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Quantifying Economic Uncertainty in Pakistan Using the MIMIC Model

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ABSTRACT

Objective: This study quantitatively explores Economic Uncertainty in Pakistan, utilizing the Multiple Indicator and Multiple Causes (MIMIC) model with indicators such as Foreign Market Instability, Political Stability, Inflation, GDP, Financial Crises, and Stock Market Volatility to provide a comprehensive assessment.
Research Gap: The research addresses the gap in understanding the complex nature of Economic Uncertainty within Pakistan's economic landscape, emphasizing the role of various indicators in quantifying it.
Design/Methodology/Approach: The study employs the MIMIC model and the Hodrick-Prescott (HP) filter to analyze Economic Uncertainty in Pakistan. The limitations of this methodology are acknowledged.
Main Findings: The study reveals that Economic Uncertainty significantly impacts various macroeconomic variables, providing insights into its multifaceted nature.
Theoretical/Practical Implications of the Findings: The research findings have vital implications for policymakers, aiding in the formulation of informed policies and investment strategies for economic stability and growth.
Originality/Value: This research contributes to the understanding of Economic Uncertainty in Pakistan by delving into its multifaceted aspects and influential factors. It provides a comprehensive foundation for informed decision-making in economic policy and investment strategies, ultimately promoting economic stability and growth.

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1. Introduction

Economic Uncertainty is a concept that has gained significant attention from researchers and policymakers in recent years. It refers to the degree of unpredictability or ambiguity that exists in the economic environment, particularly in relation to future economic conditions, and the consequences of that uncertainty for economic decision-making. Uncertainty is an inherent feature of any market-based economy, but excessive levels of economic uncertainty can have significant adverse effects on macroeconomic variables such as investment, consumption, and employment. This uncertainty can be

caused by a variety of factors, including changes in government policies, fluctuations in market demand, shifts in international trade, natural disasters, or geopolitical tensions. Researchers have provided various conceptual definitions of economic uncertainty. According to Baker et al. (2016), Economic Uncertainty can be defined as a state of doubt about future economic conditions that can affect the behavior of firms, consumers, and policymakers. Bloom (2009) defines Uncertainty as a state of incomplete knowledge about the future that can create a decline in aggregate demand.

Economic Uncertainty, a multifaceted issue triggered by factors like economic shocks, geopolitical shifts, and policy changes, profoundly affects businesses, consumers, and policymakers, thereby influencing an economy's overall well-being. It encompasses several forms: macroeconomic uncertainty, characterized by ambiguity and unpredictability in economic performance, often driven by policy changes and unexpected financial shocks (Bloom, 2009); policy uncertainty, arising from unclear government actions and intentions, making policymaking and outcomes uncertain, influenced by political shifts and legal decisions (Baker et al., 2016); financial uncertainty, marked by unpredictability in financial markets, influenced by global economic shifts, monetary policy changes, and unexpected financial shocks (Kilian & Zhou, 2018); geopolitical uncertainty, stemming from unpredictable global political and economic relations, influenced by changes in leadership, military conflicts, and diplomatic ties (Mohaddes & Raissi, 2018); and environmental uncertainty, linked to environmental risks like climate change and natural disasters, potentially requiring policy interventions. Each type can exert diverse impacts on economic dynamics, reflecting the complexity of this phenomenon.

Economic Uncertainty exerts a profound influence on key macroeconomic variables, including investment, consumption, government policies, inflation, interest rates, and stock markets. High levels of uncertainty can deter firms from making investment decisions, resulting in decreased economic growth, amplified capital costs, and investor risk aversion (Cerda et al., 2017). Similarly, consumption may decline as cautious consumers reduce spending, particularly on durable goods, during periods of elevated uncertainty (Bachmann & Sims, 2012). Economic Uncertainty also reverberates in government policies, potentially disrupting fiscal outcomes through fluctuations in tax revenues and increased government spending (Fatas & Summers, 2016). Moreover, it can elevate inflation expectations and interest rates as investors seek safer assets and brace for greater price volatility (Baumeister & Kilian, 2014). Stock prices and currency rates can suffer as well due to increased investor caution and the pursuit of higher returns (Bekaert et al., 2012).

Economic Uncertainty exerts a profound influence on both consumer and business confidence, prompting a more cautious approach that leads to diminished spending and reduced investment (Bloom, 2014). Consequently, this can trigger an economic slowdown characterized by declining demand and diminishing profits, making the prediction of future economic conditions an intricate challenge. Numerous studies underscore the disruptive effects of economic uncertainty on a spectrum of macroeconomic variables and business operations, including the elevation of risk premiums, which curtails investment and consumption and detrimentally impacts overall macroeconomic stability (Auerbach & Gorodnichenko, 2013). Businesses grapple with complex scenarios, encountering hurdles in planning, hiring, and expansion within uncertain economic landscapes. Simultaneously, investors confront obstacles, encompassing market volatility and capital raising difficulties (Butzen et al., 2003). Policymakers contend with uncertainties in assessing policy efficiency and potential unintended consequences, thereby influencing decisions pertaining to interest rates and tax policies. The influence of economic uncertainty on macroeconomic variables remains contingent upon its source and context, affecting investment strategies, stock prices, consumer behaviors, and government policies (Baker & Bloom, 2013). Furthermore, Economic Uncertainty extends its influence to international trade, finance, and financial market volatility, thereby bearing potential repercussions for global economic stability and trade dynamics.

Economic Uncertainty is a multifaceted force with profound implications for economies, and this study aims to tackle the critical challenge of comprehensively measuring and understanding it within the context of Pakistan. While existing research has made strides in exploring Economic Uncertainty using proxies like stock market volatility or text mining-derived indices, it often falls short of capturing the full range of

uncertainty's effects on real economic data. Moreover, there's a notable gap in understanding how Economic Uncertainty uniquely impacts Pakistan's economy, making this research all the more crucial. By employing the innovative Multiple Indicator and Multiple Causes (MIMIC) model, this study not only aims to measure Economic Uncertainty comprehensively, covering its domestic, political, and foreign dimensions but also seeks to unravel how it evolves over time in response to significant economic events. This research holds immense significance, as it bridges these gaps, offering both academic insights and practical guidance for policymakers to navigate and address Economic Uncertainty effectively within Pakistan's unique economic landscape.

1.2. Research Question

The primary research question addressed in this study is: How can Economic Uncertainty in the context of Pakistan be comprehensively measured and understood, and what are its implications for the country's economy?

