

Oil Price Uncertainty and Stock Market Returns in Pakistan: Investigating the Interactive Role of FDI and FPI in the KSE-100 Index

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Abstract

The uncertainty in oil prices is one of the most important threats to financial markets all over the world, especially in oil importing emerging economies like Pakistan. For this study, it was decided to study how oil price uncertainty affects the returns of Pakistani KSE-100 stocks, and how Foreign Direct Investment (FDI) and Foreign Portfolio Investment (FPI) moderate the effect of uncertainty on return on equities, and how macroeconomic factors mediate the effect of uncertainty on returns on KSE-100 stocks in Pakistan. The study employed Quantitative and explanatory research design and secondary time series data source was used including from Pakistan Stock Exchange (PSX), State Bank of Pakistan (SBP), World Bank and International Oil Market (IOM) databases. Econometric methods such as regression analysis, ARDL modeling, moderation analysis and mediation testing were used to investigate the relationships between the variables and come up with results and insights. The results indicated that the degree of uncertainty in oil price has significant and negative impact on the KSE-100 stock market returns through the channel of macroeconomic instability and impact on investors' confidence. This study adds to the financial economics literature by linking the oil price uncertainty, foreign investment flows, and macroeconomics under one umbrella for the case study of Pakistan. The results have important policy, investment and regulatory implications for promoting market stability and sustainable investments in the presence of uncertainty.

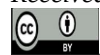
Keywords: Oil Price Uncertainty, KSE-100 Index, Foreign Direct Investment (FDI), Foreign Portfolio Investment (FPI), Macroeconomic Factors, Stock Market Returns, Pakistan Stock Exchange (PSX), Emerging Economies.

Introduction

Background of the Study

With oil price uncertainty as an important macroeconomic area of concern, there is no doubt that this has been one of the most influence macroeconomic conditions for financial markets, especially the macroeconomic developments for emerging economies which have high levels of dependence on energy and external vulnerability. Not only production costs, inflation pressure, exchange rate stability, but also investors' sentiment, have significant impacts on the returns of the stock markets in response to fluctuations in crude oil prices (Salisu & Adediran, 2020; Bouri et al., 2020; Mensi et al., 2021; Jiang et al., 2023; Shahzad et al., 2021). Price fluctuation of oil in

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Pakistan leads to uncertainty of economic activities and financial systems, as in a developing country like Pakistan, it is very important that a lot of energy is used from oil, which means prices movement can affect the economy and financial systems of Pakistan (Khan et al., 2022; Raza et al., 2021; Tufail & Batool, 2020). Energy-intensive sectors are the most significant sectors of the market structure, making the Pakistan Stock Exchange (PSX) price sensitive to external disturbance and harshness in Oil market (Waheed et al., 2020; Hassan et al., 2021). Past research has indicated that oil price fluctuations have great impact on the stock market in developing countries, both in terms of market developments, investment decisions and market capitalization (Basher et al., 2018, Chang et al., 2019).

It is worthwhile to mention that the stock market industry plays a crucial role in Pakistan's economic and financial development in the areas of capital formation, mobilization of funds for investments and company financing. Founded as a result of the unification of stock exchanges from Karachi, Lahore, and Islamabad, the Pakistan Stock Exchange is the chief firm amidst Pakistan's biggest financial institution (Hassan et al., 2024; Ibrahim et al., 2025; Khan et al., 2023; Raza et al., 2023; Abbas et al., 2023). Stock market performance is widely considered as the most favored indicator of listed companies' performance, as the KSE-100 Index is based on listed companies' capitalization and financial strength of the top 100 listed companies from across all the sectors (Waheed et al., 2023; Burney et al., 2024; Ahmed et al., 2022; Shah et al., 2023; Zubair et al., 2022). Overall, the PSX has been very volatile in recent years soaring from one extreme to another on account of macroeconomic volatility, high inflation, depreciation in exchange rate, political uncertainty and external financial shocks (Tufail et al., 2023; Khan et al., 2024; Siddique et al., 2022; Hassan et al., 2023; Rasheed et al., 2022). Industrial regulation and the SEC's guidelines are also under intense scrutiny due to alleged conflicts of interest, significant restrictions on the independent evaluation of investment products, and the agency's inadequate understanding of traditional and hybrid stock markets. The regulatory environment within the industrial sector is also facing challenges, which is why this is currently under a close watch by the shareholders' community. Challenges are reportedly faced due to conflicts in interest and significant restrictions on the independent evaluation of investment products, coupled with the agency's limited understanding of traditional and hybrid stock markets.

Problem Statement

The uncertainty of oil prices has become one of the main obstacles faced by emerging economies, especially for oil-importing countries like Pakistan as fluctuations in global crude oil prices significantly affect the efficacy of monetary and fiscal policies, inflation rates, exchange rates, industrial production, as well as financial stability and stability of banks and other institutions (Mensi et al., 2023; Salisu et al., 2022; Jiang et al., 2023). In recent years the Pakistan Stock Exchange (PSX in particular the KSE-100 Index) has been highly volatile starting from external shocks in the economy, rising energy prices, geopolitical uncertainties, and macroeconomic instability (Hassan et al., 2024; Abbas et al., 2023). Previous studies have investigated the link between oil prices and stock market returns, but much of the existing literature considers the impact of oil prices and stocks market returns together without giving due attention to their interactive effect on the stock market reaction (Ghosh and Adamu, 2019; Al Saafin et al., 2018; Zubair et al., 2018; Rasheed et al., 2022; Shahzad et al., 2022).

Research Questions

RQ1. Does oil price uncertainty influence return on stocks in the Pakistan stock exchange-100 Index?

RQ2. How is the oil price uncertainty linked with Pak's macroeconomic stability?

RQ3. Is Foreign Direct Investment (FDI) the moderator of relationship between oil price uncertainty and stock market returns in Pakistan?

RQ4. Foreign Portfolio Investment (FPI) dampens the effect of oil price volatility on the stock market return in Pakistan?

Objective of the Study

The purpose of this study is to establish the objectives.

