Public Debt Stock, Education-Centric Human Capital and Economic Growth in Nepal

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Abstract

Government borrows from domestic and foreign sources to finance its budget deficit. There are theories and empirical evidence that suggests negative effect of government debt on economic growth. By applying the autoregressive distributive lag (ARDL) approach to cointegration on time series data of Nepal spanning over 1975-2014 , this study finds positive and statistically significant effect of total public debt on the GDP of the country. This result contradicts majority of the existing empirical literature. For the positive result we resort to Keynesian view on the effect of public debt in the economy. The total debt-to-GDP ratio of Nepal shows a declining trend. This should have some policy considerations in the conduct of fiscal policy in Nepal. The contribution of education-centric human capital on GDP is found positive as predicted by theory.

Key words: *government debt stock, gross fixed capital formation, education, GDP, ARDL, Nepal*

BACKGROUND

Why do governments borrow? Can't they balance their budget? There are differences in answers that macroeconomists offer to these questions. Government in every country spends its revenue on a number of things like social welfare, capital expenditure (e.g., investments in buildings schools and hospitals, roads, public facilities etc,), national defence, compensation to government employees among others. To finance all such expenditures, government relies on taxes and other revenues. But to increase tax to finance increased expenses on several activities is not a popular way; people do not like to pay more taxes. In countries with low level of per capita income and hence with low levels of taxpaying capacity of the people, government has limitations in increasing taxes. Realized tax revenue collection of the government would be less than predicted. However government cannot stop its overall spending due to its growing role and responsibility in the economy. During time of recession revenue collection falls but government has to increase spending to stimulate the economy, increase unemployment allowances and continue spending on social security. For that reason in an era of expanding government activities, it is hard for the government to downsize its spending volume and exactly balance its budget, or increase tax every

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time to finance its rising spending. Therefore borrowing would be a healthy option to the government to finance its growing expenses as long as it can repay its debts.

Like many governments of the world, running a deficit budget and financing it by borrowing has been a feature of Nepal government's budgetary operation. Government of Nepal borrows from both foreign and domestic sources to finance its deficit-spending. Internally it borrows mainly from the banking sector and externally it borrows from both bilateral and multilateral sources. Due to continued borrowing the stock of outstanding debt of the government has become large in volume. There is fear that the large volume of outstanding debt of the government has threat to the economy. Therefore the objective of this paper is to analyze the trend of government debt and debt-to-GDP ratio and search whether the outstanding debt has any growth retarding effect in Nepal.

A TRIP ON THEORETICAL AND EMPIRICAL INFORMATION

There are theoretical grounds and empirical evidence on the effect of government/ public debt in the economy both in the short-and long-run. A survey of literature on several issues linked to the impact of government debt in the economy is found in Elmendorf and Mankiw (1999).Theoretically there are three strands on the effect of public debt on economic growth: the Keynesian approach, the neoclassical approach, and Ricardian approach.

The Keynesian approach is that expansionary fiscal policy resulting in rising budget deficit and public debt increases aggregate demand and output in the short-run through budgetary multiplier (Haavelmo, 1945; Baumol & Maurice, 1955). Furthermore debt may also lead to public investments (for example, infrastructural developments) which may enlarge the capacity to supply aggregate output.

Contrary to the Keynesian argument the neoclassical theory (Diamond, 1965; Modigliani, 1961; Saint-Paul, 1992) makes the case that increasing public debt is disadvantageous because an expansive fiscal policy increases current consumption, which in turn leads to the decline of the saving rate. Consequently the level of interest rate rises which in turn will lead to a decline in private sector's investments and a slowdown of growth. Thus there is crowd out of investment and capital and reduction in output in the long-run.

In contrast to the above two opinions, the Ricardian equivalence proposition indicates that government debt does not affect economic growth (Barro, 1989). The hypothesis means that at the time when budget deficit is growing due to fiscal stimulus government

debt speeds up and market players prepare for future period of austerity measures , tax rises, and consequently they shift their focus from consumption and investment to increasing savings, which neutralizes the impact of the demand-inducing fiscal policy.

There are diverse channels through which government debt accumulation adversely affects medium-run to long-run growth. For example, study of Gale and Orzag (2003) and Baldacci and Kumar (2010) reveal that high public debt can adversely affect capital accumulation and growth by means of higher long-term interest rates; Barro (1979) and Dotsey (1994) point out that high public debt affects growth through higher future distortionary taxation; Sargent and Wallace (1981), Barro (1995) and Cochrane (2011) point out that adverse effect of government debt on growth works through inflation channel. Analysis of Burnside, Eichenbaum and Rebelo (2001) and Hemming, Kell and Schimmelpfennig (2003) further add that large debt of government, by sparking off a banking or currency crisis, can magnify several adverse effect of public debt on growth. Some authors have also pointed out that high public debt would possibly restrict the power of countercyclical fiscal policies which may result in higher volatility and further lower growth. For example Woo (2009) investigates the effects of procyclicality and volatility of fiscal policy on growth.

Of late Reinhart and Rogoff (2010) studied economic growth and inflation at different levels of government and external debt. Their analysis is based on new data on forty-four countries spanning the period of 1790-2009.The study mainly found that (i) the relationship between government debt and real GDP growth is weak for debt-to-GDP ratios below a threshold of 90 percent and for levels above 90 percent the median growth rates fall by one percent and the average growth rates considerably more, and finally (ii) the threshold for public debt is similar in advanced and emerging economies. Kumar and Woo (2010) in their study based on a panel of advanced and emerging economies also found a similar change in the behaviour of GDP growth in relation to the debt ratio. Their empirical results suggested an inverse relationship between initial debt and subsequent growth controlling for other determinants of growth. This study found that on the average a 10 percentage point increase in the initial debt-to-GDP ratio was associated with a slowdown in annual real per capita GDP growth and of around 0.2 percentage point per year, with the impact being somewhat smaller in advanced economies.

The study of Cordella, Ricci and Ruiz-Arranz (2010) found a negative relationship between external public debt and growth in developing countries with intermediate levels of debt but no significant relationship between debt and growth in developing countries with very low or very high levels of debt. They also found that in countries

with bad policies debt may not matter at all. In a panel of around 100 developing countries, Pattillo, Poirson and Ricci (2011) found a non-linear relationship between the net present value of external debt and economic growth. Their results suggested that the marginal effect of debt becomes negative when the net present value of debt reaches 20 percent of GDP. Presbitero (2012) uses total public debt and finds no significant relationship between public debt and growth in developing countries with bad policies and institutions. Panizza and Presbitero (2013) provide a detailed survey of literature on government debt and economic growth and conclude that although there is evidence of negative correlation of public debt with economic growth, there is no study that can make a strong case for a causal relationship going from debt to growth. They also showed that the presence of debt thresholds and in general, of a nonmonotonic relationship between debt and growth is not robust to small changes in data coverage and empirical techniques.