1.3. Study Objectives

The research objective is to comprehensively measure and understand Economic Uncertainty in Pakistan, utilizing the MIMIC model and various indicators, to provide insights for policymakers and enhance economic stability and growth.

2. Literature Review

Economic Uncertainty is a vital factor that significantly impacts the economy through various channels. However, measuring this uncertainty is a challenging task due to its intangible nature. In the literature, various techniques have been utilized to quantitatively assess economic uncertainty, each with its advantages and limitations. One widely recognized method for measuring economic uncertainty is through numerical data-based indices. The Volatility Index (VIX), often referred to as the "Fear Index," stands out as a prominent example. It gauges the 30-day implied volatility of the S&P 500 index, reflecting market participants' expectations. While stock market volatility is commonly employed, it is criticized for incorporating risk premiums, potentially distorting true uncertainty measurements. Stock market volatility, while forward-looking, is only indirectly related to economic activity, making it philosophically less preferred (Ferrare et al., 2017). Text-based indices, such as the Economic Policy Uncertainty (EPU) index, utilize textual analysis of newspapers and media coverage to assess uncertainty. They count occurrences of specific terms or phrases related to uncertainty in newspaper articles. While these indices offer real-time data and broad coverage, they rely heavily on the accuracy, bias, and consistency of news reporting. Moreover, the World Uncertainty Index (WUI) is a novel text mining index designed to capture global uncertainty shocks by analyzing country reports from the Economist Intelligence Unit (EIU) (Liu & Fumin, 2022). It quantifies uncertainty by counting the frequency of the term "uncertainty" in quarterly EIU publications, creating a panel estimate for numerous nations (Ahir, Bloom & Furcei, 2022). Although advantageous for its single-source, standardized methodology and coverage of key topics, the WUI has limitations. EIU publishes only one report per country per quarter, potentially introducing significant sampling errors.

Analysts' predictions and forecasts can also serve as indicators of economic uncertainty. This method captures fluctuations in forecasts and predictions, which are more closely tied to economic activity than some other metrics. However, this approach has a brief history and may be influenced by outlier observations, potentially skewing results (Bringe & Boshoff, 2020). Composite uncertainty indices combine multiple sources of uncertainty into a single value, offering a comprehensive assessment. For example, Moore (2017) created an economic uncertainty composite index by weighing various measures, including newspaper-based uncertainty, stock market volatility, analyst earnings forecasts, and GDP growth forecast dispersion. This approach captures a wide range of economic uncertainty dimensions but may rely on subjective weightings. Some studies directly measure uncertainty through econometric models. For instance, Jurado et al. (2015) used a model to estimate common firm-level and macroeconomic uncertainty. However, this approach may have its own limitations and assumptions, and its usefulness depends on the chosen model and data.

The dilemma of how uncertainty can be measured arises since all of the proxies' assessments of uncertainty have certain limitations. We are evaluating economic uncertainty for Pakistan using the MIMIC model to address this measurement of uncertainty issue. To the best of our knowledge, this is Pakistan's first attempt to use the MIMIC model to measure uncertainty. This is the main contribution of our study.

The MIMIC model, originating from the psychometric technique of factor analysis, uses latent variables to explain correlations among observable indicators, making it valuable for various applications (Breusch, 2005). Researchers have extended this model to understand phenomena like the shadow economy's size and expansion, as demonstrated in the study focusing on France by Buehn and Schneider (2008). The relationships between the unobserved variables and their sources are given in structural equations. As a result, the MIMIC model describes the relationships between the latent variable (unobserved), which indirectly influences a collection of observed indicators variables and the observed causal variables. It is possible to establish the statistical significance of this relationship using structural equations, which can also be used to forecast the behavior of the latent variable (Dybka et al., 2019). Reverse standardization is the novel identification method suggested for the MIMIC model. It gives the MIMIC model panel-structured information on the mean and variation of the latent variable as defined by the CDA estimates by considering the data as provided in the restricted full information maximum likelihood function (Al-Shboul & Maghyereh, 2023). Thus, the extensive literature on economic uncertainty underscores its pivotal role in shaping economic outcomes. Researchers have adopted diverse methodologies and data sources to quantify and analyze this uncertainty's impact on key economic indicators. The MIMIC model, with its ability to connect latent and observable variables, has proven to be a valuable tool in unraveling intricate economic relationships and has been applied in various contexts, from understanding the shadow economy to exploring the consequences of global risk indices. As the field continues to evolve, the question of how to quantitatively measure economic uncertainty remains a central concern.

The literature review highlights the existing methods and approaches for measuring economic uncertainty, such as numerical data-based indices, text-based indices, forecasts and predictions, and composite uncertainty indices. While these methods have their advantages, they also come with limitations and potential biases. The literature review underscores the importance of finding a more direct and comprehensive measurement approach for economic uncertainty. The literature gap in the paper lies in the absence of studies that utilize econometric models like the MIMIC model to measure economic uncertainty in Pakistan. The MIMIC model, which connects latent and observable variables, offers a promising avenue for addressing this measurement gap and provides a novel contribution to the field by offering a more comprehensive and direct approach to quantifying economic uncertainty. The paper's unique focus on Pakistan further highlights the need for country-specific research in this area.

3. Research Methods

This section details the methods relevant to the study.

3.1. Theoretical Framework

The MIMIC model, initially proposed by Joreskog and Goldberger in 1975, has found widespread use across various disciplines, including economics, psychology, and social sciences. This model operates on the premise that latent variables, not directly observable but inferred from observed indicators, are influenced by these observed variables as well as additional potential sources of variation. In economics, it has been employed to investigate the relationship between economic policies and outcomes, the impact of macroeconomic shocks on human behavior, and factors affecting economic growth and development. An advantageous feature of the MIMIC model is its capacity to address measurement errors and other biases in observed indicators. It enables researchers to simultaneously estimate the connections between latent variables, their observed causes, and indicators, taking into account potential measurement errors and biases. This modeling approach has proved valuable in quantifying complex constructs like economic uncertainty, bridging the gap between latent and observable variables (Bollen & Lennox, 1991; Joreskog & Goldberger, 1975).

