Analysis of the Factors Influencing Inflationary Dynamics in Nepal

Purnanand Joshi
Kailali Multiple Campus, Dhangadhi, Kailali, Nepal
purnajoshi72@gmail.com

Abstract

Background: Inflation in Nepal has remained high and volatile, exceeding levels considered optimal for sustained economic growth. While existing studies have primarily focused on traditional domestic economic factors, Nepal's growing integration with the global economy and its history of political and economic shocks suggest that external and non-economic factors may also significantly influence its inflationary dynamics. This study addresses this research gap by investigating a broader set of potential determinants.

Objectives: The primary objective of this study is to analyze the impact of both economic and non-economic factors on inflation in Nepal. It specifically aims to assess the roles of money supply, fiscal deficit, trade openness, India's wholesale price index (WPI), the output gap, the policy shift to liberalization, and periods of unusual circumstances.

Methods: The study employs an Auto-Regressive Distributed Lag (ARDL) bounds testing approach to cointegration using annual time-series data from 1975 to 2022. Dummy variables are incorporated to capture the effects of the post-1990 liberalization policy regime (D1) and unusual circumstances such as conflict and natural disasters (D2). Diagnostic and stability tests ensure the robustness of the model.

Findings: The results confirm a long-run cointegrating relationship among the variables. In the long run, money supply, trade openness, and India's WPI have a significant positive impact on inflation in Nepal. The shift to a liberalization policy regime is associated with a significant reduction in inflation. Conversely, the fiscal deficit, output gap, and dummy for unusual circumstances are found to be statistically insignificant in explaining inflationary trends.

Conclusion: Inflation in Nepal is determined by a mix of internal monetary factors, external trade-linked factors, and policy regime changes. Monetary policy remains essential for price stability. To curb imported inflation and enhance resilience, policies should focus on boosting

domestic productive capacity through import substitution, trade diversification, and fostering a stable investment climate.

Novelty: This study contributes to the literature by being among the first in the Nepalese context to empirically incorporate and test the impact of trade openness, the output gap, and qualitative non-economic factors (policy regime change and unusual circumstances) within a unified ARDL framework, moving beyond the conventional analysis of traditional variables.

Keywords: Inflation, Money Supply, Trade Openness, ARDL Cointegration, Imported Inflation

Introduction

Inflation is a consequence of macroeconomic imbalances, which create uncertainty and hence deteriorate business confidence, discourage investment, and reduce the living standard of people as they need to spend more money even to consume the usual quantity of goods and services due to the erosion in the real value of money (NRB, 2007). It promotes income inequality through its distribution effect and reduces saving and investment, which results in a shrinkage in the economic growth rate in the economy. Moreover, inflation affects almost all economic activities such as income, employment, investment, real wage, and real interest. (Chaudhary & Xiumin, 2018). A modest level of inflation is seen as desirable for promoting economic activities; however, high and unstable inflation leads to uncertainty for business decision-making, reduces savings and investment, increases the cost of capital, and, hence, distorts the economic growth rate (NRB, 2007). Thus, the key objective of monetary policy is ensuring price stability, and the central bank's attempt is always to confine inflation within a desirable range, for which the inflation targeting regime is also adopted popularly in many countries.

In Nepal, high and unstable inflation coupled with a low economic growth rate is an inherent characteristic. Over the period of 1975- 2019, the average rate of inflation was 8.12 percent with highest rate of 22 percent recorded in 1992 and negative rate experienced in 1976. During the same period, the average rate of economic growth was 4.38 percent (Paudel & Raut, 2022). The average rate of inflation is greater than the desirable rate or optimum rate investigated by empirical studies, such as Bhusal and Silpakar (2012) and NRB (2017) for the Nepalese economy. This suggests that the high and unstable inflation in the economy of Nepal seems one of the strong reasons for sustained vulnerable economic growth. The efficacy of the conventional policy actions to counteract inflation in Nepal seems doubtful. Hence, it is essential to make comprehensive reinvestigation of additional possible determinants of inflation in the Nepalese context.

Inflation is driven by a complex interplay of factors, with the magnitude and characteristics of its effects varying across temporal and spatial contexts due to heterogeneity in the structural and institutional frameworks of different economies (Stylianou, 2022). In the literature, at international level studies have covered all possible sources of inflation, such as Johar et al. (2020) identified a positive connection between trade openness and inflation in the SAARC

region. Similarly, Chhabra and Alam (2020) found that trade openness contributes to inflation in India. A study by Sharif and Qayyum (2018) in Pakistan and Jasova et al. (2018) in both developed and emerging economies highlighted the inflationary impact of supply bottlenecks. Aisen and Veiga (2005), in an IMF study covering numerous countries, explored a strong link between political instability and elevated inflation levels. Additionally, Salahodjaev et al. (2014) demonstrated that non-economic factors significantly affect inflation dynamics in both developed and developing countries.

In the context of Nepal, the growing dependency of Nepalese economy on global market seems to have potential strong impact on inflation. So, openness might be important determinant of inflation in Nepal. The supply side of Nepal's economy, with inherent supply side constraints appears particularly important in causing inflation. Thus, supply bottleneck seems responsible for producing supply shock inflation in Nepal. Nepal had implemented liberalization policy in 1990s with the hope of promoting private sector, fostering competition and taking advantages from external sectors, however, since then the economic environment could not be favorable due the unusual circumstances such as Maoist conflict, global financial crisis, earth quake, Covid-19 and so on. All these factors have direct or indirect linkage with inflationary dynamics of the economy. However, the empirical studies in Nepal have confined merely in the investigation of the traditional economic factors overlooking the possible influence of external and untested non-economic factors. Consequently, the conventional policy practices guided by traditional theories and studies have not been efficient to confine inflation within the desirable limits in the economy. Hence, there is a research gap regarding the investigation of possible impact of additional factors on inflation in the context of Nepal. Therefore, this study is an attempt to address the gap by incorporating some untested factors such as trade openness output gap, and qualitative factors such as liberalization policy change, and unusual circumstances by applying ARDL Bound testing approach. The findings of this study aim to be additional support and ideas for the formulation of an effective policy action to maintain sustained price stability in Nepal. In addition, at international level, studies have also covered the role of institutional factors which could not be covered in this study but might be interesting for future studies.

