.97) | -0.031 |
| BLLo | -0.087 (-0.85) | 0.021 (0.26) | 0.085 (0.99) | 0.065 (1.78) | 0.081 (0.99) | 0.017 |
| BLHi | -0.031 (-0.92) | 0.014 (0.19) | 0.041 (0.60) | 0.012 (0.32) | 0.066 (0.87) | -0.014 |
| BHLo | 0.363 (0.20) | -0.009 (-0.12) | -0.019 (-0.67) | 0.018 (0.31) | 0.013 (0.22) | -0.012 |
| BHHi | -0.043 (1.06) | 0.034 (0.37) | 0.028 (0.40) | 0.026 (1.02) | 0.024 (0.37) | -0.016 |

The results of the second-pass Fama–MacBeth regressions provide evidence on whether factor betas obtained from the time-series analysis are priced in the cross-section of portfolio returns. The estimated risk premiums associated with the market, size, value, and human capital factors are generally statistically insignificant across all portfolios. In addition, the adjusted R-squared values are low or even negative, and the F-statistics indicate weak overall explanatory power. These findings suggest that although the four factors explain variations in portfolio returns over time, their estimated betas do not reliably predict future cross-sectional returns. Such a pattern aligns closely with the Efficient Market Hypothesis (EMH), which posits that asset prices already reflect all publicly available information. Consequently, past factor exposures cannot be used to systematically forecast future returns or generate abnormal profits, as markets adjust quickly to new information. The insignificance of cross-sectional risk premiums therefore supports the notion that Punjab’s equity market exhibits characteristics of semi-strong efficiency.

Hypotheses results

Table 6: Summary of Hypothesis Testing

| Hypothesis | Factor | Result | Interpretation |
|------------|----------------------------|---------------------|---|
| H1 | LMH (Human Capital) | Supported | Human capital risk explains portfolio returns. |
| H2 | Four-Factor Model Validity | Partially Supported | Strong in time-series; weak in cross-section (consistent with EMH). |

5. DISCUSSION



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The empirical results of this study, based on firms operating in Punjab, Pakistan, reveal several consistent patterns that align with both global asset-pricing evidence and prior research conducted in Pakistani markets. First, the analysis confirms the persistence of the **size effect**, as small firms listed on the PSX and active in Punjab generate higher average returns than their larger counterparts. This finding reinforces the well-established argument in asset-pricing literature that small-cap firms are inherently riskier due to limited resources, higher sensitivity to economic fluctuations, and greater vulnerability to market shocks. As a result, investors demand—and receive—a risk premium in exchange for holding smaller, more volatile stocks. This size-related performance differential mirrors results documented in numerous emerging and developed markets, suggesting that Punjab's equity environment exhibits similar structural characteristics (Han et al., 2024).

The study also provides strong evidence supporting the **value effect**, with high book-to-market portfolios earning significantly higher returns than low book-to-market portfolios. This outcome indicates that value firms—often characterized by lower market prices relative to their book values—either face higher fundamental risk or tend to be temporarily mispriced by the market. In either case, these stocks compensate investors with superior returns, consistent with longstanding empirical findings in international finance. The persistence of the value effect in Punjab underscores the relevance of firm fundamentals in shaping investor expectations and pricing dynamics (Hmood, 2025).

A central contribution of this research is its evaluation of the **human capital effect**. The results demonstrate that the labor-income-growth-based human capital factor (LMH) exhibits a positive and statistically significant relationship with excess returns across most constructed portfolios. In particular, portfolios containing firms with low labor-income growth outperform those with high labor-income growth (World Bank, 2020). This pattern suggests that human capital risk is indeed priced in Punjab's equity market. Firms experiencing slower growth in labor-related expenditures may be perceived as facing higher uncertainty, possibly due to wage rigidity, organizational restructuring, or fluctuations in workforce productivity. Such uncertainties elevate the perceived riskiness of these firms, prompting investors to require higher returns as compensation. The significance of the LMH factor highlights the important role that human capital dynamics play in shaping asset prices, especially in labor-intensive industries prevalent in Punjab (Arkol & Yildirim, 2024).

Finally, the study's **Fama–MacBeth cross-sectional regression results** reveal that time-varying betas obtained from the first-pass regressions do not possess strong predictive power for future excess returns. This outcome is consistent with the principles of the Efficient Market Hypothesis (EMH), particularly the semi-strong form, which argues that market prices fully incorporate all publicly available information. Consequently, historical risk exposures cannot be systematically exploited to generate abnormal returns. The inability of factor betas to forecast future returns suggests that Punjab's financial market adjusts relatively efficiently to new information and that investors cannot rely solely on past risk patterns to outperform the market (Muddasir & Karaca, 2023).

Collectively, these findings underscore the importance of including human capital as a key explanatory variable in asset-pricing models, particularly within developing and labor-driven economies like Punjab. The results position human capital alongside traditional Fama–French factors—size and value—as a meaningful and independent dimension of risk that shapes return behavior. This study therefore contributes to the broader understanding of asset pricing in emerging markets by demonstrating that human



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capital plays a substantial and measurable role in determining equity performance (d'Astous et al., 2024).

