The Effects of Petroleum Price on Consumer Price Index in Nepal: Through the Lens of an ARDL Approach

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Abstract

The uncontrolled and unexpected increase in inflation in the Nepalese economy has numerous consequences. Even though inflation in Nepal has been increasing each year due to increasing fuel prices; the relationship between petroleum prices and CPI inflation has not been amply studied yet. So, the major objective of this paper is to explore the effects of petroleum prices on the CPI inflation in Nepal. The Auto Regressive Distributed Lag (ARDL) Model is used in the study to explore the effects of petroleum prices on CPI inflation in Nepal. The time series data for 33 years, spanning 1990-2022, were collected from various sources such as Nepal Oil Corporation (NOC), Nepal Rastra Bank (NRB), and World Bank data. This study found a significant positive relationship between diesel prices and CPI inflation in Nepal. The impact of a broad money supply is positive and significant for CPI. However, there is a negative effect of World Oil Prices on CPI of Nepal. The government of Nepal and other concerned agencies should develop and apply appropriate fiscal and monetary policies to control the unexpected hike in the inflation rate in Nepal. An increase in inflation has numerous consequences, as it increases the cost of living and poverty in the nation. Thus, macroeconomic policies should be formulated to control inflation at a minimum rate in Nepal, as it is practiced in many other countries.

Keywords: fuel prices, NOC, CPI inflation, time series, ARDL bounds testing

JEL Classification*:* Q41, L32, E31, C22, C32

Introduction

Inflation is generally defined as the continuous increase in the general price level of goods and services in the economy. The global inflation rate was rising sharply during 1980s and 1990s, and then remained relatively stable at around five percent for few decades (World Bank, 2023). However, inflation rose sharply in 2008 due to the global financial crisis in the world economy. Despite the effects of COVID-19 pandemic, the global inflation rate fell to 3.25 percent in 2020, and slightly increased to 4.7 percent in 2021 (World Bank, 2023). Due to the effects of Russia-Ukraine war, rising energy and food prices, financial effects of pandemic have increased the global inflation at 8.75 percent in 2022 (Neill, 2023). Among a number of causes of inflation, petroleum prices have been considered one of the major causes of inflation

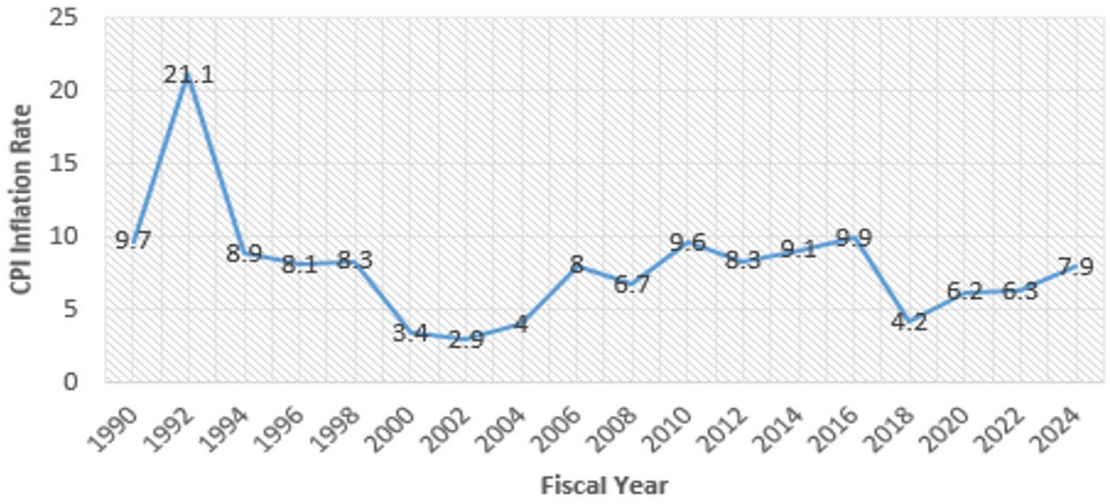
in world economy, reaching at peak in 2022. The war between Russia and Ukraine resulted in sharp rise in crude oil price above US$ 120 per barrel in early 2022 (Ding et al., 2023).

According to the report published by Nepal Rastra Bank, the CPI inflation rate peaked at 7.8 percent by the end of 2023 (NRB, 2024). During this period, the inflation rates for food and beverage recorded at 7.13 percent and non-food and services reached at 8.45 percent. As mentioned by Nepal Rastra Bank, prices of cooking oil and ghee rose by 25 percent. Likewise, the prices of fruits, milk products and eggs, pulses and tobacco products increased by 12.61%, 11.30%, 10.53% and 9.70% per year respectively (NRB, 2024). In the similar manner, price of transportations increased by around 21% (Bajracharya, 2022).

Even though, fuels have multiple uses, they are primarily used in the fields of transport and as an energy for cooking and lighting purposes. When the prices of fuel rise, it directly and indirectly affects the cost of living of households and thereby increases the CPI in the economy. The degree to which it affects the inflation depends upon whether consumers can reduce fuel consumption or switching to alternative sources of energy such as electricity (Kpodar & Liu, 2021). By analyzing the data of 190 countries, Kpodar and Liu (2021) found that fuel price increases have a strong positive effect for CPI in developing countries and relatively less inflation supportive for developed countries. The CPI inflation of Nepal recorded by Nepal Rastra Bank for few decades are given in Figure 1.