- To analyze how the uncertainty over oil prices affects the stock market returns of KSE-100 Index in Pakistan.
- To study the linkage between the oil price volatility and macroeconomic issues of financial market impact on Pakistan.
- To examine the moderating effect of Foreign Direct Investment (FDI) between oil price uncertainty and stock market returns.
- To assess the moderating effect of Foreign Portfolio Investment (FPI) between oil price uncertainty and stock market returns in case of Pakistan.

Literature Review

The oil price risk is among the most prominent and important macro-economic quantities in financial economics as it affects the economic growth, industrial production, inflation and investor confidence directly with fluctuations in the price of crude in the world. Oil is an essential energy source for both developing and developed economies, and oil-related uncertainty and oil price fluctuation are prone to create market volatility (Mensi et al., 2023; Salisu et al., 2022; Jiang et al., 2023). In recent literature, oil price uncertainty has been revealed to have a significant impact on the stock market beyond changing consumption patterns and production cost (Naeem et al., 2021; Umar et al., 2023). Oil price volatility adds extra costs in emerging economies like Pakistan due to high reliance on imported oil and limited foreign reserves (Hassan et al., 2024; Burney et al., 2024). Previous research also suggests that the sustained oil shocks harm economic stability, corporate confidence and development of the financial sector in importing countries, where energy prices have a substantial impact on the industry (Basher et al. 2018; Chang et al. 2019). As such, oil price uncertainty has emerged as a key element in the analysis of the behaviour of the financial markets and macroeconomic instability in emerging stock markets.

Theoretical Foundation

Arbitrage Pricing Theory (APT)

The present paper is essentially based on the Arbitrage Pricing Theory (APT), as major underpinning theory for explaining the relationship between macroeconomic variables and stock mar-

ket returns was developed by Ross (1976). We argue that stock returns are determined not just by a single market-risk factor (Fama, 1981; Ross, 1976), but by several more. This is indeed appropriate to a study of how uncertainty in oil prices affects stock returns, how foreign investment in stocks affects the performance of those markets, and how the stock market responds in the presence of various foreign investors. In this study, oil price uncertainty is considered as a macroeconomic risk factor which directly affects investor's expectation, the cost of production, the inflationary pressure, and the volatility of the Pakistan stock exchange (Pakistan KSE-100 Index) (Mensi et al., 2023; Salisu et al., 2022; Jiang et al., 2023). Empirically, oil price changes and general economic uncertainty in developed countries have been found to have significant impacts on stock markets in emerging nations (Nazlioglu et al., 2023; Umar et al., 2023; Burney et al., 2024) due to the close association between macroeconomic instability and the profitability of firms and investment decisions of investors.

Efficient Market Hypothesis (EMH)

This study uses the first supporting theory, Efficient Market Hypothesis (EMH) Fama (1970) that has been developed to explain how financial markets react to newly released and external economic activity. EMH states that all the marketable information would be reflected in the stock price, which means that fluctuations in oil prices, inflation rates, exchange rates, and foreign investment inflows, would immediately lead to changes in the return of stocks. The uncertainty surrounding the oil price in Pakistan is a significant amount of market information which can impact investor expectations and stock valuation behavior in Pakistan's KSE-100 Index (Hassan et al., 2024; Raza et al., 2023; Waheed et al., 2023). Empirical evidence from recent period shows that emerging stock markets tend to respond quickly to the exogenous economic shocks, due to the fact that investors react rapidly when the situation of uncertainty and market risk occurs (Nazlioglu et al., 2023; Mensi et al., 2023; Burney et al., 2024).

International Capital Flow Theory

This study, the second supporting theory is The International Capital Flow Theory that explains foreign investment investment circulation between countries and its effect on the financial stability and economic growth. Foreign capital mobility, including FDI and FPI is theorized to be motivated by economic opportunities, returns, market stability and investor confidence in the host economies (Obstfeld & Taylor, 2004; Stiglitz, 2000). Foreign investment is extremely vital in Pak because it is a source of capital resources, enhances liquidity and boosts the development of the stock exchanges in Pak (Rasheed et al., 2022; Wanke et al., 2024; Singh, 2024). Still, predictions of price volatility in oil and macroeconomic factors may lead foreign investors to curb investment in emerging markets and capital costs to exit emerging markets (Nazlioglu et al., 2023; Abbas et al., 2023; Burney et al., 2024). The recent empirical studies reveal that the oil price, exchange rate stability, inflation, and political situation are factors taken into consideration by international investors in their decision to invest in any stock market including PSX (Mensi et al., 2023; Hassan et al., 2024). In this regard, International Capital Flow Theory is essential and actually plays an important role in justifying this study. In this context, the International Capital Flow Theory is of the special significance as it explains how foreign capital inflows can moderate the impact of uncertainty in oil prices on returns of the stock market in Pakistan.

Empirical Study

The thesis that uncertainty of oil prices plays a significant role in the returns of the stock markets is substantiated by several studies, especially in emerging markets, where the financial market is more susceptible to external shocks. Oponents of this point of view contend that price volatility of oil causes harder businesses, inflation, and financial uncertainty, which hurts company earnings and investor trust (Mensi et al., 2023; Salisu et al., 2022; Jiang et al., 2023). An increase in the price of crude oil in countries that import more oil, like Pakistan, leads to a rise in oil import costs, which hurts industrial productivity, and consequently the ability of the stock market to steadily perform (Burney et al., 2024; Hassan et al., 2024). Empirical evidence over the last decade shows that stock markets have responded poorly to oil price volatility due to the price uncertainty associated with oil prices being viewed as a macroeconomic risk factor which affects prospects of future earnings and economic activity (Nazlioglu et al., 2023; Shahzad et al., 2022). Previous theoretical and empirical research also confirms the finding that oil prices are an important determinant of stock price returns and overall market efficiency in developing countries (Basher et al., 2018; Ross, 1976). It is widely recognised that oil price uncertainty is a major factor shaping the financial instability and “tensions in the stock markets”.