CONCLUSION, IMPLICATIONS, AND FUTURE RESEARCH

Conclusion

This study set out to develop and empirically validate a human capital–augmented four-factor asset-pricing model for non-financial firms associated with Punjab, Pakistan. By integrating labor-income growth as a human capital factor into the traditional Fama–French framework, the study provides new insights into the determinants of stock returns in an important emerging regional market. The empirical findings indicate that size, value, and human capital factors significantly explain the time-series variation in excess portfolio returns, while portfolios comprising small firms, high book-to-market firms, and firms with low labor-income growth consistently deliver higher average returns (Eiling et al., 2025). These results confirm the presence of size, value, and human capital premiums within Punjab’s corporate sector. However, the second-pass Fama–MacBeth tests reveal that factor betas are not reliably priced in the cross-section of returns, suggesting that past risk exposures do not predict future returns—an outcome in line with the Efficient Market Hypothesis. Collectively, the findings demonstrate that the human capital–augmented four-factor model offers a more comprehensive and contextually relevant explanation of return behavior compared to single-factor approaches, highlighting the importance of labor-market dynamics in asset pricing within Punjab.

Theoretical and Practical Implications

From a theoretical perspective, the study provides strong support for extending traditional multifactor models to include human capital as a distinct priced risk factor. The evidence highlights the interconnectedness between labor-income dynamics and financial-market behavior, demonstrating that firm-level human capital conditions—reflected through changes in labor costs and wage structures—affect expected returns. This underscores the importance of incorporating human capital into asset-pricing frameworks, particularly in emerging markets where labor-intensive industries dominate economic activity (Ullah et al., 2025). The results also reinforce the broader theoretical argument that financial markets cannot be fully understood without considering non-financial sources of risk, such as those arising from human resource investments and workforce productivity (Barras et al., 2019).

The study also offers valuable practical implications for investors and portfolio managers. The results suggest that investment strategies should account not only for conventional risk factors like market exposure, firm size, and book-to-market ratios but also for human capital indicators such as labor-income growth and employee cost patterns. Portfolios tilted toward small firms, high-BMR firms, and companies with low labor-income growth may yield higher returns but carry elevated levels of risk. Consequently, portfolio managers should employ diversification strategies that balance these premiums while managing exposures to workforce-related uncertainties. Understanding how human capital influences firm performance can also enhance risk assessment and improve investment decision-making in Punjab’s corporate sector (Wang et al., 2022).

For policymakers and regulators, the findings highlight that labor-market policies and human capital development initiatives have direct implications for financial-market outcomes. Wage regulations, education and skill-development programs, and labor-market reforms influence firm costs, productivity, and ultimately valuations in the stock



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market. Policymakers in Punjab should therefore recognize that improvements in human capital not only support economic growth but also contribute to a more stable and attractive investment climate. Strengthening the alignment between labor policies and financial-market development can enhance investor confidence and promote sustainable economic progress in the region.

Limitations

This study is subject to several limitations that should be considered when interpreting the findings. First, the analysis focuses exclusively on non-financial firms, as banks and financial institutions possess distinct regulatory frameworks and balance-sheet structures that make them incompatible with the factor construction techniques used in this study. Second, the portfolio formation relies on only eight size–value–human capital combinations rather than more detailed 5×5 or higher-dimensional portfolio sorts, primarily due to data availability and sample-size constraints within Punjab-based firms. More granular sorting could potentially enhance the precision of factor estimates. Third, the labor-income data used to construct the human capital factor are obtained at an annual frequency and subsequently matched with monthly return data, which may mask short-term fluctuations in labor dynamics and reduce the sensitivity of the human capital proxy to high-frequency economic conditions. These limitations highlight opportunities for further refinement and suggest caution when generalizing the results.

Directions for Future Research

Future research can expand the scope and depth of this study in several meaningful ways. First, scholars may extend the analysis beyond Punjab by incorporating firms from all provinces of Pakistan to conduct a comparative regional assessment, allowing researchers to explore how human capital dynamics and asset-pricing relationships differ across diverse economic environments. Second, subsequent studies may evaluate the performance of the human capital–augmented four-factor model relative to other extended frameworks, such as the Fama–French five-factor or six-factor models, or models incorporating liquidity and momentum, to assess whether human capital consistently enhances explanatory power across specifications.

Third, examining the behavior of the human capital factor during periods of economic turbulence—such as the COVID-19 pandemic, political transitions, or macroeconomic shocks—would provide valuable insights into how labor-income-related risks behave under stress (Chai et al., 2024). Finally, future studies may consider employing alternative or more refined proxies for human capital, including training expenditures, research and development intensity, employee education levels, or skill premiums, to test the robustness of the relationship between human capital and stock returns. These avenues of research can collectively contribute to a deeper and more comprehensive understanding of the role of human capital in asset pricing within emerging markets.

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