BRICS JOURNAL OF ECONOMICS
DOI 10.3897/brics-econ.6.e138160
2025 Volume 6 Number 1

Impact of Imports and Exports on Inflation Rate in Afghanistan: Does Political Instability Matter?

Yang Jingjing[I], Shah Mir Mowahed[I], Mohammad Wais Sharif Zada[I]

I *School of Economics and Trade Hunan University, Changsha, China*

Corresponding author: Shah Mir Mowahed (shahmirmowahed785@gmail.com)

Academic editor: Sheresheva M. | Received 29 September 2024 | Accepted 6 December 2024 | Published 2 April 2025

Citation: Jingjing, Y., Mowahed, S. M., & Sharif Zada, M. W. (2025). Impact of Imports and Exports on Inflation Rate in Afghanistan: Does Political Instability Matter? *BRICS Journal of Economics, 6*(1), 119–140. https://doi.org/10.3897/brics-econ.6.e138160

Abstract

Stabilizing the Consumer Price Index (CPI) to protect the populace from the adverse effects of inflation necessitates appropriate measures at both political and economic governance levels. This study examines the impacts of imports (IM) and exports (EX) on inflation (CPI) in Afghanistan using data from 1990 to 2023. The findings from the Autoregressive Distributed Lag (ARDL) model indicate that both IM and EX significantly impact CPI in the short and long term. A robustness check employing the Kernel-based Regularized Least Squares (KRLS) machine learning technique further validates these results. The analysis confirms that international trade has a substantial and positive effect on CPI. Additionally, in the context of Afghanistan, political instability acts as a positive moderator, amplifying the influence of imports and exports on inflation. The study concludes that the country requires a reevaluation of its policies regarding exchange rates and economic growth to mitigate the negative effects of imports, exports, and political volatility on the stability of the CPI.

Keywords

Afghanistan Economy, Imports, Exports, Inflation, Political Instability

JEL: F14, E31, D74, O11.

Copyright *Yang Jingjing, Shah Mir Mowahed, Mohammad Wais Sharif Zada.* This is an open access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

1. Introduction

Afghanistan's economy, marked by its unique geopolitical landscape and internal challenges, has long been vulnerable to fluctuations in trade and inflation. In a country heavily reliant on imports, the dynamics of trade flows can have profound effects on the cost of living and stability of the economy. However, the influence of trade on inflation is not merely a matter of economic theory or practice: in Afghanistan, it is intricately tied to political issues. Large trade imbalances and a persistently massive gap between imports and exports define the nation's economic environment, posing risks that could intensify inflationary pressures. Afghanistan's trade deficit as of 2023 was at 6.798 USD billion, with USD 8.576 billion in imports and USD 1.777 billion in exports (Trading Economics, 2024). These numbers highlight Afghanistan's dependence on imported products showing how easily external shocks could upset the stability of domestic prices.

The dynamics of inflation in Afghanistan are closely linked to the cost of imported commodities that accounts for a significant portion of the consumer price index (CPI). In this relationship, the exchange rate pass-through effect is crucial; as the Afghani currency depreciates in value relative to other major currencies such as the US dollar, the cost of imported goods rises sharply driving up the rate of inflation. According to a Da Afghanistan Bank study, there is a 73.79% correlation between inflation and the exchange rate, meaning that changes in currency values have a serious effect on domestic prices (Iqbal & Naqibullah, 2020). Regression research has also shown that over 44% of inflation fluctuations may be explained by changes in the exchange rate, highlighting the significance of keeping an eye on foreign exchange dynamics to comprehend inflationary patterns.

Although imports are frequently criticized for contributing to inflation, exports also have an impact that should not be disregarded. Afghanistan's export market is modest and primarily consists of low-value goods like agricultural and textile products. These sectors' performance has the potential to influence domestic supply, which in turn may have an impact on inflation. For example, a significant rise in demand for exports may lead to a reduction in the supply of domestically produced goods driving up their prices. External factors, such as global commodity pricing and supply chain disruptions, may further complicate this relationship. Afghanistan's heavy reliance on imports for essentials like food and fuel makes it especially vulnerable to shifts in international markets (UNCTAD, 2023).

One should not ignore the broader economic context. Afghanistan's economy has suffered greatly since the Taliban took power in August 2021, as evidenced by a precipitous drop in GDP and a major cutback in humanitarian assistance (Asian Development Bank, 2024). Political instability has the power to drastically increase or decrease the impact of trade on inflation by obstructing import and export routes, changing the course of policy and undermining investor confidence; it has contributed to the environment characterized by persistent inflationary pressures and high unemployment rates. These macroeconomic factors interact with trade dynamics in a complicated way, with imports and exports significantly affecting inflation rates.

Effective policymaking in Afghanistan requires an understanding of how trade dynamics affect inflation as the country navigates its way to economic recovery in the face of persistent geopolitical uncertainty. By using econometric modelling and empirical analysis, this paper seeks to conduct a thorough examination of these linkages and provide important insights that can guide policymakers' attempts to stabilize prices and foster sustainable economic growth by clarifying how changes in imports and exports affect inflation rates in Afghanistan's economic environment.

1.1. Motivation of the study

The paper aims to examine how imports and exports affect Afghanistan's inflation rates while taking political instability into account as a moderator. Research on inflationary tendencies in developing nations is abundant, but little is known about the precise dynamics of trade-induced inflation in Afghanistan, which creates a significant gap in the literature. Besides, even though Afghanistan's 2016 entry into the World Trade Organization (WTO) was a significant step toward the country's economic integration with the rest of the world, no previous study had fully investigated how this membership might affect economic stability or inflationary pressures. The absence of such studies leaves a crucial void in understanding how global trade frameworks can potentially mitigate inflation in post-conflict nations. Furthermore, the political instability brought about by the U.S. withdrawal and the Taliban's subsequent takeover of the Afghan government in 2021 has further complicated the relationship between trade, inflation, and political stability by adding a new degree of uncertainty to the nation's economic environment. By investigating the complex relationship between trade flows and inflation, the role of WTO membership in maintaining price stability and the potential moderating influence of political instability, this study seeks to close the gaps in research and provide new and thorough understanding of Afghanistan's economic difficulties.

1.2. Significance of the study

This paper analyzes the interplay between trade, inflation, and political instability in Afghanistan's precarious post-conflict economy. It emphasizes the significance of political context for the study into the consequences of trade by examining the intricate ways in which imports, exports, and political volatility all work together to drive inflation. Ultimately, the paper challenges the conventional boundaries of economic analysis by showing that the true drivers of inflation in politically unstable regions are not only the forces of supply and demand but the broader socio-political fabric that influences the interaction of trade and inflation. In doing so, it contributes to the exploration of such fields as international trade, political economy, and development studies, establishing a foundation for future research that connects economic behavior with the unique political realities of developing nations.