Literature Review

Inflation, as an issue closely linked with macroeconomic stability, often pulls attention of theorists, policy makers and researchers. Different theories and empirical studies in different times have explored the causes of inflation. In classical theory, as money has no role in the real sector, a change in money supply given the aggregate production changes the price level proportionately in the economy. This argument is based on the popular Quantity Theory of Money developed by (Fisher, 1911). In monetary theory, as the money supply is the sole determinant of inflation, the central bank through monetary management can control inflation in the long run (Friedman, 1968). In Keynesian theory, beyond full employment of an economy, the further increase in aggregate demand causes pure inflation, so, the fiscal policy remains effective in controlling inflation (Keynes, 1936). The cost-push theory claims that the primary

cause of inflation is a higher increase in money wage rate than the growth rate of productivity of labor (Tononchi, 2011). Beyond these theories there is a huge body of empirical literature in this context with versatile methodologies and findings. The following section covers the review of empirical studies at national and international level.

Review of International Empirical Studies

A comprehensive study conducted by Romar (1993) provides a theoretical basis for the linkage between inflation and openness. To test the linkage between inflation and openness, he conducts an empirical study covering 114 countries over the period 1080 – 1990. And he finds a statistically significant and inverse relationship between openness and inflation.

To retest the Romer's hypothesis in a large group of developing countries Tasci et al. (2009) also estimate panel data model during 1980-2006. They find a statistically significant and positive impact of openness along with some other control variables on inflation. The findings of this study couldn't be consistent with that of Romar's findings. This shows that developing countries are not able to minimize inflation rather these are importing inflation from rest of the world.

In the context of Middle East and North America, Reza et al. (2013) also estimate panel data model and find that the greater degree of openness stimulated inflation in the region in contrast of Romar hypothesis. They cover the period from 1990 to 2010 and include explanatory variables such as openness, GDP per capita and population growth. The study focuses on effective exchange management, and sound fiscal coordination to control demand side and imported inflation in the region.

To explore the empirical connection between fiscal deficit and inflation in the context of Asian countries Nguyen (2015) has also estimates a Polled Group Mean (PGM) estimation – based error correction model and Panel differenced GMM estimator to explore the impact of money supply and fiscal deficit in Asian Countries covering the period from 1985 to 2012. The study finds the supply of money has a positive impact on inflation only in PGM estimation whereas fiscal deficit has a positive impact on inflation in both the estimation methods in the Asian economies. He suggests to authorities for strengthening fiscal and monetary discipline as government spending, fiscal deficit and supply of money found inflationary in Asian nations.

Similarly, Kaur (2019) also estimates the ARDL model applying quarterly time series data for the period 1996-2016 from the Indian economy. He includes explanatory variables such as money supply, exchange rate, crude oil price, and output gap. The findings of the study suggest, only in the long run fiscal deficit seems to be an inducing factor of inflation in India with a significant and positive impact on inflation. However, the remaining explanatory variables have a negligible impact on inflation in the long run. As the fiscal deficit is long run factor driving inflation in India, prudent control over monetary expansion and fiscal discipline should be maintained to moderate inflation.

For the economy of Bangladesh Arif and Ali (2012) have investigated the significant and positive impact of GDP, money supply, import, and government expenditure on inflation in the long run. To investigate the impact, they used annual time series data from 1978 to 2010 and applied the Johansen-Juselius co-integration method. The study concludes that the inflation in

Bangladesh is caused by both demand-side and supply-side forces, thus, well-tuning between monetary and fiscal policy action will be only one measure to combat inflation.

In a similar context, Alam and Alam (2016) have also estimates co- integration Bound testing model to investigate the impact of money supply, exchange rate oil price, and supply bottleneck or supply gap on inflation in India covering the 1990- 2013 period. The results report that in the long run domestic factors such as monetary expansion and supply bottleneck or output gap have a stronger impact on inflation than that of external factors. In the short run, all the factors have a significant impact on inflation. The study concludes that contraction in monetary expansion seems to be a requirement to stabilize domestic price rise.as per the findings of the study, import substitution through improvement in domestic supply bottleneck seems wise strategy for inflation control in Indian economy. This study is only focuses on the conventional framework ignoring the influence of other factors such as institutional quality and other structural barriers which might have strong impact on inflation.

Jasova et al. (2018) also estimates the impact of domestic as well as global output gap on inflation. For this, they select a group of 26 advanced and another group of 22 emerging counties and apply quarterly time series data over the 1097-2017 period. They apply a New Keynesian Phillips Curve framework dividing the total period into two segments: pre-crisis period 1974-2008 and post-crisis period 2008-2017 to examine the impact of the output gap before the crisis and after-crisis periods. The results show that both in the pre-crisis period and post-crisis period the output gap has a significant positive impact on inflation. Since inflationary dynamics are influenced by both domestic supply gap and global slacks, policymakers should not be limited only in domestic economic environment rather should consider the global economic situations such as business cycle, external shocks and even global demand condition.

 For Indian economy Dua and Goal (2021) also examines the impact of both demand-side variables and supply-side variables such as the output gap along with other explanatory variables such as money supply, budget deficit, exchange rate, rainfall, international oil and food prices on inflation by applying the co- integration technique with monthly data from 1996 to 2017 in the Indian economy. The result of the study reports the demand side factors such as exchange rate, supply of money, and output gap have a significant impact on both the measures of inflation. Similarly, the supply side factors such as international oil and food prices have a significant influence on both the measures of inflation. Since both demand side factors and supply side factors jointly influence inflation in India, inflation control in India requires a well-coordinated fiscal and monetary policy strategy seems essential.

