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Savings, investment, and growth in Nepal: an empirical analysis

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Abstract

This study analyzes the relationship between savings, investment, and economic growth in Nepal over 1975–2016. The structural breaks in the variables have been accounted for using the (Zivot and Andrews's, J Bus Econ Stat 10: 251–270 1992) unit root test along with (Gregory and Hansen's, Oxf Bull Econ Stat 58: 555–560, 1996) cointegration approach. The ARDL approach to cointegration in the presence of structural breaks has also been utilized to analyze the long-and short-run dynamics of savings, investment, and growth in Nepal. The results show structural breaks in the real GDP per capita during 2001 when the Royal Massacre and a state of emergency have taken place in Nepal. After allowing for this structural break, evidence of a cointegration relationship amongst savings, investment, and economic growth was identified. The estimates of the ARDL approach suggest that investment has a significant and positive impact on economic growth. However, gross domestic savings have a negative impact on growth in the long run. These results clearly show weaknesses of the economy in mobilizing savings into productive sectors.

Keywords: Savings, Investment, Economic Growth, Structural Break, ARDL Model

Introduction

The importance of savings in developing countries depends on the long-debated economic theory that the rate of economic growth is the function of the rate of investment and the latter is constrained by the rate of domestic savings (Arndt 1991). Solow's (1956) growth model argued that economic growth depends on and follows higher saving rates. In fact, Solow (1988) subsequently stated that a developing economy that succeeds in permanently increasing its savings (investment) rate will have a comparatively higher output level than otherwise and must therefore grow faster for a period. He further indicated that stimulating investment will favor faster medium-run growth through its effect on the transfer of technology from laboratory to factory. The key is that savings contribute to economic growth by freeing up resources that can be employed to then raise the productive capacity of the economy by increasing the amount of capital-equipment, machinery, buildings, among others (Mason 1988). The importance of savings for economic growth can also be witnessed in the economic progress made by, for instance, China, India, Indonesia, Malaysia, Singapore, South Korea, and Thailand (Patra et al. 2017). However, low-income countries such as Nepal, which lack a frontier technology, mostly fail in utilizing the available savings in productive sectors.

In such economies, the absence of foreign direct investment (FDI) and, hence, the unavailability of recent technologies and skills hampers the efficient utilization of available resources. As such, increasing the efficiency of investment or the effective use of scarce capital is of great importance (Arndt 1991). In this vein, Aghion et al. (2016) argued that savings do not always matter for growth. They further asserted that poor countries require cooperation amongst foreign investors familiar with the frontier technology and the local sectors familiar with the domestic conditions to mobilize the available savings into productive sectors. In this case, domestic savings matter for technology adaptation and therefore growth.

However, low-income countries such as Nepal save at a lower rate and experience slow economic growth. The statistics show that the average gross domestic savings over 1975–2016 were around 11% of the GDP (World Bank 2018). This indicates that Nepal's consumption rate is very high. Additionally, it is worrying that consumed goods are solely imported, fueling a persistent trade deficit. The World Bank Indicators show that, during 2014–2018, Nepal's trade deficit was above 30% of the GDP. The lack of private and FDI (only 0.13% of the GDP over 1975–2016), rudimentary tradable sector of the economy, and total dependence on India for fuel are further widening the trade deficit. To this end, it is also important to note that the remittance inflow is the only source backing the current account deficit, international trade, and forex reserve of the country. Therefore, the country is not able to utilize the remittance pool in its productive sectors. Accordingly, Nepal has to consider a paradigm shift from its current remittance-led and consumption-based growth to one that is investment- and productivity-driven.

Moreover, a decade-long Civil War, from 1996 to 2006, the political turmoil in the subsequent years until 2018, corruption, weak regulatory and legal policies, poor information systems, and poor technological innovations have been major barriers to the development of Nepal's financial sector (Bist and Bista 2018). Thus, the poor and urban-based financial sector is another hurdle in channeling savings into the productive sectors in the country. Nevertheless, the new constitution and federalist system, the recent political stability[1] in the country, and government's quest for the development of the nation are likely to induce significant changes in investment policies for both domestic and foreign investors. In fact, the current government has the target of graduating the country from World Bank's low-income category to the middle-income category by 2030. To make this happen, Nepal recently organized the "Investment Summit 2019" to attract foreign investors and succeeded in signing more than 15 memorandums of understanding between foreign and domestic investors. Therefore, it has become more important than ever to analyze the relationship between savings, investment, and growth in Nepal as to assist policymakers in the policy formulation.

