DOES HIGHER EDUCATION AFFECT TOTAL FACTOR PRODUCTIVITY IN NEPAL? AN EXPLORATION THROUGH THE LENS OF ARDL BOUNDS TEST

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Abstract

Education-centered human capital is one of the variables extensively used to model growth equations with the resurgence of growth theories in the 1980s primarily with the publication of Romer's 1986 and Lucas' 1988 seminal papers. Education contributes growth through its direct benefits to the individual and positive externality to the society. Theory claims that education enhances economic growth by working as an input of production and by being an agent of technological innovation, dissemination, and imitation. Previous empirical evidence on the effect of education on growth is mixed. This paper empirically examines the effect of higher education on total factor productivity in the aggregate level of the economy of Nepal employing time series data of the period 1975-2011 applying the ARDL method of cointegration. The findings are not encouraging on the issue.

Key words: *higher education, total factor productivity series, ARDL bounds test, Nepal*

1. BACKGROUND

Growth theories have pointed out that education-centered human capital affects economic growth of an economy by (a) functioning as an input in the production process (Uzawa, 1965; Lucas, 1988; Mankiw, Romer & Weil, 1992) and (b) by being an agent of technological innovation, diffusion and catch-up processes (Nelson & Phelps, 1966; Romer, 1986, 1990; Aghion & Howitt, 1998). However, empirical studies based on cross-country data have produced both positive and negative effect of education-centered human capital on growth of nations. In particular empirical results linking human capital and economic growth vary with respect to statistical significance (significant or not), magnitude (small or large) and sign (positive or negative) of the estimated parameter. The tendency seems to be that the statistical relationship between growth and human capital weakens and the parameter sign alters over time, an effect that is mainly attributed to the advancement of statistical methods. Another conclusion is that, to the extent human capital is significant, marginal returns to human capital are high for countries where it is scarce, although the issue of causality remains unresolved.

Another likely explanation as to why education fails to show its importance is provided by Jones (1996) who argues that it is not the percentage change in educational

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attainment that counts, that is, the way education normally enters the regression, but rather the change in levels. This is in line with the original work of Mincer (1974). In other words, an increase in educational attainment from five to six years should not be expressed in terms of a 20-per cent, but rather as a one-year, increase. On the negative side, Miller and Upadhyay (2000; 2002) do not find evidence in support of human capital (education). When they add an interaction term between trade and human capital, mainly to account for threshold effects, human capital exerts a negative effect on total factor productivity growth. They then investigate whether the effect of human capital differs across levels of economic development. At low-income levels, human capital is negatively associated with TFP growth, while for middle- and high-income countries the effect is positive. This advises against treating all countries across economic development in the same way, in particular, in terms of policy prescriptions. In a cross-country panel data set of 19 OECD countries the study of Vandenbussche, Aghion and Meghir (2006) found that higher education is more important in developed countries.

As there exists lack of consensus in empirical findings on the effect of education on growth and hence on total factor productivity (TFP) and majority of the previous studies are cross-country type and there is shortage of country specific studies, the present paper investigates the impact of higher education along with other control variables to ascertain their potential effect on the total factor productivity (TFP) of Nepal employing time series data of the period 1975-2011. Following the tradition of literature quantity of higher education is measured by enrollment per capita in higher education. Applying the ARDL method of cointegration, we test the presence or absence of cointegration of log of total factor productivity (lnTFP) with measures of higher education along with export trade and activities of financial intermediaries.

Rest of the paper is structured as: section II discuses methodology and data, section III presents analysis and comparison on empirical results and section IV offers concluding observation.

2. METHODOLOGY

In this section we mainly focus on the measurement of total factor productivity (TFP), autoregressive distributive lag (ARDL) approach of cointegration and data used in the study.

2.1. Measurement of Total Factor Productivity

Total factor productivity (TFP) also known as Solow residual (SR) is the part of output growth not explained by growth in traditional inputs like capital accumulation, labour or land. It measures a combination of changes in efficiency in the use of inputs and changes in technology. Solow (1957) proposed a residual component in growth accounting method as a measure of the contribution of productivity change to economic growth. In empirical works there are different methods applied to estimate TFP (Isaksson, 2008, 2009; Del Gatto, Di Liberto & Petraglia, 2011). In the present study we apply the method of approximating TFP as residuals from regression estimate of a production function. The regression residual method of estimating TFP is used in empirical works by several researchers (Thomas &Wang, 1993; Coe, Helpman & Hoffmaister, 1997; Miller & Upadhyay, 2000; Senhadji, 2000; Khatiwada & Sharma, 2002; Vandenbussche, Aghion & Meghir, 2006, including others). Measurement of TFP, implicitly or explicitly, at the economy wide level starts from the concept of an aggregate production function. The use of production function is almost indispensable when measuring TFP and it is justified as a means to organize data in a way that makes economic sense, as well as a framework for interpreting empirical results (Isaksson, 2009).We assume that output (Y) can be properly estimated by a two factors, capital stock (K) and labour force (L), linearly homogenous Cobb-Douglas aggregate production function with Hicks neutral technological progress. The aggregate production function in the neoclassical Solow-Swan tradition is of the form

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha} \qquad (1)$$

where Y_t is real GDP in the date t, A is the efficiency index, a measure of TFP (the Solow residual), K_t is the aggregate stock of capital in the date t, and L_t is the aggregate labour force in the date t where the exponent $\alpha, (0 < \alpha < 1)$, is the share of capital in output/income. The exponents of capital (α) and labor ($1-\alpha$) in the production function are set to add up to unity in agreement with the constant returns to scale (CRS) paradigm. This production function is often used to estimate the total production possibilities of the economy because it has many properties that are well-situated to work with, such as perfect competition, constant returns to scale (CRS), and constant factor income shares. The residual from the estimated Cobb-Douglas production function of equation (1) is considered to be total factor productivity (TFP). We have not included any measure of the education-centered human capital variable in the production function to estimate TFP because empirical results have shown both positive and negative effect of the education variable in growth regressions.

The geometric index version of TFP is calculated by dividing both sides of the production function given in equation (1) by $K^{\alpha} L^{1-\alpha}$ (Lipsey & Carlaw, 2001, 2004):

$$TFP_t \text{ or } A_t = \frac{Y_t}{K_t^{\alpha} \times L_t^{1-\alpha}} \qquad (2)$$

Taking natural logarithm on both sides of equation (2) we can express the TFP equation in logarithmic form as:

$$\ln TFP_t = \ln Y_t - \alpha \ln K_t - (1-\alpha) \ln L_t \qquad (3)$$

On the other hand, the arithmetic index of TFP is given by the expression (Nadiri, 1970; Thirlwall & Kennedy, 1972):

$$TFP_t \text{ or } A_t = \frac{Y_t}{\alpha K_t + \beta L_t} \qquad (4)$$

where Y is an index of output; K is an index of capital input; L is an index of labour input; α is labour's share of output, and β is capital's share of output (with α+β=1).

