Pakistan Journal of Applied Economics, Vol.28 No.1, (83-102), Summer 2018

ARE FORESTRY AND FOREIGNERS BOUNTY FOR MACROECONOMIC PERFORMANCE? A Global Evidence

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Abstract

Forestry provides economic, social and environmental benefits along with various forest products and services. It also offers the platform for economies to develop their industrial and trade base; and link forestry and economic growth of countries intended to be explore in this study. For empirical analysis, data set of 155 countries is employed for 15 years' time-period from 1999-2013, where the estimation technique is system GMM for the dynamic panel data model. Empirical results demonstrate that forest resources and tourism are important for growth of economies. It is recommended that forest area should be preserved to enjoy its numerous economic and social benefits and to have clean and safe environment.

Key words: Timber, Forest Exports, Wood Energy, Climate Change, Tourism, Sustainable Forest Management.
JEL Classification: Q23, Q26, Q54, Z32, Q01.

I. Introduction

Forests are resources which are endowed with economic, social and environmental benefits for the society and economy. Forests are called the lungs of earth, as they absorb carbon dioxide and release oxygen in the atmosphere throughout photosynthesis. This process help in stabilizing the global temperature as carbon dioxide is a greenhouse gas which is the result of climate change. Forests in their biomass alone can pile-up carbon to around 289 giga-tonnes, consequently by holding the large potential to relieve climate change and perform a major role in maintaining the balance of carbon on earth [FRA (2010)]. Forestry provides employment, foreign exchange from exports of forest-products and also by tourism, timber, paper, fuel and furniture. It also makes available the streams of vital public goods which is identified in economic literature as 'amenities' or 'non-timber' goods like, biodiversity, mans of hunting and fishing, medicines (natural herbs), and the wild-life lodging; and preserve the land from floods, prevent soil erosion, landscape aesthetics, and control for carbon-dioxide confiscation, etc. The four forms of direct payments, i.e., biodiversity conservation, carbon storage,

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hydrological protection and recreational values, derived from environmental services of forests remained dominant until the present days [Sunderlin, et. al (2005)]. Forests provide important functions such as soil management, watershed, pest management and pollination. They also provide environmental services importance to the agriculture sector, for example, hydrological regulation but such ecosystem services provided by forests are not captured by markets [World Bank (2004)]. As a source of biomass, the most important advantage of trees and forests is their lower energy inputs and their capability to grow on locations with low fertility, as compared to requirements for agriculture (Green Facts Organization). It also plays a fundamental function towards other main concerned sectors, such as health, water and energy.

Particularly, the factors of deforestation involve rapid economic development (at the cost of environmental deterioration), urbanization, and population growth. Normally forest is converted into land used for agriculture but forest conversion to agricultural land is not beneficial from the environmental aspect and for the society and economy, as well. Conversion of natural forests to agriculture land can prove economic beneficial, only if the soils is suitable. Forest soil is often very poor and is unable to sustain agriculture on a long-term basis. In such situations, conversion to agriculture causes a host of negative externalities, specially the soil erosion and does not prove a sustainable decision [OECD (2008)]. Even such conversions for industrial purpose and for urbanization, also impose severe externalities on public health and most prominently on the environment. Poor agricultural practices and unrestrained grazing on former land under forest often covers the results in soil erosion, fertility loss and ultimately desertification [SOFO (2012) and Evans (1998)]. Presently, 17 per cent of global carbon dioxide emissions are related to deforestation [IPCC (2007)], but now, this phenomenon has widely changed the world. Estimates of the latest global forest resource assessment 2015 of FAO displays positive signs of slowdown in deforestation globally, and improved the forest management. According to its results there was a net decrease in global forest area of 3 per cent during 1990 to 2015 (from 4128 M ha to 3999 M ha). Thus, the annual rate of net forest loss halved over the 25 years period, as deforestation is being compensated by increase in the forest area [MacDicken, et al. (2015)]. The net carbon dioxide in the atmosphere declines as long as new trees are not planted to replace those that are used [SOFO (2012)]. It is a healthy sign in moving towards the green economy approach being highly desirable due to low-carbon, resource efficient and socially inclusive.

Now, there is a wider acceptance for forests as productive capital stocks and components of public infrastructure systems [FAO (2005)]. Forests, not only offer an ample variety of products and services but have the power to assist rural well-being and capacity to encourage the industrial opportunities, as well. Forests are the long-standing assets for the economy which have the capability of producing financial and non-financial benefits from time to time. They play a role in helping economy to set up the path towards development by expanding the economic base through providing a plat-

form for trade and manufacturing. Canada and Sweden are the two economies where industrialization was launched by forestry and a platform was built for diversification into other industries [Bethlehem and Dlomo (2003)].