Although a few studies having tried to investigate this relationship in Nepal (see Budha 2012; Adhikary 2015), there still exists a significant gap in the analysis of savings, investment, and economic growth. The major issue with these studies is that, although they have used time series data, there has been no attempt to address the issue of structural breaks given that Nepal's political and economic history has registered some structural changes over time. As such, ignoring these facts may severely distort

[1]The incumbent government has a more than a two third majority in the parliament. The stakeholders are thus construing it as a stable government at least for the next five years.

the findings of any related study. In fact, Perron (1989) argued that ignoring potential structural breaks can invalidate the statistical results not only of unit root tests but also of cointegration tests. Therefore, it is not clear whether the estimates of extant studies represent a valid inference instead of a spurious one.

To this end, this study seeks to contribute to this debate by using Nepal as a case study. First, there is limited knowledge on the savings, investment, and growth nexus using recent data on Nepal. To the best of our knowledge, no study has analyzed the savings, investment, and growth relationship using recent time series data analysis techniques such as the autoregressive-distributed lag (ARDL) approach or cointegration in the presence of structural breaks. Second, no study on Nepal has made the use of unit root or cointegration tests to account for structural breaks in analyzing the proposed relationship. This study is the first to use Zivot and Andrews's (1992) unit root test along with Gregory and Hansen's (1996) cointegration to account for structural breaks. Similarly, to check the robustness of the cointegration results, this study examines the presence of a long-run relationship using three cointegration techniques, namely the Johansen, Gregory–Hansen, and ARDL approaches to cointegration.

The remainder of the paper is organized as follows. Section 2 briefly reviews extant related studies. Section 3 presents the data, model specification, and empirical results. The conclusions and implications of the study's findings are drawn in the final section.

Literature review

The financial system is the backbone of an economy (Levine 1997). As such, Dermirguc-Kunt (2006) argued that a healthy financial system is the foundation on which sustained economic growth can be achieved. Therefore, financial system stability is important for the growth of a nation (Kou et al. 2019). Specifically, a well-functioning financial system affects economic growth by intervening in savings and investment. While the relationship between savings, investment, and growth has long been studied but the results remain mixed. The related literature can be dived into two main streams: one stating that savings matter for growth and the other stating that they do not always influence economic growth. Romer (1986) and Lucas Jr. (1988) argued that savings lead to increases in investment and, hence, economic growth. Their argument is that capital formation is the foundation of economic growth, becoming possible only when savings increases (Solow 1956; Domar 1946; Harrod 1939). According to the neoclassical growth theory of Solow (1956) and Swan (1956), savings are an important source of investment (capital formation) that will lead to economic growth. Therefore, the crux of this school of thought is that savings precede economic growth.

This view that saving causes economic growth has further been supported by various empirical studies. For instance, Alguacil et al. (2004) used the Granger non-causality test developed by Toda and Yamamoto (1995), and found that higher savings lead to higher economic growth. Similarly, Ang (2007) revealed a cointegrating long-run relationship between domestic savings and investment rates during 1965–2003 in Malaysia. Attanasio et al. (2000) found that investment rates Granger-cause growth rates using a panel of 123 countries over the period 1961–1994. Jangili (2011) analyzed the relationship between savings, investment, and economic growth in India and identified a cointegration relationship for which the causality is unidirectional from higher savings to investment and to growth. Further, Narayan (2005) in China, Khundrakpam and Ranjan

(2010) in India, Ma and Li (2016) in developed economies found a high correlation level between savings and investment.

Similarly, following the view that savings cause economic growth, Masih and Peters (2010), Tang and Tan (2014), Patra et al. (2017), and Tang and Chua (2012) concluded that savings precede growth. A study on the savings and growth nexus in India by Singh (2010) found long-run effects of savings on income. The study further suggested the need to accelerate domestic savings to finance capital accumulation and foster higher income and growth.

However, the literature also encompasses studies accounting the reverse causality between savings and economic growth, that is, that growth precedes savings. Keynesian theory argued that savings are a leakage dependent on the level of income or its growth (Tang and Tan 2014). Carroll and Weil (1994) asserted that the effect of savings on growth may be overstated. They found that growth Granger-cause savings, but savings do not Granger-cause growth. In fact, Carroll et al. (2000) argued that savings and growth are strongly and positively correlated across countries because high growth leads to high savings, not the other way around.