The determination of TFP requires the determination of labour's share and share of capital in output. Since no time series data on real capital stock and rental price for their use as well as actual employment status of labour force and wage for them are available in Nepal, the measurement of TFP from a macroeconomic perspective is highly restricted. Using per worker form of the production function given in equation (1) we first estimate the share of capital 'α' with time series data on actual output per worker and actual capital stock per worker for the period 1975-2011 by the ordinary least square (OLS) method. This estimate gives capital's share 'α' from which we calculate labour's share roughly as '1-α' by subtracting capital's share from one as capital's share plus labour's share equals one under the assumption of constant returns to scale and other features appended to the Cobb-Douglas production function given in equation (1). Then TFP (=A) is calculated by plugging in the share of capital 'α' and share of labour '1-α' in the actual size of the labour force/employment (L), real capital stock (K) and real GDP either in equation (2) or (3) as geometric index and in equation (4) as arithmetic index. In the absence of data on the actual employment of the labour force the size of the labour force in this study is proxied by the adult population of age group 15-64 years.

The OLS estimate of per worker production function related to equation (1) using the time series data of the period 1975-2011 produced the share of capital (α) to be 0.66 from which labour's share (1-α) is obtained to be 0.34(=1-0.66).Then we inserted these values in equation (1) along with the actual values of $\ln Y_t$, $\ln K_t$ and $\ln L_t$ to obtain the series on TFP. In the context of Nepal such a regression residual method was applied by Khatiwada and Sharma (2002) and Bhandari (2010) to compute the TFP series.

2.2. Econometric Approach

2.2.1. Unit Root Test

The ARDL bounds test approach of cointegration is based on the assumption that the variables are I (0) or I (1).However 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. For this reason, the implementation of unit root tests in the ARDL method is still necessary in order to ensure that none of the variables is integrated of order 2 or beyond (Ouattara, 2004, p.9) and to avoid spurious results.

Even though there are different methods of testing for unit root of time series variables, we apply the augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1981) which is an extended version of the Dickey-Fuller (DF) test (Dickey & Fuller, 1979) .The ADF test allows for more lags for a larger and more complicated set of time series models in which the error terms are correlated. The ADF test is conducted by "augmenting" Dickey-Fuller's (1979) equations by adding the lagged change-terms of the endogenous variable.The lags of the difference terms of the dependent variable is believed to 'soak up'(clean up) any dynamic structure (serial correlation) present in the dependent variable to make sure that the error term is not autocorrelated (Brooks & Tsolacos,2010,p.380). The general equation for the ADF test is

$$\Delta Y_t = \alpha + \beta t + \gamma Y_{t-1} + \delta_1 \Delta Y_{t-1} + ... + \delta_p \Delta Y_{t-p} + \varepsilon_t \qquad (5)$$

where Y is a time series variable, α is a constant, β the coefficient on a time trend (t), p the lag order of the autoregressive process and ε_t is a pure white noise error term.

The ADF test for a unit root tests the null hypothesis $H_0 : \gamma = 0$ (series contains a unit root) against the one-sided alternative $H_1 : \gamma < 0$ (series is stationary). If the computed Dickey-Fuller statistic is more negative than the test critical (theoretical) values, the hull hypothesis is rejected. When the constraint α=0 and β=0 are imposed in the equation it relates to modelling a random walk and using the constraint β=0 relates to modelling a random walk with a drift. Thus there are three main versions of the test of unit root of a time series: a random walk, a random walk with drift and a random walk with drift around a stochastic trend.

By including the lags of the order p the ADF formulation allows for higher-order autoregressive processes. A major task is applying the ADF test is the determination of the lag length p One of the approaches is to apply information criteria such as the Akaike information criteria (AIC), Bayesian information criteria (BIC) or the Hannan-Quinn information criterion (HQC).In the present analysis the lag length of the variables for unit root test is selected on the basis of the Swartz Bayesian criterion (SBC) automated in the Econometric Software Eviews 7. The inclusion of intercept(C) or time trend (t) in the variable is decided after observing the visual plot of each of the variables: if the variable does not pass through the origin and possesses positive or negative intercept and also has an upward or downward trend over time we added both the intercept and trend in the estimates but if it does not exhibit a trend we included the intercept term only.

2.2.2. Cointegration: ARDL Bounds Test

We employ the bounds testing approach to cointegration within an autoregressive distributed lag (ARDL) framework innovated 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. In recent years the ARDL approach of testing for the existence of a long-run relationship among the variables has been established as a major workhorse in dynamic single-equation regressions. As detailed in Pesaran, Shin and Smith (2001) the basic statistics underlying the ARDL method is the familiar F-statistic in a generalized Dickey-Fuller(1979,1981) type regression used to test the significance of lagged levels of the variables under consideration in a conditional unrestricted equilibrium correction model(UECM). Because dynamic effects necessarily occur over time, the econometric model used to estimate dymanic causal effects needs to incorporate time 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 other bi-variate and multivariate cointegration procedures. Firstly, 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. The potency of the ARDL approach is that it can be applied to studies that have a small sample size as in our present study. The second advantage of the ARDL cointegration technique is that it can distinguish dependent and explanatory variables and allow tests for the existence of relationships between variables in levels irrespective of whether the time series being considered are integrated of order one, I(1), and/or order zero, I(0) or mutually cointegrated. Obviously as the ARDL approach does not depend on pre-testing the order of integration of the variables, it reduces the uncertainty associated with pre-testing the order of integration. Thirdly, a dynamic error-correction model (ECM) through linear transformation can be derived from ARDL (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). Finally, as documented in Harris and Sollis (2003) the ARDL technique generally provides unbiased estimates of the long-run model and valid t-statistics even when some of the regressors in the model are endogenous.

The ARDL procedure of cointegration involves two stages. The first stage requires the test of the existence of a long-run relationship between the variables under investigation by computing the F-statistic for testing the significance of the lagged levels of the variables in the error correction form of the underlying ARDL model. If the first stage suggests existence of cointegration among the variables, the second stage involves a 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). In the Software Microfit 4 and 5 there are automated options like the Akaike Information Criterion (AIC), the Schwartz Bayesian Criteria (SBC) or Hannan-Quinn Criterion (HQC) to choose the lag order to obtain a parsimonious model. After selecting the appropriate lag, the selected model is estimated by the ordinary least squares (OLS) technique. In the present analysis we use the Akaike Information Criterion (AIC) to choose appropriate lag length. We restrict a maximum lag length of 2 periods as our sample is small.