Thus majority of the existing empirical literature reports a negative association between government debt and GDP. Does the negative relation also hold in the context of Nepal? There has not been sufficient empirical analysis in the context of Nepal to quantify the impact of total outstanding debt of government on the GDP of the country by covering a longer time period as of this study (sample period 1975-2014) by testing the time series property of the variables considered. To the best of the knowledge of this author the impact of public debt stock combined with education-centric human capital on the GDP of Nepal has not been made. This study fills this gap by applying the ARDL method of cointegration by incorporating debt stock data with gross fixed capital formation and education-centric human capital to analyze their impact on the GDP of Nepal. This work should be an interesting stuff to the intellectual community and policy practioners.

RESEARCH STRATEGIES

The strategy of this paper to quantify the relationship of Nepal Government's debt stock with the GDP of the country starts with a production function. We specify a Cobb-Douglas production function characterized by constant returns to scale in four arguments *viz*, gross fixed capital formation (GFCF), government's total debt stock (TD), a measure of education-centric human capital (HC), and labour force (L).

$$GDP_t = A_t \, GFCF_t^{\alpha} \, TD_t^{\beta} \, HC_t^{\lambda} \, L_t^{1-\alpha-\beta-\lambda} \qquad (1)$$

where GDP is gross domestic product measured in millions of local currency, is A scale factor (overall production efficiency parameter), and t is an index of time.

The variables GDP, GFCF, and TD are measured in current prices of millions of NRs (Nepalese rupees).Labour force (L) is proxied by the projected population of the age group 15-64 years. Education-centric human capital (HC) is proxied by total number of students enrolled in school level education of Nepal (from primary level to secondary level).

Government's total debt stock (TD) is the main variable of interest of this study. We include the debt variable (TD) in the production function drawing upon neoclassical production theory and studies by Johnston (1969), Levhari and Patinkin (1968), and Nadiri (1969) who suggest that money is one of the input factors of the real GDP growth rate. GFCF is a proxy measure of capital, a conventional factor of production.

Education centric-human capital is incorporated in the production function following new (endogenous) growth theory innovated by Lucas (1988) and Romer (1990a). In particular the theoretical literature on economic growth pinpoints the following channels through which education-centric human capital may affect economic growth performance of nations: (i) Human capital works as a factor of input in production activities and shift growth towards a higher equilibrium level of output (Lucas, 1988; Mankiw, Romer, & Weil, 1992; Uzawa, 1965).(ii) Accumulation of education-centric human capital can increase the innovative capacity of the economy and the new knowledge on new technologies, products, and processes promotes endogenous growth (Romer, 1990b).(iii) Education can facilitate the diffusion and transmission of knowledge needed to understand and process new information (technological diffusion) and to successfully implement new technologies created by others (technological catch-up), which again promotes economic growth (Benhabib & Spiegel, 1994; Nelson & Phelps, 1966; Romer, 1986).(iv)Accumulation of human capital generates positive externalities, the members and fellow workers become more productive which leads to endogenous growth (Lucas, 1988). (v) Human capital accumulation may affect physical capital investment and thus create an indirect effect on growth performance (Benhabib & Spiegel, 1994).

For ease in operation we drop the time subscript and divide both sides of equation (1) by L to express the production function in per capita term as

$$\frac{GDP}{L} = A\left(\frac{GFCF}{L}\right)^{\alpha}\left(\frac{TD}{L}\right)^{\beta}\left(\frac{HC}{L}\right)^{\lambda} \qquad (2)$$

Taking natural logarithm on both sides of equation (2)

$$\ln Y = \ln A + \alpha \ln GFCF + \beta \ln TD + \lambda \ln H \qquad (3)$$

Where lnY=Natural logarithm of GDP per worker, lnGFCF=Natural logarithm of GFCF per worker, lnTD =Natural logarithm of total debt per worker, lnH=Natural logarithm of per worker education-centric human capital. The term 'lnA' is treated as an intercept in the regression estimation.

Data Sources

The sample period of this study is 1975-2014.The required data are collected from *Economic Survey*(several issues) published by Ministry of Finance, Government of Nepal, and *A Handbook of Government Finance Statistics Vol.III* published by Nepal Rastra Bank (the Central Bank of Nepal) (2010).

Unit Root Test of the Time Series

The autoregressive distributed lag(ARDL) approach also known as bounds testing approach to cointegration, originally developed by Pesaran and Shin (1997) and later extended by Pesaran, Shin and Smith (2001), is based on the assumption that time series under investigation are integrated of order zero, I (0), or integrated of order one, I (1) or mutually cointegrated. Therefore, before applying this method of cointegration, we have to test for the order of integration of all variables using the unit root tests to be sure that none of the variables are integrated of order 2 or beyond (Ouattara, 2004) because in the presence of I (2) variables the computed F-statistic provided by Pesaran, Shin and Smith (2001) are not valid and we cannot interpret the given F-statistics.

We apply the augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1979, 1981) to identify the stationarity or non-stationarity of the time series under investigation. The ADF test for a unit root up to the pth lag, AR (p), tests the null hypothesis $H_0 : \delta = 0$ (non-stationary/has unit root) against the one-sided alternative $H_1 : \delta < 0$ (stationary/ no unit root) estimating regression equation (4) by OLS method:

$$\Delta Y_t = \beta_0 + \phi T + \delta Y_{t-1} + \gamma_1 \Delta Y_{t-1} + \gamma_2 \Delta Y_{t-2} + ... + \gamma_p \Delta Y_{t-p} + u_t \qquad (4)$$

where ϕ is an unknown coefficient of the variable time index 'T', and the ADF statistic is the OLS t-statistic(tau-statistic) testing $\delta = \sigma - 1 = 0$ in equation (4).This equation tests the alternative hypothesis that Y_t is stationary around a deterministic linear time trend.