Similarly, Sinha and Sinha (1998), Gavin et al. (1997), and Abu (2010) suggested that, contrary to conventional wisdom, higher savings precede economic growth, the causality running from economic growth to savings. However, Bolarinwa and Obembe (2017) and Mohan (2006) observed mixed results. Specifically, Bolarinwa and Obembe (2017) found unidirectional causality running from economic growth to gross domestic savings for Ghana and Burkina Faso; from gross domestic saving to economic growth for Liberia, Niger, and Sierra; and no causality between savings and growth for Nigeria. Similarly, Odhiambo (2009) found bi-directional causality between savings and economic growth. However, Sothan (2014) identified no causal relationship between savings and economic growth in Cambodia. Budha (2012) found short-run bidirectional causality between investment and gross domestic product and between gross domestic savings and investment, but no short-run causality between gross domestic savings and gross domestic product in Nepal.

Similarly, it is also important to note that extant studies have even found a negative relationship between domestic savings and economic growth. For instance, Verma (2007), Sahoo et al. (2001), and Bist and Bista (2018) observed a negative and statistically significant impact of savings on economic growth. Aghion et al. (2016) explained this negative relationship by the lack of coordination between foreign firms familiar with frontier technology and local units familiar with local conditions. Similarly, Chao et al. (2019) argued that the use of cross-border capital flows as an arbitrage tool in financial markets is harmful to both financial market and economic progress in developing countries.

Therefore, with no global consensus on the relationship between savings, investment, and growth, this study analyzes this relationship in the context of Nepal. Despite the abundance of studies on investment, savings, and growth in other countries, their results cannot be generalized in the context of Nepal because of the differences between political systems, financial systems, policies and regulations, and other country-specific factors affect this relationship. Therefore, this study contributes to the literature by providing recent evidence on the relationship between savings, investment, and growth in Nepal.

Data, model specification, and empirical results

Annual data for a period of 43 years from 1974 to 2016 were used in the study. Data for gross domestic savings, gross domestic investment, and economic growth were collected from the World Bank (2018) of the World Bank. Economic growth has been measured using the real GDP per capita (2010 USD = 100%) and the gross domestic savings and gross fixed capital formation (proxy for investment) are expressed in billions USD. The graphical representation of the data is shown in Fig. 1.

The figure shows that all variables used in this study are upward trending. Therefore, before using any econometric techniques to analyze the relationship between savings, investment, and economic growth, it is important to test the stationarity of the variables. Thus, considering the trending nature of the data, this study used augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) unit root tests along with the Zivot and Andrews (1992) (ZA) unit root test, which endogenously corrects for one structural break to test the order of the integration among the variables. Table 1 shows the results of the ADF and PP unit root tests.

The results of the ADF and PP unit root tests are presented in Table 1, which shows that all variables used in this study are first-difference stationary. Therefore, it can be concluded that the real GDP per capita, gross domestic savings, and investment are integrated of order one (i.e., I (1)). However, Lee and Chang (2005) argued that standard ADF and PP tests that lead to the non-rejection of a unit root may be suspect when the sample under consideration incorporates economic events capable of causing shifts in regime. Therefore, the result of the ZA test are presented in Table 2.

Table 2 shows that structural changes in real GDP per capita took place in 2001, the year of the Royal Massacre in Nepal. During the same year, the then King Gyanendra Shah declared a state of emergency in Nepal. The ZA test results find a breakpoint in 1997 in gross domestic savings and in 2005 in investment.

Cointegration and long-run relationship

Considering the nature of the variables (all are I (1)) and the presence of structural breaks, this study has made the use of three cointegration techniques namely, Johansen cointegration, Gregory–Hansen cointegration, and ARDL. The results of Johansen cointegration test are presented in Table 3.

The results of both the trace and maximum eigenvalue tests show one cointegrating vector at the 5% or better significance level. Following the Johansen cointegration results, the Gregory–Hansen procedure for cointegration is estimated to test the existence of a long-run relationship between growth, savings, and investment with an endogenously determined structural break. The results and critical values are reported in Table 4.

The results show a long run cointegrating relationship between growth, savings, and investment when economic growth is used as a dependent variable in the structural break of 2001. As previously mentioned, the break year of 2001 detected by the Gregory–Hansen procedure corresponds with the Royal Massacre and a state of emergency in Nepal.