2. Literature Review

Many researchers have examined the connection between inflation and trade flows, especially in developing and emerging nations. Since international trade is the main channel through which external economic forces affect domestic price levels, the importance of this relationship should not be underestimated. Prior research on this subject has mostly concentrated on how imports and exports affect inflation in larger economic contexts, paying special attention to trade liberalization, price stability, and the function of currency rates. The idea that trade plays a crucial role in reducing inflationary pressures through its impact on competition, market efficiency and access to foreign goods is usually supported by empirical data. Trade flows can help reduce inflation by improving resource allocation, increasing the supply of goods, and stabilizing domestic prices through integration with international markets.

Hussain and Malik (2011) investigate the connection between Pakistan's inflation and economic growth and discover a strong inverse relationship. According to their study, excessive rates of inflation reduce purchasing power and raise doubts about investment choices, which impedes economic progress. This fundamental knowledge emphasizes the necessity of understanding how the external trade, primarily imports and exports, can affect inflationary tendencies. To design a successful economic policy that would cope with detrimental effects of inflation, the authorities need to have a strong grasp of trade dynamics. Following up on this idea, Ghauri et al. (2022) investigate how exports contribute to economic growth. They contend that exports boost foreign exchange reserves, which in turn helps reduce inflationary pressures while also promoting economic growth. This implies a clear correlation between export performance and inflation management, suggesting that increasing export capacity can be a strategic reaction to rising prices. Inflation stability and exports are positively correlated, which highlights the significance of trade policies that give priority to export growth.

In a related study, Munir and Javed (2018) examine the export composition of South Asian nations and how it affects economic expansion. They maintain that nations with a larger proportion of manufactured exports typically see better growth results. This suggests that the kind of exports has a significant impact on how economies develop when inflation rates fluctuate, supporting Raheem et al. who have shown that not only the size but also content of exports matters when it comes to their capacity to counteract inflation. Ghauri et al. (2022) evaluate Pakistan's export dynamics using ARDL cointegration analysis. According to their findings, exports have a favorable impact on economic growth. However, when demand exceeds supply, they may also exacerbate inflationary pressures. The intricacy of overseeing export-led growth strategies in the face of price increases is highlighted by this dual effect. Here, the relationship between export growth and domestic price stability becomes clear, indicating that in order to prevent inflation from getting worse, authorities must carefully balance these elements.

Amiti et al. (2024), moving from national contexts to global perspectives, examine the rise in the U. S. import prices during the COVID-19 pandemic. They discovered that, because of global supply shocks and increases in demand unique to the United States, higher import price had a major impact on domestic inflation levels. For developing nations like Pakistan, where reliance on imports might worsen inflationary tendencies during global disruptions, this conclusion is especially pertinent. Their research shows how domestic inflation rates can be directly impacted by overseas market situations.

The relationship between inflation and import prices in the USA is examined by Corrigan (2005), who points out that rising import costs can result in higher consumer prices. This is exactly what happens in many developing countries like Pakistan whose economies depend significantly on imports for necessities. Corrigan's observations align with the findings of Amiti et al. as they both show how countries that rely on imports may become economically vulnerable because of changes in global import prices. Herawati and Sidik (2022) conducted an analysis of how interest rates and imports affected inflation in ASEAN nations between 2006 and 2019. The idea that dependence on imports can worsen inflationary pressures in emerging nations is supported by their findings, which show that increasing import costs may contribute substantially to domestic inflation. Corrigan's discoveries regarding import price sensitivity highlight the necessity for developing nations to diversify their economies and reduce their dependence on imported goods.

Using a Granger causality method, Usman and Bashir (2022) investigate how imports affect China's economic growth. They find a reciprocal relationship in which imports both influence inflation dynamics and spur growth, demonstrating how managing growth and inflation can be made more difficult by interwoven trade relationships. Given that this link is reciprocal, policymakers should take into account both the influence of imports on growth and its subsequent effects on inflation. Turning their attention to regional research, Jackson et al. (2023) examine the factors that contribute to inflation in Sierra Leone, highlighting important variables including import costs and currency rates that have a major impact on inflation rates. Their results are consistent with prior research showing that external factors are important for domestic price levels, implying that both regional contexts and trade influences should be taken into account when examining inflation dynamics. Andinuur (2013) investigates the interaction of Ghana's economic development and foreign direct investment (FDI). According to the study, excessive inflation can discourage foreign investment, posing a cyclical dilemma for policymakers, even if FDI can reduce inflationary pressures by increasing productive capacity. This cyclical relationship implies that internal economic conditions can impact external investment flows and control over inflation becomes essential for drawing in foreign direct investment (FDI).

The existing research suggests that imports, exports, and inflation rates interact in a complicated way. Imports frequently cause inflation through higher prices and supply chain weaknesses; increases in exports are typically associated with rising inflation because of improved domestic demand and price adjustments. These connections, however, have not been fully examined in relation to Afghanistan,

especially considering the nation's persistent political unrest and the economic fallout from the U.S. withdrawal. Since Afghanistan's economic resilience has been severely undermined by the sudden end of international aid, it is crucial to comprehend how trade dynamics affect inflation in this particular setting. This paper offers a thorough examination of the connections between imports, exports, and inflation in the context of Afghanistan. It does this in an effort to educate policymakers on practical methods for maintaining price stability and encouraging long-term economic growth in a country that has to deal with excessive reliance on trade.

3. Data and methodology

3.1. Data and Variables

This study is based on time series data for Afghanistan from 1990 to 2023. It uses a number of important variables, such as the Consumer Price Index (CPI), Imports (IM), Exports (EX), GDP Per Capita (GDP), Exchange Rate (EXR), Political Instability (PI), Afghanistan's World Trade Organization (WTO) membership, and the United States' withdrawal from Afghanistan (USAW). The CPI is calculated using 2010 as the base year (2010=100), whereas IM and EX are expressed in the US dollars. The official USD exchange rate is reflected in EXR, while GDP is expressed as per capita real GDP in USD adjusted to 2015 constant prices, and TAX refers to taxes on international trade. Political stability and lack of violence are evaluated by PI, and estimates are given. The dummy variables for WTO accession and USAW are set to 0 before 2016 and 1 after that, and 0 before 2021 and 1 after that, respectively. The Trade Map and the World Bank database provided the data for every variable (see Table 1).