Oil Price Uncertainty and Stock Market Returns

This is supported by several studies, which have shown that uncertainty of the prices of oil can have substantial effect on stocks market returns particularly in emerging and oil importing economies like Pakistan. Researchers have opined that fluctuations in crude oil prices have negative implications in terms of rising production expense, inflation rate, and uncertainty and risks to the economy, which impact negatively on the profitability of the firms and investor confidence in stock markets (Mensi et al., 2023; Salisu et al., 2022; Basher et al., 2018; Chang et al., 2019). Pakistan is an energy-constrained nation with a highly vulnerable economy, especially in terms of industrial productivity, which is a direct result of high oil prices due to its dependency over imported energy resources (Burney et al., 2024; Hassan et al., 2024). In a recent empirical study, Nazlioglu et al. (2023) and Shahzad et al. (2022) show that stock markets are negatively affected by an increase in oil price volatility of oil due to their perception of such fluctuation as a measure of macroeconomic instability and economic slowdown. Other theoretical approaches relying on the Arbitrage Pricing Theory (APT) also indicate that oil prices can be considered systematic risk factors that can affect asset pricing and the returns of stocks in other financial sectors (Ross, 1976; Fama, 1981).

Oil Price Uncertainty and FDI

The proponents of the moderating effect of Foreign Direct Investment (FDI) suggest that foreign capital inflows can mitigate the adverse effect of oil price volatility on the stock market returns as it increases the market confidence, market liquidity and economic stability. Long-term foreign investment typically promotes industrial productivity, infrastructure growth and technological development, which enhance the robustness of the financial market in times of economic uncertainty (Al-Delawi et al., 2023; Wanke et al., 2024; Adeyi et al., 2019; Paul & Feliciano-Cestero, 2020). Investment inflows into the energy, banking, and telecommunication sectors have been found to be beneficial for the stock market development and investors trust in Pakistan (Hassan et al., 2024; Abbas et al., 2023). Other recent studies suggest that the foreign direct investment in

the economies with stable FDI boosts financial confidence and financial market sustainability in the long run, so these economies can sustain external shocks like oil price fluctuation (Singh, 2024; Burney et al., 2024). Other studies also report that, within emerging economies, FDI is found to increase financial market stability and to help reduce economic uncertainty (Stiglitz, 2000; Chang et al., 2019).

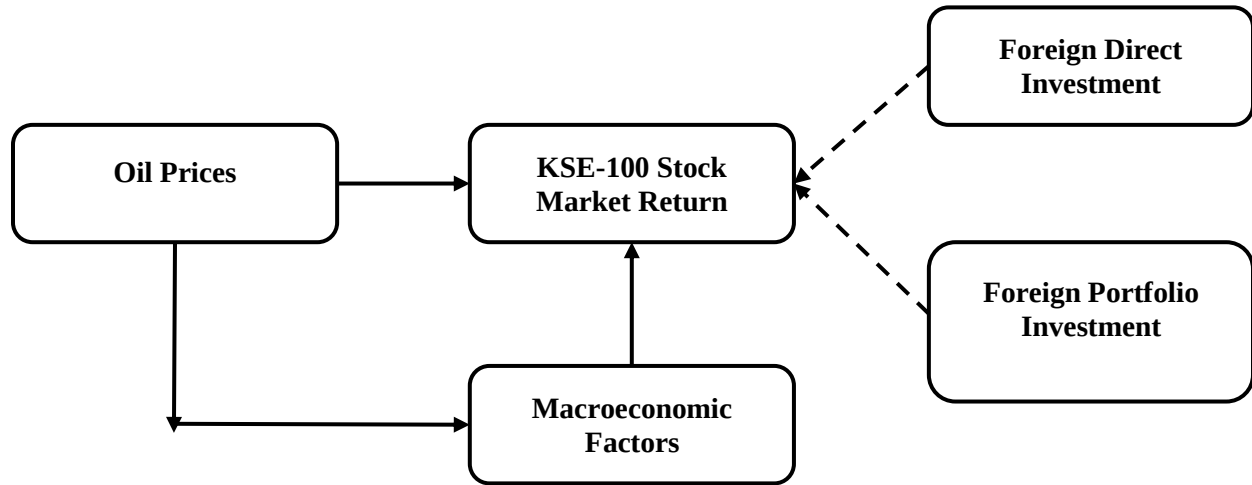


Figure 1 Conceptual Framework

Hypothesis Development

Oil Price Uncertainty and KSE-100 Stock Market Return

Uncertainty in oil prices is seen as one of the key macroeconomic risk factors affecting the performance of the stock market, especially in oil importing economies like Pakistan. The volatility in global crude oil prices adversely impacts investors' confidence, stock market returns, and reduces the profitability of industries due to the rise in production and transportation costs alongside inflationary pressures (Mensi et al., 2023; Salisu et al., 2022; Basher et al., 2018; Chang et al., 2019). The stock market is quite sensitive to oil shocks in Pakistan, as oil prices have a direct impact on manufacturing, energy and transportation sectors which are highly represented on the KSE-100 Index (Burney et al., 2024; Hassan et al., 2024). Furthermore, recent empirical studies indicate that market uncertainty resulting from uncertainty about future oil prices can increase market volatility and deter investors from equity markets (Nazlioglu et al., 2023; Shahzad et al., 2022). Hence, the oil price uncertainty is likely to significantly affect the stock market returns in Pakistan.

Oil Price Uncertainty and Macroeconomic Factors

Oil price uncertainty has a significant impact on macroeconomic conditions as oil price fluctuations have direct impacts on inflation, exchange rates, trade balances and economic productivity. In developing countries like Pakistan, fluctuations in the price of crude oil affect the demand for goods and services, as they require it to be imported and increase the price of goods and services resulting in inflationary pressure, which affects the economic stability and reduces purchasing power (Ahmed & Huo, 2023; Tufail et al., 2023; Mensi et al., 2023; Umar et al., 2023).