Although the Johansen and Gregory–Hansen procedures for cointegration show a cointegrating relationship between savings, investment, and growth, Pesaran et al. (2001) argued that Johansen's cointegration test is sensitive to sample size. Therefore,

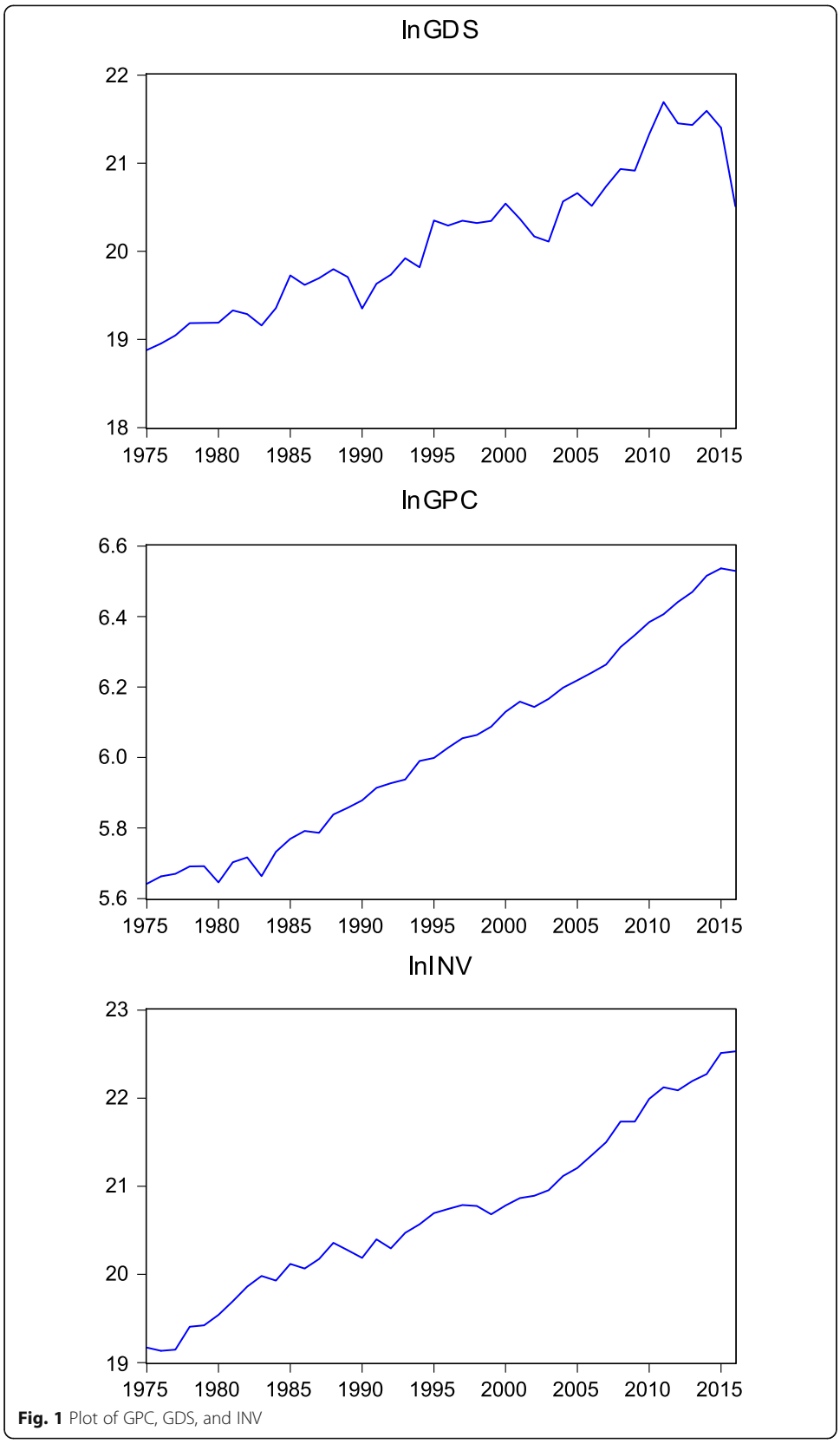

Fig. 1 Plot of GPC, GDS, and INV

Table 1 Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) unit root tests

Variables	Level		First difference	
	ADF	PP	ADF	PP
lnGPC	0.967	1.654	−7.468[a]	−7.580[a]
lnGDS	−1.580	−1.580	−4.863[a]	−4.864[a]
lnINV	0.533	0.660	−7.946[a]	−7.858[a]