Formal is a contribution of forestry in global GDP and is approximately one per cent [SOFO (2014)]. Forests and trees of forests play an important role for the living of people (above 1.6 billion) [FRA (2010)]. For their health care, about 65 per cent to 80 per cent of the global population depends on medicines derived from forests in its primary form. Moreover, the value of non-monetary benefits attained from forests is anticipated to be more than two to three times of the contribution to GDP (IUFRO and ICSU). People depending on forests for their source of income are globally over 25 per cent of the population or about 1.6 billion, and among them about 1.2 billion utilize vegetations on farms for getting food and cash (FAO).[1] Also, several nations of the developing world make use of fuel wood for fulfilling their energy requirement to the extent of 90 per cent, as wood energy is commonly the single energy source and is specifically imperative for poor public. About 13.2 million people are employed in the formal forest sector whereas informal employment in this sector is at least 41 million people. Female employment as a proportion of total employment in forestry sector is 24 per cent. The worldwide contribution of wood-fuel and charcoal to employment is 1.2 per cent; and further 29 million is the estimated number of people who get benefits from the private forest ownership which is 0.4 per cent in terms of share of total population [SOFO (2014)]. Per capita consumption of food from forests is 10.9 kg in terms of animal-based NWFPs and plant-based NWFPs, while the total consumption is 76138 thousand tonnes. Contribution of edible NWFPs to total food supply is 0.6 per cent. Alternatively, food supply from edible NWFPs (animal-based and plant-based NWFPs) is 16.5 per cent in terms of kcal/person/day. Consumption of wood energy derived from forests and industry is 496 and 277, respectively, making the figure of 772 collectively in million tonnes of oil equivalent (MTOE).[2] Estimated income from informal production of wood-fuel and forest products used for house construction in 2011, is given in Appendix (Table A-1); it also contains estimated income from the informal production of non-wood forest products (NWFPs) in 2011.

There are several forest-based industries offering lots of special items. They provide as broad range of products that flows into various sectors of economy as both, the consumption goods and intermediate goods and their demand; increases as the economic growth rise. Three sub-sectors of forest-based industries are forestry activities, wood industry and the paper and pulp industry. In the LDCs, particularly forests plays an eminent function in several food systems for human nourishment [Vinceti, et al. (2008), Arnold, et al. (2011) and J amnadass, et al. (2011)], or through ecosystem services essential for both the near and distant agro-ecological systems [Millennium

[1] FAO, Forests and poverty reduction.

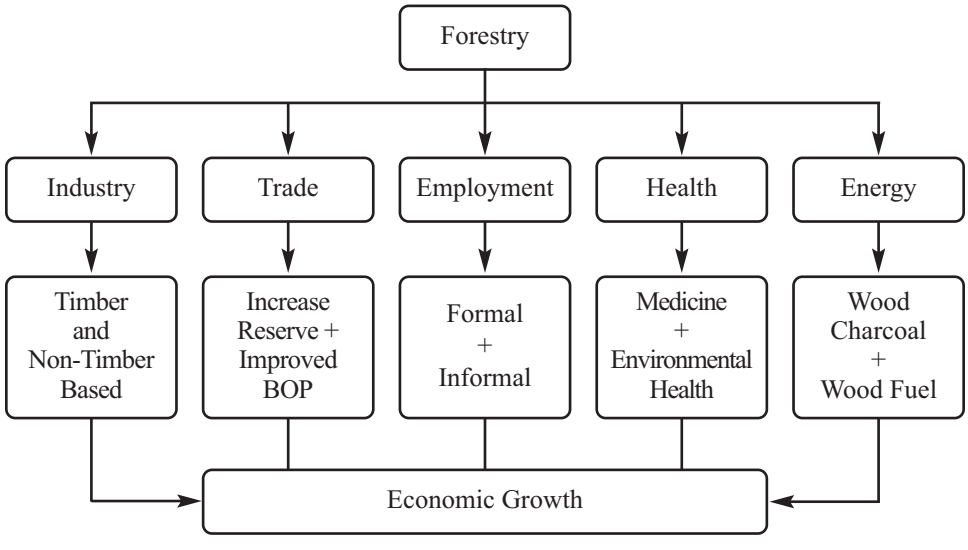
[2] Where One MTOE equals approximately 3.8 million m3 of wood.