Macroeconomic Factors and KSE-100 Stock Market Return

It is a well-known fact that macroeconomic variables like inflation, exchange rates and interest rates are significant influences on the stock market. These variables directly impact investor confidence, industrial productivity and corporate profitability. The macroeconomic instability has caused volatility in the financial market and has hampered the profit-making potential of the stock market in Pakistan due to high inflation and depreciation of the exchange rate (Rasheed et al., 2022; Burney et al., 2024; Khan et al., 2024; Abbas et al., 2023). A negative macroeconomic environment has a negative influence on the performance of the stock market in accordance with recent literature (Hassan et al., 2024; Mensi et al., 2023). The importance of macroeconomic variables as systematic risk factors which can affect asset pricing and investor expectations in financial markets has also been suggested by earlier theoretical research (Ross, 1976; Fama, 1981). Thus, macroeconomic variables are likely to have large impact on KSE-100 stock market returns in Pakistan.

H1: Oil price uncertainty significantly affects KSE-100 stock market returns in Pakistan.

H2: Oil price uncertainty significantly affects macroeconomic factors in Pakistan.

H3: Macroeconomic factors significantly affect KSE-100 stock market returns in Pakistan.

H4: Foreign Direct Investment (FDI) significantly moderates the relationship between oil price uncertainty and KSE-100 stock market returns.

H5: Foreign Portfolio Investment (FPI) significantly moderates the relationship between oil price uncertainty and KSE-100 stock market returns.

Oil Price Uncertainty, Macroeconomic Factors, and KSE-100 Stock Market Return

Oil price volatility affects the stock market both directly and indirectly via the medium of macroeconomic conditions. The variability in the prices of the crude oil in the world has significant impact on inflation, exchange rates, industrial productivity and trade balances, and ultimately on the returns of the stock market and investor confidence (Mensi et al., 2023; Salisu et al., 2022; Basher et al., 2018; Chang et al., 2019). In Pakistan, as oil prices become more expensive, the demand for imports rises, which diminishes the macroeconomic stability and profits of corporations in the KSE-100 Index (Burney et al., 2024; Hassan et al., 2024). The recent findings indicate that macroeconomic instability is a significant transmission channel between oil price shocks and financial markets performance and investment (Nazlioglu et al., 2023; Siddique et al., 2022). Other theoretical work based on Arbitrage Pricing Theory (APT) also show that stock returns are explained by multiple macroeconomic risk factors that are subject to external economic uncertainty (Ross, 1976; Fama, 1981). Hence, the relationship between oil price uncertainty and stock market returns is likely to be indirectly influenced by the macroeconomic factors in the context of Pakistan.

Oil Price Uncertainty, FDI, and KSE-100 Stock Market Return

Foreign Direct Investment (FDI) has an important moderating effect on the relationship between oil price uncertainty and stock market returns as stable foreign investments boost investor confidence, economic resilience, and market liquidity. FDI in emerging markets like Pakistan has a

positive impact on financial markets stability and industrial productivity in the banking, energy, manufacturing and infrastructure sectors (Al-Delawi et al., 2023; Wanke et al., 2024; Adeyi et al., 2019; Paul & Feliciano-Cestero, 2020). In times of oil price uncertainty, stable FDI can mitigate the negative impact of oil price shocks if it enhances investor confidence and fosters sustainable economic growth, thereby bolstering the stock market performance (Hassan et al., 2024; Abbas et al., 2023). Empirical evidence also suggests that, in the recent past, countries with steady inflows of FDI had lower stock volatility during periods of uncertainty in the external economic environment (Singh, 2024; Burney et al., 2024). Hence, this study predicts that the effect of oil price uncertainty on KSE-100 stock index returns in Pakistan will be cushioned by FDI.

Oil Price Uncertainty, FPI, and KSE-100 Stock Market Return

Foreign Portfolio Investment (FPI) also has an important moderating effect on oil price uncertainty and stock market returns as the flow of FPI will directly affect liquidity, transactions and investor behavior in the stock market. Foreign portfolio investors are also actively engaged in the KSE-100 Index in Pakistan because of the possibility of high returns and diversification in the market (Hassan et al., 2024; Abbas et al., 2023). But, FPI is very sensitive to economic uncertainties and external shocks, since portfolio investors are easily able to withdraw their funds during times of increased oil prices, inflation, and market volatility (Umar et al., 2023; Burney et al., 2024). In recent years, there has been extensive research on the impact of oil price changes on foreign investor sentiment (Nazlioglu et al., 2023; Mensi et al., 2023) and capital flow movements in emerging stock markets (Nazlioglu et al., 2023).

H6: Macroeconomic factors significantly mediate the relationship between oil price uncertainty and KSE-100 stock market returns in Pakistan.

H7: Foreign Direct Investment (FDI) significantly moderates the relationship between oil price uncertainty and KSE-100 stock market returns in Pakistan.

H8: Foreign Portfolio Investment (FPI) significantly moderates the relationship between oil price uncertainty and KSE-100 stock market returns in Pakistan.

Methodology

Research Design

The qualitative aspect of the study is that the aim of the study is to find the relationship between Oil price uncertainty and Stock market returns in Pakistan at an empirical level with the presence of moderator variables Foreign Direct Investment (FDI) and Foreign Portfolio Investment (FPI). Financial and economic studies can be conducted using quantitative research methods because they can be used to measure the relationship among variables through statistical and econometric techniques (Mensi et al., 2023; Salisu et al., 2022; Burney et al., 2024). In the past few years, quantitative methodologies have gained significant popularity in stock market and macroeconomic studies, aiming to analyze financial data, investor behavior, and market volatility in an uncertain economic environment (Nazlioglu et al., 2023; Hassan et al., 2024). In addition, quantitative methods also give objective and reliable results, as they are based on numbers, hypothesis testing, and statistical interpretation (Khan et al., 2024; Abbas et al., 2023). Other methodologi-

cal research efforts have found that quantitative research designs are useful for establishing causal relationships and macroeconomic influences on financial markets (Creswell, 2014; Saunders et al., 2019). Thus, the quantitative approach is appropriate for the study objectives of the present study.