Figure 1

The Inflation Rate in Nepal (1990 to 2024)



Note. NRB, 2024

Studies are conducted by international researchers and policy makers to identify the effects of fuel prices on CPI inflation. To the best of my knowledge, very few studies have been conducted especially covering the Nepalese economy by using the time series data of petroleum prices. Thus, there is the dearth of literature, and the present study found knowledge gap in the field of effects of petroleum prices in CPI inflation in Nepal.

The research question and main problem to be addressed in present study is, "Do petroleum prices affect the CPI inflation in Nepal"? This study takes the prices of diesel as the proxy of petroleum prices. Hence, the objective of the study is to explore the effects of petroleum prices on CPI inflation of Nepal. It is expected that rise in fuel prices boosts up the

inflation rate in Nepal. Besides it, the specific objectives are to identify the effects of diesel prices, broad money supply (M2) and World oil prices on consumer price index (CPI) in Nepal. To address the research question, the rest of the parts of this study are organized into different sections and sub-sections as follows: Section two is the review of literatures of this study; Section three shows research methodology; Section four presents the results and discussion; Section five is about summary and conclusion.

Review of Literature

Theoretically, economists and researchers have focused on demand pull and supply shock inflation. This study mainly focuses on cost-push inflation and one of the causes is increase in fuel prices. The increase in consumer price index due to hike in fuel prices has several consequences on economic activities and human life especially after World War – II. An increase in the prices of fuels such as diesel, kerosene, LP gas has a number of shocks on macroeconomic variables such as price level, aggregate demand and aggregate supply. A rise in petroleum prices reduces the aggregate demand as well as aggregate supply in the economy. As the prices of energy rises, business firm consumes less energy, and thus the productive capacity of firm decreases. Reduction in aggregate output leads to fall in labour productivity, income levels and, consequently, reduces in aggregate demand (Cunado & Gracia, 2004). It is a very common fact that inflation reduces the purchasing power of low, medium and fixed income group. Shrestha and Chaudhary (2012) claimed that 10 percent rise in food prices raises poverty by 4 percent in Nepal.

Most of the previous studies on the similar topic have found the positive and significant effect of fuel prices on CPI inflation in various countries. Unexpected and persistent rise in price level in the economy due to domestic and other causes adversely affects the economic activities in the nation. Rise in aggregate demand, higher cost of production are the traditional and theoretical causes of inflation. However, Russia-Ukraine war has turned into the most recent cause of inflation in the world economy. Similarly, increase in world oil prices has also resulted into higher inflation (Cunado & Gracia, 2004; Le Blanc & Chinn, 2005; Celik & Akgul, 2011; Alper, 2018; Esmaeili & Shokoohi,2011; Bashir, 2011; Kilian & Zhou, 2021).

To identify the effects of oil prices on economic activities and inflation in six Asian Countries, Cunado and Gracia (2004) conducted their research. They used the time series data over the period 1975 to 2002. The study used the econometric tools such as correlation, GARCH model, cointegration model and Granger causality tests. This study concluded that oil prices have a significant effect on price index. The study further concludes that increase in oil prices in selected countries significantly rises the consumer price index. This study further recommended that suitable monetary policies are the key to overcoming the problem of inflation.

Le Blanc and Chinn (2004) research in order to identify the effect of oil prices on inflation for selected developed countries USA, UK, France, Germany and Japan. The study used the augmented Phillips curve technique and found positive relation between oil price and inflation rate. Ansar and Asaghar (2013) found that there is no relationship between oil prices and CPI inflation in Pakistani economy.

The development and practice of globalization in the world is also a responsible factor causing inflation in import- based economy. The rate and causes of inflation have changed in

OECD countries during mid-1990s, at the time when globalization started to expand markedly (Pain et al., 2008). Relating to this fact, Pain et al. (2008) conducted their study in order to examine the effects of import price, per unit cost of labour and the domestic output gap on private consumption deflator. This study covers the 21 OECD countries over the time period 1980-2005 and employed error-correction model for empirical findings. The study found that import prices are more important determinant of consumer prices over the analysis period in all OECD countries. They further claimed that domestic inflation is less sensitive to change in domestic output gap.

After suffering from a long period of hyperinflation, the inflation rate in Turkey has decreased to around 10 percent due to appropriate policy adapted by the government. Being the oil importer nation, increase in crude oil prices obviously push the inflation rate in the economy. Relating to this fact, Celik and Akgul (2011) employed the VECM model for their empirical findings. The study used the monthly time series data from 2005 to 2010 and concluded that 1% rise in petroleum prices increases the CPI inflation by 1.26% in an average. Likewise, Alper (2018) also claimed that petroleum prices have increased the inflation in Turkey.

Assessing the effect of oil price on world food prices, Esmaeili and Shokoohi (2011) found that crude oil prices have indirect effect on food prices. The study examined weather oil prices affects the food prices of seven products, namely eggs, meat, milk, oilseeds, rice, sugar and wheat between 1961 and 2005. The authors suggested for monitoring the oil prices and its effect on agro-products prices and thereby food security.

Most of the research findings reveal that world oil price is one of the key factors rising domestic inflation. In order to explore the effects of oil prices on CPI in South Africa, Sukati (2013) used the cointegration analysis technique, VECM, ADF tests. The empirical finding shows positive relationship between oil prices and CPI inflation in South Africa.