The MIMIC model serves as a robust tool for evaluating Economic Uncertainty by amalgamating various economic activity indicators with an underlying latent variable representing uncertainty, offering a more precise measurement than traditional methods. As Economic Uncertainty remains a significant concern for policymakers and businesses worldwide, the MIMIC model is poised to play an increasingly crucial role in comprehending and mitigating its impact on economic outcomes. This structural equation modeling (SEM) approach leverages both observed and latent variables, making it a valuable technique for understanding latent constructs like uncertainty. The MIMIC model involves two key components: a structural equation linking exogenous causes to the latent variable and a measurement equation connecting observable indicators to the same latent variable. These equations, expressed in vector form, enable researchers to estimate the structural parameters and evaluate the model's fit. Visual representations of MIMIC models through path diagrams aid in illustrating the relationships between constructs and covariates, facilitating discussions in latent variable modeling (Trebicka, 2014).

The theoretical framework for this study clarifies the intricate relationships between various key factors and economic uncertainty. Foreign market instability has a multifaceted link with economic uncertainty, as it can disrupt trade balances and suggest policy responses that, in turn, affect economic stability (Campa & Goldberg, 2005; Baker et al., 2016). Political stability is theorized to reduce economic uncertainty by fostering transparent governance and investor confidence, thus contributing to lower uncertainty levels (Aisen & Veiga, 2013). Inflation, particularly high inflation rates, is linked to increased economic uncertainty, while low and stable inflation is believed to mitigate uncertainty (Friedman, 1977). Economic uncertainty negatively influences GDP growth by reducing investments and consumer spending, whereas economic stability is conducive to growth (Bloom, 2014; Jurado et al., 2015). Additionally, financial crises are known to significantly elevate economic uncertainty, particularly due to their impact on financial institutions and government responses (Bloom, 2009; Baker et al., 2016). Lastly, the study explores the relationship between economic uncertainty and stock market volatility, highlighting that higher uncertainty is associated with increased market volatility (Baker et al., 2016). This comprehensive theoretical framework establishes the foundation for investigating the impact of these factors on economic uncertainty and subsequently on Pakistan's economic landscape.

3.2. Empirical Specification

Given Pakistan's sizeable growing economy, 22 IMF bailouts, and one of the lowest credit-to-GDP ratios in South Asia, it is easy to understand the significance of uncertainty for this nation (Choudhary et al., 2020). Economic Uncertainty (EUC) is a latent variable in our MIMIC model. Literature reveals the causes of uncertainty by Foreign Market Instability (FM), Political Stability (PI), and Inflation (INF), while consequences are Output (GDP), Financial Crisis Indicator (FC), and Stock Market Volatility (VIX).

3.2.1. Causes of Uncertainty

Foreign Market Instability (FM)

The financial crisis was generated from the US subprime market in 2007 but spread to the global real market in late 2008. In early 2009, world production and trade declined sharply. The financial crisis in developed countries has become global because financial markets are closely integrated with each other at the international level, and a sudden rise in financial market volatility is transmitted worldwide. According to the World Bank Development Report (2013), sectors in developing nations are more susceptible to price fluctuations for commodities, including rubber, sugar, copper, and especially oil. The US oil embargo was prompted by a tripling in oil prices, which led to increased global unrest and the 1973 OPEC oil price shock (Bloom, 2009). Moore (2017) found that foreign uncertainty in the US Economy was an important and larger source of Australia’s uncertainty. Similar results were found in the case of India, where the effect of US uncertainty was measured on Indian uncertainty. The findings revealed that economic uncertainty in India had a sizable international spillover effect (Bicchal & Durai, 2020). The literature demonstrates that one of the reasons for Economic Uncertainty is the unpredictability of the overseas US market.

Political Stability (PI)

Government instability, the inefficiency of political parties, and a weak political culture have become severe problems, especially in developing countries. Political instability generates economic uncertainty. The relationship between political stability and economic uncertainty can be explained with the help of the Economic Policy Uncertainty (EPU) of Pakistan. In 2013 and 2014, uncertainty was high due to the election and Azadi March, respectively. Another example of political instability was in 2017 when the "Panama Verdict" the Supreme Court of Pakistan announced incidentally increased uncertainty (Choudhary et al., 2020). These incidents prove that political crisis instability causes economic uncertainty in the economy. The political stability index created by the World Bank is a composite measure based on numerous different indices from various sources, including the Economist Intelligence Unit, the World Economic Forum, and the Political Risk Services, among others. The underlying indices take into account the probability of a disruptive transition of power, armed conflict, violent protests, social unrest, international tensions, terrorism, as well as ethnic, religious, or regional conflicts.

Inflation (INF)

One of the key objectives of the monetary policymaker is price stability. Uncertainty and inflation have a significant relationship. High inflation breeds uncertainty about inflation, which undermines the efficiency of the price mechanism and leads to economic inefficiency (Fountas, 2010). Therefore, one of the reasons for Economic Uncertainty is Inflation.

3.2.2. Indicators of Uncertainty

Financial Crisis Indicator (FC)

The financial sector is strongly interdependent with macroeconomic variables. The financial sector affects economic performance through different transmission channels. Firstly, it supports the consumption and investment of households and firms by providing funds that boost economic growth. However, on the other hand, the stress in the financial market causes a macroeconomic downturn, which brings financial crises, as observed in the Global Financial Crisis (GFC) of 2008 (Zabavnik & Verbic, 2021). Thus, in line with Hristov and Roth (2019) and Danielsaon et al. (2018), it is clear that the financial crisis indicator is one of the consequences of uncertainty that identifies the immediate effect of uncertainty shock. The most effective Financial Crisis Indicator is the gross debt to GDP ratio (Hristov & Roth, 2019).

National Output (GDP)

The overall macroeconomic performance of an economy is indicated by GDP, which represents the real side of the economy. Unanticipated shock in uncertainty drives business cycles and propagates the GDP Growth rate. According to the literature by Moore (2017), Ghirelli et al. (2021), and Jamil and Majeed (2015), it is uncertainty that affects the business cycle. Any unexpected shocks in uncertainty cause a persistent negative downfall in real GDP. Moore (2017) found a negative correlation between GDP growth and the economic uncertainty index for Australia. Jamil & Majeed (2015) found unidirectional causality from inflation uncertainty to output growth in Pakistan. Baker et al. (2020) also found that GDP drops due to uncertainty shock because high adjustment costs force every individual firm to reduce their hiring and investment activity. Thus, from the above reference, it is clear that GDP is one of the consequences of Economic Uncertainty.