To test whether education has any effect on total factor productivity (TFP) in the economy of Nepal we regress TFP on a set of the measure of higher education along with other control variables. Higher education is entered in the estimates in entirety and also segregating it into general and technical higher education. The basic TFP equation is specified as:

$$\ln TFP = \lambda + \mu_1 \ln EDU_{it} + \mu_2 \ln FSD_t + \mu_3 \ln RXGDP_t + error \qquad (6)$$

where EDU_{it} is a measure of education quantity (enrollment per capita in tertiary level of education), this is the most important variable in the regression; FSD(financial sector development) is an indicator measuring the extent of loan and advancing activities of the commercial banks (the financial intermediaries); FSD is measured as loans and advances of commercial banks as a share of real GDP; RXGDP is the real export as a share of real GDP, a measure of openness to foreign trade, λ is the intercept term and $\mu_i s (i = 1,2,3)$ are long run regression coefficients to be estimated.

Following Pesaran, Shin and Smith (2001), an ARDL representation of equation (6) is specified as:

$$\Delta \ln TFP_t = \mu + \sum_{i=0}^{m} \eta_i \Delta \ln TFP_{t-i} + \sum_{i=0}^{n} \omega_i \Delta \ln EDU_{t-i} + \sum_{i=0}^{p} \phi_i \Delta \ln FSD_{t-i} + \sum_{i=0}^{q} \pi_i \Delta \ln RXGDP_{t-i}$$
$$+ \theta_1 \ln TFP_{t-1} + \theta_2 \ln EDU_{t-1} + \theta_3 \ln FSD_{t-1} + \theta_4 \ln RXGDP_{t-1} + u_t \qquad (7)$$

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

Equation (7) 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 specified in equation (7) 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 (7) the coefficients (θ_1 to θ_4) represent the long-run relationship whereas the remaining expressions with summation sign (coefficients $\eta_i, \omega_i, \phi_i, \pi_i$) represent the short-run dynamics of the model.

The financial sector variable is incorporated in the TFP equation following existing theoretical and empirical literature. It is claimed that as the financial sector of an economy develops, overall economic productivity improves through efficient reallocation of scarce resources from firms with low productivity to those with high promising growth prospects (Levine, 1997). The development of financial sector transfers the incentives of producers towards the goods with increasing returns to scale and makes inter-sectoral specialization to happen (King & Levine, 1993; Rajan & Zingales, 1998; Wurgler, 2000). Empirical evidence at the aggregate level provides support for the idea that financial development promotes productivity. For example, using cross-country aggregate data Beck, Levine and Loayza (2000) and Levine and Zervos (1998) show that financial development has positive and significant effects on total factor productivity (TFP) because better functioning financial intermediaries improve resource allocation and accelerate TFP growth with positive repercussions for long-run economic growth. Benhabib and Spiegel (2000) divide the relationship between financial development and growth to examine whether financial development affects growth totally through its contribution to factor accumulations or whether it also has a positive impact on TFP. Their finding is that indicators of financial development are correlated with both investment and TFP. Jeong and Townsend (2007) using transitional growth models and micro data of the period of 1976-1996 found a significant part of TFP explained by financial-deepening in Thailand. In a more recent study relating to Pakistan Shahbaz (2012) found positive effect of financial sector development on the productivity. As the effect of financial sector development on the total factor productivity in the economy of Nepal has not been empirically tested covering an extended set of data, this variable is included in the TFP regression model.

Export trade component is incorporated in the TFP equation following theoretical and empirical literature. The hypothesis is that export trade expansion enhances competition and efficiency in production and allows for technology transfer which is a powerful source for increased TFP. The export-led growth theorists in general argue that export enhances productivity growth (Bonelli, 1992; Haddad, de Melo & Horton, 1996; Weinhold & Rauch, 1999; Yean, 1997; Sjoeholm, 1999).These theorists assert that firms tend to learn advanced technologies through exports which they should implement to compete in the foreign marketplace (Balassa, 1978; Krueger, 1980; Nishimizu & Robinson, 1982). Firms also learn by doing and imitate through the trial and error processes inherent in the production and sale of export goods (Grossman & Helpman, 1991).Moreover, expansion in production resulting from exports reduces unit production prices and thus increase productivity (Helpman & Krugman, 1985). Assuming these view points as foundation we include the export trade variable as a determinant of TFP. In their investigation of the determinants of TFP Miller and Upadhyay (2000) used the ratio of export to GDP as a measure of trade openness to identify its effect on TFP.

In the ARDL method the long run estimate allows finding the relation between variables on a level framework because levels more accurately capture the long-run effects of the variables compared to the use of growth rates. Senhadji (2000) has accumulated the reasons on why growth and TFP regression equations need to be estimated in level values.

2.3. Data

The present research is based on time series data accessed from secondary sources. The data on the current price GDP and investment of Nepal are taken from '*A Handbook of Government Finance Statistics 2010 Volume III* ' published by Nepal Rastra Bank (NRB,2010), *Statistical Year Book 2011* published by Central Bureau of Statistics (CBS, 2012), and *Economic Survey of fiscal year 2011/12* published by Ministry of Finance ,Government of Nepal(2012). The GDP figures are the values at producers' price at the current market price. Total investment is the sum of gross fixed capital formation and change in stocks. Data on exports are taken also from *Economic Survey* published by the government of Nepal.

Enrollment data on higher education are extracted from Economic Surveys published by the government of Nepal. Higher education enrollment per capita is the total enrollment in higher education as a share of total work force of the age group 15-64 years.

The GDP deflator figures come from *Economic Surveys* of fiscal years 2010/11 Part II and 2011/12 published by Government of Nepal, Ministry of Finance (GoV/N, MOF). The given deflators of base year 2000/01 = 100 are rebased to 1991/92=100 at least to value the nominal figures by taking more or less midway time year. We have used the construction material price deflator to transform the current price investment series into real terms. The construction material price deflator was accessed from the Office of the Central Bureau of Statistics (CBS) of the Government of Nepal referring to Statistical Year Books, Statistical Pocket Books and National Accounts Booklets, all published by CBS.

As there are no capital stock data on a time series basis for the Nepalese economy, we approximated capital stock by applying the perpetual inventory method (PIM) first innovated by Goldsmith (1951) and later used by researchers in empirical works to estimate capital stock data from investment figures (Baffes & Shah, 1998; Hall & Jones, 1999; Caselli, 2005; Vandenbussche, Aghion & Meghir, 2006; Abu-Qarn &Abu-Bader, 2007, among others). Given the initial stock of capital and real flow of investment series, capital stock under the PIM is derived as:

$$K_t = (1-\delta)K_{t-1} + I_t \qquad (8)$$

where K_t and I_t are capital stocks and investment expenditure at time t and δ is the depreciation rate.