Nguyen (2014) employs annual time series data for the period 1970-2010 to apply both bi-variate and tri-variate co-integration Vector Error Correction techniques in the context of emerging three Asian countries. According to the findings, public spending and money supply are long-run leading factors of inflation in all three countries. But in the short run, the impact is not unique. In India, also in the short run, public spending has a positive impact on inflation which supports the Keynesian proposition. As supply of money and government spendings found leading factors of inflation, the study suggests for strengthening the monetary and fiscal

discipline and well coordination between these policies to curb inflationary pressure in these economies.

For similar purpose Gelos and Ustyugova (2012) also conducted an empirical study in 31 developed and 61 emerging economies to assess the impact of the commodity price shock at the international level on domestic inflationary dynamics. The result of their study suggests that the central bank's independence, and overall better governance contribute to anchor the inflationary expectations and reducing the post-effects of international commodity price shocks.

On a similar issue, Salahodjaev et al. (2014) also conducts an empirical investigation to examine the impact of the quality of institutions on inflation using panel data from 1991 to 2007. The quality of institution is measured by domestic credit to private sector to GDP. The study finds that in the economies with high rate of inflation the financial sector cannot prevent current inflation central bank's independence cannot reduce inflation where banks and financial institutions are operating in the existing monetary environment. The study concludes that the inflation dynamics are inversely associated with high institutional quality, hence, improvement in institutional quality seems helpful to counteract inflation and maintain macroeconomic stability.

In the context of Asian nations Shaji et al. (2025) examine the long run and short run determinants of inflation for selected Asian ten nations with inflation targeting framework for the period 195-2022 applying panel ARDL and polled mean group estimator to capture the short run and long run effect of private sector credit, FDI, oil price, GDP growth, import, money supply real effective exchange rate on inflation. The findings report the significant impact of GDP growth, imports, broad money growth, FDI inflows, and global crude oil prices on inflation while export, credit, FDI and real exchange rate have impact in short run. According to findings of the study, the Asian nations should focus on the sound monetary management and external sector management to moderate inflation. Though this study applies suitable advanced panel ARDL-PMG method to capture long run homogenous effect and short run country specific effect, it couldn't capture the possible interdependence among variables and their indirect effect which can be handled by structural equations modelling.

Ekanayake (2025) analyses the sources of inflation in Sri Linka for the period 2020 to 2024 using monthly data with VAR and multiple regression method where global oil price, exchange rate, money supply, policy rate, global supply chain pressure and unemployment are explanatory variables. The results report the exchange rate, money supply, global supply chain pressure and policy rate are significant drivers of inflation in Sri Lanka. The study uses the monthly data which is high frequency data for a short period. Such a data set can capture the impact of unusual shocks but unable to examine the normal behavior of variables like inflation. The findings conclude that monetary management with exchange rate stability and measure to supply chain resilience.

Che Yahya et al. (2024) estimate panel data model for Asian nations: Malaysia, Indonesia, Singapore, Thailand, and the Philippines to examine the effect of key macroeconomic factor on inflation employing static panel data model over the period 2001-2002. The study's result

report the negative association between unemployment and inflation and positive association between economic growth and inflation reflecting the tradeoff following the Phillips Curve. Though the study applies the static panel regression which may not capture dynamic adjustments related to external price shocks, it suggests Asian nations to make balance in economic policies for maintaining employment stability, sustainable growth and inflation control.

Review of National Empirical Studies

Nasrat (2020) estimates a panel data model to examine the impact of trade openness on inflation in six South Asian countries including Nepal by covering the period from 1980 to 2016. To re-test Romar's hypothesis he estimates fixed effect and random effect models including money supply, gross saving, exchange rate, and domestic credit with openness as explanatory variables. The result of the study shows a significant and positive impact of openness on inflation in South Asian countries and remaining explanatory variables have also significant impact on inflation. The findings of this study do not support Romar's hypothesis in Asian countries. This study follows the conventional direct method to examine the impact of trade openness on inflation, however, effect of trade openness may also transmit to inflation through indirect channels which cannot be capture through this direct relationship. Despite the limitation of the method, the study suggests to recognize the side effect of trad openness with the formulation of effective policy actions.

To test the empirical linkage between fiscal deficit, money supply, and inflation in Nepal, Bhusal (2013) conducted a study to explore the long-run relationship between inflation, money supply, and budget deficit in Nepal. Johansen co-integration and Granger causality tests have been applied to investigate the long-run relationship and pairwise casualty among the variables. The empirical findings reveal that the money supply and budget deficit have a significant impact on inflation in the long run. Similarly, there is a unidirectional relationship between the supply of money and inflation and budget deficit and the rate of inflation.

Applying monthly data from 1996 to 2006, Ginting (2007) investigates the long-run association between the inflation in India and inflation in Nepal. The study applies the time series technique to investigate the long-run relationship and found a long-run co-integration between inflation in Nepal and inflation in India. Further, within 7 months the inflation of India passes through or converses to Nepalese inflation. Identifying the wholesale price index (WPI) of India rather than consumer price index (CPI) as a more relevant factor that determines inflation in Nepal is new contribution in the literature.

Koirala (2008) has conducted an empirical study to investigate the relationship between inflation expectation and inflation in Nepal. The study has found a significant and positive impact of inflation expectation on inflation. To undertake this study, he used the annual time series data from 1976 to 2006 and applied the Adaptive Expectation Hypothesis (AEH) to estimate the impact of inflation expectation on inflation in Nepal. Further, the findings suggest that the current inflation expectations have greater forecast ability than that of the inflation expectation intern of past or lagged inflation.