Table 1. Variables Definition and Data Sources

Variables	Variables Definition	Data Sources
CPI	Consumer Price Index (2010=100)	WDI
IM	Goods and Services Import Value in US$	Trade Map
EX	Goods and Services Export Value in US$	Trade Map
PI	Political Stability and absence of violence (Estimate)	WDI
EXR	Official Exchange Rate Afghani per US$	WDI
GDP	Per Capita Real GDP	WDI
TAX	Taxes on International Trade (% of revenue)	WDI
WTO	Afghanistan Accession to WTO (1 after 2016, 0 before)	Dummy
USAW	USA Withdrawal from Afghanistan (1 after 2021, 0 before)	Dummy

Note: To address the issue of missing values in the dataset, we employed interpolation techniques to ensure the continuity and completeness of the data. Specifically, we used both forward interpolation and backward interpolation methods to fill the missing entries.

Furthermore, Table 2 and Fig. 1 display the descriptive statistics and pairwise correlation matrix for the variables in question. The correlation between IM and CPI is 0.93, indicating a very strong positive relationship that suggests the CPI tends to rise as imports do, and the correlation between EX and CPI is 0.65, indicating a moderately positive relationship, which suggests that higher exports are associated with an increase in CPI, albeit with a less noticeable impact than imports.

Table 2. Descriptive Statistics

Descriptive Statistics	CPI	IM	EX	PI	EXR	GDP	TAX
Mean	1.959	6.679	6.167	-2.433	1.722	2.625	0.981
Maximum	2.218	6.993	6.468	-1.872	1.945	2.765	1.343
Minimum	1.747	6.403	5.770	-2.795	1.563	2.456	0.500
Std. Dev.	0.167	0.211	0.177	0.210	0.106	0.094	0.264
Skewness	0.244	0.316	-0.380	0.531	0.681	0.322	-0.265
Kurtosis	1.427	1.418	2.497	3.185	2.490	1.667	1.737
Jarque-Bera	3.844	4.114	1.176	1.647	2.994	3.106	2.658
Probability	0.146	0.128	0.555	0.439	0.224	0.212	0.265
Observations	34	34	34	34	34	34	34

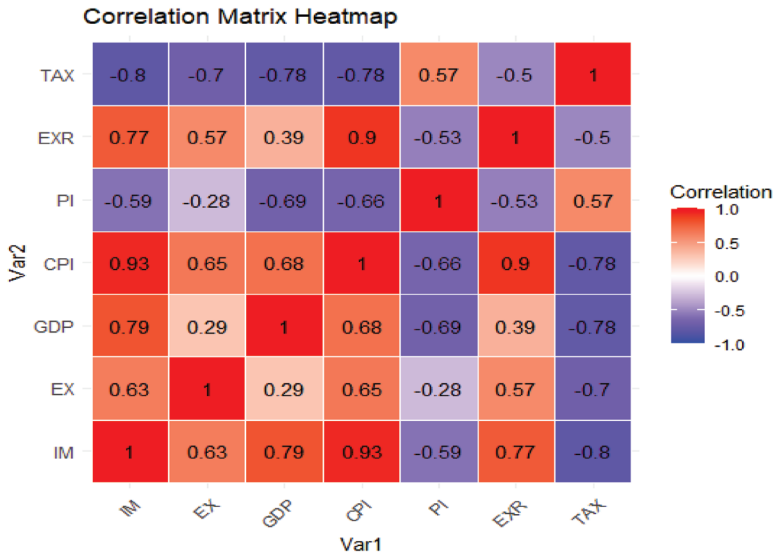

Figure 1. Matrix of paired correlation coefficients

3.2. Model Extraction

The present study employs an empirical approach to examine the influence of IM and EX on CPI (Inflation) while accounting for the moderating role of PI in achieving the CPI variations in Afghanistan. The following equation (1) represents the econometric model of the linear association between these fundamental variables:

$$\mathrm{Ln}(CPI)_t = \beta_0 + \beta_1 \mathrm{Ln}(IM)_t + \beta_2 \mathrm{Ln}(EX)_t + \beta_3 (PI)_t + u_i \quad (1)$$

Before empirical estimation, all the variables were transformed using natural logarithm to standardize the dataset, generate stationary series and facilitate accurate estimations by removing heteroskedastic and outlier effects. Moreover, the model has been validated, and the omitted variable bias has been resolved by including five additional variables, namely EXR, GDP, TAX, WTO and USAW. Henceforward, the log-transformed econometric function of equation (1) can be rewritten as follows:

$$\mathrm{Ln}(CPI)_t = \beta_0 + \beta_1 \mathrm{Ln}(IM)_t + \beta_2 \mathrm{Ln}(EX)_t + \beta_3 (PI)_t + \beta_4 \mathrm{Ln}(EXR)_t +$$

$$+ \beta_5 \mathrm{Ln}(GDP)_t + \beta_6 \mathrm{Ln}(TAX)_t + \beta_7 (WTO)_t + \beta_8 (USAW)_t + u_i \quad (2)$$

In equation (1-2), Ln(CPI) is used as a proxy for inflation rate, ln(IM) represents the natural logarithm of import, Ln(EX) shows the natural logarithm of export, PI is the political stability index, Ln(EXR) stands for exchange rate, Ln(GDP) refers to GDP per capita level, Ln(TAX) is Tax on international trade, (WTO) is a dummy variable for Afghanistan membership in World Trade Organization in 2016, and (USAW) represents USA withdrawal from Afghanistan in 2021. Finally, u_i represents the error term that accommodates any residual variability in the model that cannot be accounted for by the other variables.

3.3. Methods

The present research uses the ARDL bond test technique to estimate Model (2) and study the long- and short-term connections between perceived variables and CPI. The specific characteristics of time series data are critical to the choice of the most suitable methods of analysis. Time series data have an autoregressive attribute, which allows current values to be associated with historical ones. The sequential integration of variables and their cointegrating interactions play a major role in determining the best estimation framework for time series analysis. Fig. 2 & Fig. 3 present the theoretical and empirical analysis roadmaps, respectively.