Drawing upon Baffes and Shah (1998), Hall and Jones (1999), Kruger (2003), and Caselli (2005) the initial period capital stock (i.e., capital stock at time t=0) for the present study is estimated as:

$$\left.\begin{aligned} K_0 &= \frac{I_0}{g_I + \delta} \\ \text{i.e,}\ K_{1975} &= \frac{I_{1975}}{g_I + \delta} \end{aligned}\right\} \quad (9)$$

where g_I is the growth rate of investment series over a specific period of time(in the present case 1975-2011) and δ is the depreciation rate. We have assumed a 6 % depreciation rate of capital following previous literature.

The expression $K_0 = \frac{I_0}{g_I + \delta}$ is the term for the capital stock in a steady state of the Solow growth model (Caselli, 2005).

In the present study growth is proxied by real GDP per work force where work force is the adult population of the age group of 15-64 years (Mankiw, Romer & Weil 1992;
(8) Papageorgiou, 2003; Vandenbussche, Aghion &Meghir, 2006).

3. EMPIRICAL RESULT

3.1. Unit Root Test Result

The results of the Dickey-Fuller unit root test of the time series under study are given in Table 1.

Table 1: Dickey-Fuller Unit Root Test Result

In Level	Computed value	Critical values
lnTFP⊗	-2.366348^{a}	-3.626784^{q};-2.945842^{r};-2.611531^{s}
lnEDUH♣	-2.264381^{a}	-4.234972^{q};-3.540328^{r};-3.202445^{s}
lnHGEN♣	-1.573950^{a}	-4.234972^{q};-3.540328^{r};-3.202445^{s}
lnHTEC♣	-1.864735^{a}	-4.234972^{q};-3.540328^{r};-3.202445^{s}
lnRXGDP⊗	$-3.121934^{n,**}$	-3.699871^{q};-2.976263^{r};-2.627420^{s}
lnFSD♣	-1.999666^{a}	-4.234972^{q};-3.540238^{r};-3.202445^{s}
In First Difference		
dlnTFP‡	-5.322197^{a}	-2.632688^{q};-1.950687^{r};-1.611059^{s}
dlnEDUH‡	$-5.435949^{a,*}$	-2.632688^{q};-1.950687^{r};-1.611059^{s}
dlnHGEN ‡	$-6.056758^{a,*}$	-2.632688^{q};-1.950687^{r};-1.611059^{s}
dlnHTEC‡	$-5.286707^{a,*}$	-2.632688^{q};-1.950687^{r};-1.611059^{s}
dlnFSD‡	$-3.659368^{a,*}$	-2.632688^{q};-1.950687^{r};-1.611059^{s}

Note:♣includes intercept and trend; ‡ includes no intercept ,no trend; ⊗ includes intercept ; [a] indicates no lag; [n] indicates 9 lags. Superscripts [q, r] and [s] respectively represent test critical values at 1%, 5% and 10 % levels of significance. [*]Significant at 1% level. [**] Significant at 5% level.

Source: Researcher's estimate in Eviews 7.

Test indicates that the variables total factor productivity (TFP), higher education(EDUH),general category of higher education(HGEN),technical higher education(HTEC) and financial intermediaries' activities indicator(FSD) are non-stationary(i.e., contain unit root) in level but stationary in first difference ,that is, they are integrated of order one, I(1). The export variable (XGDP) is stationary in level at 5 % probability level, that is, it integrated of order zero, I (0).Thus none of the variables are integrated of order two, I(2) and we can apply the ARDL bounds test.

We tested whether TFP has any cointegrating relation with higher education along with other control variables. We could not include the teacher-student-ratio (TSR) as quality measure of higher education because it is not possible to compute a time series of TSR in higher education of Nepal primarily because of the inaccessibility of data on the number of teachers working in different universities. We have estimated three variants of the model: one with overall higher education enrollment per capita (EDUH), the second with enrollment per capita in general type of higher education (HGEN), and the third enrollment per capita in technical category of higher education (HTEC).

3.2. Higher Education in Entirety and Total Factor Productivity

The result of the first stage of the ARDL method of cointegration for higher education in general (EDUH) are given in Table 2 in which dependent variable is lnTFP with 35 observations used for estimation from 1977 to 2011.Test includes intercept(C) and order of the ARDL is set to two.

Table 2: Autoregressive Distributed Lag Estimates

Model: lnTFP=f (lnRXGDP, lnFSD , lnEDUH, C)

ARDL(2,1,0,2) selected based on Akaike Information Criterion

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
lnTFP(-1)	1.0003	.11480	8.7135[.000]
lnTFP(-2)	-.28566	.10673	-2.6765[.013]
lnRXGDP	.10709	.017265	6.2024[.000]
lnRXGDP(-1)	-.095803	.018075	-5.3002[.000]
lnFSD	-.0083867	.017809	-.47093[.642]
lnEDUH	-.014489	.019800	-.73177[.471]
lnEDUH(-1)	-.031055	.023401	-1.3271[.196]
lnEDUH(-2)	.061531	.020034	3.0713[.005]
C	-.45643	.20079	-2.2732[.032]

R-Squared = .91655; R-Bar-Squared= .89087; F-Stat. F(8,26) =35.6946[.000];DW-statistic= 1.9271

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
5.3919	3.6362	4.8636	2.9686	4.0734

Source: Output of *Microfit 5* estimated by the researcher.

The first stage test result indicates the existence of a cointegrating relation of the dependent variable 'lnTFP' with its regressors because the computed F-statistic of value 5.3919 is greater than the upper bound test critical values at both 95 % (5.3919 > 4.8636) and 90 % (5.3919 > 4.0734) confidence levels. The existence of cointegration implies that the variables of the model have a tendency of moving together over the period of time. After finding that there is cointegration in the model we computed the long run coefficients of the ARDL model which are given in Table 3.

Table 3: Estimated Long Run Coefficients using the ARDL Approach

ARDL(2,1,0,2) selected based on Akaike Information Criterion

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
lnRXGDP	.039543	.048663	.81260[.424]
lnFSD	-.029392	.064607	-.45494[.653]
lnEDUH	.056028	.074578	.75126[.459]
C	-1.5996	.40084	-3.9907[.000]

Source: Output of *Microfit 5* estimated by the researcher.

The estimated long run coefficients of export (lnRXGDP) and higher education (lnEDUH) variables are positive but statistically insignificant. Similarly the negative coefficient of the financial intermediaries' variable (lnFSD) is insignificant statistically. As the coefficients of all the main regressors of the model are statistically insignificant, the model investigating the level relationship seems redundant. In spite of this result in the level relationship the result of the error correction representation of the ARDL model is given in Table 4 in which the dependent variable is dlnTFP with 35 observations used for estimation from 1977 to 2011.