Practically we reject the null hypothesis of non-stationarity (i.e., $\delta = 0$) if δ is adequately statistically negative (i.e., for rejection of the null hypothesis the computed tau (τ) statistic must be more negative than the critical values and must be statistically significant. The lag length p in the autoregression can be determined by using the

Schwarz Information Criteria (SIC) also called Swartz Bayesian Criteria (SBC) or Akaike Information Criteria (AIC) or Hanna-Quinn Criteria (HQC). The rule is to choose the lag length by minimizing an 'information criteria' among the possible choices (Stock & Watson, 2006). Values associated to these information criterions are automated in different econometric Softwares. In this study we use the SIC (SBC) criteria to select lag in the ADF unit root test.

Cointegration Test: The ARDL Approach

Even if there are different approaches of testing cointegration (e.g., Engle & Granger, 1987 ; Stock & Watson, 1988 ; Johansen,1988, 1991; Johansen & Juselius , 1990) , we employ the bounds testing approach to cointegration within an autoregressive distributed lag (ARDL) framework developed by Pesaran and Shin (1997), and Pesaran, Shin and Smith (2001). An ARDL model refers to a model with lags of both the dependent and explanatory variables. Because dynamic effects necessarily occur over time, the econometric model used to estimate dymanic causal effects needs to incorporate lags.To do so the dependent varaible can be expressed as a distributed lag of current and p past values of the explanatory variables (Stock & Watson, 2006).

The ARDL method of cointegration has certain econometric advantages over alternative cointegration procedures. Firstly, this technique is robust for cointegration analysis with small sample study (Narayan & Smith, 2005). The bi-variate cointegration test introduced by Engle and Granger (1987) and the multivariate cointegration technique proposed by Stock and Watson (1988), Johansen (1988, 1991) and Johansen and Juselius (1990) may be applicable for large sample size and are not reliable for small sample sizes (as in the case of this study). The second benefit is that it can be applied irrespective of whether the regressors are I (0), I (1), or even integrated of the same order or mutually cointegrated. This is well known that the conventionally used cointegration approaches, for example Engle and Granger (1987), Johansen(1988) , and Johansen and Juselius (1990),are applicable for nonstationary series with same order of integration, I(1). The third advantage is that the unrestricted error correction model (UECM) is likely to have better statistical properties than the two-step Engle-Granger (E-G) method (Narayan & Smith, 2005) because unlike the E-G method, the UECM does not push the short run dynamics into the residual terms (Banerjee, Dolado, Galbraith & Hendry, 1993; Banerjee, Dolado & Mestre, 1998; Pattichis, 1999). Additionally this approach allows to derive a dynamic error-correction model from ARDL through simple linear transformation (Banerjee, Dolado, Galbraith & Hendry, 1993) that integrates the short-run dynamics with long-run equilibrium without losing long-run information and thus allows to draw inference for long run estimates that is not available in other alternative cointegration procedures (Sezgin & Yildirim,

2002). The ARDL approach estimates both the long-run and short-run relationships simultaneously.

The fourth plus point of the ARDL bounds test approach is that it is capable of distinguishing dependent and explanatory variables and thereby helps avoiding the problems of endogeneity (Rehman & Afzal, 2003). Fifthly, the ARDL approach involves just a single-equation set-up, making it simple to implement and interpret. Sixthly, the ARDL approach offers more choices regarding the inclusion of number of endogenous and exogenous variables, if any, the treatment of deterministic elements, as well as the order of vector autoregression (VAR) , and the optimal number of lags to be used which are limited in Johansen's method (Pahlavani, Wilson & Worthington, 2005; Pesaran & Smith, 1998). Finally, the ARDL bounds testing procedure generally provides unbiased estimates of the long-run model and valid t-statistics because they avoid the problems that may arise due to serial correlation and endogeneity (Harris & Sollis, 2003; Odhiambo, 2009).

Steps in the ARDL Approach

The ARDL bounds test method of cointegration involves two stages. The first stage requires the test of the existence of a long-run relationship between the variables under research by means of the computation of the F-statistic for testing the significance of the lagged levels of the variables in the error correction form of the underlying ARDL model. The F-test depends upon: (i) whether variables included in the ARDL model are I (0) or I (1), (ii) the number of regressors (k), and (iii) whether the ARDL model contains an intercept and/or intercept and trend. If the computed F-statistics is greater than the proper upper bound critical values, the null hypothesis of no cointegration is rejected in favour of cointegration. If the computed F-statistics falls below the lower bound critical values, the null of no cointegration cannot be rejected in which case there is absence of cointegration. If the computed F-statistic falls within the critical value band (i.e., if it falls within the upper and lower bounds), the result is inconclusive. Under the inconclusive situation, following Kremers, Ericsson and Dolado (1992) and Banerjee, Dolado and Mestre (1998), the error correction term (ECT) will be a useful way of confirming cointegration (Verma, 2007). Of course we have to rely on the significance of the error correction term as a useful way for establishing cointegration.

The second stage test is dependent upon the result of the first stage F-test. If the first stage test suggests the existence of cointegration among the variables, then the second stage involves additional two-step procedure: an estimation of the long run and short run parameters using the related ARDL and error correction models (ECMs).In doing so in the first step the orders of the lags in the ARDL model are selected. The ARDL model is computationally expensive (Laurenceson & Chai, 2003), requiring to estimate

$(p+1)^k$ number of regression equations in order to obtain the optimal lag length for each variable, where p is the maximum number of lag(s) to be used and k is the number of variables (regressors) in the equation (Liang & Cao, 2007).

Lag Length Selection in the ARDL Model

ARDL test results often depend significantly on the number of lagged differences included in the regression equation. If random lag values are specified, the resulting statistical inferences are likely to be invalidated. In response to this problem one of the procedures proposed for determining the proper length of the distributed lag is the use of selection criteria. We can use the Akaike Information Criterion (AIC), the Schwartz Bayesian Criteria (SBC) or Hannan-Quinn Criterion (HQC) to choose the lag order to obtain a parsimonious ARDL model. Though the theoretical limitation of the AIC is that in large samples it will overestimate p with nonzero probability, it is widely used in practice (Stock & Watson, 2006). The BIC may possibly produce a model with too few lags and hence the AIC provides a reasonable alternative (Stock & Watson, 2006). The SIC or the BIC is known as selecting the parsimonious model by selecting the smallest possible lag length whereas AIC is known for selecting the maximum relevant lag length (Shrestha, 2005). Regarding the choice of the model, the specification with smaller AIC or SIC/SBC are better (Studenmund, 2000). In our study we use the BIC (SBC) to select the optimum lag in the ARDL model.