Stock Market Volatility (VIX)

Jurado et al. (2015) found that Stock Market Volatility also had significant independent variation and Economic Uncertainty. Quantitatively important economic uncertainty shocks occur far more infrequently than stock market volatility. They use stock return as a predictor of uncertainty. The stock market is primarily driven by shocks other than economic uncertainty, but it is a good predictor. As a result, stock market volatility is seen as an effect of economic uncertainty in our MIMIC model. The Karachi Stock Exchange 100 Index, a significant stock market index that tracks the performance of the biggest companies by market capitalization from every sector of the Pakistani economy listed on The Karachi Stock

Exchange, serves as the benchmark for measuring it. It has been a free-float index since October 15, 2012. As of November 1991, the KSE100 has a base value of 1000.

3.2.3. Model Specification

In light of the above discussion, the structural equation of our MIMIC model is:

$$Economic\ Uncertainty = \alpha_1 Foreign\ market\ instability + \alpha_2 Political\ Stability + \alpha_3 Inflation + \zeta \quad (1)$$

Measurement equations is

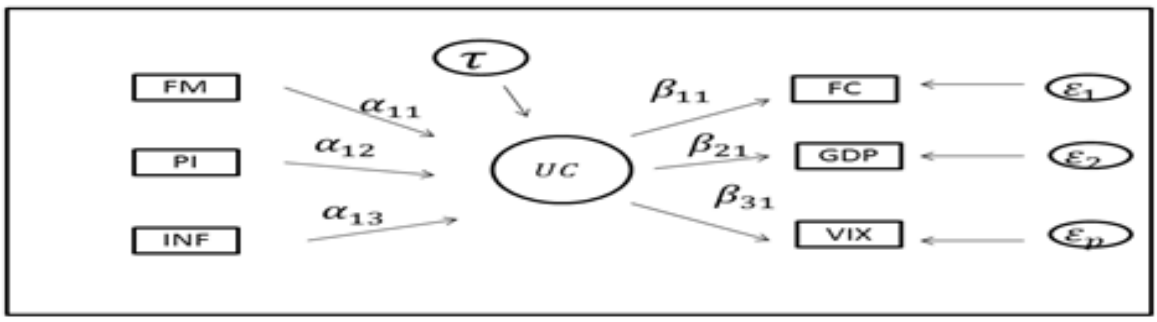
$$Financial\ Crisis = \beta_1 Economic\ Uncertainty + \varepsilon_1 \quad (2)$$

$$GDP = \beta_2\ Economic\ Uncertainty + \varepsilon_2 \quad (3)$$

$$Stock\ market\ volatility = \beta_3\ Economic\ Uncertainty + \varepsilon_3 \quad (4)$$

where UC represents Economic Uncertainty, FM represents Foreign Market Instability, PI represents Political stability, FC represents Financial Crisis indicator, GDP represents total output, and VIX shows stock market volatility. The path diagram for our model specification is in Figure 1.

Figure 1 Path Diagram of Economic Uncertainty MIMIC Model



Source: Authors' Compilation

There is a wide range of literature in which the MIMIC model has been used in psychology and social sciences to measure a latent variable. Chang et al. (2020) used the MIMIC model to measure gender disparity in adult cognitive functioning, Trebicka (2014) used it to estimate the shadow economy. Posey et al., (2015) used it to measure protection protection-motivated behaviors. However, to the best of our knowledge, MIMIC has not been used to measure Economic Uncertainty, which is one of our study's most important contributions.

3.3. Data Sources

The study estimates the model by utilizing Pakistani macroeconomic variable quarterly time series data for the years 1990 Q1 through 2021 Q4. The World Bank and Federal Reserve Economic Data provided the study's data. The official exchange rate is used as a gauge of the volatility of foreign markets. Political Stability is gauged using variables: political stability and the absence of terrorism having rates from -2 to +2. However, the consumer price index is used to calculate Inflation. While GDP is calculated as GDP constant 2015 US dollars, the gross debt to GDP ratio is utilized to represent the financial crisis., Stock Price Volatility is a measure of stock market volatility.

4. Results

This section discusses the results of the study.

4.1. Unit Root Test

For the MIMIC model, our data cover each Quarter between 1990 Q1 to 2021 Q4. This section presents the result of the statistical analysis. Structural equation modeling with the maximum likelihood estimation technique is used. Descriptive Statistics of MIMIC variables are mentioned in Table 1.

Table 1: Descriptive Analysis

Variable	Mean	Standard Deviation	Minimum	Maximum
Foreign Market Instability (LCU per US$)	18.233	9.7229	5.3110	40.792
Political Stability (range from -2 to +2)	-0.46851	-0.1488	-0.7066	-0.2541
Inflation CPI (2010 = 100)	21.11977	14.645	4.3934	55.71
GDP (2015 US$, in Billion)	49.9	18.1	24.7	86.6
Financial Crisis (Gross Debt to GDP Ratio)	15.372	2.028	11.611	20.141
Stock Market Volatility	6.1598	2.2853	2.9759	10.383

Sourcer: Auhors' Estimations

In order to run the MIMIC model, the unit root test is the first step of analysis to check data stationary. Using the conventional unit root Augmented Dickey-Fuller (ADF) test, it is found that all variables are I (1), as shown in Table 2.

Table 2: Analysis of Stationarity of the MIMIC Model

Variable	Test Equation	Level		First Difference	
Causes		**ADF**	**P value**	**ADF**	**P value**
Foreign Market Instability	C	1.7225	0.9997	-3.7393	0.0046***
Political Stability	C	-1.5495	0.5051	-2.6539	0.0853*
Inflation	C	-0.8316	0.8061	-2.5243	0.1010*
Indicator					
Financial Crisis	C	-1.7250	0.4161	-3.4268	0.0119***
GDP	C	-0.2540	0.9270	-3.3450	0.0151**
Stock Market Volatility	C	-1.4096	0.5754	-2.6226	0.0913*

Sourcer: Auhors' Estimations

*Stationarity at 1%, ** Stationarity at 5%, *** Stationarity at 10% Note: Critical value of Augmented Dickey-Fuller (ADF) test for a test equation with constant and trend (C) are: -2.5798 (10% level), -2.88586 (5% level) and -3.48606 (1% level).

4.2. MIMIC Model Results

We have estimated the MIMIC model to construct the Economic Uncertainty variable in the case of Pakistan. We have utilized certain causes, including Foreign Market Instability, Political Stability, Inflation and certain indicators, including the GDP, Financial Crisis and Stock Market Volatility.