Table 4: Error Correction Representation for the Selected ARDL Model

ARDL(2,1,0,2) selected based on Akaike Information Criterion

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
dlnTFP1	.28566	.10673	2.6765[.012]
dlnRXGDP	.10709	.017265	6.2024[.000]
dlnFSD	-.0083867	.017809	-.47093[.641]
dlnEDUH1	-.014489	.019800	-.73177[.470]
dlnEDUH1(-1)	-.061531	.020034	-3.0713[.005]
ECM(-1)	-.28534	.085478	-3.3381[.002]
ECM = lnTFP -.039543lnRXGDP + .029392lnFSD -.056028lnEDUH1 + 1.5996			
R-Squared = .73173; R-Bar-Squared= .64918; F-Stat. F(6,28)=11.8193[.000] ; DW-statistic= 1.9271			

Note: dlnTFP = lnTFP-lnTFP (-1); dlnTFP1 = lnTFP (-1)-lnTFP (-2); dlnRXGDP = lnRXGDP-lnRXGDP (-1); dlnFSD = lnFSD-lnFSD (-1); dlnEDUH1 = lnEDUH1-lnEDUH1 (-1); dlnEDUH1 (-1) = lnEDUH1 (-1)-lnEDUH1 (-2)

Source: Output of *Microfit 5* estimated by the researcher.

The negative and statistically significant coefficient (significant at 99 % confidence level) of the one period lagged error correction term 'ECM_{t-1}' indicates the existence of a cointegrating relationship of the dependent variable 'lnTFP' with the set of its regressors. The error correction term with the coefficient size of -.28534 indicates the rapidity of adjustment by about 28.5 % in the deviation of the dependent variable caused by disturbance in one or more of the regressors. The coefficient of one period lagged change in TFP (dlnTFP1) is positive and statistically significant implying the strong effect of past period's TFP on its current level. The short run effect of export trade (dlnRXGDP) is positive and statistically significant. This indicates the importance of export trade in enhancing TFP in the economy of Nepal even in the short run. The coefficient of higher education variable (dlnEDUH1 and dlnEDUH1 (-1)) is negative which does not sound good as education is expected to enhance productivity. Financial sector does not support TFP as indicated by the negatively insignificant coefficient of the variable 'dlnFSD'. The short run dynamic model is good as indicated by the significant F-statistic [F-Stat. F (6, 28) =11.8193[.000]] and the value of R-Squared or R-Bar-Squared.

The result of the diagnostic test of the ARDL model is given in Table 5.

Table 5: Diagnostic Test of the ARDL Model: lnTFP=f (lnRXGDP, lnFSD , lnEDUH1, C)

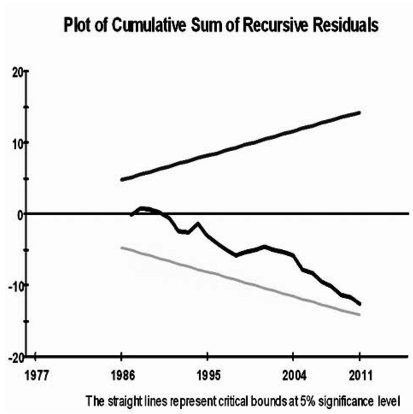
ARDL(2,1,0,2) selected based on Akaike Information Criterion

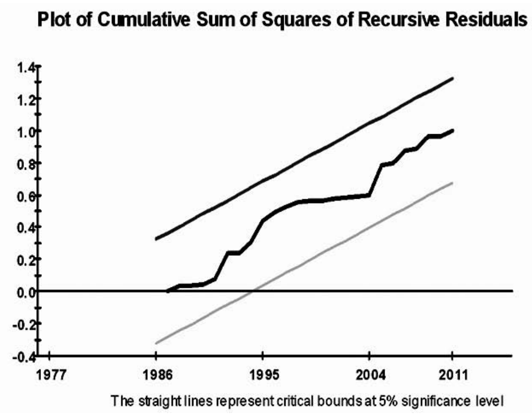
Test Statistics	LM Version	F Version
A: Serial Correlation	$\chi^2_{(1)}$ = .015202[.902]	F(1,25) = .010863[.918]
B: Functional Form	$\chi^2_{(1)}$ = 2.8761[.090]	F(1,25) = 2.2383[.147]
C: Normality	$\chi^2_{(2)}$ = .071592[.965]	Not applicable
D: Heteroscedasticity	$\chi^2_{(1)}$ = .12610[.723]	F(1,33) = .11932[.732]

Note: A: Residual Serial Correlation test; B: Functional Form (Ramsey's RESET test using the square of the fitted values); C: Normality (Based on a test of skewness and kurtosis of residuals); D: Heteroscedasticity (Based on the regression of squared residuals on squared fitted values).

Source: Output of *Microfit 5* estimated by the researcher.

The diagnostic test indicates that the model adequately passes the econometric pathology for residual serial correlation, functional form (Ramsey's RESET test), normality of residuals and heteroscedasticity. This is indicated by the *p*-value given within the square brackets. We further searched the stability of the ARDL model by plotting the cumulative sum of recursive residuals (CUSUM) and the CUSUM of squares (CUSUMSQ) as given in the figure.





The plots clearly demonstrate that both the CUSUM and CUSUMSQ curves stay within the 5 % critical bound lines. On the average we can infer that the space of the parameters of the ARDL model of cointegration is stable and the model is not misspecified.

3.3. General Category of Higher Education and Total Factor Productivity

In the general category of higher education we have included the enrollment in law, management, education, humanities and social science, arts and Sanskrit. The result of the first stage of the ARDL test of cointegration for general category of higher education is given in Table 6 in which dependent variable is lnTFP with 35 observations used for estimation from 1977 to 2011.Test includes intercept(C) and order of the ARDL is set to two.

Table 6: General Higher Education and TFP: ARDL Bounds Test

Model: lnTFP=f (lnRXGDP, lnFSD , lnHGEN, C)

ARDL(2,1,0,2) selected based on Akaike Information Criterion

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
lnTFP(-1)	.84582	.12248	6.9056[.000]
lnTFP(-2)	-.18411	.10557	-1.7439[.093]
lnRXGDP	.095991	.015580	6.1612[.000]
lnRXGDP(-1)	-.083950	.017282	-4.8578[.000]
lnFSD	-.015675	.0073689	-2.1272[.043]
lnHGEN	.0074571	.014859	.50184[.620]
lnHGEN(-1)	-.023689	.018146	-1.3055[.203]
lnHGEN(-2)	.053579	.015408	3.4773[.002]
C	-.44978	.12908	-3.4844[.002]

R-Squared = .93007; R-Bar-Squared = .90856; F-Stat. F(8,26) = 43.2268[.000]; DW-statistic = 2.1473

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
7.8249	3.6362	4.8636	2.9686	4.0734

Source: Output of *Microfit 5* estimated by the researcher.