Note: The optimal lag order for ADF and bandwidth for PP unit root tests are determined using the Schwarz information criterion (SIC) and Bartlett kernel, respectively. lnGPC, lnGDS, and lnINV stand for logarithm of real GDP per capita, gross domestic savings, and investment, respectively. The null hypotheses of the ADF and PP tests refer to the existence of a unit root

[a]significant at the 1% level

owing to the low power and other problems associated with these tests, the ARDL bounds testing approach for cointegration has also been performed to analyze the long and short-run dynamics of savings, investment, and growth. Since ARDL does not consider the structural breaks in the system, a dummy variable (based on the ZA unit root test and Gregory–Hansen cointegration) is introduced in the model to represent the breakpoint in the series. Therefore, the estimated ARDL representation takes the following forms:

$$\Delta \ln \mathrm{GPC}_t = \alpha + \sum_{i=1}^{p} \lambda_{1i} \Delta \ln \mathrm{GPC}_{t-i} + \sum_{j=0}^{q} \lambda_{2j} \Delta \ln \mathrm{GDS}_{t-j} + \sum_{k=0}^{r} \lambda_{3k} \Delta \ln \mathrm{INV}_{t-k} + \delta_1 \ln \mathrm{GPC}_{t-1} + \delta_2 \ln \mathrm{GDS}_{t-1} + \delta_3 \ln \mathrm{INV}_{t-1} + \delta_4 D_{2001} + e_t \quad (1)$$

$$\Delta \ln \mathrm{GDS}_t = \alpha + \sum_{i=1}^{p} \lambda_{1i} \Delta \ln \mathrm{GDS}_{t-i} + \sum_{j=0}^{q} \lambda_{2j} \Delta \ln \mathrm{GPC}_{t-j} + \sum_{k=0}^{r} \lambda_{3k} \Delta \ln \mathrm{INV}_{t-k} + \delta_1 \ln \mathrm{GDS}_{t-1} + \delta_2 \ln \mathrm{GPC}_{t-1} + \delta_3 \ln \mathrm{INV}_{t-1} + \delta_4 D_{1997} + e_t \quad (2)$$

$$\Delta \ln \mathrm{INV}_t = \alpha + \sum_{i=1}^{p} \lambda_{1i} \Delta \ln \mathrm{INV}_{t-i} + \sum_{j=0}^{q} \lambda_{2j} \Delta \ln \mathrm{GDS}_{t-j} + \sum_{k=0}^{r} \lambda_{3k} \Delta \ln \mathrm{GPC}_{t-k} + \delta_1 \ln \mathrm{INV}_{t-1} + \delta_2 \ln \mathrm{GDS}_{t-1} + \delta_3 \ln \mathrm{GPC}_{t-1} + \delta_4 D_{2007} + e_t \quad (3)$$

where Δ is the difference operator and GPC the real GDP per capita (USD 2010 = 100%). Since the results of the ZA test show that the regressand (GDP per capita) undergoes a structural break in 2001, dummy variable D_{2001} is introduced in eq. (1) to represent the structural break. The dummy variable (D_{2001}) takes 0 until 2000 and 1 thereafter. Similarly, dummy variable D_{1997} is introduced in eq. (2) to control for the structural break in the GDS and dummy variable D_{2007} is in eq. (3) to control for the structural break in the INV.

The coefficients (λ_1–λ_3) represent the short-term dynamics of the model, whereas δ_1–δ_3 are the long-run coefficients. The values (p, q, r) are the selected number of lags

Table 2 Zivot and Andrews test for unit roots with one structural break

Variables	Tα	Year of break	Result
GPC	−3.0269	2001	Unit root
GDS	−5.0269	1997	Unit root
INV	−3.6305	2005	Unit root

Note: The lag order is determined by the Schwarz information criterion (SIC). GPC, GDS, and INV stand for real GDP per capita, gross domestic savings, and investment, respectively. The null hypotheses of the ADF and PP tests refer to the existence of a unit root

Table 3 Johansen cointegration test

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	Critical Value	*P*-value
None*	0.5197	28.5984	21.1316	0.0037
At most 1	0.1241	5.1664	14.2646	0.7207
At most 2	0.0008	0.0309	3.8415	0.8604