In the MIMIC model, the relative magnitude of the parameter along with the level is estimated by setting a scale for the unobservable latent variable i.e., Economic Uncertainty. It is a necessary condition, and its most convenient way is to set the coefficient of one of the indicator variables in the measurement model equal to non-zero, which in our case is GDP equal to one (Buehn & Schneider, 2008). In our study, we fix the coefficient of the variable GDP in the MIMIC model. This is a normalization technique, and it serves as a reference point or baseline against which other variables are measured.

There are several reasons for selecting GDP as a constraint in the measurement equation in the MIMIC model of uncertainty. Firstly, GDP is a widely used indicator of economic activity inside a nation. It includes the overall value of goods and services produced during a certain period of time. The MIMIC model can incorporate economic considerations that can affect uncertainty levels by including GDP. The total amount of products and services that are in demand within an economy is represented by GDP. So, GDP is a good indicator of a nation's general economic health.

Table 3: MIMIC Model and Parameter Estimates

Variable	Coefficient	Standard Error	Z Statistic (p-value)
	Structural		
	Economic Uncertainty<-		
Foreign Market Instability	0.00694	0.0018	3.91*** (0.000)
Political Stability	-0.26237	0.0428	-6.13*** (0.000)
Inflation	0.37815	0.0261	14.49*** (0.000)
	Measurement		
GDP<-			
Economic Uncertainty	1.000 (constrained)		
Constant	23.260	0.0316	736.12*** (0.000)
	Financial Crisis<-		
Economic Uncertainty	-0.0145	0.4897	-0.33 (0.976)
Constant	15.391	0.6642	23.17*** (0.000)
	Stock Market Volatility<-		
Economic Uncertainty	-5.5382	0.2550	-21.72*** (0.000)
Constant	13.395	0.3820	35.06*** (0.000)
	Statistic		
Chi 2(6)	267.64		
Prob	0.0000		
Log Likelihood	-554.753		

Source: Authors' Estimations

* Significance at 10% level, ** significance at 5% level and *** significance at 1% level.

The degree of uncertainty felt by individuals, firms, and the economy as a whole can directly be impacted by economic changes such as recession or booms. The MIMIC model can reflect the relationship between economic conditions and uncertainty by introducing GDP as a constraint. The GDP is frequently used as a

gauge of market performance and general economic health. Because financial markets are sensitive to economic situations, uncertainty may have an impact on changes in stock prices and other financial factors. The MIMIC model can represent the relationship between market performance, foreign market stability, economic condition, and uncertainty by including GDP as a constraint. Parameter estimates and primary test statistics of the MIMIC model are presented in Table 3.

We now summarize our findings from the estimation. The estimated coefficients of all variables are highly statistically significant at the 1% significance level except for the Financial Crisis, which proves to be statistically insignificant even at 10%.

The MIMIC model analysis is conducted to measure Economic Uncertainty (EUC) by understanding the factors that influence it. The latent variable of EUC is examined with its causes, including Foreign Market Instability, Political Stability, and Inflation. The results of the MIMC model highlighted the complex relationships between Foreign Market Instability, Political Stability, Inflation, and EUC. Notably, the Stock Market Volatility in the measurement equation is negative and significant, which means that the indicator contributes to the construction of a latent variable, i.e., EUC (Fortin et al., 2023; Baker et al., 2016; Bloom, 2009). However, the Financial Crisis Indicator, i.e., debt to GDP ratio in the measurement equation is insignificant, which means that the indicator does not contribute to the construction of a latent variable, not in line with (Danielsaon et al., 2018; Phan et al., 2021; Hristov & Roth, 2019). Cronbach alpha values for the multiple indicators are α_{FC}= -0.01 and α_{VIX}= -0.91. According to Johansson et al. (2004), the acceptable value of Cronbach alpha should be greater than 0.70. Thus, -0.94 of Stock Market Volatility is acceptable, while -0.01 value of Financial Crisis is not acceptable. The lack of significance of the Financial Crisis as an indicator in Pakistan's uncertainty model could be attributed to political challenges, government debt management strategies, unexpected external impacts, data accuracy, economic structure, and model design. The combined effect of these factors might decrease the Financial Crisis relevance in reflecting uncertainty in Pakistan's economy.

In our MIMIC model, we retain the structurally significant causal variables, which are predictors of the latent variable. The relationship between Foreign Market Instability and Stock Market Volatility in Pakistan is justified due to the country's global economic connections. This dynamic is influenced by logical factors such as the nation's reliance on international trade and investments, which make it vulnerable to global fluctuations. The behavior of foreign investors, global uncertainties, and external factors like exchange rates also contribute to the complexity of latent variables (Bicchal & Durai, 2020; Moore, 2017; Forbes & Warnock, 2012). Similarly, the connection between Political Stability and Stock Market Volatility is notable in Pakistan. Political Stability influences investor confidence and sentiments, leading to either increased investments and reduced volatility in stable periods or cautious behavior and heightened volatility during uncertain times. Consistent policies and foreign investment are impacted by Political Stability, ultimately shaping the Stock Market's behavior (Choudhary et al., 2020; Jensan & Wantchekon, 2004). Overall, these findings highlight the intricate interplay of global economic factors and Political Stability in shaping Stock Market Volatility in Pakistan, which is an indicator of EUC.