The first stage test result is in favour of the null hypothesis that there is cointegration of the dependent variable 'lnTFP' with the set of main regressors because the computed F-statistic of value 7.8249 is greater than the upper bound test critical values at both 95 % (7.8249 > 4.8636) and 90 % (7.8249 > 4.0734) confidence levels. After finding that there is cointegration in the model we computed the long run coefficients of the ARDL model which are given in Table 7.

Table 7: Estimated Long Run Coefficients using the ARDL Approach

ARDL(2,1,0,2) selected based on Akaike Information Criterion

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
lnRXGDP	.035592	.034772	1.0236[.315]
lnFSD	-.046337	.020558	-2.2539[.033]
lnHGEN	.11040	.037478	2.9457[.007]
C	-1.3296	.18671	-7.1210[.000]

Source: Output of *Microfit 5* estimated by the researcher.

The results show that general category of higher education (lnHGEN) has a positive and statistically significant effect on the TFP whereas financial intermediaries' activity (lnFSD) has negative and statistically significant effect on TFP. The coefficient of the export trade variable 'lnRXGDP' is positive but statistically insignificant. The error correction representation of the ARDL model is given in Table 8 in which the dependent variable is 'dlnTFP' with 35 observations used for estimation from 1977 to 2011.

Table 8: Error Correction Representation for the Selected ARDL Model

ARDL(2,1,0,2) selected based on Akaike Information Criterion

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
dlnTFP1	.18411	.10557	1.7439[.092]
dlnRXGDP	.095991	.015580	6.1612[.000]
dlnFSD	-.015675	.0073689	-2.1272[.042]
dlnHGEN	.0074571	.014859	.50184[.620]
dlnHGEN1	-.053579	.015408	-3.4773[.002]
ECM(-1)	-.33829	.077881	-4.3437[.000]

ECM = lnTFP -.035592lnRXGDP + .046337lnFSD -.11040lnHGEN +1.3296

R-Squared = .77520 ; R-Bar-Squared= .70603; F-Stat. F(6,28)=14.9433[.000]; DW-statistic= 2.1473

Note: dlnTFP = lnTFP-lnTFP (-1); dlnTFP1 = lnTFP (-1)-lnTFP (-2); dlnRXGDP = lnRXGDP-lnRXGDP (-1); dlnFSD = lnFSD-lnFSD (-1); dlnHGEN = lnHGEN-lnHGEN (-1); dlnHGEN1 = lnHGEN (-1)-lnHGEN (-2)

Source: Output of *Microfit 5* estimated by the researcher.

In the error correction representation the negative and statistically significant coefficient(significant at 99 % confidence level) of the one period lagged error correction term 'ECM_{t-1}' further suggests that there is a cointegrating relationship of the dependent variable 'lnTFP' with the set of its regressors. The error correction term with the coefficient size of -0.33829 indicates the speed of adjustment by about 33.8 % towards equilibrium when the dependent variable deviates due to some shocks in one or more of the regressors. Export trade has positive and significant impact on TFP but financial intermediary's resource allocating activities has negative and statistically significant effect on TFP. The effect of general category of higher education (lnHGEN) on TFP is ambiguous as its coefficient appears with both positive and negative sign in the error correction estimation. The short run dynamic model is good as indicated by the significant F-statistic [F (6, 28) =14.9433[.000]] and the value of R-Squared or R-Bar-Squared.

In addition we investigated the strength of the ARDL model focusing on the result of the diagnostic test as given in Table 9.

Table 9: Diagnostic Test of the ARDL Model: lnTFP=f (lnRXGDP, lnFSD , lnHGEN, C)

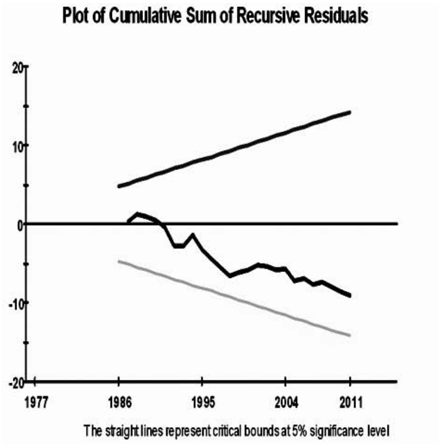
ARDL(2,1,0,2) selected based on Akaike Information Criterion

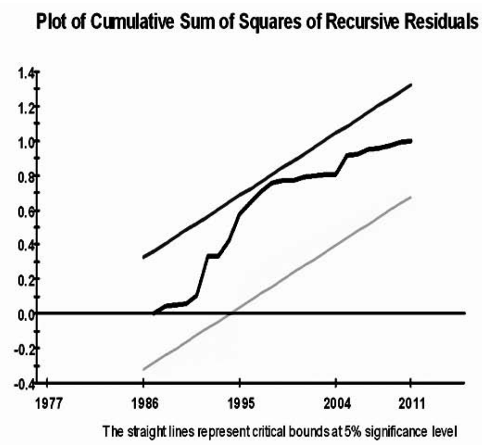
Test Statistics	LM Version	F Version
A: Serial Correlation	$\chi^2_{(1)}$ = .45510[.500]	F(1,25) = .32936[.571]
B: Functional Form	$\chi^2_{(1)}$ = 11.7835[.001]	F(1,25) = 12.6887[.002]
C: Normality	$\chi^2_{(2)}$ = .73364[.693]	Not applicable
D: Heteroscedasticity	$\chi^2_{(1)}$ = .16956[.681]	F(1,33) = .16065[.691]

Note: A: Residual Serial Correlation test; B: Functional Form (Ramsey's RESET test using the square of the fitted values); C: Normality (Based on a test of skewness and kurtosis of residuals); D: Heteroscedasticity (Based on the regression of squared residuals on squared fitted values).

*Source***:** Output of *Microfit 5* estimated by the researcher.

The diagnostic test indicates that the model adequately passes the econometric pathology for residual serial correlation, normality of residuals and heteroscedasticity but there is question on the specification of the model as indicated by the probability value of Ramsey's RESET test. We further tested the stability of the ARDL model by plotting the cumulative sum of recursive residuals (CUSUM) and the CUSUM of squares (CUSUMSQ) as given in the figure.





The plots demonstrate that the CUSUM and the CUSUMSQ curves fall within the critical bounds lines at 5 % significance level. Therefore we can infer that the space of the parameters of the ARDL model of cointegration is stable and the model is not grossly misspecified.

3.4. Technical Higher Education and Total Factor Productivity

In the technical category of higher education we have included the enrollment in engineering, agriculture and animal science, medicine, forestry, and science and technology. The result of the first stage of the ARDL method of cointegration for technical category of higher education(HTEC) is given in Table 10 in which dependent variable is lnTFP with 35 observations used for estimation from 1977 to 2011.Test includes intercept(C) and order of the ARDL is set to two.