Similarly, Poudel (2014) examines the long-run and short-run impact of macroeconomic factors such as the budget deficit, Indian prices, broad money supply, real GDP, and exchange rate on inflation in the Nepalese economy. He applies the Wickens - Breusch Single Equation Error Correction model and founds that all the explanatory variables are significant and contribute to producing inflation in the long run. However, in the short run only budget deficit, Indian Prices, and the money supply cause inflation in the economy of Nepal. The study concludes that the dominance of Indian prices seems a challenge to the effectiveness of fiscal and monetary measures to control inflation. Thus, along with fiscal and monetary discipline, expansion in domestic production of goods and services through the maximum use of available resources and an investment-friendly environment, increase in FDI in areas like energy, infrastructures, and production can be the measures to improve supply and hence control inflation.

Using monthly time series data from 2000 to 2017, Shrestha and Bhatta (2018) also estimate the ARDL model to investigate the impact of money supply with other variables on inflation in Nepal. The result reports money supply seems to have a strong impact on inflation. Similarly, imported inflation from India has also significant impact on inflation in Nepal. However, the exchange rate doesn't have any association with the price level in Nepal. The study recommends for a prudent monetary management to control inflation in the economy. This study focuses only in demand side to analyze the inflationary determinants overlooking the potential effect of supply side factors of the economy, however, in Nepal, the supply side factors found more responsible to produce inflation.

 In a similar context, Byanjankar (2020) examines the long-run and short-term effects of macroeconomic variables on inflation in Nepal by applying the Auto Regressive Distributive Lag (ARDL) bound test method. The findings of the study suggest that Indian inflation, exchange rate, and real income have a long-run impact and fiscal deficit, and Indian inflation, and exchange rate have a short run impact on the inflation in Nepal. The study recommends for effective measures of both fiscal and monetary policies alongside the exchange rate and external price shock managing strategy to curb inflation.

Similarly, Adhikari et al. (2024) estimate co-integration and Vector Error correction Model and Granger causality for the period 1975-2022 to explore the impact of selected macroeconomic factors on inflation for the economy of Nepal. the findings suggest that money supply and private consumption are major determinants of inflation in both long run and short run. It also shows that there is significant bi directional causality between inflation and budget deficit. The study also recommends for coordinated fiscal and monetary strategies, external price monitoring and fiscal discipline to counteract inflation in Nepal. Though the study applies suitable VECM model to capture the long run equilibrium relationship and distinguish short run deviation from long run effect, this study is limited to the traditional economic factors whereas the factors beyond these have also prominent impact on inflation.

 Ghimire and Poudel (2025) also estimate the impact of macroeconomic factors such as money supply, remittance, government expenditure and Indian CPI on inflation in Nepal using OLS and Johansen cointegration method for the period 2001-2021. The study finds a significant and

positive effect of Indian CPI, remittance and money supply while government spending and import have weaker impact in short run. Though the study is based on short time period which might not be suitable for cointegration method, it emphasizes policy strategy such as productive use of remittance, liquidity control and import substitution for maintaining to moderate inflation in Nepal.

To analyses the supply side and demand side factors determining inflation in Nepal, Shrestha and Timilsena (2025) estimate ARDL and ECM model. The Indian inflation, money supply growth, output growth, petroleum price and GDP growth as explanatory variables. According to research findings, the money supply and Indian inflation have long run positive impact and in short run the agriculture output growth has negative impact on inflation which further suggest for promoting agricultural productivity and monetary management to stabilize inflation through demand side and supply side in Nepal. The study attempts to segregate the impact of demand side and supply side determinants of inflation, it also focuses the conventional framework overlooking the indirect impact of variable through transmission channels which could capture the direct and indirect effect of macroeconomic factors on inflation.

The review of existing literature concludes that the analysis of inflation by traditional theories is confined within closed economic setting which is not adequate in the modern era of globalization. Empirical studies at international level have widely covered the investigation of additional potential sources of inflation beyond the conventional settings and found notable influence in determining inflation. However, in the context of Nepal, empirical studies are limited merely in testing and retesting the impact of conventional factors on inflation overlooking the possible impact of trade openness, output gap and non-economic factors on inflation which have been found profound impact on inflation in different studies at international level. Given the supply side constraints, the potential production capacity of the economy cannot fully be realized, hence, the out put gap exists which is potential source of inflation in Nepal. Similarly, the growing import dependency of the economy exposes the domestic inflation to external price shocks which shows the doubtful role of trade openness in determining inflation in the economy. Similarly, the unusual circumstances through supply side disruption translate to price rise leading to cost push inflation. Output gap, trade openness and unusual circumstances, therefore, have potential strong impact on inflation dynamics of Nepal which are untested. Hence, there is a gap in the literature. This study has attempted to address this gap by including the impact of trade openness, output gap and even non-economic qualitative factors such as policy change and un usual circumstances through the inclusion of the dummy variables in the model.
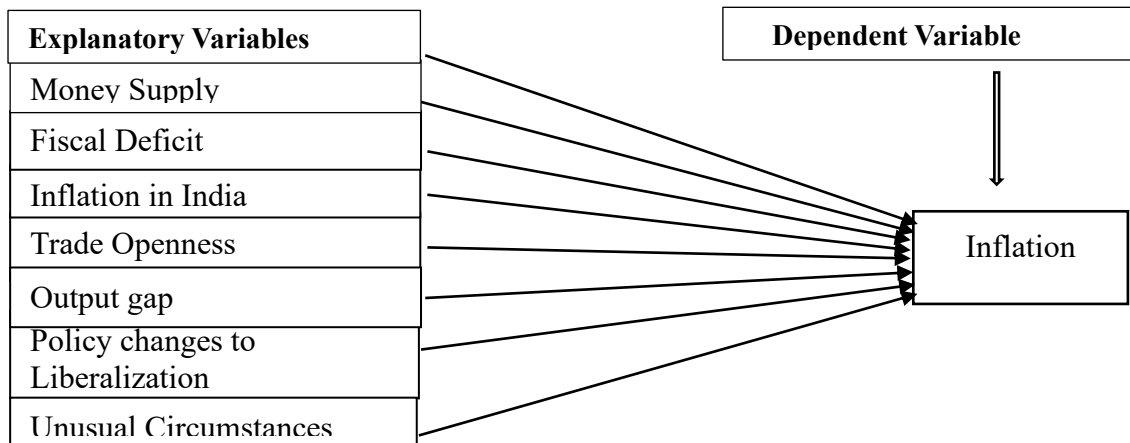
Conceptual Framework