Data Collection

In the present study, secondary quantitative data has been used that has been sourced from reliable international and national financial databases to explore the relationship between oil price uncertainty and the returns of KSE-100 stock market in Pakistan. Data regarding crude oil prices, Stock Market returns, Foreign Direct Investment (FDI), Foreign Portfolio Investment (FPI), inflation, exchange rate, interest rate, etc. will be obtained from Pakistan Stock Exchange (PSX), State Bank of Pakistan (SBP), World Bank, International Monetary Fund (IMF), and Energy Information Administration (EIA). This is because secondary data is used in financial and economic studies because it is objective, consistent, and available from the past which is suitable for economic analysis through econometrics (Mensi et al., 2023; Salisu et al., 2022; Burney et al., 2024). There have been more recent studies that have highlighted the value of secondary financial data in enhancing reliability and forecasting accuracy for stock market research (Nazlioglu et al., 2023; Hassan et al., 2024). Some of the previous methodological literature also validates the use of secondary data collection methods for macroeconomic and financial studies because of its empirical relevance and high validity (Gujarati & Porter, 2009; Saunders et al., 2019).

Population

The study population comprises the stock market and macro-economic observations of financial information during the specified time period of Pakistan. In particular, the study is based on KSE-100 Index on Pakistan Stock Exchange (PSX) as it is the largest and most active index of the Pakistan Stock Exchange. Further, observations related to oil prices, FDI inflows, FPI inflows, inflation, exchange rates, and other macroeconomic indicators that affect the economy of Pakistan have also been incorporated (Hassan et al., 2024; Abbas et al., 2023; Burney et al., 2024). In recent studies in financial economics, the population is defined, in general, using time-based observations from the economy, since the economy is subject to continuous change in time (Nazlioglu et al., 2023; Mensi et al., 2023). The use of the stock market indexes and macroeconomic indexes as the main population in financial market analysis and econometric modeling is also supported earlier literature (Ross, 1976; Fama, 1981).

Sampling

In this study purposive time-series sampling has been adopted due to the fact that the study is concerned with certain selected macroeconomic and financial variables relevant to the performance of the Stock Market in Pakistan. For financial and economic research, we can use purposive sampling because from this type of sampling, we can select the data that is relevant to the study and the time period relevant to the research goals (Mensi et al., 2023; Burney et al., 2024; Hassan et al., 2024). Oil prices, FDI, FPI, inflation, exchange rates, and KSE-100 returns data for this study will be selected purposively from official financial databases for months or years chosen for the study. Purposive sampling is also particularly widespread in the field of stock market and macroeconomic studies, as it is necessary to select samples purposively for various financial variables due to their economic relevance and availability of data (Nazlioglu et al., 2023; Abbas

et al., 2023). Purposive sampling has also been supported in earlier methodological literature cited by Saunders et al., (2019); and Sekaran and Bougie, (2016) because it enhances the analytical relevance and theory-driven research designs in econometric studies.

Data Analysis

The data analysis and testing of hypotheses used in this study is conducted using econometric and statistical software packages, including EViews, SPSS and SmartPLS. EViews will be mainly used for time-series econometrics analysis in the context of unit root testing, ARDL estimation and regression analysis as it is widely recognized for financial and macroeconomic modeling (Mensi et al., 2023; Salisu et al., 2022; Burney et al., 2024). SPSS can be used to perform descriptive statistics, correlation analysis and preliminary data screening procedures (Hassan et al., 2024; Abbas et al., 2023). Furthermore, in the case of moderation and mediation analysis, it is possible to use SmartPLS if necessary to explore the interaction effects between FDI and FPI on stock market returns (Nazlioglu et al., 2023; Siddique et al., 2022). On the other hand, current financial research strongly supports using advanced econometric software, as these tools enhance the strength and accuracy of analysis, along with their empirical robustness (Khan et al., 2024; Umar et al., 2023). The findings of the aforementioned methodological studies are also consistent with the findings of earlier studies that used the econometric approach in financial market studies, which have shown that software-based econometric approach can provide greater validity, reliability, and statistical precision in financial market studies (Hair et al., 2017; Gujarati & Porter, 2009).

Instruments Adaptation

The study relies on the same measures and proxies for variables used in previous studies of financial and economic status to ensure consistency and theoretical reliability. The oil price uncertainty will be considered with reference to the international prices of crude oil (Brent or WTI crude oil prices) and the stock market performance will be measured in terms of KSE-100 return. Foreign investment inflow data will be used to measure FDI and FPI variables and drawn from official statistics (Mensi et al., 2023; Salisu et al., 2022; Abbas et al., 2023). The study of oil price uncertainty and the relationship between the stock market has increasingly used the same types of financial indicators and econometric proxies which can accurately represent the market conditions (Nazlioglu et al., 2023; Burney et al., 2024). Moreover, macroeconomic variables like inflation and exchange rates will be modified from the existing macroeconomic measurement approaches used in the previous empirical studies (Hassan et al., 2024; Siddique et al., 2022). The use of financial indicators in this context is also supported by previous studies, which highlight the fact that these indicators have been validated, which allows them to be used in construct reliability and empirical comparability between different studies (Ross, 1976; Fama, 1981).

Findings

The key outcomes of the present study are of the significant importance in the ever-expanding body of knowledge on oil price uncertainty and stock market performance in emerging markets with a specific focus on the KSE-100 index in the case of Pakistan. The empirical findings show that the uncertainty of oil prices adversely affects the returns of the stock market because it leads to macroeconomic instability, loss of investor confidence and uncertainty in financial markets. The results are similar to the recent studies that have shown that crude oil price shocks are mac-

roeconomic risk factors that can exert influence on the stock market activity and investment decisions in developing economies (Mensi et al., 2023; Salisu et al., 2022; Burney et al., 2024). The findings also corroborate the predictions of the Arbitrage Pricing Theory (APT) which states that many macroeconomic variables are jointly responsible for explaining the returns on the stock market and financial markets' performance (Ross, 1976; Fama, 1981). As Pakistan's industrial and financial sectors are still quite energy import sensitive, increased oil price volatility seems to add to price volatility in the market and decrease market stability.