Note: Dummy variable (D_{2001}) is used as an exogenous series to account for the structural break in economic growth. The critical values follow MacKinnon et al. (1999)
* significant at the 1% level

for the cointegrating equations based on the SIC. The bound testing has been performed to test for the existence of a long-run relationship among variables by conducting an F-test for the joint significance of the coefficients of the lagged levels of the variables. The Wald coefficient restriction test has been performed to test for the level effect with the null hypothesis of no level effect, that is,

$$H_{null:}\ \delta_1 = \delta_2 = \delta_3 = 0$$

In sum, this study tests for the joint significance of the lagged level variables using the standard Wald or F-test. If the calculated F-statistic is greater than the upper bound critical values I (1) provided by Pesaran et al. (2001), the null hypothesis of no cointegration can be rejected. However, if the calculated F-statistic is below the lower bound critical values I (0), the null hypothesis of no cointegration cannot be rejected. However, if the calculated F-statistic falls between the lower and upper bound critical values, the cointegration inference is indecisive.

The ARDL specification of the short-run dynamics can be derived by constructing an error correction model (ECM) of the following form:

$$\Delta \ln \mathrm{GPC}_t = \alpha + \sum_{i=1}^{p} \lambda_{1i} \Delta \ln \mathrm{GPC}_{t-i} + \sum_{j=0}^{q} \lambda_{2j} \Delta \ln \mathrm{GDS}_{t-j} + \sum_{k=0}^{r} \lambda_{3k} \Delta \ln \mathrm{INV}_{t-k} + \lambda_6 \mathrm{ECM1}_{t-1} + e_t \quad (4)$$

$$\Delta \ln \mathrm{GDS}_t = \alpha + \sum_{i=1}^{p} \lambda_{1i} \Delta \ln \mathrm{GDS}_{t-i} + \sum_{j=0}^{q} \lambda_{2j} \Delta \ln \mathrm{GPC}_{t-j} + \sum_{k=0}^{r} \lambda_{3k} \Delta \ln \mathrm{INV}_{t-k} + \lambda_6 \mathrm{ECM1}_{t-1} + e_t \quad (5)$$

$$\Delta \ln \mathrm{INV}_t = \alpha + \sum_{i=1}^{p} \lambda_{1i} \Delta \ln \mathrm{INV}_{t-i} + \sum_{j=0}^{q} \lambda_{2j} \Delta \ln \mathrm{GDS}_{t-j} + \sum_{k=0}^{r} \lambda_{3k} \Delta \ln \mathrm{GPC}_{t-k} + \lambda_6 \mathrm{ECM1}_{t-1} + e_t \quad (6)$$

where Δ is the first difference operator and ECT_{t-1} the lagged value of error correction term. ECM indicates both long-run causality and the speed of adjustment. The first important issue to be considered is whether $\lambda_6 \neq 0$. If this is not the case, the cointegration findings would not be reliable. The results of the bound testing are reported in Table 5.

Table 4 Gregory–Hansen cointegration test with structural break

Model	T-statistics (ADF)	Break year	Critical value 5%	Result
F (lnGPC/lnGDS, lnINV)	−6.140	2001	−5.960	Cointegration

Note: The null hypothesis is of no-cointegration. GPC, GDS, and INV stand for real GDP per capita, gross domestic savings, and investment, respectively. Full structural break; trend is included in the model

Table 5 Bound testing for existence of a level relationship

Equation	F-value	Break Year	Lag order	Critical Value-Upper bound (1%)	
				Pesaran et al. (2001)	Narayan (2005)
F (ln GPC/ln GDS, ln INV)	8.541[a]	2001	(3, 3, 3)	6.36	7.337
F (ln GDS/ln GPC, ln INV)	2.64	1997	(1, 2, 1)	6.36	7.337
F (ln INV/ln GDS, ln GPC)	1.26	2007	(2, 1, 0)	6.36	7.337

Note: The values between parentheses are the selected number of lags based on the Schwarz information criterion (SIC). GPC, GDS, and INV stand for the real GDP per capita, gross domestic savings, and investment, respectively. The critical value from Narayan (2005) is obtained for an unrestricted intercept and no trend ($n = 40$ and $K = 2$).
[a]significant at the 1% level

Similar to the results of the Johansen and Gregory–Hansen cointegration tests in the previous section, the results in Table 5 show that when the real GDP per capita is used as the dependent variable, the calculated F-statistics (8.541) is higher than the upper bound critical value of 6.36 and 7.337 (Narayan 2005) at the 1% level. This indicates a cointegrating relationship between savings, growth, and investment. However, the results show no evidence of cointegration or a long-run relationship when saving and investment are used as dependent variables. Therefore, it can be concluded that the long-run causality is unidirectional from savings and investment to economic growth in Nepal. However, these findings are not consistent with the Carroll–Weil hypothesis (Carroll and Weil 1994), which states that economic growth causes savings. Similarly, our results are not consistent with the findings of Abu (2010), Bolarinwa and Obembe (2017), Mohan (2006), Odhiambo (2009), and Sothan (2014).