Economic growth studies that apply the ARDL method of cointegration have used a lag order of one or two. For example, Seetanah (2008) used one lag while Laurenceson and Chai (2003) and Narayan and Smith (2005) used two lags. Drawing upon the previous literature we use a lag order of two in the ARDL equation. The choice of the order of ARDL in this study is also influenced by the limited capacity of the demo version of *Microfit 5* in the estimation.

Following Pesaran, Shin and Smith (2001), an ARDL representation of equation (3) is specified as:

$$\Delta \ln Y_t = \mu + \sum_{i=0}^{m} \eta_i \Delta \ln Y_{t-i} + \sum_{i=0}^{n} \omega_i \Delta \ln \text{GFCF}_{t-i} + \sum_{i=0}^{p} \phi_i \Delta \ln \text{TD}_{t-i} + \sum_{i=0}^{q} \pi_i \Delta \ln H_{t-i}$$
$$+ \theta_1 \ln Y_{t-1} + \theta_2 \ln \text{GFCF}_{t-1} + \theta_3 \ln \text{TD}_{t-1} + \theta_4 \ln H_{t-1} + u_t \qquad (5)$$

where Δ denotes first difference operator, μ is the intercept term, and u_t is the usual white noise residuals.

Equation (5) differs from standard distributed lag models in that it includes a linear combination of the lagged level of all variables, normally referred to as an error-correction term (Bahamani-Oskooee & Ardalani, 2006). The ARDL model given in equation (5) integrates the short-run dynamics with the long run equilibrium without losing any information for the long run. From the model estimated in the first step, the long run coefficients are obtained as the coefficients of the one-period lagged explanatory variables (multiplied by a negative sign) divided by the coefficients of the lagged dependent variables (Bardsen, 1989; Akinboade, Ziramba & Kumo, 2008).Thus in the ARDL specification of (5) the coefficients ' θ_1 to θ_4' represent the long-run relationship whereas the remaining expressions with summation sign (coefficients η_i , ω_i , ϕ_i , π_i) represent the short-run dynamics of the model. In time series regression models the coefficients of non-lagged explanatory variables indicate the contemporaneous or immediate effect of a unit change in the regressor on the dependent variable. But in autoregressive models involving the time lag(s) among the regressor(s), the coefficient of the regressor(s) implies the effect only after the specified period. Thus in relation to the autoregressive distributed lag model (5) the dynamic causal effect is the sum of sequence of coefficients η_i, ω_i, ϕ_i, and π_i of the differenced variables, and the coefficients $\theta_1, \theta_2, \theta_3,$ and θ_4 of the one period lagged level variables.

If the variables of the production function with 'lnY' as the dependent variable are found cointegrated in the first step F-test, then the conditional long-run model can be produced from the reduced form solution of equation (5) when the first-differenced variables jointly equal to zero, that is, by setting $\Delta \ln Y_t = 0 = \Delta \ln GFCF_t = \Delta \ln TD_t = \Delta \ln H_t$ the cointegration equation is defined as

$$\theta_1 \ln Y_{t-1} + \theta_2 \ln GFCF_{t-1} + \theta_3 \ln TD_{t-1} + \theta_4 \ln H_{t-1} = 0 \qquad (6)$$

The bounds test methodology of Pesaran, Shin and Smith (2001) investigates the null hypothesis of no cointegration through a joint significance test of the lagged levels of variables $\ln Y_{t-1}$, $\ln GFCF_{t-1}$, $\ln TD_{t-1}$ and $\ln H_{t-1}$ based on the familiar F-statistics under which the null hypothesis $H_0 : \theta_1 = \theta_2 = \theta_3 = \theta_4 = 0$ (no cointegration) is tested against the alternative hypothesis $H_1 : \theta_1 \neq 0, \theta_2 \neq 0, \theta_3 \neq 0, \theta_4 \neq 0$ (cointegration). Thus following Pesaran et al. (2001), cointegration can be expected if the long-run coefficients of all lagged level variables are jointly significant (i.e., values of $\theta_i s > 0$, for $i = 1,..., 4)$.

If variables of a model are cointegrated, there exists an error correction representation. The advent of Granger's representation theorem (Engle & Granger, 1987) has immensely increased the use of error-correction model in applied time series econometrics. In

the ARDL approach to cointegration the lagged error correction term (ECM_{t-1}) is generated out of the long-run coefficients to replace linear combination of lagged variables, and the model is re-estimated at the optimum lags selected by using model selection criterion (Bahamani-Oskooee & Ardalani, 2006). Hence the short-run error correction version of model (5) is specified as:

$$\Delta \ln Y_t = \mu_1 + \sum_{i=0}^{m} \eta_i \Delta \ln Y_{t-i} + \sum_{i=0}^{n} \omega_i \Delta \ln GFCF_{t-i} + \sum_{i=0}^{p} \phi_i \Delta \ln TD_{t-i} + \sum_{i=0}^{q} \pi_i \Delta \ln H_{t-i} + \xi ECM_{t-1} \qquad (7)$$

In equation (7) ECM is the error correction mechanism term obtained as residual from the estimation of the long run cointegrating equation (3); $\eta_i, \omega_i, \phi_i,$ and π_i are the short-run dynamic coefficients of the model's convergence to equilibrium, and ξ is the speed of adjustment from short run to long run. The error correction mechanism term is thus defined as:

$$ECM_t = \ln Y_t - \gamma_1 \ln GFCF_t - \gamma_2 \ln TD_t - \gamma_3 \ln H_t \qquad (8)$$

where $\gamma_1 = -\left(\dfrac{\theta_2}{\theta_1}\right), \gamma_2 = -\left(\dfrac{\theta_3}{\theta_1}\right), \gamma_3 = -\left(\dfrac{\theta_4}{\theta_1}\right)$ are the ordinary least square (OLS) estimators obtained from equation (5).

The error correction term (ECM) among a set of cointegrated series implies that changes in the response variable are a functions of both the levels of disequilibrium in the cointegrating relationship (represented by the ECM) and the changes in other explanatory variables. The coefficient 'ξ' of the error correction term in equation (7) is expected to be less than zero ($\xi < 0$) and statistically significant to confirm the existence of cointegrating relation. Banerjee, Dolado and Mestre (1998) note that significant lagged error term with negative sign is the way to prove that established long run relationship is stable. The larger the size of the negative coefficient of the error correction term, the greater is the speed of adjustment from short run to long run.

RESULT AND DISCUSSION

The analysis proceeds first by making an overview of the evolution of Nepal government's debt stock and total Debt-to-GDP ratio.