Realizing the dearth of literature on impact of crude oil prices on inflation in Pakistani economy, Saleem and Ahmad (2015) completed their study on the existence and intensity of relation between crude oil price and inflation in Pakistan. The study used the time series data for 33 years, since 1979 to 2012 and employed Johansen's Co-integration technique for empirical findings. This study concludes that money supply, crude oil prices, exchange rate, interest rate and indirect tax have positive effect on inflation in Pakistan. The authors further pointed that more than 62 % electricity in Pakistan is produced from thermal plant. It justifies that Pakistani economy is highly sensitive to change in crude oil prices. In order to explore the determinants of inflation in Pakistan, Bashir et al. (2011) used the Cointegration and Vector Error Correction models by using the time series data since 1972 to 2010. The study concluded that money supply rises the inflation in Pakistan.

Honorata and Aruges (2020), used ARDL model covering the period from 21 January 2020 to 2 June 2020 and claimed that rise in fuel prices increases the CPI based inflation. The impact of rising oil prices is felt not only by developing nations, but it is a major macroeconomic problem in developed economy such as United States as well. To justify this fact, Kilian and Zhou (2021) studied about the impact of rising oil prices on U. S. inflation and inflation expectations in 2020-23. This study used the VAR model in order to find the

relationship between nominal retail gasoline prices, heading inflation, core inflation and the Michigan Survey of consumers inflation expectations. The study concluded that increase in oil prices rises the inflation in the economy. Policy makers can make inflation expectations for the smooth operation of their economy.

The relationship between oil prices and CPI in the Turkish Economy was examined by Karadag, H. (2021) using 10 years data, spanning 2010 - 2020. The author employed the econometric tools such as cointegration test and Granger causality tests to analyze the relationship between the selected variables. The study claimed that rise in oil prices increased the CPI in the Turkish economy. The author recommends that oil prices should be monitored by concerned authorities to control inflation.

A study conducted by Sek (2022) focused on sectoral consumer price index in industry and productive sectors of Malaysia. By using Markov-Switching (MS) regression model, the study found positive effects of fuel prices on CPI in Malaysia. Arintoko et al. (2023) studied the effects of fuel prices on CPI based inflation in Indonesia by using monthly time series data for 22 years, spanning 2001 to 2022. By employing dynamic OLS model, the study found significant positive effects of fuel prices on CPI in Indonesia. This study suggested to control fuel import and to provide fuel subsidy to keep inflation under control.

A study conducted by Belloumi et al. (2023), by using nonlinear ARDL model over the period 1980 to 2021 in Saudi Arabia, found that rise in crude oil prices induce higher inflation in the economy. There were very limited studies on the impacts of fuel prices on different sectors in Ghana. To address this issue, Anyars and Adabor (2023) examined the impact of oil price change on inflation in Ghana. By employing the nonlinear ARDL model and the time series data for 21 years, spanning 2000 to 2021, the authors claimed that rise in fuel prices increases the inflation in Ghana.

Research Gap and Value-Added

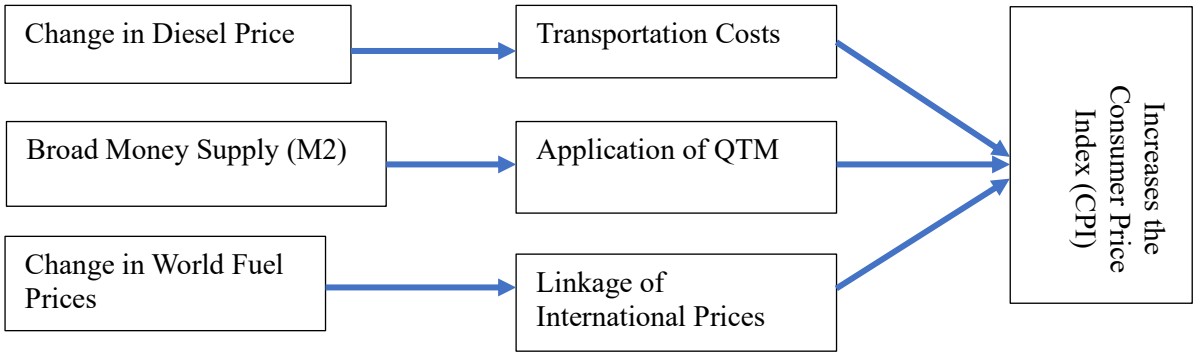
Change in petroleum prices in domestic economy has a number of effects in different sectors of the economy. However, to the best of my knowledge, very limited research works are done by Nepalese researchers to identify the effects of petroleum prices on consumer price index. Hence, this study found the knowledge gap in the field effects of petroleum prices in consumer price index in Nepal. So, empirical research is quite significant to explore the extent to which the petroleum/fuel prices affect the consumer price index and it assist the planners, research practitioners and policy makers to make appropriate policy to control unexpected rise in inflation in Nepal.

Conceptual Framework

Figure 2 depicts the conceptual framework designed for present study. Figure 2 depicts the conceptual framework designed for the study. Change in diesel price in Nepal changes the consumer price index in the same direction. Quantity theory of money (QTM) says that increase in broad money supply by Central bank increases the consumer price index and change in world fuel prices affects the inflation in Nepal.