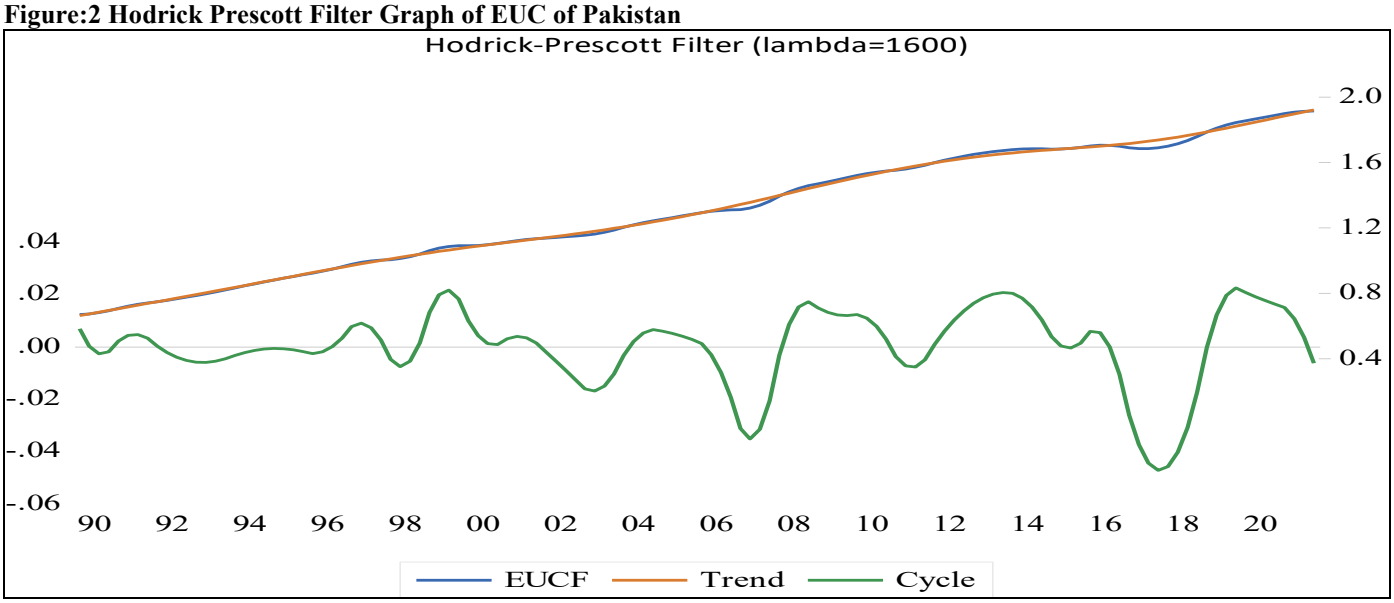
Moreover, in Pakistan, the connection between Inflation and Output, known as the Phillips Curve, carries significant implications. High inflation can erode consumers' purchasing power, leading to reduced spending and a decrease in aggregate demand for goods and services. This can result in lower production and output as businesses experience decreased demand. Moreover, Inflation introduces Economic Uncertainty, causing businesses to be cautious about investing due to uncertain profitability in an inflationary environment, ultimately impacting economic activity and output (Fountas, 2010).

4.3 Time Path of Economic Uncertainty

With the help of the MIMIC model, we calculate the extent of the EUC. This EUC variable's focus on Pakistan's economy, taking into account distinct historical events, policies, and economic conditions, enhances its relevance and ability to reveal long-term trends in EUC. This customized approach acknowledges economic factors that are specific to Pakistan and thus, the EUC variable provides a more

detailed and steady view of how uncertainty plays out in Pakistan's economy. In order to fulfill one of the most important objectives of this study, which is to analyze the change in Economic Uncertainty over time with respect to events in Pakistan, we employed the Hodrick- Prescott Filter on the EUC index of Pakistan to separate trend and cycle from its data. Figure 2 shows the Hodrick-Prescott Filter graph of EUC.

Figure:2 Hodrick Prescott Filter Graph of EUC of Pakistan



Source: Authors' Compilation from E-Views

We use the Hodrick-Prescott (HP) filter to look at Pakistan's Economic Uncertainty, and we see two main things happening. First, there's a clear increase in uncertainty over time – it's like uncertainty is gradually going up. This rise could be because of different events in Pakistan, like shifts in policies, technological advancements, and changing global dynamics. These factors together are making the overall uncertainty in the country go higher.

Simultaneously, the presence of pronounced cyclical fluctuations around this ascending trend adds layers of complexity to the analysis. These short-term oscillations are closely tied to Pakistan's economic cycles and its vulnerability to rapid changes brought about by global events. The fluctuation of economic activities, coupled with sudden geopolitical developments, policy alterations, and market shifts, contribute to the rapid ups and downs in uncertainty levels.

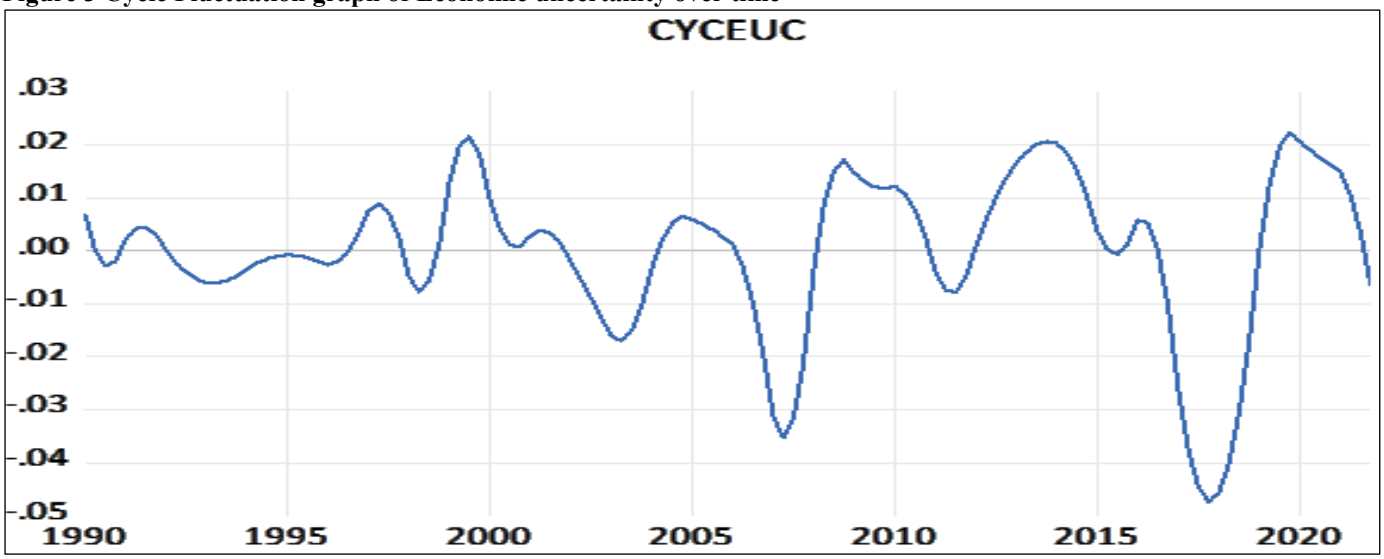
The interplay between the two – the growing trend of more uncertainty over time and the frequent ups and downs – is unique to Pakistan's economic landscape. It is like a mix of slow and steady growth in uncertainty along with sudden and fast changes. This happens because of a lot of reasons, both from inside Pakistan and from the world. Also, when the economy gets more uncertain, this can affect other activities and make the ups and downs even stronger.