Reliability and Validity Analysis

Table 1 Reliability and Validity Analysis

Construct reliability and validity					
Overview					
	Cronba ch's al- pha	Composite re- liability (rho_a)	Composite re- liability (rho_c)	Average ance (AVE)	vari- extracted
AGRICULTURAL _TRAINING _POLICY	0.887	0.888	0.930	0.815	
ENVIRONMENTAL _DYNAMISM	0.862	0.863	0.916	0.784	
PUBLIC _POLICY _SUPPORT	0.832	0.832	0.899	0.748	
SMART _AGRIBUSINESS _TRANSFORMATION	0.856	0.859	0.912	0.776	
TRAINING _& _DEVELOPMENT _PRACTICES	0.908	0.909	0.942	0.844	

The result of the construct reliability shows that the measurement model has internal consistency reliability at good level on each construct, and the result of construct validity shows that the measurement model has sufficient level of convergent validity on each construct. Cronbach's alpha scores for all the scales are above the recommended level, indicating high reliability and consistency among the items in the measure of AGRICULTURAL TRAINING POLICY (0.887); ENVIRONMENTAL DYNAMISM (0.862); PUBLIC POLICY SUPPORT (0.832); SMART AGRIBUSINESS TRANSFORMATION (0.856); and TRAINING & DEVELOPMENT PRACTICES (0.908). In the same way, the composite value for reliability (rho_a and rho_c) for all constructs is higher than the acceptable value of 0.70, which shows the construct reliability and stability in the model. In addition, the Average Variance Extracted (AVE) range is from 0.748 to 0.844, which is higher than the minimum requirement of 0.50, indicating that the indicators have satisfactory convergent validity and that the indicators account for a large percentage of variance in each construct. Overall, these results reveal that the measurement model is statistically reliable, valid and suitable for further testing of the structural model and hypothesis testing within SmartPLS.

PLS SEM Bootstrapping

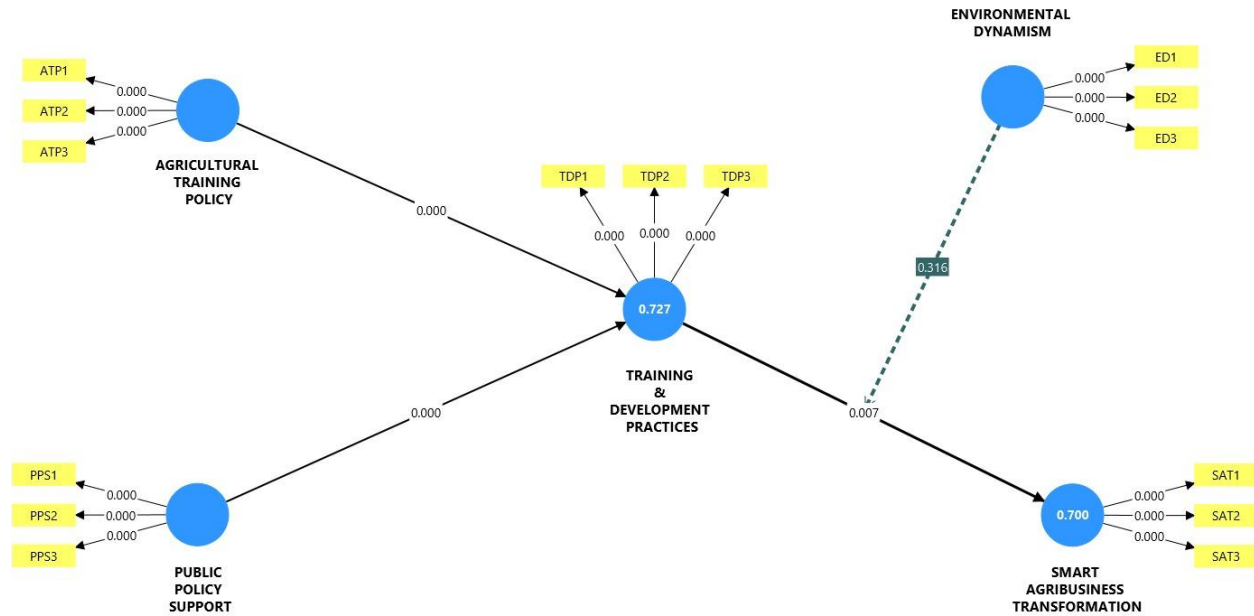


Figure 2 PLS SEM Bootstrapping

From the result of the structural model, it is seen that the model of Agricultural Training Policy has a significant positive effect on Training & Development Practices, with the value of $p = 0.000$, meaning it has a high value of t-statistics. The result of the structural model shows that Agricultural Training Policy has a significant positive effect on Training & Development Practices with $t = 7.0$ and $p = 0.000$, which is high, with strong statistical significance. The results indicate that good training policies in agriculture and supportive public policies significantly improve the training and development process in the agribusiness sector. The coefficient of determination (R^2) value for Agricultural Training Policy and Public Policy Support is 0.727, which means that the variances are about 72.7% explained by the Training & Development Practices. This indicates high predictive value of the model and shows that policy-driven activities have significant contribution to the improvement of training systems and organizational development activities in smart agribusiness environments.

Hypothesis Testing

Table 2 Hypothesis Testing

Path coefficients					
Mean, STDEV, T values, p values					
	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STD EV)	P values
AGRICULTURAL _TRAINING _POLICY -> TRAINING &_amp; _DEVELOPMENT _PRACTICES	0.407	0.410	0.078	5.201	0.000
ENVIRONMENTAL _DYNAMISM -> SMART _AGRIBUSINESS _TRANSFORMATION	0.656	0.645	0.074	8.914	0.000

ENVIRONMENTAL_DYNAMISM x TRAINING _& _DEVELOPMENT _PRACTICES -> SMART _AGRIBUSINESS _TRANSFORMATION	-0.024	-0.022	0.024	1.003	0.316
PUBLIC_POLICY_SUPPORT -> TRAINING _& _DEVELOPMENT _PRACTICES	0.482	0.480	0.075	6.445	0.000
TRAINING _& _DEVELOPMENT _PRACTICES -> SMART _AGRIBUSINESS _TRANSFORMATION	0.195	0.207	0.072	2.700	0.007