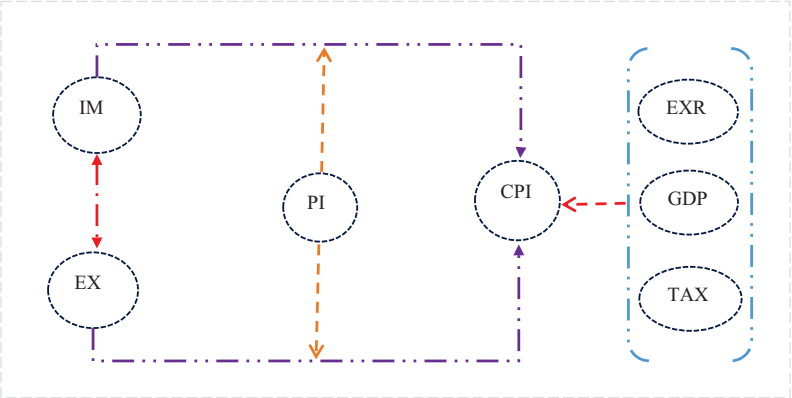

Figure 2. Theoretical Roadmap

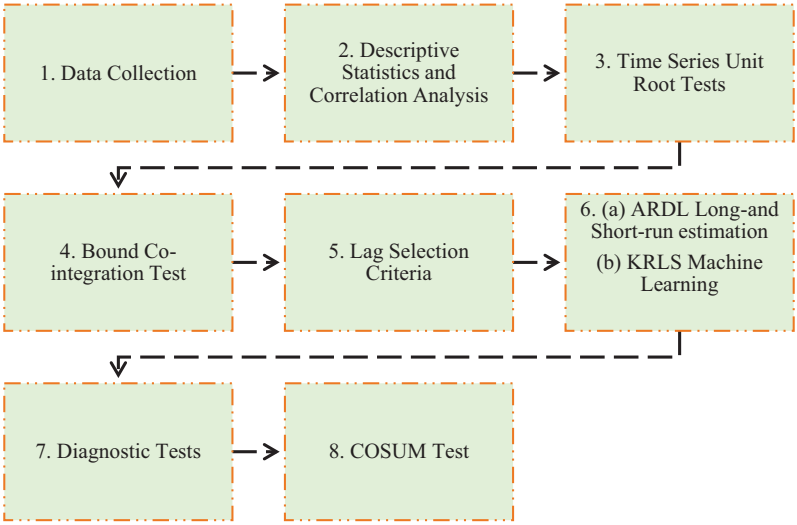

Figure 3. Empirical Analysis Roadmap

3.4. Unit Root Testing

Most economic factors exhibit temporal variation, i.e. they are non-stationary variables. Conventional estimation techniques, like ordinary least squares (OLS), yield unreliable and biased estimations when applied to non-stationary series. Therefore, improper application of estimation techniques in time series analysis without due regard for the stationarity characteristics of the series under investigation can result in spurious regression. The conventional approach to statistical estimation in applied econometrics is based on the presumption of normality, where the mean and variance become

stable over time and it may happen that objectively non-connected variables are found to have significant connections according to regression results. Making inferences from such findings can result in serious errors.

In this study, the Augmented Dickey-Fuller (ADF) unit root test, created by Dickey and Fuller (1979), was used to assess the unit root characteristic of the series. When examining the unit root, it is essential to take into account the series' structural break, so the Zivot and Andrews (2002) unit root test helped resolve problems with structural breaks in time series data and the ensuing errors in statistical analysis.

3.5. Co-integration Test

To find out whether there was cointegration between the variables after confirming their stationarity, we chose the ARDL bound cointegration test created by Pesaran et al. (2001). As it does not require that all of the variables be integrated into order one I(1), this test was considered superior to other cointegration tests. The bound test is also effective and robust when it comes to analyzing the cointegration of variables with orders of integration of I (0), I (1), or a mix of both, with the exception of I(2). To assess the statistical significance of the lagged levels of variables in a univariate equilibrium correction mechanism, the ARDL limits test approach uses the F- and T-statistics. With the regressors integrated of order zero or one, the ARDL limits test's hypothesis (H_0) states that there is no level relationship. The short-run ARDL and error correction mechanism (ECM) are used to create the long-run relationship if a level relationship between variables is found. On the other hand, only the short-term ARDL is stated if the results of the bound tests show that there is no level relationship. When the ARDL bound test's F- and T-statistics fall within the I(0) and I(1) bounds, the conclusion is considered inconclusive (Bahmani-Oskooee & Goswami, 2003; Wang et al., 2024).

3.6. Long-run and Short-run ARDL Estimation

The study used autoregressive distributed lag error correction framework created by Pesaran et al. (2001) to empirically analyze the calculating of the long-term and short-run association between variables. The autoregressive distributed lag (ARDL) method is an accurate technique for estimating parameters and making trustworthy policy inferences from historical data. The ARDL model is a dependable framework for conducting analyses that involve distributed lagged variations, which are changes in an economic variable that may have an impact on other economic variables beyond the current period. It is useful for small datasets because it can produce estimates for both long-term and short-term effects at the same time. In addition to its beneficial flexibility and efficiency when used with small sample sizes, it has been found to be the most appropriate and feasible choice for cointegrating regressions when compared to other cointegrating estimators, such as fully modified dynamic ordinary least squares (FMDOLS).

By allowing the lag of the dependent factor to be combined with the lags of the other independent variables, it also helps to overcome the problem of collinearity. Compared to alternative techniques within the parametric single-equation cointegration estimators' category, the ARDL model can alleviate the second-order asymptotic consequences of cointegration. The ARDL model is based on several essential assumptions that include the absence of autocorrelation in the error terms, consistency of variance and mean throughout the model, normal distribution of the data, and variable stationarity (Arize, 2017).

Below is a mathematical representation of the ARDL model that incorporates the lagged error correction term (ECT), which indicates the pace of convergence of the long-run equilibrium state, as well as the derivation of empirical estimates for both short- and long-term effects:

$$\Delta \mathrm{Ln}(CPI)_t = \beta_0 + \beta_1 \mathrm{Ln}(IM)_{t-1} + \beta_2 \mathrm{Ln}(EX)_{t-1} + \beta_3 (PI)_{t-1} + \beta_4 \mathrm{Ln}(EXR)_{t-1} +$$

$$+ \beta_5 \mathrm{Ln}(GDP)_{t-1} + \beta_6 \mathrm{Ln}(TAX)_{t-1} + \sum_{k=1}^{p} \beta_{ak} \mathrm{Ln}(CPI)_{t-k} + \sum_{k=1}^{p} \beta_{bk} \mathrm{Ln}(IM)_{t-k} +$$

$$+ \sum_{k=1}^{p} \beta_{ck} \mathrm{Ln}(EX)_{t-k} + \sum_{k=1}^{p} \beta_{dk} (PI)_{t-k} + \sum_{k=1}^{p} \beta_{ek} \mathrm{Ln}(EXR)_{t-k} + \sum_{k=1}^{p} \beta_{fk} \mathrm{Ln}(GDP)_{t-k} +$$

$$\sum_{k=1}^{p} \beta_{gk} \mathrm{Ln}(TAX)_{t-k} + ECT_{t-1} + \mu_t \tag{3}$$

Equation (3) shows the long and short-run coefficients which are specified by $\beta_a, \ldots, \beta_g$ and $\beta_1, \ldots, \beta_6$ respectively. Similarly, Δ stands for first-difference operator and μ_t denotes the error term.