A comprehensive review of existing literature helps this study to explore the idea regarding the coverage of existing studies and gap which guides for the specification of the variables for this study. The rational of the variables selection is mentioned in introduction section in detail. On the basis of that, Broad money supply, fiscal deficit, output gap, Whole sale price index (WPI) of India, Trade openness, policy change to liberalization and unusual circumstances are specified as explanatory variables and consumer price index (CPI) for Nepal is dependent

variable. The linkage between dependent variable and explanatory variables is exhibited as follows:

Figure 1

Conceptual Framework

Hypothesized Relationships

This study attempts to empirically test the following research hypothesis for both quantitative and qualitative determinants

H_1: There is short-run and long-run effects of macroeconomic factors on inflation in Nepal's economy.

H_1: There is the impact of policy change to liberalization and unusual circumstances on inflation trends in Nepal's economy.

Research Methodology

Data and Variables

This study is based on secondary time series data over the period from 1975 to 2022. Due to the unavailability of data on some variables the fiscal years 2023 and 2024 could not be covered in the study. The data on the fiscal deficit, real GDP, broad money supply, export, import, and CPI, have been obtained from different issues of the Economic Survey published by ministry of finance, government of Nepal, the economic bulletin published by Nepal Rastra Bank, and the data on the WPI of India has been obtained from World Bank open data source. The summary of description of the variables and sources of data for the model is presented in following table 1.

Table 1

Description of the Variables

Variables	Details	Sources
CPI	Consumer Price Index of Nepal (FY 2014/15=100)	NRB Annual Report
FD	Absolute difference between government revenue and government expenditure to GDP ratio in Nepal	Economic Surveys of the Ministry of Nepal
MS	Nominal form of Broad money (Narrow money + Time deposits)	Nepal Rastra Bank Annual Report
TO	Trade Openness (Sum of export value and Import value to GDP ratio)	Nepal Rastra Bank Annual Reports
GDP_gap	Estimated by applying HP filter technique from real GDP, (2010 = 100)	Nepal Rastra Bank Annual Report
WPII	Wholesale Price Index of India (FY 2010)	World Bank open data sources.
D1	Dummy Variable where (D_1=1) for the period after liberalization police adaptation since 1991/92 and (D1=0) for the period before liberalization policy adaptation	
D2	Dummy Variable where (D_2=1) for the presence of unusual circumstances such as Maoist conflict, earthquake, Indian embargo, Covid in particular years and (D_2 = 0) is otherwise in normal years	

Analytical Framework

This study has incorporated conventional factors such as supply of money, fiscal deficit, inflation in India and some additional factors like supply bottleneck, trade openness, policy shift, and unusual circumstances, which are relevant but have not been tested in Nepalese context. With some modification, this study has followed the functional form used by Kaur (2019). The basic functional form of the econometric model applied in this study is as follows:

LCPI = f (LMS, LFD, LWPII, LGDP_gap, LTO, D1, D2,) ………. (1)

Where, LCPI is the log of the Consumer Price Index, LMS is the log of money supply, LFD is the log of fiscal deficit to GDP ratio, LWPII is the log of the wholesale price index in India, LGDP_gap is the log of real GDP gap and LTO is the log of trade openness (Trade volume to GDP ratio), D1 is dummy variable for policy change to liberalization and D2 is also Dummy variable for the unusual circumstances.

Estimation Methods

The Ordinary Least Square (OLS) method is based on the assumption that the variables under the study should be stationary at level, otherwise it may produce spurious result. Thus, if the variables are not stationary at their levels, the next step is to go for a co-integration technique. There are three widely recognized co-integration methods out of which the Engle-Granger (1987) and Johansen - Julius (1990) approaches require all variables to be integrated of the

same order. The Auto Regressive and Distributed Lagged (ARDL) approach, proposed by Pesaran et al. (2001), addresses this limitation by allowing the use of variables integrated of different orders, specifically a mix of I (0) and I (1). Due to these advantages, the ARDL method has become popular in time series analysis. Several empirical studies, including those by Alam and Alam (2016), Kaur (2019), Tahir et al. (2023), and Aragaw (2023), have utilized the ARDL model to explore the effects of various macroeconomic factors on inflation. Hence, given the small sample and mixed integration in this study, the ARDL model has been employed to estimate the effects of selected determinants on inflation in Nepal. The log-linear form of ARDL can be presented as follows:

ΔLCPI= $\beta0$ + $\sum \beta$ ΔLCPI + $\sum \beta$ ΔLMS + $\sum \beta$ ΔLFD + $\sum \beta$ ΔLWPII + $\sum \beta$ ΔLGDP_gap + $\sum \beta$ LTO + αLCPI + αLMS + αLFD +αLWPII +αLGDP_GAP +αLTO +$\alpha D1$+$\alpha D2$ + μ ………….(2)

where, the Δ first difference operator, t-1 represents the first lag, $\beta0$ is a constant, βi, i = 1,2,3,4,5, are short-run dynamics, αi, i=1,2,3,4,5,6,7, represent the long run coefficients, and μ is a white noise error term.

The F-Bound Test

Under the ARDL approach to co-integration proposed by (Pesaran & Shin 1998; Pesaran et al. 2001), long-run co-integration among the variables is tested in two steps: first by the Bound test, that is, F, test and second by the Error correction term. For this, the following hypothesis are tested.