After confirmation of the cointegration between variables, the long-run estimates are presented in Table 6.

Table 6 shows domestic savings have a negative impact on economic growth. Ceteris paribus, a 1% increase in gross domestic savings causes a 0.068% decrease in real GDP per capita in the long run. However, this result is not significant. The negative long-run beta coefficients for gross domestic savings indicate domestic savings do not influence growth in Nepal. This finding is against the logic of the endogenous growth model, which states that savings influence growth. One explanation comes from Aghion et al. (2016), who state that domestic savings do not always matter for growth. Specifically, according to Aghion et al. (2016), growth in relatively poor countries mainly results

Table 6 ARDL model: Long-run results

Regressor	Coefficient	*P*-values
Dependent variable: ln GPC		
ln GDS	−0.068	0.638
ln INV	0.427***	0.009
D_{2001}	0.077	0.161
Intercept	−1.134	0.210
Diagnostic test statistics		
	Test stats	*P*-value
LM	0.061	0.807
JB	0.985	0.611
Ramsey	1.055	0.314

Note: GPC, GDS, and INV stand for the real GDP per capita, gross domestic savings, and investment, respectively. LM, JB, and Ramsey denote the test statistics for serial correlation, normality of errors, and functional form, respectively
*** significant at 1% level

from innovations that allow local sectors to catch up with the current technology frontier. However, catching up with the frontier in any sector requires the co-operation of a foreign investor who is familiar with frontier technology and a domestic entrepreneur familiar with the local conditions to which the technology must be adapted. In such a country, domestic savings matter for technology adaptation and therefore growth. However, Nepal has not been able to draw on the technological potential and other contributions that foreign investment can make to the process of development (Pant, 2010). In other words, Nepal has failed to catch up with the frontier and, hence, domestic savings do not have a positive impact on economic growth in this case. This finding is also consistent with those of Sahoo et al. (2001) and Verma (2007).

Similarly, the results show that investment defined as fixed capital formation has a positive and significant impact on economic growth in Nepal. In the long run, keeping other things constant, a 1% increase in investment will lead to an increase of 0.427% in the real GDP per capita. This shows that formation of capital in an economy leads to higher growth in the long run.

The diagnostic statistics show the used ARDL model seems to be data congruent and free from specification errors. Further, the error terms are normally distributed (Jarque–Bera test) and serially independent (LM test) and the model is dynamically stable (Ramsey test). Therefore, the results are not spurious.

The results of the ECM are presented in Table 7. The lagged real GDP is negative and significant at the 1% significance level. This indicates that the Nepalese economy was unable to sustain the pace of its economic growth during the study period. Similarly, unlike the long run, the short-run impact of gross domestic savings is positive. However, the coefficients are not significant. This shows the weakness of the economy in using savings in productive sectors. The main policy implication of this finding is that policymakers should formulate policies in such a

Table 7 ARDL model: ECM results

Regressor	Coefficient	Prob.
Dependent variable: ΔGPC		
$\Delta \ln GPC_{-1}$	− 0.5417[a]	0.0003
$\Delta \ln GPC_{-2}$	− 0.5027[a]	0.0008
Δln GDS	0.0240	0.0722
$\Delta \ln GDS_{-1}$	0.0211	0.3267
$\Delta \ln GDS_{-2}$	0.0327	0.1022
Δln INF	−0.0208	0.5046
$\Delta \ln INF_{-1}$	0.0266	0.5070
$\Delta \ln INF_{-2}$	−0.1458[a]	0.0002
D_{2001}	0.0143	0.2356
ECM_{-1}	−0.1868[b]	0.0161
Diagnostic test statistics		
R_squared	0.7279	
F-value	6.9582	
DW-statistic	2.0240	

Note: ECM = ln GPC + 0.0683 ln GDS - 0.4267 ln GFC - 0.0767 D_{2001} + 1.1341 Intercept
[a]significant at the 1% level
[b]significant at the 5% level

way that savings could be utilized in productive sectors by increasing capital formation in the country.