Figure 2

Conceptual Framework



Note Compiled by the Author

Materials and Method

Data Sources and Variables

This study is initiated to explore the impacts of petroleum prices on Consumer Price Index (CPI) in Nepalese economy. It used an extended set of data for 32 years, spanning 1990 -2022. The main variable of interest of the study is fuel prices. The yearly average price of diesel is used as the proxy of petroleum prices, which is core independent variable in the study. The different variables used, their meaning and sources of data are summarized in Table 1 below.

Table 1

Variables Used and Sources of Data

Variables used	Meaning of variables	Sources of data
CPI	Consumer price index used to calculate inflation rate	Quarterly Economic Bulletins published by Nepal Rastra Bank (NRB)
DIP	Yearly average price of diesel as the proxy of fuel prices	Publications of Nepal Oil Corporation (NOC)
WOP	World oil price per barrel	World Bank Data
M2	Broad money supply	Quarterly Economic Bulletins published by Nepal Rastra Bank (NRB)

The Auto Regressive Distributed Lag approach is employed for the empirical findings. Unit root, a very common problem of time series data, for stationary of times series data is tested with the help of ADF Unit Root test. EViews 10 software is used for empirical results.

An Empirical Model Specification

This study is planned to examine the effects of fuel prices on Consumer Price Index (CPI) in Nepal. As petroleum price is the main variable of interest in this study, it is added to explore its effect on CPI in Nepal. Besides it, other important control variables which affects to CPI are World Oil Prices (WOP), broad money supply by Nepal Rastra Bank (M2) for the study.

Now, the CPI function, adding fuel prices and other control variables is written as:

$$CPI_t = f(DIP_t, WOP_t, M2_t) \quad \ldots\ldots. (1)$$

After applying natural log on equation (1), the linear form of CPI model becomes:

$$LnCPIt = \beta_0 + \beta_1 LnDIPt + \beta_2 LnWOPt + \beta_3 LnM2t + \eta_t \quad \ldots\ldots (2)$$

Where CPI_t = consumer price index in year 't', DIP_t = diesel price in year 't', WOP_t = world oil price in year 't', $M2_t$ = broad money supply in year 't', and β_0 = an intercept. β_1, β_2 and β_3 = parameters to be estimated. The expected sign of β_1, β_2 and β_3 are positive expecting that consumer price index or inflation increases due to increase in diesel price, world oil price and broad money supply in Nepal and η_t = pure white noise error term.

ARDL Model Estimation

This study employed the latest model of time series data analysis, ARDL bounds testing model, developed by Pesaran and Shin (1999). An ARDL model has several advantages as compared with other time series cointegration techniques; such as Engle and Granger (1987), Johansen's approach (1988). These two approaches are used only to identify the long run relationship and they are not appropriate for small size of sample. However, ARDL model can be used even in case of lesser size of samples, it estimates the short-run and long-run relationship between the selected variables, can be used if the data are stationary at I (0) or I (1) or the combination of both (Pesaran et al., 2001; Dahal, 2013; Lawal et al., 2016; Khan et al., 2019; Mamun & Kabir, 2023; Lamsal, 2023).

Among the various methods developed by scholars to investigate cointegration, Pesaran and Shin (1999) developed an ARDL bounds testing approach to identify cointegration (Dahal, 2013; Lamsal, 2023). The general form of the ARDL Model according to Pesaran and Shin (1999) is given below:

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \ldots. + \beta_k Y_{t-p} + \alpha_0 X_t + \alpha_1 X_{t-1} + \alpha_2 X_{t-2} + \ldots. + \alpha_q X_{t-q} + \varepsilon t \quad \ldots.. (3)$$

Where Y_t = dependent variable at time period 't', Y_{t-i} = lagged values of 'Y', β_I = coefficients of lagged values of 'Y', $X_{t-i.}$ = lagged values of independent variable 'X', α_I = coefficients of lagged values of 'X', and εt = white noise error term.

Having gone through a number of advantages of ARDL approach, this study employs the bounds test in order to identify the cointegration among the selected variables for the model. To identify the cointegration as stated in equation (3), the ARDL framework is presented in equation (4) and ECM Model is given in equation (5) below.

$$\Delta \text{ Ln CPIt} = \alpha_0 + \sum_{i=1}^{p} \alpha_{1i} \Delta \text{ Ln CPI}_{t-i} + \sum_{i=1}^{q} \alpha_{2i} \Delta \text{ Ln DIP}_{t-i} + \sum_{i=1}^{q} \alpha_{3i} \Delta \text{ Ln WOP}_{t-i} + \sum_{i=1}^{q} \alpha_{4i} \Delta \text{ Ln M2}_{t-i} + \alpha_{11} \text{Ln CPI}_{t-1} + \alpha_{12} \text{Ln DIP}_{t-1} + \alpha_{13} \text{ Ln WOP}_{t-1} + \alpha_{14} \text{ Ln M2}_{t-1} + \eta_{1t.} \quad \ldots. (4)$$

$$\Delta \text{ Ln CPIt} = \alpha_0 + \sum_{i=1}^{p} \alpha_{1i} \Delta \text{ Ln CPI}_{t-i} + \sum_{i=1}^{q} \alpha_{2i} \Delta \text{ Ln DIP}_{t-i} + \sum_{i=1}^{q} \alpha_{3i} \Delta \text{ Ln WOP}_{t-i} + \sum_{i=1}^{q} \alpha_{4i} \Delta \text{ Ln M2}_{t-I} + \beta \text{ ECT}_{t-1} + \eta_{1t.} \quad \ldots. (5)$$

Where α_{1i}, α_{2i}, α_{3i} and α_{4i} = short run dynamic coefficients of model's adjustments in the long run equilibrium, α_{11}, α_{12}, α_{13} and α_{14} = long run coefficients, β = speed of adjustment parameter with negative sign, and ECT = error correction term.