Additionally, the Akaike information criteria are used to calculate the lag length prior to performing an empirical computation using ARDL. Lastly, it should be mentioned that the identification of a long- or short-term cointegrating relationship does not ensure that the models used in research will remain stable in the course of the study. The Durbin-Watson statistic, the Breusch-Pagan-Godfrey heteroscedasticity test, the Breusch-Godfrey serial correlation LM test, the Ramsey RESET test, and the Jarque-Bera test were therefore used as residual diagnostics tests.

3.7. Kernel-based Regularized least squares (KRLS) machine learning algorithm technique

To confirm the most reliable outputs, the Kernel-based Regularized Least Squares (KRLS) machine learning algorithm approach was applied; it was proposed by Hainmueller & Hazlett (2014) and later updated by Sarkodie and Owusu (2020). This approach is useful for evaluating "partial derivatives," which represent the marginal impacts of each chosen indicator at each dataset point. Although it is feasible to

estimate the average marginal effect, our main goal will be to examine and connect the distribution of these effects with the findings of the ARDL inquiry. In order to prevent over-fitting and enhance the well-fitted model, the KRLS technique additionally incorporates a penalty term. Subject to the assumptions of rational symmetry, the KRLS technique eventually exposes a good empirical outcome, such as stability, unbiasedness, and asymptotic normality.

The Gaussian kernel utilized by KRLS is shown below:

$$K(x_i, x_j) = e^{-\frac{\left|x_i - x_j\right|^2}{\sigma^2}} \tag{4}$$

In equation (4), x_i and x_j are the two associated dataset points with the squared Euclidean distance term ($\left|x_j - x_i\right|^2$), and the parameter (σ^2) which controls the width of the kernel. In addition, the kernel reaches its maximum value when comparing two data points, x_i, and x_j, that are identical (*i.e.*, $x_i = x_j$). As the distance between x_i and x_j increases, the value of the kernel decreases and approaches zero.

4. Empirical Results and Discussion

Descriptive data are presented in Table 2 above, and the study shows the standard deviations of CPI, IM, EX, PI, EXR, GDP, and TAX, confirming that these indicators represent a moderate level of volatility. Furthermore, the Jarque-Bera statistic indicates that the expected observations have a normal distribution and proves that the P-Value is not statistically significant. Before doing any quantitative analysis, the stationarity of the time series must be verified in order to prevent pseudo-regression and confirm the veracity of the expected results. This study uses the ARDL technique to estimate the long and short-run effect of explanatory variables on CPI. One unique aspect of the ARDL technique is that it focuses on the interactions between identical sequences without requiring that their components be connected. To maintain the economic importance of the data, it should limit the inclusion of the factors in the framework to the first order. With too much information excluded, capturing the second-order variance could result in erroneous regression.

Table 3 displays the results of the ADF and Zivot & Andrews structural break unit root tests that we used. It is also possible to confirm that all parameters remain dependable stationary at the first difference. The date of the break is considered to be an endogenous study variable in the structural break unit root test, which was created by Zivot and Andrews (1992). The results of the Zivot and Andrews test are also included in Table 3, which indicates that all the variables are stationary at the first difference along with the associated break years. Clearly, the ARDL model is a good choice for the subsequent stages of analysis. Before applying ARDL technique, we might ascertain whether the variables are co-integrated and, if so, whether it is

worthwhile to move further with the boundary test by calculating the estimated value of the F-Statistic and T-Statistics.

Table 3. ADF and Structural Break unit-root test

ADF Unit Root Test					
Variables	**At level C**	**At 1st diff C**	**At level C&T**	**At 1st diff C&T**	**Outcome**
CPI	-0.016	-7.060***	-2.293	-7.017***	I(1)
IM	-1.337	-3.643**	-0.624	-3.690**	I(1)
EX	-2.989**	-5.872***	-3.351*	-5.880***	I(0)
PI	-2.780*	-5.424***	-2.600	-5.343***	I(0)
EXR	0.493	-6.014***	-1.480	-6.182***	I(1)
GDP	-0.941	-4.386***	-0.298	-4.478***	I(1)
TAX	-2.721*	-5.842***	-3.667**	-5.979***	I(0)
Zivot Andrews Structural Break Unit-Root Test					
Variables	**Leve t-statistic**	**Break year**	**At 1st diff t-statistic**	**Break year**	**Outcome**
CPI	-4.420	2008	-5.894***	2006	I(1)
IM	-3.781	2010	-6.014***	2012	I(1)
EX	-5.387***	2013	-6.821***	2018	I(0)
PI	-3.646	2007	-5.812***	2003	I(1)
EXR	-2.791	2015	-7.335***	2012	I(1)
GDP	-1.746	2007	-6.235***	2002	I(1)
TAX	-2.795	2016	-6.690***	2014	I(1)

Note: *** (1%), ** (5 %), and * (10 %) level of significance. C = Constant, C&T =Constant and trend, and I(0)=Level and I(1) = First difference.

Table 4 depicts the outcomes of the boundaries cointegration test and lag selection criterion. One practical choice for determining the lag sequence is the AIC, which is used to perform boundary tests on the data, with the optimal lag order determined to be 1. The results at 1 % significance level, show that there is a strong co-integration relationship between the variables because the calculated F-Statistic and T-Statistic values of 7.636 and -4.291 greatly exceed the critical values.

We performed a sequential analysis prior to applying the ARDL technique to examine the short- and long-term effects of explanatory factors. In order to better understand the relationship between IM, EX, PI and CPI, benchmark regression and moderation effect exploration were required.

Table 4. Bound Co-integration test and lag-order selection results

Variables			F-Statistics		T-Statistics			
CPI = F(IM, EX, PI, EXR, GDP, TAX)			7.636**		-4.291*			
Kripfganz and Schneider's critical and approximate p-values								
Statistic	10%		5%		1%		p-value	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
F	2.641	4.321	2.945	3.831	3.712	4.621	0.000	0.002
T	-2.542	-4.763	-2.783	-4.375	-3.914	-4.904	0.005	0.004
ARDL Lag-Order Selection Criteria								
Lag	LL	LR	FPE	AIC	HQ	SC		
0	68.843	NA	2.5e-06	-4.389	-4.344	-4.249		
1	149.839	161.990	2.1e-08*	-9.189*	-9.009*	-8.628*		
2	152.783	5.889	3.2e-08	-8.785	-8.471	-7.804		
3	161.993	18.420*	3.3e-08	-8799	-8.351	-7.398		

Note: ** and * expresses 5% and 10% significance level respectively. LR (Logistic Regression); AIC(Akaike Information Criterion); HQ(Hanna-Quinn Information Criterion); and SC(Schwartz Information Criterion).