H_0: $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0$. The long-run relationship does not exist.

H_1: $\alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq \alpha_5 \neq 0$. The long-run relationship exists.

Bound test is compared with two critical value bounds proposed by Pesaran and Pesaran (1995) and Pesaran et al. (2001). A lower bound assuming all variables are I(0) and an upper bound assuming all are I(1). If the F-statistic exceeds the upper bound, H₀ is rejected; if below the lower bound, H₀ is not rejected; if between the bounds, the result is inconclusive (Nkoro & Uko, 2016).

Selection of lag length

This study applies the Akaike Information Criterion (AIC) which is suitable for small sample. In small sample the AIC criterion by allowing the sufficient lags properly captures the short run fluctuations in the series whereas the Bayesian Information Criterion (BIC) or Schwarz Information Criterion, SIC) takes few lags to capture the short run deviations leading poor results (Akaike, 1974; Pesaran, Shin, & Smith, 2001). Hence, the AIC criterion is often preferred in case of small samples.

The Error Correction Model (ECM)

The specification of Error Correction Model (ECM), including the specified variables under this study, can be expressed as:

ΔLCPI$_i$ = β_0 + $\sum_{i=1}^{n} \beta_{1i}\Delta$ LCPI$_{t-1}$ + $\sum_{i=1}^{n} \beta_{2i}\Delta$ LMS$_{t-1}$ + $\sum_{i=1}^{n} \beta_{3i}\Delta$ LFD$_{t-1}$ + $\sum_{i=1}^{n} \beta_{4i}\Delta$ LWPII$_{t-1}$ + $\sum_{i=1}^{n} \beta_{5i}\Delta$ LGDP_gap$_{t-1}$ + $\sum_{i=1}^{n} \beta_{6i}\Delta$LTO$_{t-1}$ + ρECM(-1) ε_t………..(3)

In the error correction model, all the variables are pre-defined and their respective coefficients. Δ is the first difference operator, ECM (-1) is the lagged residual term, ρ is the rate of adjustment in short-run deviations, and ε_t is the residual.

Findings and Discussion

Unit Root Test

  The unit root test confirms whether the time series variable is stationary at the level of its first difference. The ARDL approach to co-integration is applicable when none of the variables is integrated of order higher than one. To confirm that no variable is stationary at the second difference, the ADF test has been performed. The findings of the ADF test have been presented in Table 2.

Table 2

Results of the Augmented Dickey-Fuller (ADF Test for Unit Root)

Variable	Level Form		First Difference		Remark
	Constant	**Constant & trend**	**Constant**	**Constant & trend**	
LCPI	-1.76 (0.391)	-1.28 (0.879)	4.95*** (0.002)	5.27*** (0,004)	I(1)
LFD	0.36 (0.976)	-2.91 (0.169)	-4.80*** (0.000)	-6.15*** (0.000)	I(1)
LMS	-1.66 (0.444)	-2.00 (0.567)	-4.61*** (0.000)	-4.76*** (0.002)	I(1)
LTO	-2.30 (0.175)	-1.97 (0.660)	-5.73*** (0.000)	-5.71*** (0.000)	I(1)
LWPII	-2.30 (0.286)	-0.99 (0.983)	-4.98*** (0.000)	-5.82*** (0.000)	I(1)
LGDPgap	-6.01*** (0.000)	6.90*** (0.000)	-9.65*** (0.000)	-6.86*** (0.000)	I(0)

Note: ***, **, and * represent the level of significance at 1%, 5%, and 10%, respectively. The values in the parentheses represent p-values.

Source: Researcher's own calculation.

Table 2 reports that only the GDP gap is stationary at level both with only constant and with constant and trend at the one percent level of significance. Remaining variables are stationary at only first difference at the one percent level of significance. The result of the unit root test shows the mixed nature of the stationarity of variables which shows a strong justification for the use of the ARDL approach to co-integration in the study.

Bound Test (F-Test)

The conformity of the existence of a long-run equilibrium relationship among the variables in the ARDL model has been tested by the Bound Test (F-test). Table 4 reports the result of the bound test to confirm the existence of the long-run relationship among the variables.

Table 3

Result of the Bound Test (F-test)

Test Value	Statistic	Level of Significance	Lower Bound	Upper Bound
F-statistics	12.41	At 10 percent	2.131	3.223
		At 5 percent	2.504	3.723
		At 1 percent	3.383	4.832

Source: Researcher's own calculation

In Table 3, the value of F- F-statistic is 12.41, which is higher than both the lower bound of critical values and the upper bound of critical values at even one percent level of significance. This reveals that at a one percent level of significance, there is long run co-integration among the variables in the system.

Result of Long Run Model

The ARDL approach to co-integration offers the long-run as well as the short-run analysis. The long-run relationship of the variables has been reported in Table 4

Table 4

Result of the Long Run Model

Dependent Variable is LNCPI, ARDL (1,0,1,0,1,0,0,0) Selected Based on AIC Criteria			
Regressors	Coefficients	T- ratios	Probability
LFD	0.022	0.774	0.4435
LMS	0.283	5.368	0.0000
LOPN	0.234	2.436	0.0199
LWPII	0.563	3.697	0.0007
LGDP_gap	-0.0048	-0.644	0.5232
D1	-0.074	-2.537	0.0156
D2	-0.001	-0.108	0.9141

Source: Researcher's own calculation

The result exhibits that the long-run coefficient of fiscal deficit is not statistically significant. The coefficient of money supply is positive and statistically significant at one percent. The long-run coefficient of the money supply is 0.28 which suggests that a one percent expansion in the money supply produces 0.28 percent inflation in the economy. The long-run coefficient of trade openness is also positive and significant at less than five percent. The coefficient of trade openness is 0.23, indicating that a one percent increase in trade openness promotes inflation by 0.23 percent in the Nepalese economy. This confirms that the increasing trade openness is also a strong source of inflation in Nepal. Similarly, the long-run coefficient of the wholesale price index (WPI) of India is positive and significant at even one percent. The

coefficient of WPI of India is 0.56, which indicates that a one percent increase in WPI in India causes a 0.56 percent increase in inflation in the Nepalese economy. The long-run coefficient of the output gap is not significant in this study. The long-run coefficient of the dummy variable for the change in policy regime to liberalization is negative and significant at one percent. The coefficient of it is -0.074 refers to the negative impact of it on inflation in Nepal. However, the dummy variable for unusual circumstances has no impact on inflation as it is not statistically significant.