Evolution of Government's Debt in Nepal

The trend of the evolution of the debt stock of the government of Nepal over the period of 1975-2014 is portrayed in Figure 1.These data give some sense of the history of government debt in Nepal.
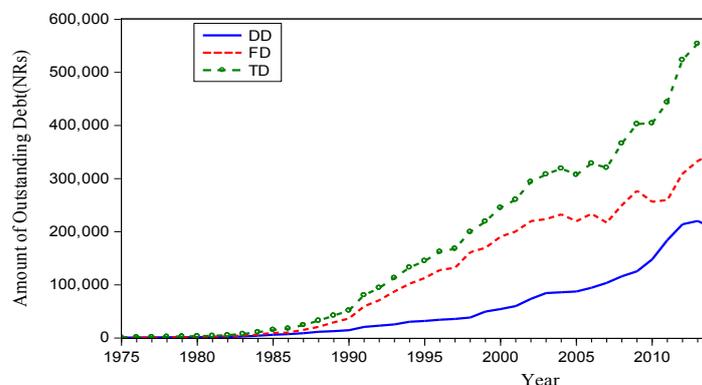
Figure 1: Progression of Nepal's Outstanding Debt

The accumulation of domestic debt (DD), foreign debt (FD) and total debt (TD) has increased over the period of this study. Obviously the stock of foreign debt exceeds the stock of domestic debt.

Debt-to-GDP Ratio

The ratio of a country's government debt-to-GDP indicates a country's ability to pay back its debt. The ratio of domestic debt to GDP (DD-to-GDP), foreign debt to GDP (FD-to-GDP) and total debt to GDP (TD-to-GDP) is given in Table 1.

Table 1: Public Debt-to-GDP in Ratio in Nepal

Year	DD-to-GDP	FD-to-GDP	TD-to-GDP	Year	DD-to-GDP	FD-to-GDP	TD-to-GDP
1975	3.61	2.08	5.69	1995	14.63	51.56	66.18
1976	4.24	2.74	6.98	1996	13.76	51.44	65.20
1977	5.83	3.64	9.48	1997	12.79	47.09	59.88
1978	6.18	4.93	11.11	1998	12.77	53.59	66.35
1979	6.26	5.95	12.20	1999	14.52	49.55	64.07
1980	6.41	7.74	14.15	2000	14.32	50.25	64.57
1981	5.27	8.98	14.24	2001	13.60	45.39	58.99
1982	6.11	10.25	16.37	2002	16.02	47.91	63.94
1983	8.49	13.95	22.44	2003	17.20	45.39	62.59
1984	11.04	16.09	27.13	2004	16.05	43.37	59.42
1985	12.95	19.75	32.70	2005	14.86	37.26	52.12
1986	12.90	18.53	31.44	2006	14.48	35.77	50.25
1987	14.09	23.76	37.84	2007	14.26	29.76	44.02
1988	15.13	27.08	42.21	2008	14.23	30.65	44.87
1989	14.44	32.73	47.17	2009	12.72	28.03	40.75
1990	14.19	35.59	49.77	2010	12.41	21.48	33.90
1991	17.33	49.44	66.76	2011	13.48	18.99	32.46
1992	15.54	47.44	62.99	2012	14.01	20.25	34.26
1993	14.85	50.98	65.83	2013	13.00	19.67	32.67
1994	15.37	51.17	66.54	2014	10.65	17.86	28.51
1995	14.63	51.56	66.18				

Source: Author's computation from the data available in the publications of Nepal Rastra Bank (the Central bank of Nepal), and Ministry of Finance, Government of Nepal.

The figures given in Table 1 reveal that the debt-to-GDP ratio of Nepal is in falling trend. The burden of both domestic and foreign debt as a percent of country's GDP is not alarming. There is room for the government to borrow to finance its budget deficit and enhance the productive capacity of the economy. The money borrowed if spent in expanding transportation facility, hydro or solar power generation, increasing irrigation facility, production of fertilizer for cultivation, capacity building of the labour force and so on would help increase the GDP of the country. The trends of domestic debt to GDP ratio (DDGDP), foreign debt to GDP ratio (FDGDP), and total debt to GDP ratio (TDGDP) is shown in Figure 2.
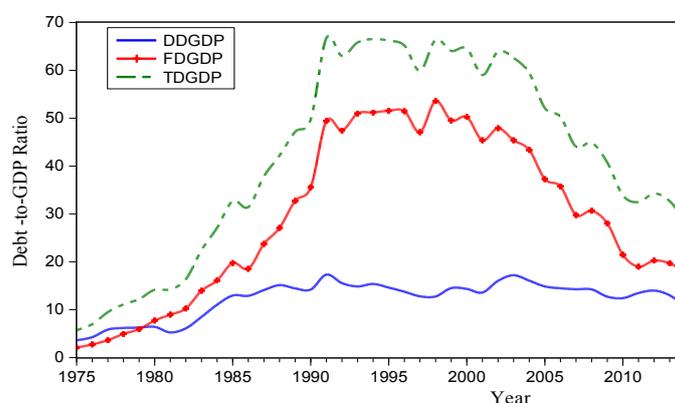

Figure 2: Trends of Nepal's Debt-to-GDP Ratio

Figure 2 shows a clear inverse U-shapes of the foreign debt-to-GDP ratio (FDGDP) and total debt-to-GDP ratio (TDGDP).This raises question on the fiscal policy move: Has there been considerable rise in tax revenue and the government of Nepal reduced the dependence on debt to finance its budget deficit? Or has the government been unable to spend its proposed budgetary amount, and thereby reduced the revenue-expenditure gap and slashed the dependence on public debt from both domestic and foreign sources?

Unit Root Test Result

The augmented Dickey-Fuller unit root test result (given in Annex–I) indicate that none of the four variables of the model *viz* per worker GDP(lnY), per worker gross fixed capital formation (lnGFCF), government's total stock of debt (lnTD), and education-centric human capital per worker(lnH) are integrated of order two; lnY, lnTD and lnH are integrated of order one(I~1) and lnGFCF is integrated of order zero(I~0),that is, lnGFCF has stationary property in level and other variables of the model are stationary in their first difference. Thus we can apply the ARDL approach to cointegration.

Cointegration Test Result

The result of the ARDL approach to cointegration on the effect gross fixed capital formation per capita (lnGFCF), total debt (TD) and education-centric human capital per worker (lnH) on per worker real GDP (lnY) is given in Table 2. Test includes intercept (C) in the set of fixed regressors; lag order of the ARDL model is set to two. The adjusted sample period is 1977-2014.