Results and Discussion

Unit Root Test

The common problem associated with time series data is the stationary problem or unit root problem in the data. So, the first step in using the ARDL approach is to identify whether the

selected variables are stationary, i.e., to find the order of integration. To apply the ARDL model, the variables used in the model should be stationary at I (0) or I (1) or a combination of both and, none of the variables should be integrated at I (2) (Pesaran et al., 2001; Dahal, 2013; Lamsal, 2023).

Table 2 shows the result of ADF unit root using EViews 10 software.

Table 2

Result of ADF Test for Unit Root

Variables	Model	Level: I(0)		First Difference: I(1)	
		t-statistic	p-value	t-statistic	p-value
Ln CPI	Intercept	0.542012	0.9846	- 5.200296	0.0004
Ln DIP	Intercept	- 0.715334	0.8288	- 4.178932	0.0027
Ln M2	Intercept	0.415193	0.9805	- 4.958305	0.0003
Ln WOP	Intercept	- 0.907427	0.7728	- 5.418810	0.0001

Table 2 shows the calculated values of ADF unit root. The p-values of all the selected variables are greater than 0.05 at I(0). It means they have unit root problem at level. However, p-values of all the variables are less than 0.05 at first difference. Thus, they have no unit root at I(1). It verified that all variables used in this study are stationary at first difference; I (1). Thus, ARDL model is suitable in the study (Pesaran et al., 2001).

Descriptive Statistics

Table 3 presents the summary statistics of all the selected variables for the study.

Table 3

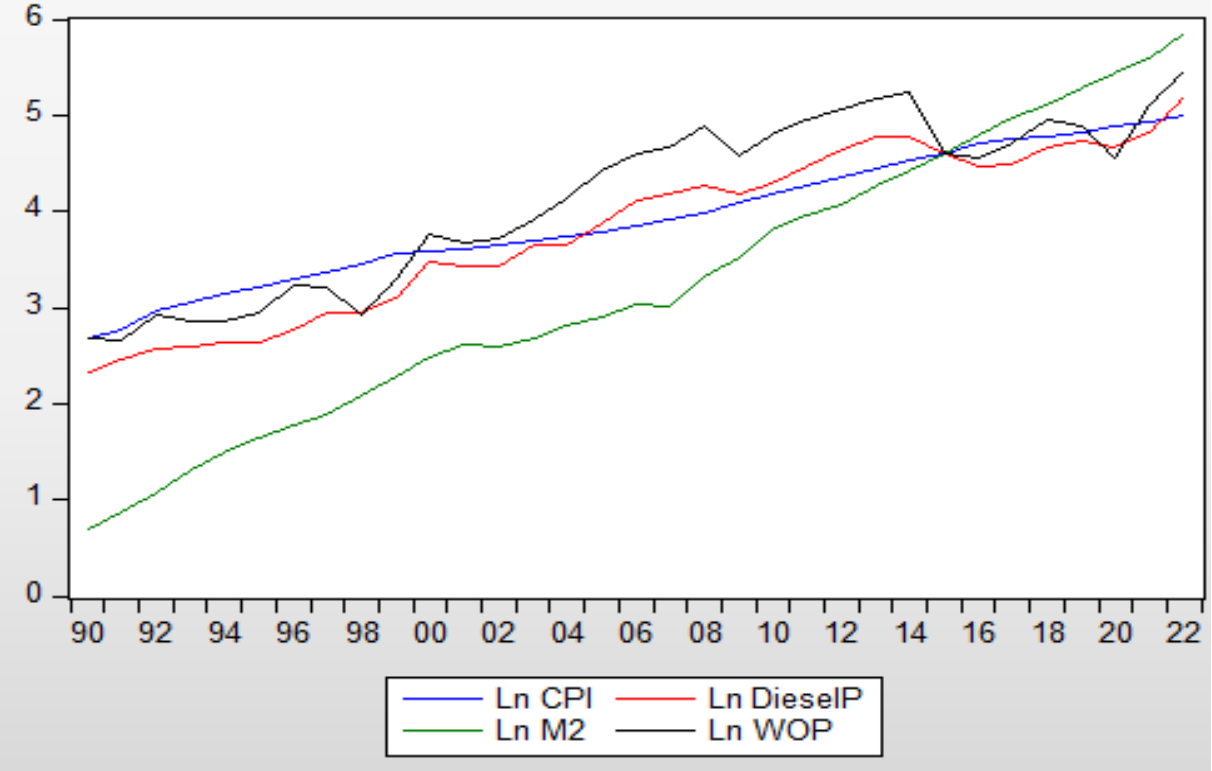
Results of Descriptive Statistics

	LN CPI	LN DIP	LN M2	LN WOP
Mean	3.928920	3.812809	3.221683	4.121915
Median	3.852273	4.117713	3.008381	4.555117
Maximum	4.985559	5.184719	5.862396	5.464181
Minimum	2.687847	2.319877	0.700548	2.654233
Std. Dev.	0.673088	0.863819	1.485512	0.891711
Skewness	-0.034533	-0.300620	0.101413	-0.340558
Kurtosis	1.899569	1.677923	1.915890	1.648815
Jarque-Bera	1.671612	2.900395	1.672596	3.148226
Probability	0.433525	0.234524	0.433312	0.207191
Observations	33	33	33	33