The results in Table 7 also show the lagged values of investment have a significant negative impact on economic growth in the short run at the 1% significance level. Similarly, ECM_{-1} has the correct sign and implies that nearly 19% of the disequilibria in the real GDP per capita from the previous years' shock adjusts back to the long run in the current year.

This study also performed the cumulative sum (CUSUM) of recursive residuals and cumulative sum of square (CUSUMSQ) of recursive residuals stability tests. Fig. 2 shows the CUSUM and CUSUMSQ plots.

From Fig. 2, the CUSUM and CUSUMSQ statistics are well within the critical bounds, implying that the model is stable over the analyzed period.

Conclusions and policy recommendations

This study examined the relationship amongst saving, growth and investment in the context of Nepal using an annual dataset for 1975–2016. The time series properties of the data were first analyzed for possible structural breaks using the Zivot and Andrews (1992) model. Cointegration has been identified using the Johansen, Gregory–Hansen, and ARDL approaches.

The empirical evidence indicates a stable long-run relationship between savings, investment, and economic growth in the presence of structural breaks but only when economic growth is the dependent variable. This indicates that the long-run relationship is running from savings and investment to economic growth in Nepal. These findings support the view of Solow (1988) in that savings cause economic growth. This implies policymakers must emphasize increasing savings in the country. Since Nepal is an import-based country financed by remittances, the domestic savings along with remittances has been spent largely on the consumption of imported goods and services. Therefore, this creates an urgency for a policy that focuses on utilizing available resources into the tradable sector of the economy by encouraging both production-based consumption and remittance-based investment.

Similarly, the long-run estimates of the ARDL model indicate that investment has a positive significant impact on economic growth. However, the results showed a negative impact of gross domestic savings on economic growth in Nepal. This finding indicates the weakness of the Nepalese financial sector in mobilizing the savings to the productive sectors. These findings further support the argument that savings in Nepal are not investment friendly. On average, the 11% of the GDP in domestic savings, 0.13% in FDI, and above 40% in trade deficit support the study findings and argue that

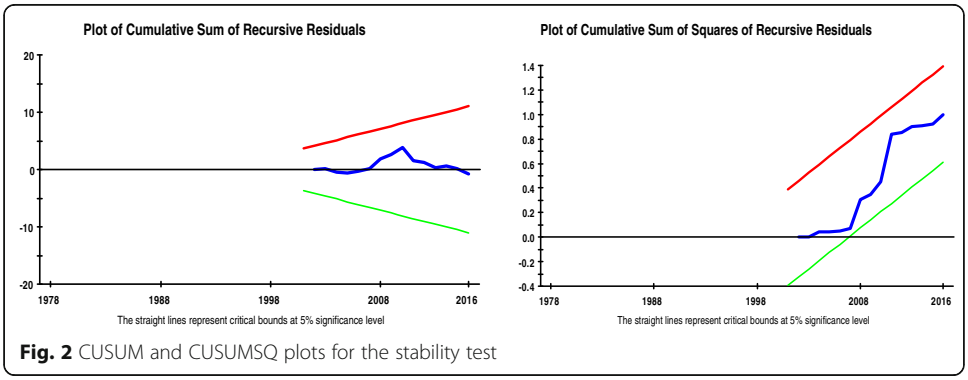

Fig. 2 CUSUM and CUSUMSQ plots for the stability test

investment is low in Nepal. Therefore, to fulfil the current economic target of the government of graduating the country to the middle-income category by 2030, policymakers have to pay attention to the existing relationship between savings, investment, and growth. This also highlights the urgency in formulating policies that enhance the effective mobilization of savings into productive sectors. Such policies will in turn lead to increases in investment and thus economic growth.

We strongly suggest that generalizations of this study should be considered with caution. The main limitation of the study corresponds to the country considered. That is, the study is confined to the Nepalese context. Therefore, the results may not be relevant to the contexts of other countries.

Abbreviations

ADF: Augmented dickey-fuller; AIC: Akaike information criterion; ARDL: Autoregressive distributed lags; CE: Cointegrating equations; CUSUM: Cumulative sum of recursive residuals; CUSUMSQ: Cumulative sum of square of recursive residuals; GDP: Gross domestic product; GDS: Gross domestic savings; GPC: GDP per capita; INV: Investment; PP: Phillips–Perron test; SIC: Schwarz information criterion; ZA: Zivot and Andrews test

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Availability of data and materials

The data for the variables of this study were collected from the World Bank (2018) (http://databank.worldbank.org/data/source/world-development-indicators).

Competing interests

The authors declare that they have no competing interests.

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