Table 2 : Government Debt, Human Capital and GDP : ARDL Bounds Test for Cointegration
Model : lnY = f (lnGFCF, lnD,lnH, C)
ARDL(1,0,0,1) Selected Based on Schwarz Bayesian Criterion

Computed F	95 %		90 %	
	Lower bound	Upper bound	Lower bound	Upper bound
5.0922	3.5601	4.8365	2.9234	4.0364

Source: Output of Microfit 5, estimated by the author.

The calculated F-statistic of size 5.0922 is greater than the upper bound critical value at 95 percent confidence level (5.0922 > 4.8363). Therefore we cannot accept the null hypothesis of no cointegration; we accept the alternative hypothesis that there is a long run cointegrating relationship of the dependent variable real GDP per worker (lnY) with the set of main regressors entered in the estimation. The complete result of the first stage of the ARDL approach to cointegration is provided in Annex-II. From Annex–II it is obvious that GDP per worker (lnY) and education capital per worker (lnH) enter in the estimation with one lag when the lag selection is on the basis of the Schwarz Bayesian Criterion (SBC).

Long-run Coefficients

As the first stage F-test indicated the existence of cointegration, in the first step of the second stage of the ARDL approach we estimated the long run coefficients which are given in Table 3.

Table 3 : Estimated Long Run Coefficients Using the ARDL Approach
ARDL(1,0,0,1) Selected Based on Schwarz Bayesian Criterion

Regressor	Coefficient	Standard Error	t-ratio[Prob.]
1nGFCF	.5595	.1251	4.4759[.000]
lnTD	.2265	.0797	2.8410[.008]
lnH	.1778	.0592	3.0052[.005]
Intercept	4.1322	.6411	6.4459[.000]

Source: Output of Microfit 5 estimated by the researcher.

The result indicates positive impact of gross fixed capital formation (lnGFCF), total debt (lnTD), and education (lnH) on the real GDP per worker (lnY) since the positive coefficients of the explanatory variables are statistically significant at the conventional level of significance. The coefficient size of lnGFCF is 0.5595 which would mean that the increase in GFCF by one percentage point would on the average add to GDP per worker by about 0.56 percentage points. The statistically significant coefficient of government's total stock of debt per worker (lnTD) is of the size of .2265 which would indicate that a one percentage point increase in debt assist real GDP per capita to grow by about .23 percentage point. One of the purposes of government borrowing is to finance its investment projects which should produce positive effect on GDP of Nepal. The positive and statistically significant coefficient of education-focussed human capital (lnH) is of the magnitude of .1778 which would mean that an increase in school-level enrollment per worker by one percentage point could bring increase in per worker GDP by about .18 percentage point.

The Short-run Dynamics

The result of the error correction representation of the second step of the second stage of ARDL method to cointegration is given in Table 4. Dependent variable is 'dlnY' with data of the adjusted sample period of 1977-2014.

Table 4 : Error Correction Representation for the Selected ARDL Model ARDL(1,0,0,1) Selected Based on Schwarz Bayesian Criterion

Regressor	Coefficient	Standard Error	t-ratio[Prob.]
dlnGFCF	.1212	.0504	2.4035[.022]
dlnTD	.0491	.0144	3.4001[.002]
dlnH	.1677	.0486	3.4504[.002]
ECM(-1)	-.2166	.0525	4.1291[.000]

dlnY= lnY-lnY(-1);dlnGFCF = lnGFCF-lnGFCF(-1); lndTD = lnTD-lnTD(-1); dlnH = lnH-lnH(-1)

 ECM = lnY-.55952lnGFCF-.22652lnTD -.17781lnH-4.1322

 R^2=.49334; $\overline{R}^2$=.41417; F-Stat.(4,33) = 7.7896[.000]; DW=1.8139

Source: Output of Microfit 5 estimated by the author.

The negative and statistically significant coefficient of the one period lagged error correction term 'ECM_{t-1}' provides further support to the existence of cointegration of the dependent variable 'real GDP per worker ' with its regressors included in the estimates. The size of ECM_{t-1} is -0.2166 which suggests that about 22 percent of the disequilibrium caused by previous period's shocks in the system converges back to the

long-run equilibrium. The positive and statistically significant short run coefficients related to gross fixed capital formation (dlnGFCF), total debt (dlnTD), and education-centric human capital (dlnH) indicate their respective importance in affecting the real GDP per worker. This suggests that the short run dynamic effect of the selected regressors on GDP per worker is positive.

The fit of the short-run model is good as indicated by the fairly significant F-statistic [F.(4, 33) = 7.7896[.000] and the model explains about 41.42 percent of the variation (indicated by R-Bar-Squared] in the dependent variable 'dlnY' (change in real GDP per worker).

Thus our empirical result on the effect of government debt on the GDP of Nepal stand in sharp contrast to the empirical findings of several previous studies which have reported a negative association between government debt and economic growth. To support the positive effect of total debt to GDP we base on the Keynesian proposition. The Keynesian thesis is that easy fiscal policy characterised by rising budget deficit and public debt increases aggregate demand and output in the short-run through budgetary multiplier (Haavelmo, 1945; Baumol & Maurice, 1955). In addition debt may also lead to public investments (for example, infrastructural developments like roads, hydropower generation, implementation of irrigation projects, etc.) which may enlarge the capacity to supply aggregate output. In least developed country like Nepal the involvement of government in infrastructural capital building is significant. Government every year makes investment in gross capital formation. The data on Nepal's foreign loan disbursement reveal that foreign loan is used in the agriculture, transportation and health as well as education sectors among others. These types of spending definitely help in bringing rise in the level of GDP of the country. There is no doubt that in Nepal government debt is used at least partly to finance productive public capital and an increase in debt would have positive effects up to a certain threshold and beyond then only it would produce negative effect.

Diagnostic Test

The reliability of the estimated ARDL model [lnY= f (lnGFCF, lnTD, lnH, C)] is further investigated through its diagnostic test of serial correlation, functional form, normality and heteroscedasticity of residual variances. The results are given in Table 5. The result contains both the Lagrangian multiplier (LM) and F-test versions of the statistic as automated in Microfit 5.