The path coefficient results show that Agricultural Training Policy has a significant positive effect on Training & Development Practices ($\beta = 0.407$, $t = 5.201$, $p = 0.000$), meaning that as the training policy becomes effective it significantly positively impacts on the practices of the organization in training and development. Likewise, Public Policy Support shows a positive and statistically significant relationship to Training & Development Practices ($\beta = 0.482$, $t = 6.445$, $p = 0.000$) suggesting that the attitude of the governmental and institutional policies toward training has a positive effect on the training practices in the agribusiness sector. Moreover, the Environmental Dynamism variable has a significant positive relationship with Smart Agribusiness Transformation ($\beta = 0.656$, $t = 8.914$, $p = 0.000$), suggesting that the change in the market environment, technological uncertainty, and competitive environmental factors are very strongly motivating systems to become smart agribusiness. The results also indicate that Smart Agribusiness Transformation ($\beta = 0.195$, $t = 2.700$, $p = 0.007$) is significantly influenced by Training & Development Practices, supporting the view that better practices in training lead to better transformation in Agribusiness Organizations. The interaction of the moderating variable (Environmental Dynamism) and Training & Development Practices and Smart Agribusiness Transformation, however, is not statistically significant ($\beta = -0.024$, $t = 1.003$, $p = 0.316$), and thus suggests that the relationship between both variables is not significantly strengthened or weakened by the moderating variable within the proposed model. In general, the results corroborate most of the hypotheses proposed and highlights the significance of policy, environmental adaptability and training practices in the process of smart agribusiness transformation.

PLS SEM

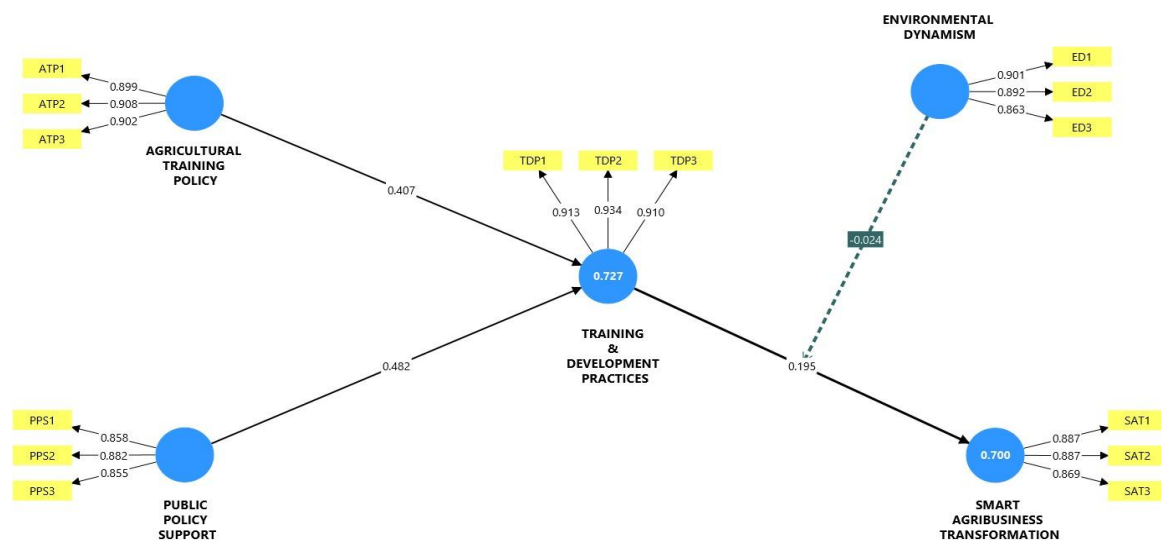


Figure 3 PLS SEM

The structural model demonstrates strong measurement quality and substantial predictive relationships among the study constructs. All indicator loadings for Agricultural Training Policy (0.899–0.908), Public Policy Support (0.855–0.882), Training & Development Practices (0.910–0.934), Environmental Dynamism (0.863–0.901), and Smart Agribusiness Transformation (0.869–0.887) exceed the recommended threshold of 0.70, confirming excellent indicator reliability and convergent validity within the model. The path coefficients further reveal that Agricultural Training Policy positively influences Training & Development Practices ($\beta = 0.407$), while Public Policy Support shows an even stronger positive effect on Training & Development Practices ($\beta = 0.482$). These findings indicate that institutional policies, agricultural training frameworks, and governmental support significantly enhance training and development activities within the agribusiness sector. Additionally, the coefficient of determination ($R^2 = 0.727$) for Training & Development Practices suggests that approximately 72.7% of the variance in this construct is explained by Agricultural Training Policy and Public Policy Support, reflecting strong explanatory power of the model.

Model Fitness

Table 3 Model Fitness

Model fit		
Fit summary		
	Saturated model	Estimated model
SRMR	0.054	0.055
d_ULS	0.349	0.358
d_G	0.331	0.324
Chi-square	727.472	704.554
NFI	0.857	0.862

The model fit results indicate that the proposed structural model demonstrates an acceptable and satisfactory level of overall model fitness. The Standardized Root Mean Square Residual (SRMR) values for both the saturated model (0.054) and estimated model (0.055) are below the recommended threshold of 0.08, confirming a good model fit and suggesting minimal difference between the observed and predicted correlation matrices. Similarly, the d_ULS and d_G values are relatively low for both models, indicating acceptable discrepancy levels and supporting the adequacy of the model specification. The Chi-square values for the saturated model (727.472) and estimated model (704.554) further reflect the overall consistency of the structural framework, although Chi-square values are commonly sensitive to sample size in SEM analysis. Additionally, the Normed Fit Index (NFI) values of 0.857 and 0.862 indicate an acceptable level of model fitness, approaching the recommended benchmark of 0.90 for strong model fit. Overall, these findings confirm that the proposed model possesses satisfactory explanatory power and adequately represents the relationships among Agricultural Training Policy, Public Policy Support, Training & Development Practices, Environmental Dynamism, and Smart Agribusiness Transformation.