Table 3 depicts the summary statistics of all the selected variables in the present study. It shows the values of arithmetic mean, median, standard deviation, skewness, kurtosis, Jarque-Bera, probability, etc. All the selected variables in the study are normally distributed as the p-value of the Jarque-Bera test is more than 5 percent. The calculated values of standard deviations of each selected variables is less than one. The lower values of standard deviation show that there is less deviation or scatteredness of given values from their mean value. Figure 3 shows the graphical summary of CPI, DIP, M2 and WOP.

Figure 3

Graphs of Selected Variables in the Study



Lag Length Selection

Appropriate lag length is required in order to estimate the ARDL model, for Bounds Testing and Long Run Forms, to estimate the long-run and short run coefficients, and for Error Correction models (Pesaran & Shin, 1999; Dahal, 2013; Lamsal, 2023). Popular Lag operators used by researchers are: FPE, AIC, SC, and HQ. However, the optimal Lag length is that which has the lowest values as calculated by each method (Pesaran & Shin, 1999; Pesaran et al., 2001). Table 4 presents the Lag length criteria for the study.

Table 4

VAR Lag Order Selection Criteria

Lag	Log L	LR	FPE	AIC	SC	HQ
0	-28.54922	NA	0.393981	1.906401	1.952659	1.921480
1	64.15376	173.4443*	0.001062	-4.009920	-3.917405	-3.979762
2	65.97731	3.294153	0.001007*	-4.063052*	-3.924279*	-4.017816*

ARDL Model Estimation

The Auto Regressive Distributed Lag (ARDL: 2, 0, 0, 0) model is selected on the basis of Akaike Info Criterion. This study uses 33 years' time series data. The suitable lag length is automatically selected by the EViews 10, as per Akaike Info Criterion (AIC). Table 5 shows the empirical results ARDL model.

Table 5

Empirical Result of ARDL Model

Variables	Coefficients	Std. Error	t-Statistic	Prob.
LNCPI(-1)	0.935946	0.195985	4.775607	0.0001
LNCPI(-2)	-0.324998	0.154221	-2.107359	0.0453
LNDIP	0.113741	0.064619	1.760173	0.0906
LNM2	0.138032	0.049572	2.784488	0.0101
LNWOP	-0.057277	0.040981	-1.397654	0.1745
C	0.909596	0.270993	3.356532	0.0025
R-squared	0.998450	Mean dependent var		4.006055
Adjusted R-squared	0.998140	S. D. dependent var		0.617793
S. E. of regression	0.026643	Akaike info criterion		-4.240579
Sum squared resid	0.017747	Schwarz criterion		-3.963033
Log likelihood	71.72897	Hannan -Quinn criterion		-4.150106
Durbin-Watson Stat	1.728576			

Table 5 show that consumer price index (CPI) is significantly affected by diesel price set by Nepal Oil Corporation, broad money supply (M2) as well as world oil price. There is a significant positive effect of diesel price and broad money supply on CPI inflation and a negative effect of world oil price on inflation in Nepal. The value of R^2 is 0.99. It shows that the dependent variable i.e., consumer price index is affected by 99 percent by the selected independent variables. The value of Durbin - Watson Statistic is 1.72 which shows that the model is free from autocorrelation. The results of the pre-study are similar to Cunado and Gracia (2004), Le Blanc and Chinn (2004), Celik and Akgul (2011), Alper (2018), Sukati (2013), Saleem and Ahmad (2015), Bashir et al. (2011), Kilian and Zhou (2021), and Karadag (2021). However, the empirical findings of this study contrast with the findings of Ansar and Asaghar (2013).

ARDL Bounds Test for Co-integration and Long Run Form

The bounds test for cointegration is employed to examine the relationship between the dependent and independent variables, assisting to determine whether a long-run or short-run relationship exists among them. This econometric technique, as outlined by Pesaran et al. (2001), is based on the Joint F-statistic, which is tested under the null hypothesis (H_0) of no cointegration between the variables in the model. The alternative hypothesis (H_1) asserts the presence of cointegration. The test is conducted by comparing the calculated F-statistic with the critical values corresponding to the lower bound I(0) and the upper bound I(1) of the series. The empirical results of the bounds test for cointegration are presented in Table 6. Additionally, the results from the Error Correction Model (ECM) are shown in the subsequent table.

Table 6

Results of ARDL Bound Test for Cointegration and Long-Run Form

Test Statistic	Value	Significance	I (0)	I (1)
F-statistic	5.372814	10%	2.37	3.2
k	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66

Data presented in Table 6 show the ARDL bounds test results for cointegration. The empirically calculated F-Statistic for the bounds test is 5.372814 which is greater than the lower bound value of 3.65 and upper bound value 4.66 at 1 percent level of significance. Thus, the empirical findings justified that there is long-run relationship between CPI, Diesel price, Broad money supply and World Oil price.