In short, when we use the HP filter to understand Pakistan's economic uncertainty, we see two important patterns: uncertainty is getting higher overall, and it's also going up and down in quick cycles. These two things together make up how uncertainty works in Pakistan's economy, showing that it's a complex and ever-changing situation.

In our estimated EUC, there is a continuously increasing trend along with cyclical fluctuation in Pakistan from 1990 to 2021 shown in figure 3. This is attributed to major political and socioeconomic events mentioned by Shakir and Razi (2006) that have shaped the country's economic uncertainty fluctuation. Firstly, in 1990Q3, Economic Uncertainty was high. This is because Pakistan experienced political instability and frequent changes in government in that period. There were several exchanges of power and political unrest leading to uncertainty in policy continuity and economic direction. In 1999, Q3-Q4 Economic Uncertainty in Pakistan again rose as General Pervez Musharraf led a military coup, which

increased political uncertainty and raised concerns about governance and stability. Moreover, the 9/11 attacks significantly impacted Pakistan's security situation in 2005 Q1, as Pakistan was also involved in the global War on Terror. The rise of terrorism, particularly along the Afghanistan-Pakistan border, introduced a new level of uncertainty in the social-economic landscape.

Figure 3 Cycle Fluctuation graph of Economic uncertainty over time



Source: Authors Compilation from E-Views.

The global financial crisis in 2008Q3, along with the drastic earthquake, led to economic instability, inflation, and fiscal deficit in Pakistan. These problems increased uncertainty regarding economic growth and stability, and it prevailed until 2010Q2. In 2008, Pakistan experienced a significant change in its political system when it transitioned to a democratic form of government. These political uncertainties from political leadership and policy decisions have created an environment where people are uncertain about the future direction of the country. Another strike in Economic Uncertainty was seen in 2014 when the Peshawar school incident occurred. The Peshawar school massacre was a tragic terrorist attack in Peshawar on December 16, 2014. During the attack, a group of seven heavily armed Taliban militants targeted an army-operated primary and secondary school. The attackers' violent actions resulted in the loss of 150 lives, including at least 134 innocent students.

There was a slight increase in Economic Uncertainty in 2016 Q2 when the Panama Papers were released, which declared the offshore financial assets of individuals, including prominent leaders in Pakistan, caused political confusion and increased uncertainty. In 2019, the Q3 global COVID-19 pandemic hit Pakistan and had a prominent effect on uncertainty in Pakistan. The pandemic closed economic acuity, caused massive job losses, and strained the health care system. The uncertainty surrounding the duration and severity of the pandemic, as well as the effectiveness of government measures in managing the crisis, has contributed to heightened uncertainty in various sectors of the economy. Thus, these events have collectively contributed to the increasing trends of uncertainty in Pakistan over the past three decades.

In our study, we explore the implications of EUC within Pakistan using the MIMIC model, which offers a data-driven foundation for analyzing the multifaceted connections between EUC and economic decision-making. Our MIMIC model results, driven by factors such as political stability and foreign market instability, unveil how EUC significantly influences investment choices. We demonstrate how shifts in EUC are associated with corresponding variations in government policies, central bank actions, interest rates, and fiscal decisions. Through visual representations of our MIMIC model outcomes, including graphs and data-driven evidence, we establish the link between EUC and shifts in consumer behavior, stock market volatility, employment rates, and business strategies. Our study thus solidifies the significance of measuring EUC, providing concrete insights into its impact on economic decisions specific to Pakistan.

5. Conclusion and Policy Implications

This study employs the MIMIC model to quantitatively measure Economic Uncertainty (EUC) in Pakistan, revealing the intricate relationships among various contributing factors. Key indicators such as Foreign Market Instability, Political Stability, Inflation, GDP, Financial Crisis, and Stock Market Volatility play significant roles in shaping EUC. While most variables exhibit strong statistical significance in relation to EUC, the Financial Crisis seems less influential. The study highlights the impact of internal and external forces, including political shifts, global events, and economic cycles, on Pakistan's economic uncertainty. It underscores the importance of fostering political stability, creating an investment-friendly environment, and maintaining flexible fiscal and monetary policies. Clear communication of economic policies, diversifying trade partners, building consumer confidence, and establishing targeted social safety nets are also recommended policy measures. This research contributes to a better understanding of uncertainty's influence on decision-making and economic performance. However, limitations related to data adequacy, model assumptions, endogeneity, and generalizability should be considered. Nonetheless, this study provides valuable insights for informed financial decision-making within Pakistan's economy.

References

Ahir, H., Bloom, N., & Furceri, D. (2018). The World Uncertainty Index. *IMF SSRN eLIbrary 3275033*, 1-33.

Aisen, A., & Veiqa, F. (2013). How does political instability affect economic growth? *European Journal of Political Economy 29 (C)*, 151-167.

Al.Shboul, M., & Maghyereh, A. (2023). Did real economic uncertainty drive risk connectedness in the oil stock nexus during the COVID-19 outbreak? A partial wavelet coherence analysis. *Economic Structures 12, 1-22*. https://doi.org/10.1186/s40008-023-00306-x

Auerbach, A. J., & Gorodnichenko, Y. (2013). Output spillover from fiscal policy. *American Economic Review 103 (3)*, 141-146.

Bachmann, R., & Sims, E. (2012). Confidence and the Transmission of Government Spending Shocks. *Journal of Monetary Economics 59(3)*, 235-249.

Baker, S. R., & Bloom, N. (2013). Does uncertainty reduce growth? Using disasters as natural experiments. 10.3386/w19475.

Baker, S. R., Bloom, N., & Davis, S. (2016). Measuring Economic Policy Uncertainty. *The quarterly journal of economics, 131(4)*, 1593-1636.

Baker, S., Bloom, N., & Terry , S. (2020). Using Disasters to esimatethe impact of uncertainty. *IMF Reserach Paper 27167*.

Baumeister, C., & Kilian, L. (2014). Real Time Analysis of Oil Price Risks using Forecast Scenarios. *IMF Economic Review, 62(1)*, 119-145.

Bekaert, G., Hoerova, M., & Duca , M. (2012). Risk, Uncertainty and Monetary Policy . *National Bank of Belgium, Working Paper Reserach 229*.

Bicchal, M., & Durai, S. (2020). Assessing Macroeconomic Uncertainty for an Emerging Economy. *ADBI Working Paper 1124*.

Binge, L., & Boshoff, W. (2020). Economic uncertainty in South Africa. *Economic Modelling*, *88*(C),113-131.