Results from Error Correction Model (ECM)

The error correction model reconfirms the co-integration among the variables in the model and the speed of adjustment of short run deviations, which have been displayed in following Table 5.

Table 5

Findings from the Short Run Error Correction Model (ECM)

Regressors	Coefficients	T- Ratio	Probability
ΔLFD	0.009	0.767	0.448
ΔLMS	0.123	2.743	0.009
ΔLOPN	0.101	2.280	0.028
ΔLWPII	0.005	-0.042	0.966
ΔLGDPgap	-0.0021	-0.690	0.494
ECM (-1)	-0.434	-3.765	0.001

Source: Researcher's own calculation

Table 5 displays the short-run coefficients of the explanatory variables along with the error correction term. In the short run, the money supply has a positive effect and is significant at the 5% level, with a coefficient of 0.12, indicating that a 1% increase in money supply leads to a 0.12% rise in inflation in the short term. The coefficient for trade openness is 0.10, showing that a 1% increase in trade openness results in a 0.10% increase in inflation in the short run. The output gap, fiscal deficit, and India's wholesale price index are not significant in the short run. The error correction term is negative, less than one, and highly significant at the 1% level, confirming the presence of a long-run co-integration relationship among the variables. It also indicates the speed at which short-run deviations are adjusted. With a value of -0.43, the error correction term suggests that 43% of the short-term deviations are corrected each year, allowing the system to return to long-run equilibrium within about two and a half years.

Discussion

Based on the results from both the long-run and short-run analyses of the ARDL models, in Nepal, the continuously expanding money supply has been identified as a primary source of inflation which is consistent with the findings of the studies at national and international levels, such as (Bhusal, 2013; Poudel, 2014; Shrestha & Bhatta, 2018; Nguyen, 2015; Kaur, 2019). The increasing government expenditure alongside a limited revenue base has resulted in a fiscal deficit, which subsequently leads to an expansion in the money supply, thereby acting as a

strong driver of inflation in Nepal. However, fiscal deficit does not have a significant impact on inflation in this empirical analysis, which contrasts with the conclusions of some prior studies. In case of Nepal's economy, the deficit is often largely financed for overhead capital and reconstructions taking a long period for implementation leading to weakening its immediate inflationary effect. On the other hand, the inflation in Nepal is heavily determined by external inflation and the inflation caused by fiscal stimulus is offset by imported price (ADB, 2020; IMF, 2019).

The findings of the study also suggest that trade openness is a significant determinant of inflation in Nepal. This outcome contradicts Romer's (1993) hypothesis but aligns with the results of panel studies conducted in South Asian countries, including Nepal (Nasrat, 2020; Tasci et al., 2009), which have shown that trade openness exerts a positive influence on inflationary trends in developing economies. The literature suggests that the effect of trade openness tends to be negative in developed economies but positive in developing ones. Following the adoption of liberalization policies, Nepal's foreign trade volume has increased significantly, accompanied by a rising trade deficit. During the study period, the Indian economy also experienced inflationary pressures. Given Nepal's substantial trade reliance on India, an open border, and a pegged exchange rate, inflation has directly been imported from India. This argument is strongly supported by the statistically significant positive impact of wholesale price index (WPI) of India which is also in the line of Ginting (2007). However, India's WPI does not have a significant impact on inflation in the short run.

Supply bottlenecks have not been found to have any significant effect on inflation in Nepal. supply bottleneck is a difference between actual real GDP and potential GDP which is widely calculated by popular HP filtering method, however, this method is designed to estimate this gap for the stable series in advanced economies. The timeseries in developing nations are often exhibit volatile nature for which this method weakly estimates the gap leading to incorrect result (Perron, 1989; Hamilton, 2018). For this case also this technique might not be fit leading to unexpected result. From macroeconomic perspective, Nepal is highly dependent on import of fuel, manufactured goods and foods. The shortages due to supply bottlenecks are offset by imports preventing the effect of output gap transmitting to inflation (IMF, 2019).

In addition to these internal and external economic factors, the study also explores the influence of changes in the policy regime toward liberalization and unusual circumstances, by incorporating dummy variables into the model. Despite the adverse political and economic environment in the economy the policy change to liberalization has the expected negative effect on inflation. In Nepal, after moving to liberalization era the increased access to global market makes easy for the inflow of goods and inputs which reduces the domestic supply constraints and shortages leading to control the upward pressure on prices. On the other hand, the increasing global competition pressurizes the domestic producers to enhance competitive capacity which compels market to adopt competitive price leading to lowering inflation (NRB, 2022; IMF, 2019). Hence, the effect of policy change to liberalization on inflation in Nepal is expected.

Similarly, unusual circumstances such as the Maoist conflict, earthquake, and COVID-19 pandemic are not statistically significant in this study. In case of Nepal, the price change follows the imported inflation to a large extend leading to a limited influence of domestic shocks on inflation. Similarly, the unusual circumstances are often short lived the resulted disruption of supply is compensated by import and government interventions such as price control, subsidy and distribution control which prevents translating such shocks into domestic inflation (IMF, 2019; W B, 2021; NRB, 2022). Therefore, despite their strong impact expected impact on inflation, incase of Nepal these are not inflationary.