Table 5 : Model: lnY = f (lnGFCF, lnTD, lnH,C); Sample:1977-2014
ARDL (1, 0, 0, 1) Selected Based on Schwarz Bayesian Criterion

Test Statistics	LM Version	F Version
A: Serial Correlation	$\chi^2_{(1)}$ = .16921[.681]	$F(1,31)$ = .13865[.712]
B: Functional Form	$\chi^2_{(1)}$ = .63377[.426]	$F(1,31)$ = .52579[.474]
C: Normality	$\chi^2_{(2)}$ = .29900[.861]	Not applicable
D: Heteroscedasticity	$\chi^2_{(1)}$ = .18796[.665]	$F(1,36)$ = .17895[.675]

Note: A: Lagrange multiplier test of residual serial correlation
　　　 B: Ramsey's RESET test using the square of the fitted values
　　　 C: Based on a test of skewness and kurtosis of residuals
　　　 D: Based on the regression of squared residuals on squared fitted values
Source: Output of Microfit 5 estimated by the author.

The ARDL model fairly passes all diagnostic tests required for a good regression model. This is indicated by the probability values corresponding to each of the test statistics given within the square brackets which are all more than 0.05. We further examined the stability of the ARDL cointegration space of the model [lnY = f (lnGFCF, lnTD, lnH, C)] by plotting the cumulative sum of recursive residuals (CUSUM) and the CUSUM of squares (CUSUMSQ) which are given in Figure 3.
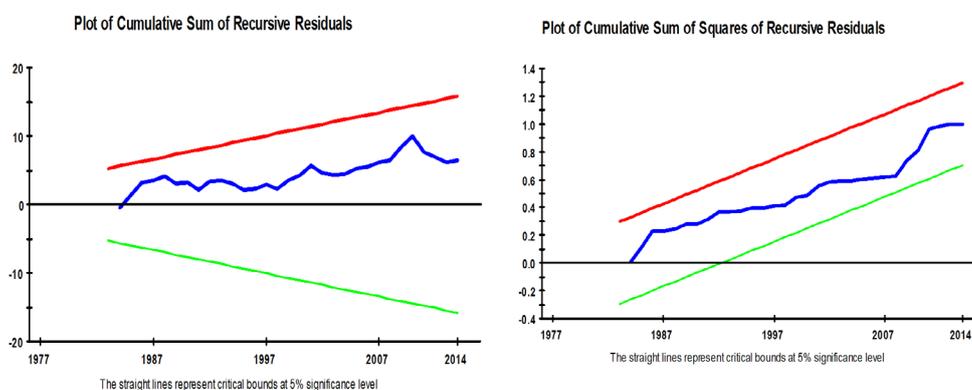

Figure 3: CUSUM and CUSUMSQ Plots

In the plots CUSUM and CUSUMSQ curves lie within the 5 percent critical bound providing evidence that the parameters of the model do not suffer from any structural instability over the period of the study and the ARDL model is not misspecified.

CONCLUSION

This paper investigated the impact of government debt stock on the level of GDP per worker of Nepal using data of the period 1975-2014 by incorporating gross fixed capital formation (GFCF) and a measure of education-centric human capital in a Cobb-Douglas production function framework applying the ARDL approach to cointegration. The result shows that the outstanding total stock of Nepal Government's debt has no growth retarding effect; debt has positive effect on the level of per worker GDP. We rely on Keynesian proposition on the positive effect of public debt on Nepal's GDP. However this result is to be taken as indicative rather than definitive. In the face of continuously falling debt-to-GDP ratio (see Table 1 and Figure 2) the tentative suggestion of this result is that public debt in Nepal is not detrimental to the per worker GDP of the country.

The declining total-debt-to-GDP ratio arising from the falling domestic debt-to-GDP ratio and falling foreign debt-to-GDP ratio is not an alarming signal for the economy. So we conclude by saying that borrowing would be a healthy option for the government to finance its development projects to boost economic growth until the government is able to service both the domestic and foreign debt in time. Future studies should separately consider the impact of domestic debt and foreign debt on the GDP of country and attempt to approximate the optimum debt-to-GDP ratio. One more conclusion of our study is that education-centric human capital has growth accelerating effect and hence expansion of school level education should be a top priority agenda in public policy in Nepal.

Annexes

Annex I: Augmented Dickey-Fuller Unit Root Test

(i) Per Worker GDP

Null Hypothesis: lnY has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.673417	0.7435
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Dependent Variable: d(lnY)

Method: Least Squares

Sample (adjusted): 1977 2014

Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
lnY(-1)	-0.096124	0.057442	-1.673417	0.1034
d(lnY(-1))	0.413449	0.148353	2.786932	0.0086
C	0.781648	0.428127	1.825739	0.0767
@TREND("1975")	0.010097	0.006102	1.654803	0.1072
R-squared	0.216251	Mean dependent var		0.102273
Adjusted R-squared	0.147096	S.D. dependent var		0.045402
S.E. of regression	0.041930	Akaike info criterion		-3.406322
Sum squared resid	0.059777	Schwarz criterion		-3.233945
Log likelihood	68.72013	Hannan-Quinn criter.		-3.344992
F-statistic	3.127071	Durbin-Watson stat		2.200487
Prob(F-statistic)	0.038385			

In First Difference

Null Hypothesis: d(lnY) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.230050	0.0019
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Dependent Variable: d(lnY,2)

Method: Least Squares

Sample (adjusted): 1977 2014

Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
d(lnY(-1))	-0.625267	0.147816	-4.230050	0.0002
C	0.064859	0.016282	3.983401	0.0003
R-squared	0.332014	Mean dependent var		0.002431
Adjusted R-squared	0.313459	S.D. dependent var		0.051171
S.E. of regression	0.042399	Akaike info criterion		-3.432184

Sum squared resid	0.064717	Schwarz criterion	-3.345995
Log likelihood	67.21150	Hannan-Quinn criter.	-3.401519
F-statistic	17.89332	Durbin-Watson stat	2.148773
Prob(F-statistic)	0.000153		

(ii) Per Worker Gross Fixed Capital Formation

Null Hypothesis: lnGFCF has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.095572	0.0010
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

*MacKinnon (1996) one-sided p-values.