Bloom, N. (2009). The impact of uncertainty shocks. *Econometrica, 77(3)*, 623-685.

Bloom, N. (2014). Fluctuation in Uncertainty. *Journal of Economic Perspectives 28 (2)*, 153-176.

Bollen, K., & Lennox, R. (1991). Conventional wisdom on measurement: A Structural Equation Perspective . *Psychological Bulletin, 110* , 305-314.

Breusch, T. (2005). Estimating the underground economy using MIMIC models. *Journal of Tax Administration, 2*(1), 41-72.

Bringe, L. H., & Boshoff, W. (2020). Economic Uncertainty in South Africa . *Economic Modelling, 88 (C)*, 113-131.

Buehn, A., & Schneider, F. G. (2008). MIMIC models, Cointegration and Error Correction: An application of French Shadow Economy. *IZA Discussion Paper No. 3306*, 1-30.

Butzen, P., Fuss, C., & Philip, V. (2003). The impact of uncertainty on investment plans: A survey data approach. *Firms' Investment and Finance Decision* , 227-252.

Campa, J., & Goldberry, L. (2005). Exchange rate pass - through into import prices. *The Review of Economics and Statistics 87(4)*, 679-690.

Cerda, R. A., Silva, A., & Valente, J. T. (2017). Economic Uncertainty Impact in a Small Open Economy: The Case of Chile. *Applied Economics, 50*(26), 2894-2908.

Chang, C., Gardiner, J., Houang, R., & Yu, Y.-L. (2020). Comparing multiple statistical software for multiple indicator, multiple cause modeling: an application of gender disparity in adult cognitive functioning using MIDUS II dataset. *BMC Medical Reserach Methodology 20, 275*.

Chenyao, H., Jie, Y., & Jiavin, C. (2023). The impact of Economic Uncertainty on the cash Flow of Listed Real Estate Companies in China. *Social Security and Administration Management 4,* 1-7.

Choudhary, M. A., Pasha, F., & Waheed, M. (2020). Measuring Economic Policy Uncertainty in Pakistan. *MPRA Paper 100013*.

Danielsson, J., Valenzuela, M., & Zer, I. (2018). Learning from history: Volatility and Financial Crisis. *The Review of Financial Studies 31(7)*, 2774-2805.

Dybka, P., Kowalczuk, M., Olesinsk, B., Toroj, A., & Ruzkrut, M. (2019). Currency Demand and MIMIC models: towards a structured hybrid method of measuring the shadow economy. *International Tax and Public Finance 26(1)*, 4-40.

Fatas, A., & Summers, L. (2018). The Permanent Effects of Fiscal Consolidations. *Journal of International Economics 112*, 238-250.

Ferrara, L., Lhuissier, S., & Tripier, F. (2017). Uncertainty Fluctuations: Measures, Effects and Macroeconomic Policy Challenges. *CEPII Policy Brief No. 20*.

Forbes , K., & Warnock, F. (2012). Capital flow waves: Surges, stops, flight, and retrenchment. *Journal of International Economics, 88*, 235-251.

Fortin, I., Hlouskova, J., & Sogner, L. (2023). Financial and economic uncertainties and their effects on the ecnomy. *Empirica 50*, 481-521.

Fountas, S. (2010). Inflation, inflation uncertainty and growth : Are they related? *Economic Modelling 27* (5), 896-899.

Friedman, M. (1977). Nobel Lecture: Inflation and Unemployment. *Journal of Political Economy, 85,* 451-472.

Ghirelli, C., Gil, M., Perez, J., & Urtasum, A. (2021). Measuring economic and economic policy uncertainty and their macroeconomic effects: the case of Spain. *Empirical Economics, 60*(2), 869-892.

Hristov, N., & Roth, M. (2019). Uncertainty Shocks and Financial Crisis Indicators. *Deutsche Bundesbank Discussion Paper No. 36/2019*.

Jamil, M., & Majeed, S. (2015). Relationship between real and nominal uncertainty in pakistan : Analysis based on Bivariate GARCH (BEKK) Approach. *Forman Journal of Economics Studies 11*, 53-66. 10.32368/FJES.20151104.

Jensen, N., & Wantchekon, L. (2004). Resource Wealth and Political Regimes in Africa. *Comparative Political Studies 37*(7), 818-841.

Johansson, M., Heldt, T., & Johansson, P. (2004). Latent variables in a travel mode choice model Attitudinal and Behaviourial Indicator Variables. *Swedish National Road and Transport Reserach Institute VTI Notat 6A-2004*.

Joreskag, K. G., & Goldberger, A. (1975). Estimation of a model with Multiple Indicators and Multiple Causes of a single Latent variable. *Journal of the American Statistical Association 70(351)*, 631-639.

Jurado, K., Ludvigson, S., & Ng., S. (2015). Measuring Uncertainty . *American Economic Review 105(3)*, 1177-1216.

Kilian, L., & Zhou, X. (2018). Modeling fluctuations in the global demand for commodities . *Journal of International Money and Finance, 88*, 54-78.

Liu, N., & Fumin, G. (2022). The world uncertainty index and GDP growth rate. *Finance Research Letters*, 103137.

Mohaddes, K., & Raissi, M. (2018). Compilation, Revision and Updating of the Global VAR (GVAR) Database, 1979Q2-2016Q4. *Apollo- University of Cambridge Repository*.

Moore, A. (2017). Measuring Economic Uncertainty and its effects. *Economic Record 93 (303)*, 550-575.

Phan, D., Iyke, B., Sharma, S., & Affandi , Y. (2021). Economic policy uncertainty anf financial stability -- Is there a relation? *Economic Modelling 94*, 1018-1029.

Posey, C., Roberts, T., Lowry, P., & Bennett, R. (2015). Multiple Indicators and Multiple Causes (MIMIC) Models as a Mixed - Modeling Technique: A Tutorial and an Annotated Example. *ommunications of the Association for INformation System 36(11)*, 1-33.

Shakir, S. H., & Razi, R. (2006). *Pakistan 58 saal 14 Aug 1947 say 14Aug2005 Tak.* Sang-e-meel.

Trebicka, B. (2014). Mimic Model: A tool to estimate the shadow economy. *Academic Journal of Interdisciplinary Studies 3(6)*, 295-300.

Zabavnik, D., & Verbic, M. (2021). Relationship between the Financial and the Real Economy: A Bibliometrics Analysis. *International Review of Economics and Finance,75,* 55-75.

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