Diagnostic Tests

The regression analysis is based on some of its fundamental assumptions, such as no serial autocorrelation, no heteroscedasticity, no multi-collinearity, and normality of residual. For statistical validation of findings of the regression model are tested by performing some diagnostic tests.

Serial Correlation Test

This study has applied the B.G. serial correlation LM test. The null hypothesis for this test, that there is no autocorrelation, is tested to confirm that the model is free from serial autocorrelation.

Table 6

Serial Autocorrelation Test

Breusch-Godfrey Serial Correlation L M Test			
Ho: Residuals are not serially correlated			
F-Statistic	1.829	Prob. F(2,34)	0.175
Obs*Rsquared	4.469	Prob. Chi-Square (2)	0.107

Source: Researcher's own calculation

Table 6 displays the result of serial autocorrelation. Since the probability of both the F-statistic and Obs. R-squared is more than five percent, so we cannot reject the null hypothesis of no serial autocorrelation. This assures that the model is free from the problem of autocorrelation.

Heteroscedasticity Test

The variance of the error term is assumed to be constant or homoscedastic in the regression model. The null hypothesis for this is that residuals are homoscedastic, which is tested by applying   the   Breusch-Pagan-Godfrey   test.

Table 7

Heteroscedasticity Test

Breusch-Pagan-Godfrey Test			
Ho: residuals are not Heteroskedastic			
F- Statistics	0.772	Prob. F (9,36)	0.642
Obs. R-Square	7.445	Prob. Chi-Square (9)	0.590

Source: Researcher's own calculation

Table 7 reports the result of the heteroscedasticity test. The probability of both the F-statistic and Obs. R-Squared is more than five percent does not allow us to reject the null hypothesis of the residuals are homoscedastic.

Normality Test

Residual is assumed to be normally distributed. To test the normality of residuals, the JB test has been performed to test the hypothesis that residual is normally distributed.

Table 8

Normality Test

Jarque-Bera Test			
Ho: Residuals are normally distributed			
Jarque-Bera Statistic	1.995	Probability	0.368

Source: Researcher's own calculation

Table 8 displays the test of the Normality of residuals. The probability of JB statistics is more than 5 percent does not allow us to reject the null hypothesis that residuals are normally distributed.

Stability Test

The Cumulative Sum (CUSUM) and the Cumulative Sum of Squares (CUSUM) tests proposed by Pesaran and Pesaran (1997). These are recursive-residual-based stability diagnostics commonly used to confirm the stability of error variance over the sample period and structural stability of coefficients in regression model. The following diagrams depict the model stability.
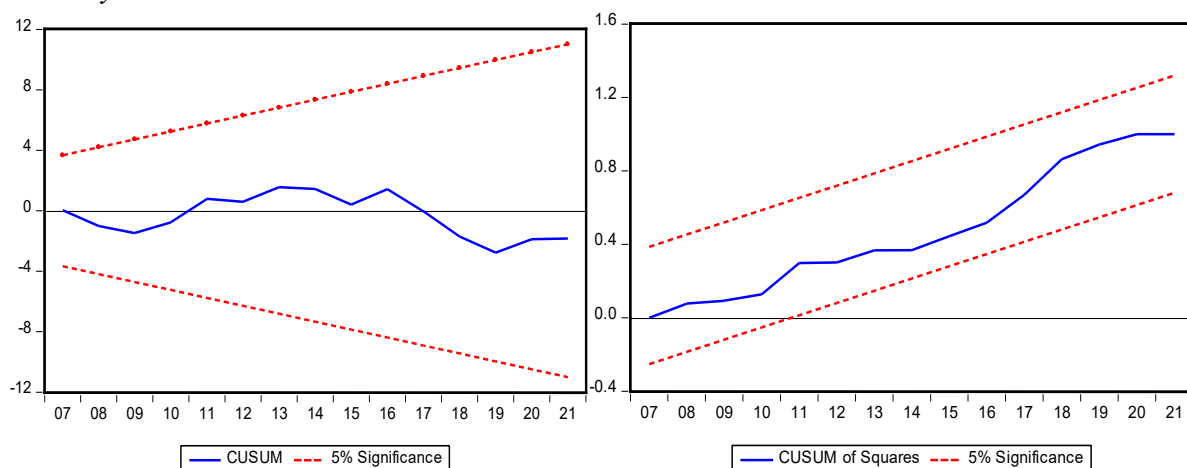
Figure 2

Stability Tests

Figure 1 shows that both CUSUM and CUSUMSQ are within the boundary of five percent, indicating the stability of the long-run parameters of the model.

Conclusion and Recommendations

The main objective of this study is to analyze the effects of specified factors on inflation dynamics in Nepal. The ARDL model has been utilized to assess how these factors influence inflation. The results show that money supply, trade openness, and inflation in the Indian economy significantly contribute to promote the long-term inflation in Nepal. The adoption of liberalization policies appears to help reduce inflationary pressures in the country. Overall, inflation in Nepal is driven by a mix of internal and external, economic and non-economic factors. The findings emphasize that both monetary and fiscal policies are vital for controlling inflation in Nepal. Furthermore, as trade openness increases, Nepal experiences a substantial trade deficit. Given the pegged exchange rate between the Nepali and Indian currencies, an open border, and heavy trade dependence on India, inflation is directly imported from India.

In this situation, as an import dependent economy, Nepal can not restrict import because it further increases the cost of domestic production, disrupts the chain of supply leading to sluggish economic growth rate. Instead, Nepal should focus on enhancing the productive capacity by promoting domestic capacity and competition, reducing energy cost and encouraging agricultural products with the target-based policy so that the economy could substitute import and mitigate the inflationary impact of openness and minimize the direct import of inflation from India.

This study, therefore, suggests that Nepal should focus on boosting its domestic productive capacity by promoting import substitution and diversifying trade. This can be supported by encouraging both domestic and foreign investments, while ensuring sustained peace, security, political stability, and a favorable economic environment.

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