Table 10: Technical Higher Education and TFP: ARDL Bounds Test

Model: lnTFP=f (lnRXGDP, lnFSD , lnHTEC, C)

ARDL(1,1,0,2) selected based on Akaike Information Criterion

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
lnTFP(-1)	.70404	.081792	8.6077[.000]
lnRXGDP	.11180	.015855	7.0514[.000]
lnRXGDP(-1)	-.072287	.018450	-3.9180[.001]
lnFSD	-.034593	.011323	-3.0551[.005]
lnHTEC	.010068	.032224	.31243[.757]
lnHTEC(-1)	-.026597	.036265	-.73340[.470]
lnHTEC(-2)	.11002	.030395	3.6198[.001]
C	.12770	.23270	.54878[.588]

R-Squared = .92368 ; R-Bar-Squared = .90389; F-Stat. F(7, 27) = 46.6809[.000]; 1.7991; Durbin's h-statistic = .67901[.497]

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
8.3608	3.6362	4.8636	2.9686	4.0734

Source: Output of *Microfit 5* estimated by the researcher.

The first stage test result suggests the existence of a cointegrating relation of the dependent variable 'lnTFP' with the set of its regressors because the computed F-statistic of value 8.3608 is greater than the upper bound test critical values at both 95 % (8.3608 > 4.8636) and 90 % (8.3608 > 4.0734) confidence levels. The existence of cointegration implies that the variables of the model have a tendency of comovement over the period of time. We see that the technical education variable enters in the model with two lags but the coefficient of only of the second lag is positive and statistically significant. After finding that there is cointegration in the model we computed the long run coefficients of the ARDL model which are given in Table 11.

Table 11: Estimated Long Run Coefficients using the ARDL Approach

ARDL(1,1,0,2) selected based on Akaike Information Criterion

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
lnRXGDP	.13351	.047889	2.7880[.010]
lnFSD	-.11688	.048408	-2.4145[.023]
lnHTEC	.31590	.12091	2.6126[.015]
C	.43148	.86251	.50026[.621]

Source: Output of *Microfit 5* estimated by the researcher.

The result show that export trade and technical category of higher education have positive and statistically significant coefficient which signifies TFP enhancing effect of export trade and technical higher education. On the other hand the resource allocating activities of the financial intermediary of Nepal have negative effect on TFP.In the second step of the second stage of the ARDL procedure of cointegration we estimated the error correction model the result of which are given in Table 12.

Table 12: Error Correction Representation for the Selected ARDL Model

ARDL(1,1,0,2) selected based on Akaike Information Criterion

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
dlnRXGDP	.11180	.015855	7.0514[.000]
dlnFSD	-.034593	.011323	-3.0551[.005]
dlnHTEC	.010068	.032224	.31243[.757]
dlnHTEC1	-.11002	.030395	-3.6198[.001]
ECM(-1)	-.29596	.081792	-3.6185[.001]
ECM = lnTFP -.13351lnRXGDP + .11688lnFSD -.31590lnHTEC -.43148			
R-Squared = .75465 ; R-Bar-Squared= .69104; F-Stat. F(5,29) = 16.6091[.000]; DW-statistic= 1.7991			

Note: dlnTFP = lnTFP-lnTFP (-1); dlnRXGDP = lnRXGDP-lnRXGDP (-1); dlnFSD = lnFSD-lnFSD (-1); dlnHTEC = lnHTEC-lnHTEC (-1); dlnHTEC1 = lnHTEC (-1)-lnHTEC (-2)

Source: Output of *Microfit 5* estimated by the researcher.

The negative and statistically significant coefficient (significant at 99 % confidence level) of the one period lagged error correction term 'ECM_{t-1}' indicates the existence of a cointegrating relationship of the dependent variable 'lnTFP' with the set of its regressors. The error correction term with the coefficient size of -.29596 indicates the pace of adjustment by about 29.6 % in the deviation of the dependent variable caused by disturbance in one or more of the regressors. The short run dynamic effect of export trade is strongly positive on TFP whereas financial intermediary's activities do not seem producing TFP enhancing effect as indicated by the negative and statistically significant coefficient of the variable 'dlnFSD' even in the short run. The short run effect of technical category of higher education on TFP is unclear as indicated by the simultaneous presence of positive and negative coefficient related to the variable 'lnHTEC', the negative coefficient being statistically significant.

The result of the diagnostic test of the ARDL model involving the technical category of higher education is given in Table 13.

Table 13: Diagnostic Test of the ARDL Model: lnTFP=f (lnRXGDP, lnFSD , lnHTEC, C)

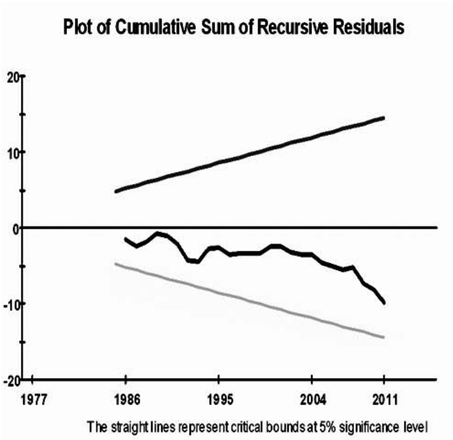
ARDL(1,1,0,2) selected based on Akaike Information Criterion

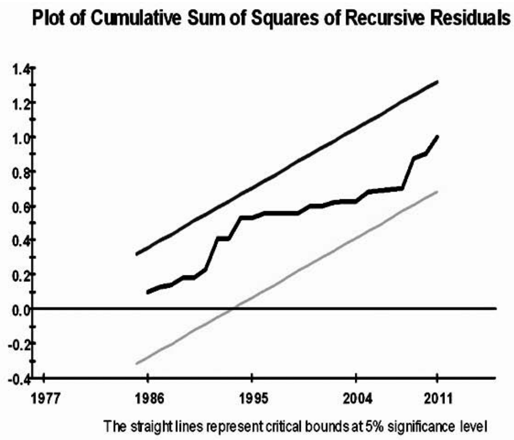
Test Statistics	LM Version	F Version
A: Serial Correlation	$\chi^2_{(1)}$ = .10992[.740]	F(1,26) = .081910[.777]
B: Functional Form	$\chi^2_{(1)}$ = 2.3989[.121]	F(1,26) = 1.9132[.178]
C: Normality	$\chi^2_{(2)}$ = 2.4510[.294]	Not applicable
D: Heteroscedasticity	$\chi^2_{(1)}$ = .22813[.633]	F(1,33) = .21651[.645]

Note: A: Residual Serial Correlation test; B: Functional Form (Ramsey's RESET test using the square of the fitted values); C: Normality (Based on a test of skewness and kurtosis of residuals); D: Heteroscedasticity (Based on the regression of squared residuals on squared fitted values).