The findings of the benchmark regression analysis are shown in Table 5. Given that the IM and EX coefficients are positive and significant at 1% and 5% significance level, it may be concluded that rising IM and EX support CPI. Likewise, there is still a favorable association between PI and CPI. To account for their possible impact on CPI and separate the precise effects of IM and EX, control variables including EXR, GDP and TAX were added.

The moderating effect of Political Instability (PI) on the influence of IM and EX on CPI is displayed in Table 6. The moderating variable PI amplifies the effects of both IM and EX on CPI, as indicated by the positive coefficients for the interaction terms (IM*PI and EX*PI). In particular, this indicates that the positive effect of IM on CPI increases with PI levels, indicating that higher PI amplifies the advantages of imports on consumer costs.

Reliance on imported goods that often increases during brief periods of stability becomes even greater because of limited domestic output and prices rising in the absence of competition. High prices are also a result of ongoing inflationary pressures, speculative pricing, and currency volatility. Besides, CPI can be impacted by improved supply chain capabilities and growing customer preferences for imports, especially when a small number of companies control a large portion of the market.

Table 5. Benchmark regression analysis results

Variables	Model-1	Model-2	Model-3
IM	0.257*** (0.091)		
EX		0.045** (0.019)	
PI			0.360*** (0.038)
EXR	0.818*** (0.112)	0.845*** (0.065)	0.741** (0.064)
GDP	0.352* (0.180)	0.339*** (0.113)	0.353*** (0.105)
TAX	0.191*** (0.048)	0.188*** (0.052)	0.184*** (0.134)
Constant	-0.539 (0.541)	-0.566 (0.594)	-0.623** (0.303)
N	34	34	34
Adj-R^2	0.971	0.965	0.969

Note: *** (1%), ** (5 %), and * (10 %) level of significance.

Table 6. Moderation Effect Analysis

Variables	Model-1	Model-2
IM	0.257*** (0.091)	0.257*** (0.091)
EX	0.105* (0.063)	0.105* (0.063)
PI	0.182** (0.075)	0.182** (0.075)
IM*PI	0.315** (0.087)	
EX*PI		0.189* (0.048)
Control	Yes	Yes
Constant	Yes	Yes
N	34	34
Adj-R^2	0.970	0.975

Note: *** (1%), ** (5 %), and * (10 %) level of significance.

Similarly, the positive impact of EX*PI on CPI might also be a result of higher demand for Afghan products in politically stable environments, which could raise prices because of higher production costs or more competition in the market. In the case of Afghanistan, these dynamics highlight the intricate connection between political circumstances and economic conduct.

Table 7 shows that Afghanistan's Consumer Price Index (CPI) is negatively impacted by WTO membership, with a significant coefficient of -0.076, suggesting that greater trade activity results in reduced costs. On the other hand, the US exit is associated with an increase in the CPI, as indicated by a significant coefficient of 0.094, meaning that it causes instability and higher expenses. Other variables are controlled for in both models (with high adjusted R-squared values of 0.972 and 0.976), underscoring the significance of these processes in determining Afghanistan's economic environment after significant political shifts.

Table 7. WTO and USAW Effect on CPI

Variables	Model-1	Model-2
WTO	-0.076*** (0.027)	
USAW		0.094*** (0.024)
Control	Yes	Yes
Constant	Yes	Yes
N	34	34
Adj-R^2	0.972	0.976

Note: *** (1%), ** (5 %), and * (10 %) level of significance.

The ARDL approach can be used to estimate the regression and draw conclusions about long-term impacts once the Boundary test has shown the presence of a long-term cointegration relationship among parameters. At this point, we analyze the long-term effects and investigate how IM, EX, and PI affect CPI over an extended period of time. Table 8 depicts the ARDL long- and short-term estimation outcomes. Long-term results indicate that IM and EX have a positive impact on CPI, with coefficients of 0.214 and 0.187, respectively. This means that a 1% increase in IM and EX will result in an increase in CPI of 0.214% and 0.187%, respectively. Stronger effects are shown by PI and EXR, with coefficients of 0.286 and 0.769, respectively, suggesting that strong inflationary pressures are linked to increased currency instability and depreciation. With TAX showing a slight positive effect (0.084), GDP likewise exhibits a positive correlation with a coefficient of 0.305 which are significant at 5% and 10% significance level, respectively. The long- and short-run estimations presented in this paper align with Amiti et al. (2024) and Herawati et al. (2022), where import and export positively affect CPI.

The results of additional residual diagnostic tests are also shown in Table 8, including the Jarque-Bera, Ramsey RESET, Breusch-Godfrey serial correlation LM, Durbin-Watson stat, and Breusch-Pagan-Godfrey heteroscedasticity test. The diagnostic tests show that the long-term estimating techniques have produced consistent, dependable results with useful policy implications. We employed the CUSUM approach to assess the prediction model's durability in an effort to avoid aptitude model unsteadiness

that results from parameter upheaval. The model's structure is consistent, as shown by Fig. 4, with the residuals (CUSUM) between the borders.

Table 8. ARDL Long and Short-run Estimation

Variables	Long-run Estimation		Short-run Estimation	
	Coefficients	P-Values	Coefficients	P-Values
IM	0.214**	0.028	0.198***	0.000
EX	0.187*	0.069	0.129**	0.021
PI	0.286***	0.007	0.319***	0.000
EXR	0.769***	0.000	0.620**	0.000
GDP	0.305*	0.057	0.217*	0.057
TAX	0.084**	0.028	0.123*	0.061
ECT_{t-1}			-0.701***	0.000
Diagnostic Tests	**$\chi^2(P-Value)$**		**Results**	
Durbin-Watson	3.154			
Adj-R^2	0.957			
Breusch-Godfrey LM Test	3.504 (0.148)		No serial correlation evidence	
Breusch-Pagan-Godfrey	7.591 (0.569)		No heteroscedasticity evidence	
ARCH	0.159 (0.608)		No evidence of heteroscedasticity	
RESET	4.625 (0.150)		Model Correctly Specified	
Jarque-Bera Test	2.621 (0.208)		Estimates of residuals are normal	

Note: Standard errors in parentheses, * p < 0.1, ** p < 0.05, *** p < 0.01.