Dependent Variable: d(lnGFCF)

Method: Least Squares

Sample (adjusted): 1976 2014

Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
lnGFCF(-1)	-0.839753	0.164801	-5.095572	0.0000
C	4.916805	0.952700	5.160916	0.0000
@TREND("1975")	0.090792	0.018668	4.863470	0.0000
R-squared	0.419050	Mean dependent var		0.114965
Adjusted R-squared	0.386775	S.D. dependent var		0.516236
S.E. of regression	0.404257	Akaike info criterion		1.100273
Sum squared resid	5.883265	Schwarz criterion		1.228240
Log likelihood	-18.45533	Hannan-Quinn criter.		1.146187
F-statistic	12.98374	Durbin-Watson stat		2.047585
Prob(F-statistic)	0.000057			

In First Difference

Null Hypothesis: d(lnGFCF) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-10.55350	0.0000

Test critical values:	1% level		-3.615588	
	5% level		-2.941145	
	10% level		-2.609066	

*MacKinnon (1996) one-sided p-values.
Dependent Variable: d(lnGFCF,2)
Method: Least Squares
Sample (adjusted): 1977 2014
Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
d(lnGFCF(-1))	-1.511488	0.143221	-10.55350	0.0000
C	0.174256	0.075696	2.302062	0.0272
R-squared	0.755728	Mean dependent var		0.002539
Adjusted R-squared	0.748942	S.D. dependent var		0.909500
S.E. of regression	0.455711	Akaike info criterion		1.317279
Sum squared resid	7.476204	Schwarz criterion		1.403468
Log likelihood	-23.02831	Hannan-Quinn criter.		1.347945
F-statistic	111.3764	Durbin-Watson stat		2.314826
Prob(F-statistic)	0.000000			

(iii) Total Stock of Debt per Worker

Null Hypothesis: lnTD has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-0.392140	0.9844
Test critical values:	1% level		-4.211868	
	5% level		-3.529758	
	10% level		-3.196411	

*MacKinnon (1996) one-sided p-values.
Dependent Variable: d(lnTD)
Method: Least Squares
Sample (adjusted): 1976 2014
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
lnTD(-1)	-0.009064	0.023114	-0.392140	0.6973
C	0.348627	0.133305	2.615254	0.0129
@TREND("1975")	-0.006478	0.003574	-1.812610	0.0782
R-squared	0.540204	Mean dependent var		0.141521

Adjusted R-squared	0.514660	S.D. dependent var	0.121191
S.E. of regression	0.084430	Akaike info criterion	-2.031994
Sum squared resid	0.256621	Schwarz criterion	-1.904028
Log likelihood	42.62389	Hannan-Quinn criter.	-1.986081
F-statistic	21.14783	Durbin-Watson stat	1.595715
Prob(F-statistic)	0.000001		

In First Difference

Null Hypothesis: d(lnTD) has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.919168	0.0016
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Dependent Variable: d(lnTD,2)

Method: Least Squares

Sample (adjusted): 1977 2014

Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
d(lnTD(-1))	-0.809195	0.164498	-4.919168	0.0000
C	0.246654	0.057714	4.273759	0.0001
@TREND("1975")	-0.006594	0.001773	-3.719268	0.0007
R-squared	0.409503	Mean dependent var		-0.006516
Adjusted R-squared	0.375760	S.D. dependent var		0.105645
S.E. of regression	0.083469	Akaike info criterion		-2.053035
Sum squared resid	0.243845	Schwarz criterion		-1.923752
Log likelihood	42.00766	Hannan-Quinn criter.		-2.007037
F-statistic	12.13603	Durbin-Watson stat		2.065217
Prob(F-statistic)	0.000099			

(iv) Education-Centric Human Capital per Worker

Null Hypothesis: lnH has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*

			t-Statistic	Prob.
Augmented Dickey-Fuller test statistic			-1.523960	0.8040
Test critical values:	1% level		-4.211868	
	5% level		-3.529758	
	10% level		-3.196411	

*MacKinnon (1996) one-sided p-values.

Dependent Variable: d(lnH)

Method: Least Squares

Sample (adjusted): 1976 2014

Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
lnH(-1)	-0.153319	0.100606	-1.523960	0.1363
C	-0.698075	0.485636	-1.437446	0.1592
@TREND("1975")	0.014384	0.008587	1.675116	0.1026
R-squared	0.074461	Mean dependent var		0.097589
Adjusted R-squared	0.023042	S.D. dependent var		0.364038
S.E. of regression	0.359820	Akaike info criterion		0.867376
Sum squared resid	4.660928	Schwarz criterion		0.995342
Log likelihood	-13.91383	Hannan-Quinn criter.		0.913289
F-statistic	1.448126	Durbin-Watson stat		1.895153
Prob(F-statistic)	0.248374			

In First Difference

Null Hypothesis: d(lnH) has a unit root

Exogenous: None

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-5.800839	0.0000
Test critical values:	1% level		-2.627238	
	5% level		-1.949856	
	10% level		-1.611469	

*MacKinnon (1996) one-sided p-values.

Dependent Variable: d(lnH,2)

Method: Least Squares

Sample (adjusted): 1977 2014

Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
d(lnH(-1))	-0.952136	0.164138	-5.800839	0.0000
R-squared	0.476275	Mean dependent var		-0.002738

Adjusted R-squared	0.476275	S.D. dependent var	0.527368
S.E. of regression	0.381650	Akaike info criterion	0.937339
Sum squared resid	5.389304	Schwarz criterion	0.980433
Log likelihood	-16.80944	Hannan-Quinn criter.	0.952671
Durbin-Watson stat	2.002737		

Source: Output of Eviews 8.

Annex II

First Step Test Result of the ARDL Approach to Cointegration

Model: $lnY=f(lnGFCF, lnTD, lnH,C)$; Sample:1977-2014
ARDL(1,0,0,1) Selected Based on Schwarz Bayesian Criterion

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
lnY(-1)	.78341	.052456	14.9347[.000]
lnGFCF	.12119	.050422	2.4035[.022]
lnTD	.049063	.014430	3.4001[.002]
lnH	.16766	.048592	3.4504[.002]
lnH(-1)	-.12915	.049558	-2.6060[.014]
Intercept	.89500	.16127	5.5498[.000]

R-Squared=.99925; R-Bar-Squared =.99914; S.E. of Regression=.034751;F-Stat. $F_{(5, 32)}$ = 8566.0 [.000]; Mean of Dependent Variable = 9.7528 ; S.D.of Dependent Variable = 1.1828 ; Residual Sum of Squares = .038643 ; Equation Log-likelihood = 77.0087; Akaike Info. Criterion=71.0087 ; Schwarz Bayesian Criterion=66.0960;DW-statistic = 1.8139;   Durbin's h-statistic= .60604[.544]

Testing for existence of a level relationship among the variables in the ARDL model				
	95 %		90 %	
Computed F	Lower bound	Upper bound	Lower bound	Upper bound
5.0922	3.5601	4.8365	2.9234	4.0364

Source: Output of Microfit 5, estimated by the author.

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