*Source***:** Output of *Microfit 5* estimated by the researcher.

The diagnostic test indicates that the model satisfactorily passes the econometric pathology for residual serial correlation, functional form (Ramsey's RESET test), normality of residuals and heteroscedasticity. This is indicated by the probability values (p-values) given within the square brackets. The guide line is that if the computed p-value is more than 5 %, we cannot reject the null hypothesis, rather we accept the null. We further tested the stability of the ARDL model by plotting the cumulative sum of recursive residuals (CUSUM) and the CUSUM of squares (CUSUMSQ) as given the figure.





The plots reveal that the CUSUM and the CUSUMSQ curve falls within the critical bound lines at 5 % significance level. Therefore we can infer that the space of the parameters of the ARDL model of cointegration is stable and the model is not misspecified.

4. DISCUSSION AND COMPARISON

In our study the effect of higher education on TFP is almost ambiguous. Quantity of higher education measured by enrollment per capita in higher education in entirety or categorized as general or technical higher education appears with positive and negative sign as well in the ARDL method of cointegration. The log run (i.e., the level value) estimates showed positive effect of overall higher education (EDUH), general category of higher education (HGEN) and technical type of higher education (HTEC) but in the error correction model (ECM) estimates the coefficient of all measures of higher education variable turned to be negative and significant also. This cast serious doubt on the effect of higher education in enhancing productivity in Nepal. Miller and Upadhyay (2000) found a negative effect of human capital on TFP in high-income countries and a positive effect in middle-income countries. The effect of human capital on TFP in low-income countries moved from negative to positive as the country moved from a low to a higher level of openness. The study made by Pritchett (2001) showed a large and significantly negative impact of human capital on TFP growth. As Nepal is still an agro-based economy and hi-tech industrial activities are in low level higher education should be less influential.

The finding of the present study that trade openness (measured as real export's share in real GDP) has positive and statistically significant effect on growth are similar to the findings of Miller and Upadhyay (2000) in their cross country study. The export-led growth theorists in general claim that export enhances productivity growth (Bonelli, 1992; Haddad, de Melo & Horton, 1996; Weinhold & Rauch, 1999; Yean 1997; and

Sjoeholm, 1999).These theorists claim that firms tend to learn advanced technologies through exports which they should implement to compete in the foreign marketplace (Balassa, 1978; Krueger, 1980; Nishimizu & Robinson, 1982). Firms also learn by doing and replicate through the trial and error processes innate in the production and sale of export goods (Grossman & Helpman, 1991).Moreover, expansion in production resulting from exports reduces unit production prices and thus increase productivity (Helpman & Krugman, 1985).These arguments must have worked to make the effect of export trade positive and significant on the total factor productivity in the economy of Nepal.

The financial sector development measured by loans and advances of commercial banks excluding claims on government as a share of real GDP of the country shows negative and statistically significant effect on TFP.This finding contradicts with the claim that financial intermediary institutions enhance productivity through efficient reallocation of resources from less productive to more productive sectors. In cross-country studies Beck, Levine and Loayza (2000) and Levine and Zervos (1998) found that financial development has positive and significant effects on total factor productivity (TFP) because better functioning financial intermediaries improve resource allocation and accelerate TFP growth with positive repercussions for long-run economic growth. These claims do not agree with the negative result obtained in the present study. One of the explanations for the negative coefficient of the financial intermediaries' activities may be that the loans and advances made by commercial banks of Nepal is not being used in overall productivity enhancing activities rather it is being used in normal economic activities in different sectors of the economy. Or it may be that the fund made available by the commercial banks is inadequate to bring TFP improvement.

Earlier studies on the issues addressed by this study do not report results of diagnostic tests on their regression. This makes the reliability of the results in previous studies questionable. To examine the reliability of our results, and to determine whether or not there are any problems with the TFP regression equations we estimated, a series of diagnostic tests is performed in our study. Hence findings of the present study should be more reliable.

In the context of the result on the effect of higher education on TFP, one natural question is: Why does not higher education seem influencing total factor productivity in Nepal? There are different explanations Neo-institutionalists like North (1990) offer the argument that educational and occupational choices may be influenced by the incentives structure created by the institutional framework. Depending on the relative balance or imbalance between these choices, higher education can or cannot promote growth. Intuitively, each field taught at university level might be favourable to growth provided that it is not "over-supplied" in relation to the socioeconomic needs of the nation. Furthermore, qualitative elements like the reluctance of economic decision-makers in relation to formal knowledge may help in explaining differences in terms of the contribution of higher education to growth between countries whose quantitative developments are of similar magnitude.

Studies have also shown that allocation of educated talents have great impact in economic growth. In this regard Murphy, Shleifer and Vishny (1991) concluded that a country's most talented people typically organize production by others, so they can spread their ability advantage over a larger scale. When they start firms, they innovate and foster growth, but when they become rent seekers, they only redistribute wealth and reduce growth. Occupational choice depends on returns to ability and to scale in each sector, on market size, and on compensation contracts. In most countries, rent seeking rewards talent more than entrepreneurship does, leading to stagnation. They found that countries with a higher proportion of engineering college majors grow faster; whereas countries with a higher proportion of law concentrators grow more slowly. The analysis made by Hvide (2003) on the allocation of talents concludes that when worker with particular level of education is over or under supplied in the economy, it will have no impact in output growth. Pissarides (2000) argues that the growth effect of higher education depends on the growth-enhancing quality of education as well as the efficiency with which labour markets allocate skilled labour to productive activities.

One or more of the explanations offered above might have made ambiguous the effect of higher education on total factor productivity. Nepal is mainly an agricultural economy which lacks sufficient opportunity to accommodate the human resource with tertiary level of education. As Nepal's industrial sector is very small and meagerly expanding the market for increasing number of higher education graduates is small. Or it may be that enrollment per capita as used in this study to proxy higher education might not possibly link it to total factor productivity.

5. CONCLUSION

Education has direct benefits to the individuals and positive spill over effect in the society. Society and hence the entire nation benefits from educated citizens. By taking the case of Nepal with time series data of the period 1975-2011 this paper empirically tested the effect of higher education on the total factor productivity also called the Solow residual using the more recent ARDL method of cointegration. We found that the effect of higher education is ambiguous in enhancing multifactor productivity (TFP) in Nepal. Further research is deemed essential on this issue. The loan and advancing activities of the financial intermediaries also does not appear enhancing TFP. But export trade has significant effect on total factor productivity in the economy of Nepal. Therefore we conclude by offering the suggestion that export trade should be promoted by introducing and implementing a series of measures.

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