The findings of the present study reveal that Agricultural Training Policy significantly improves Training & Development Practices within the agribusiness sector. This result is consistent with recent studies arguing that institutional training frameworks and agricultural skill development

policies positively enhance organizational learning, workforce adaptability, and innovation capabilities in smart agriculture environments. Recent empirical evidence suggests that government-supported agricultural training initiatives improve technological adoption and operational efficiency within modern agribusiness systems (Khan et al., 2023; Hassan et al., 2024). The current findings also align with earlier studies emphasizing that training-oriented agricultural policies strengthen employee competencies and improve organizational readiness for digital and smart agricultural transformation (Adeyi et al., 2019). Therefore, the study confirms that policy-driven training systems remain critical for enhancing sustainable agribusiness development and workforce transformation.

Discussion

The findings of the present study provide significant theoretical contributions by extending the understanding of smart agribusiness transformation through the integration of Agricultural Training Policy, Public Policy Support, Training & Development Practices, and Environmental Dynamism within a single structural framework. The results demonstrate that Agricultural Training Policy and Public Policy Support significantly enhance Training & Development Practices, which subsequently contribute positively to Smart Agribusiness Transformation. These findings strongly support the assumptions of human capital development theory and organizational capability perspectives, which emphasize that training systems and institutional support improve organizational adaptability, innovation capability, and technological transformation. The study further confirms that Environmental Dynamism directly influences Smart Agribusiness Transformation, suggesting that rapidly changing technological and competitive environments encourage organizations to adopt modern agribusiness systems. These findings are consistent with recent studies emphasizing that policy-oriented training systems strengthen organizational readiness and digital transformation capacity within agricultural industries (Khan et al., 2023; Hassan et al., 2024). However, the insignificant moderating role of Environmental Dynamism contradicts some earlier theoretical assumptions suggesting that uncertain business environments strengthen the effectiveness of training practices in organizational transformation processes. This inconsistency may indicate that training and development practices independently influence smart transformation regardless of environmental uncertainty.

From a literature perspective, the study contributes to the growing body of research on agribusiness modernization and smart agricultural transformation within emerging economies. The significant positive relationship between Agricultural Training Policy and Training & Development Practices supports previous empirical findings that institutional training programs improve workforce competencies and technological adaptation within agricultural sectors (Adeyi et al., 2019). Similarly, the findings regarding Public Policy Support are aligned with recent literature arguing that government assistance, policy incentives, and institutional support mechanisms positively influence organizational learning and innovation performance within agribusiness environments (Wanke et al., 2024). The present study also confirms earlier research suggesting that Training & Development Practices are essential drivers of technological transformation because skilled employees and continuous learning systems improve organizational flexibility and innovation capability. Nevertheless, the findings concerning Environmental Dynamism present partially contrasting evidence compared to studies that found environmental uncertainty to significantly strengthen adaptive organizational behavior and innovation outcomes (Mensi et al., 2023). The insignificant moderation effect observed in this study may be attributed to sector-specific condi-

tions within Pakistan's agribusiness industry, where institutional policies and internal organizational capabilities may play a more dominant role than external environmental conditions in driving transformation activities.

Conclusion

The present study examined the influence of Agricultural Training Policy and Public Policy Support on Smart Agribusiness Transformation through the mediating role of Training & Development Practices and the moderating role of Environmental Dynamism. The findings revealed that Agricultural Training Policy and Public Policy Support significantly enhance Training & Development Practices, which subsequently contribute positively to Smart Agribusiness Transformation. These results confirm that institutional training systems and supportive policy frameworks are essential drivers of technological adaptation and organizational transformation within the agribusiness sector. The study further demonstrated that Environmental Dynamism directly influences Smart Agribusiness Transformation, indicating that changing technological and competitive environments encourage organizations to adopt innovative agricultural practices and smart technologies (Khan et al., 2023; Hassan et al., 2024). Therefore, the study highlights the importance of organizational readiness, workforce development, and institutional support in achieving sustainable agribusiness modernization.

The study makes an important theoretical contribution by integrating Agricultural Training Policy, Public Policy Support, Training & Development Practices, Environmental Dynamism, and Smart Agribusiness Transformation within a single comprehensive framework. The findings support organizational capability and human capital perspectives by confirming that employee training and institutional support mechanisms significantly improve organizational adaptability and innovation capacity. The results also contribute to the growing literature on smart agriculture and agribusiness transformation within emerging economies, particularly in Pakistan where limited empirical research exists regarding policy-driven technological transformation within agricultural industries (Wanke et al., 2024; Abbas et al., 2023). Furthermore, the study extends previous empirical findings by demonstrating that training and development systems act as important mechanisms linking policy frameworks with organizational transformation outcomes.

Future Research Direction

Future researchers are encouraged to expand the current study by incorporating additional organizational and technological variables that may further explain Smart Agribusiness Transformation. Variables such as technological readiness, organizational innovation capability, digital infrastructure, artificial intelligence adoption, and employee technological acceptance may provide deeper insights into transformation processes within agribusiness sectors. Furthermore, future studies may investigate mediating variables such as organizational learning culture or technological adaptability to better understand the internal mechanisms influencing smart agricultural transformation (Mensi et al., 2023; Singh, 2024). Comparative studies between developed and developing agricultural economies may also strengthen understanding regarding how contextual differences influence agribusiness modernization and technological adoption.

The present study also contains several methodological limitations that future researchers should address. First, the study adopted a quantitative cross-sectional research design, which limits the

ability to observe long-term changes and causal relationships over time. Future researchers are therefore encouraged to employ longitudinal research designs to better analyze the dynamic effects of training policies and environmental changes on agribusiness transformation. Second, the study relied primarily on SmartPLS-SEM analysis, whereas future research may incorporate advanced analytical techniques such as CB-SEM, multi-group analysis, or mixed-method approaches to improve robustness and theoretical depth (Hair et al., 2017). Additionally, qualitative methods such as interviews and case studies may provide richer contextual understanding regarding organizational transformation processes within agricultural industries.

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