Calculation of Long-Run Coefficients Using ARDL Approach

After confirming the cointegration of variables for the long run, the next step in applying the ARDL model is to estimate the long-run coefficients. To estimate the long-run parameters, the appropriate lag length is determined using the Akaike Information Criterion (AIC). Based on this criterion, the optimal lag length for the model is found to be ARDL (2,0,0,0), as indicated in Table 4. The estimated long-run coefficients derived from the ARDL model are presented in Table 7.

Table 7

Estimated Long -Run Coefficients Using ARDL (2,0,0,0) Model Based on AIC.

Variables	Coefficients	Std. Error	t-statistic	Prob.
LNDIP	0.292354	0.161297	1.812521	0.0519
LNM2	0.354789	0.042817	8.286131	0.0000
LNWOP	-0.147221	0.103138	-1.427425	0.1658
C	2.337981	0.128752	18.15883	0.0000

Data presented in Table 7 show the long-run coefficients of the study using ARDL model. The correlation of LNDIP and LNM2 with LNCPI are positive and significant at 10 % and 1% level respectively. However, LNWOP is negative and statistically insignificant with LNCPI. The Long Run Model mentioned in equation (2) can be restated as:

LNCPI = 2.33 + 0.29 * LNDIP + 0.35 * LNM2 – 0.14 * LNWOP

When diesel price increases by 1 %, it leads to 0.29 % increase in consumer price index (CPI) in the long-run. Likewise, a 1% increase in M2 leads to 0.35 % increase in CPI. The result of this study is similar with Cunado and Gracia, 2004; Le Blanc and Chinn, 2005; Celik and Akgul, 2011; Alper, 2018; Esmaeili and Shokoohi, 2011; Bashir, 2011; Kilian and Zhou, 2021.

This study was designed and initiated in order to explore the empirical findings of the effects of petroleum prices on consumer price index in Nepal. The ARDL Bounds Testing Model is employed for empirical findings by using the time series data covering the period of 33 years, from 1990 to 2022. The empirical results show that there is a positive and significant relation between the consumer price index (CPI) and diesel prices in Nepal for the study period. Likewise, there is a positive and significant effect of broad money supply to boost the CPI inflation in Nepal. However, there is a negative effect of the world oil price on CPI inflation. The study found that average price level i.e., CPI rises due to an increase in diesel price.

As presented in Table 7, the estimated coefficient of Log of diesel price (DIP) is 0.292354. It shows that when diesel price increases by 1 percent, CPI inflation rises by

0.292354 percent. Likewise, the calculated coefficient of Log of broad money supply (M2) is 0.354789. It shows that CPI inflation rises by 0.354789 percent when broad money supply increases by 1 percent. However, the effect of world oil price (WOP) is negative and insignificant to CPI inflation in Nepal.

The empirical results of the ECM model are presented in Table 8. The coefficient of CointEq is -0.389052 and the probability is significant at 1%. It indicates that there is a long-run equilibrium relationship between the selected variables in the study. The absolute value of coefficient of ECM (which is around 0.39) indicates the speed of adjustment towards long-run equilibrium through a number of short-run adjustments. The model tends towards equilibrium by the speed of adjustment around 39 percent per year.

Table 8

Result of Error Correction Regression

Variables	Coefficient	Std. Error	t-Statistic	Prob.
D(LNCPI (-1))	0.324998	0.115305	2.818591	0.0093
Coint Eqⁿ (-1) *	-0.389052	0.069694	-5.582322	0.0000

Residual Diagnostics

After estimating the empirical model, various residual diagnostic tests are conducted to assess the adequacy of the model and the behavior of its residuals. Specifically, tests for serial correlation (LM Test), heteroscedasticity, and normality are performed to ensure the reliability of the model. The results of these diagnostic tests are provided in Table 9. The results revealed that the estimated ARDL model was statistically robust; thus, the model was free from serial correlation, heteroskedasticity, and residual is normally distributed.

Table 9

Results of Residuals Diagnostics Tests and their Conclusion

Test	Serial Correlation	Heteroskedasticity Test	Normality Test
F-Value	0.439705	2.326588	0.498163
Probability	0.6495	0.7260	0.779516
Conclusion	No serial correlation as Prob. > 5 percent.	No heteroskedasticity as Prob. > 5 percent.	Data are normal as Prob. > 5 percent

Stability Diagnostics

The stability test for the consumer price index (CPI) model has been applied to investigate the stability of the long-run and short-run parameters. For the same, cumulative sum (CUSUM) and cumulative sum of squares (CUSUM SQ) tests are employed. It verifies the stability of the ARDL model for the structural break. The results of the CUSUM and CUSUM of Squares tests are shown in Figure 4 and Figure 5 respectively. The plot of USUM and CUSUM of Squares both are within the critical boundaries of 5% level of significance. It shows the model is good fit.