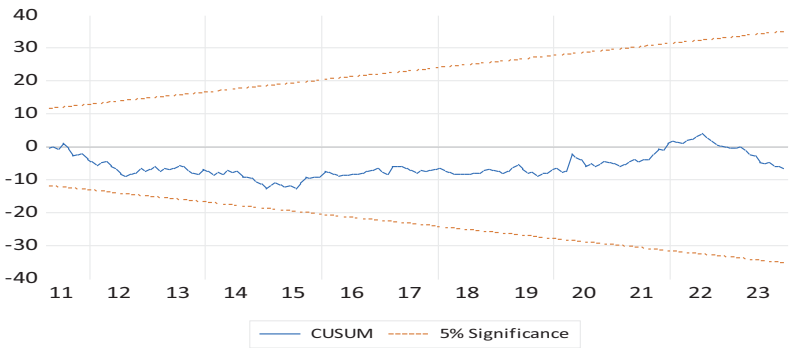

Figure 4. COSUM

4.1. Robustness check: KRLS-based machine learning approach

The current study examines the causal link between chosen indicators using point-wise differentials and the KRLS machine learning algorithm. By examining the forecasters' marginal effects at each stage, the previously indicated empirical method enables us to investigate the structural changes in Afghanistan's economic management. The effects of IM, EX, PI, and EXR are shown to be positive and significant in Table 9. In keeping with the primary finding of the ARDL approach, the effects of GDP and TAX are likewise positive but not statistically significant. The model's R^2 result, which is 0.9888, shows that the 98.88% adjustments may be justified by the current model's analytical ability with the specific regression. Using derivatives, the percentiles obtained (25^{th}, 50^{th}, and 75^{th}) indicate the time-wise marginal impacts on the dependent variable (CPI) of the explanatory variables (IM, EX, PI, EXR, GDP, and TAX). The point-wise derivatives support the findings' sensitivity, suggesting that the diverse marginal effects of the impacted indicators are absent. As an immediate consequence, we analyze the long-term modifications of the explanatory indicators, such as how their changes impact the difference in the regressed CPI.

Table 9. Results of Machine Learning Approach

Variables	Average	SE	P-Value	P25	P50	P75
IM	0.071	0.010	0.000	0.170	0.302	0.372
EX	0.045	0.021	0.042	0.035	0.060	0.061
PI	0.032	0.002	0.000	0.021	0.086	0.098
EXR	0.098	0.043	0.018	0.894	0.696	0.622
GDP	0.051	0.043	0.501	0.124	0.157	0.234
TAX	0.013	0.009	0.105	-0.198	0.208	0.162
Diagnostic						
	Lambda	Tolerance	sigma	Eff.df	R^2	Looloss
	0.0108	0.0428	0.0174	4.1633	0.9888	33.1309

According to the data displayed in Fig. 5, the marginal impact of IM primary indicates a positive and growing influence on Afghanistan's CPI. It tends to fluctuate and stay positive at higher CPI levels. EX also has an increasingly positive impact on CPI. The CPI is positively impacted by PI and EXR, which are somewhat flat at the beginning, sharp in the middle, and then tend to slow down at the end. At the beginning, GDP had a negative impact on CPI; at the end, however, its effect turned positive. In a similar vein, TAX had a slight positive effect on the CPI at first, but later it became stronger. The results obtained are consistent with our primary model, the ARDL-based counterfactual assessment.

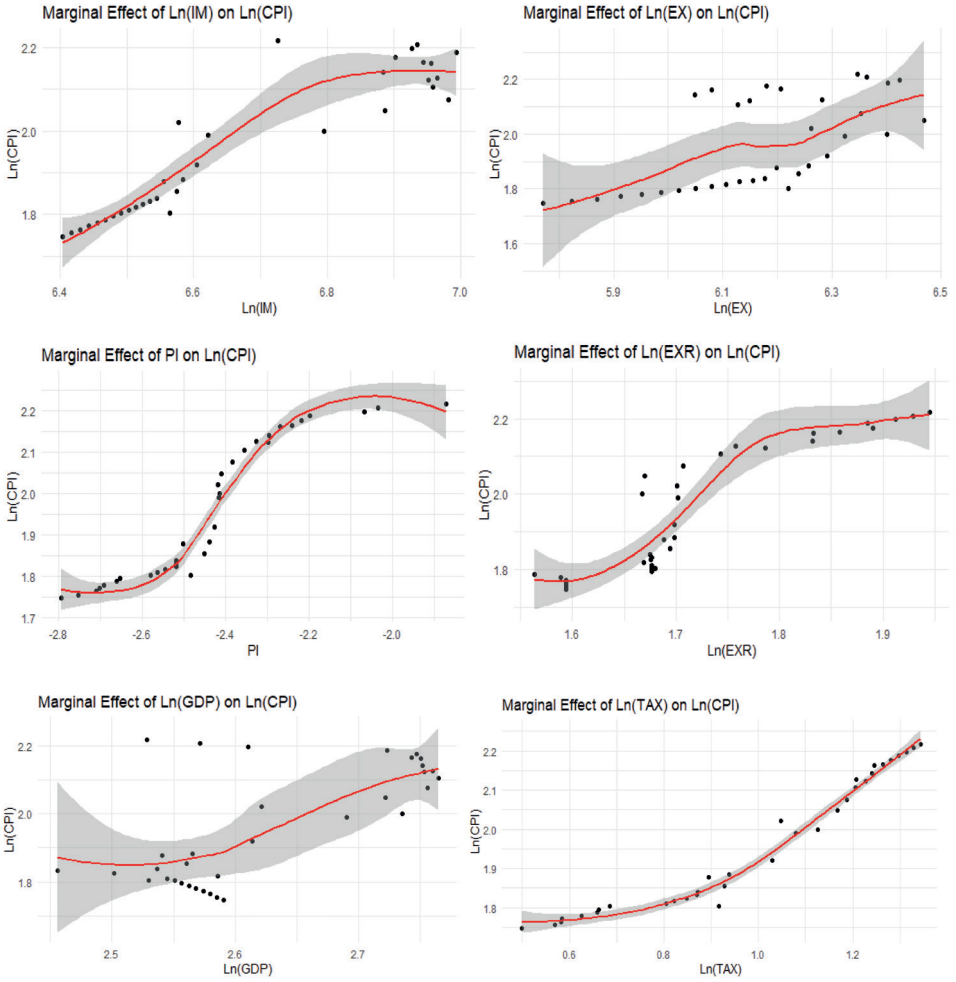

Figure 5. Marginal Effects Through Machine Learning Approach

5. Conclusion

In this study we aim to find out how imports (IM), exports (EX), and political instability (PI) affect Afghanistan's Consumer Price Index (CPI), taking into account the impact of important macroeconomic factors like GDP, taxation (TAX), and exchange rates (EXR). The study covers the years 1990–2023, offering a thorough examination of the ways in which both domestic and international factors influence changes in the country's price level. According to the findings, the currency rate volatility, GDP growth, and taxation policies all have a major impact on Afghanistan's CPI. The analysis has shown that rising imports and exports have compounding impacts on local market pricing and availability of products and services. Political instability exacerbates price volatility, interferes

with market systems and undermines economic stability. Together, these factors show that a complex interaction between fiscal policies, external trade activity, and sociopolitical issues shapes Afghanistan's CPI.