Figure 4

Plot of Cumulative Sum (CUSUM) of Recursive Residuals

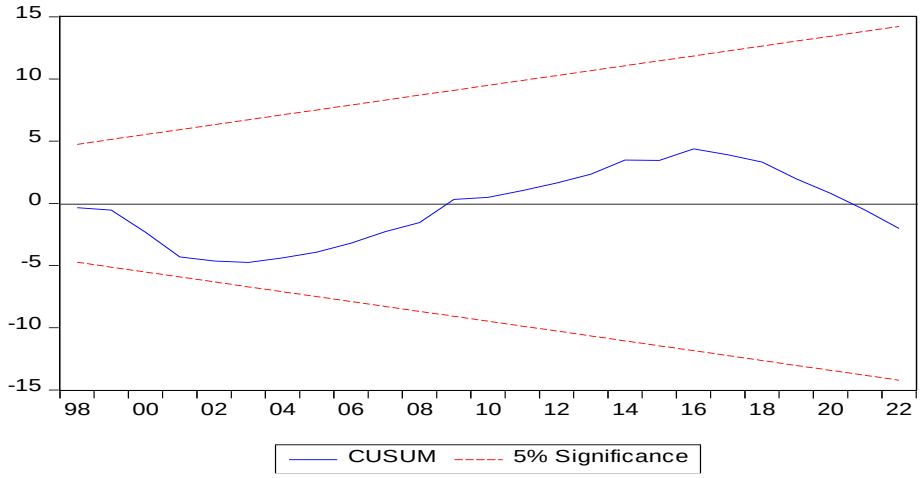
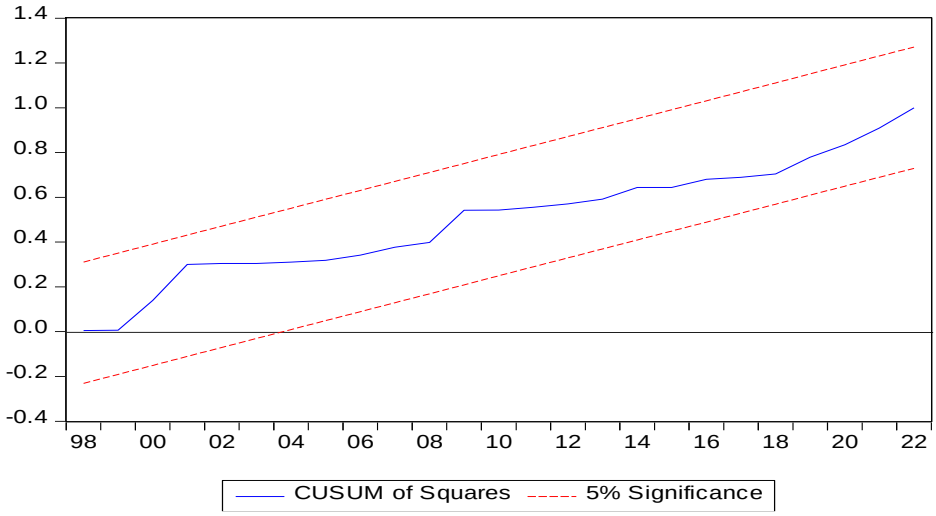


Figure 5

Plot of Cumulative Sum (CUSUM) of Squares of Recursive Residuals



Conclusion and Policy Recommendations

This study investigates the effects of petroleum prices, specifically diesel prices, on the Consumer Price Index (CPI) in Nepal, utilizing the Auto Regressive Distributed Lag (ARDL) model over a 33-year period (1990–2022). The findings reveal a positive and significant relationship between diesel prices and CPI, indicating that increases in diesel prices lead to higher inflation in Nepal. This suggests that changes in fuel costs directly impact consumer prices, potentially contributing to inflationary pressures in the economy. The analysis also highlights the role of domestic monetary factors, as the broad money supply (M2) is positively associated with CPI, reinforcing the idea that monetary expansion can exacerbate inflationary trends.

In contrast, the study uncovers an unexpected negative relationship between world oil prices (WOP) and CPI in Nepal. This finding may be attributed to the impact of government subsidies or price controls, which could cushion the domestic economy from the full effect of global oil price fluctuations. While global oil price movements may influence domestic energy

prices, the government's interventions appear to mitigate the direct transmission of these shocks into the broader consumer price levels.

Based on these findings, several policy recommendations emerge. First, the Nepalese government should carefully manage diesel price adjustments to minimize inflationary shocks to consumers. A flexible fuel pricing system, aligned with market conditions, could better absorb global price changes and reduce sudden price spikes. Second, to curb inflation driven by monetary expansion, the Nepal Rastra Bank (NRB) should adopt stricter control measures over broad money supply growth, ensuring that monetary policy is in line with economic output. Lastly, while subsidies on petroleum products offer short-term relief to consumers, it may be prudent for the government to gradually reduce these subsidies, coupled with targeted social safety nets, to promote fiscal sustainability without distorting market signals. Future research could further explore the impact of sector-specific fuel price changes and consider the role of renewable energy in mitigating Nepal's dependency on petroleum.

Future Prospects of Research

This study could not collect the yearly average prices of all the petroleum such as LP gas due to unavailability of data. Another limitation is that it has used only three determinants of inflation while formulating the model. Future studies could explore the dynamic interactions between diesel prices, CPI, and other macroeconomic variables such as exchange rates, wages, and productivity. Additionally, incorporating sectoral analyses to assess the impact of diesel price changes on specific industries (e.g., transportation, agriculture, and manufacturing) could provide a more granular understanding of the transmission mechanisms. It could be another possible research issue in the field of academia.

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