5.1. Policy Recommendations

A number of policy initiatives are suggested to address the variables affecting Afghanistan's Consumer Price Index (CPI). It is crucial to stabilize the exchange rate through export diversification, formal remittance inflows, and larger currency reserves. Reliance on imports can be decreased by encouraging home manufacturing and economic diversity, while fair trade laws should make sure that exports do not jeopardize domestic supplies. The impact of inflation on vulnerable households can be alleviated by decreasing the tax burden on necessities and implementing social programs involving cash transfers or subsidies.

Economic resilience depends on political stability, which calls for improved governance and inclusive discourse. Import expenses can be decreased and prices can be stabilized by investments in trade infrastructure to ensure expedited customs procedures and optimization of taxes on international trade. In order to combat instability, trade agreements and development assistance should be the main goals of regional alliances and international collaborations. Together, these actions can lessen inflationary pressures and lay the groundwork for long-term steady growth.

5.2. Limitation of the study

This study has a number of limitations that should be taken into account. First, there can be issues with the data's dependability and accessibility. The quality and representativeness of the data sources, which may have biases or limits, are critical to the study's conclusions. Second, even if the study finds connections between many characteristics, it might be difficult to prove causation in observational research. Causal links between the variables under analysis cannot be conclusively established by the study. Thirdly, it is important to note that the results can be context-specific and only applicable to the country being studied, therefore extending these findings to other geographic or economic situations cannot be recommended.

CRediT authorship contribution statement

Yang Jingjing: Supervision, Writing – review & editing, Validation, Resources, Project administration, Funding acquisition. **Shah Mir Mowahed:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization, Software. **Mohammad Wais Sharif Zada:** Software, Validation, Visualization, Writing – review & editing, Investigation, Data curation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgement(s)

This work was supported by the research on impact of Hunan Talent policy to technology innovation. Funded by Hunan Provincial Social Science Foundation, Reference No.22YBA027.

Data availability

Data is available up-on request.

References

Amiti, M., Itskhoki, O., & Weinstein, D. (2024). US import price inflation during the COVID-19 pandemic. *NBER Digest*. https://www.nber.org/digest/202405/us-import-price-inflation-during-covid-19-pandemic

Andinuur, J. (2013). Inflation, foreign direct investment and economic growth in Ghana. *University of Ghana*.

Arize, A. C. (2017). A convenient method for the estimation of ARDL parameters and test statistics: USA trade balance and real effective exchange rate relation. *International Review of Economics & Finance*, *(50),* 75-84. https://doi.org/10.1016/j.iref.2017.03.024.

Asian Development Bank. (2024). *Economic Outlook for Afghanistan*. https://www.adb.org/sites/default/files/publication/957856/afg-ado-april-2024.pdf

Bahmani-Oskooee, M. M., & Goswami, G. G. (2003). A disaggregated approach to test the J-curve phenomenon: Japan versus her major trading partners. *Journal of Economics and Finance*, *27*(1), 102-113. https://doi.org/10.1007/BF02751593.

Corrigan, T. D. (2005). The relationship between import prices and inflation in the United States. *WCBT Faculty Publications*. https://digitalcommons.sacredheart.edu/wcob_fac/18

Dickey, D. A., Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American statistical association, (74),* 427–431. https://doi.org/10.1080/01621459.1979.10482531.

Ghauri, S. P., Qadir, H., Ahmed, R. R., Streimikiene, D., & Streimikis, J. (2022). The exports performance of Pakistan: Evidence from the ARDL cointegration analysis. *Romanian Journal of Economic Forecasting*, 25(4), 150-168.

Hainmueller, J., & Hazlett, C. (2014). Kernel regularized least squares: Reducing misspecification bias with a flexible and interpretable machine learning approach. *Political Analysis*, *22*(2), 143-168. https://doi.org/10.1093/pan/mpt019

Herawati, M., & Sidik, M. (2022). Impact of Imports and Interest Rates on Inflation: A Case Study in ASEAN Countries 2006-2019. *Economics and Business Quarterly Reviews*, *5*(3), 66-74. https://doi.org/10.31014/aior.1992.05.03.436

Hussain, S., & Malik, S. (2011). Inflation and economic growth: Evidence from Pakistan. *International Journal of Economics and Finance*, *3*(5), 262-276. https://doi.org/10.5539/ijef.v3n5p262

Iqbal, S., & Naqibullah, M. (2020). *Exchange Rate Pass-through Effect on Inflation in Afghanistan*. DA Afghanistan Bank. https://dab.gov.af/sites/default/files/2021-04/Exchange%20Rate%20Pass-Through%20Research%202020.pdf

Jackson, E. A., Kamara, P., & Kamara, A. (2023). Determinants of Inflation in Sierra Leone. *SSRN*, 4443790. http://dx.doi.org/10.2139/ssrn.4443790

Munir, K., & Javed, Z. (2018). Export composition and economic growth: evidence from South Asian countries. *South Asian Journal of Business Studies*, 7(2), 225-240. https://doi.org/10.1108/SAJBS-10-2017-0117

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of applied econometrics*, *16*(3), 289-326. https://doi.org/10.1002/jae.616

Sarkodie, S. A., & Owusu, P. A. (2020). Impact of meteorological factors on COVID-19 pandemic: Evidence from top 20 countries with confirmed cases. *Environmental Research, (191),* 110101. https://doi.org/10.1016/j.envres.2020.110101

Trading Economics. (2024) *Afghanistan balance of trade*. https://tradingeconomics.com/afghanistan/balance-of-trade

UNCTAD. (2023). *Trade and Development Report 2023*. https://unctad.org/publication/trade-and-development-report-2023

Usman, K., & Bashir, U. (2022). The Effects of Imports and Economic Growth in Chinese Economy: A Granger Causality Approach under VAR Framework. *Journal of Risk and Financial Management*, 15(11), 531. https://doi.org/10.3390/jrfm15110531

Wang, Y., Shinwari, R., Payab, A. H., & Feng, J. (2024). Harmonizing sustainability: Unveiling the nexus of public private investment, natural resources, and environmental dynamics by applying ARDL and machine learning approach. *Ecological Indicators*, *(161),* 111931. https://doi.org/10.1016/j.ecolind.2024.111931

Zivot, E., & Andrews, D. W. K. (2002). Further evidence on the great crash, the oil-price shock, and the unit-root hypothesis. *Journal of business & economic statistics*, *20*(1), 25-44. https://doi.org/10.1198/073500102753410372