Ecosystem Assessment (2005)]. Increased trade in forest products provide benefits to economy by strengthening export and improving their terms of trade, thus BOP.

Wood is the most essential single source of renewable energy providing over 9 per cent of the global total primary energy supply (TPES). Wood energy is as important as other sources of renewable energy (geothermal, hydro, biogas, wastes, solar and liquid biofuels). Over two billion people depend on wood energy for cooking and heating mostly in the LDCs, making production of charcoal and fuel-wood, specifically used for woody biomass in these and the countries' transition economies. Wood energy is a renewable energy source which is regarded as a climate neutral and socially viable, by simply fulfilling the given requirements. Firstly, wood is obtained from sustainably managed forest resources and secondly, is the cascade use of wood fibers, i.e., reuse and recycling before energy use (FAO). Wood energy is the only renewable energy source which can be produced sustainably, as trees used for energy purpose can be replaced with the new ones.

Summarized contribution of forestry in economic growth through different channels explained above is presented in Figure 1.

Forestry possess quite high rate of multiplier effect on capacity utilization, employment generation and foreign exchange earnings. These considerations therefore, justify the demand and modernization of forestry to be given due priority to ensure



Source: Authors' design.

FIGURE 1

Mechanism of Forestry Role in Economic Growth

concerted desire for economic development [Olopeomia (1983)]. The focus of this study is to explore links between forestry and economic growth and in turn to provide evidence empirically that forest resources are among the potential contributor factors of economic growth. Forest related variables only connected to economic aspects are taken for investigating the empirical linkage of forestry with economic growth.[3] The hypothesis of the study is:

H_A : Forestry contributes in economic growth of the countries.

After the introduction (Section I), the rest of the paper is presented as follows. Literature review is laid in Section II; and, data and methodology is enlightened in Section III. Empirical results of the study are developed and interpreted in Section IV and finally, the paper ends up with conclusion and recommendations.

II. Literature Review

The literature where income, employment and other factors are linked to forestry is available in many studies. Riihinen (1981) took into account the functioning of forestry and forest industries in equating or differentiating economic growth. Various aspects of forestry points-out that forestry would no doubt be a substantial agent in speeding up development, if its possibilities are not fully utilized. Pearce (2001) presented the economic value of forest ecosystem and put forward that all ecological functions performed by forests are also the economic functions. Additionally, relationship between income changes and forest growth is scrutinized by Foster and Rosenzweig (2003). They performed the empirical investigation using general-equilibrium framework and investigated hypothesis that escalation in the demand for forest products is linked with population. They further demonstrated that growth in income leads to forest development.

Aoyagi and Managi (2004), empirically tested the influence of subsidies on forestry production and efficiency of Japan by employing time-series data for 26 years (1975 to 2000). They tested the hypothesis and concluded that there is an adverse impact of government subsidies on economic performance of forestry; as increased level of subsidy reduce the efficiency level significantly. Moreover, relationship between urban forests presence, income of households and population density of the nine Southeastern United States using 149 cities with population over 40,000 was explored by Zhu and Zhang (2006). Their empirical findings using OLS showed characteristics of environmental Kuznet curve across the cities for urban forest percentage. Higher income sets the path for higher environmental quality at the cost of substitute land use and palnting, and the supervision of urban forests.

[3] Other than the economic aspect of forestry, there are environmental aspect as well, but the objective of the paper is to highlight only the economic contribution. Role of forestry in environmental improvement is discussed in Appendices.

Furthermore, Mamo, et al. (2007) observed the dependency on forests resources by collecting primary data of rural households in Chilimo and Ethiopia. They also studied the related research by Kalu and Okojie (2009) and concluded that these forest resources have valuable potential in equalizing income among rural households. The impact of forestry on gross domestic product (GDP) of Nigerian economy was examined by using time-series data from 1970 to 2000. Taking forest product output, price index of timber and timber export, exchange rate and inflation as explanatory variables and GDP as controlled variable, they used the ordinary least square and the Exact AR (1) inverse interpolation methods. The results specify that to sustain economic growth and development indefinitely, forestry sector should not be ignored. In addition, Foster, et al. (2010) presented six concepts for guiding and helping forest owners and managers for implementing the sustainable forest management. Mehmood and Ramzan (2015) introduced forestry in growth regression for the selected Asian countries. However, none of the study have investigated the relationship of forests and economic growth in collaboration with tourism for a global dataset; and hence, this study tries to fill this void in the existing literature.

III. Data and Methodology

For undertaking this study, the data of 155 countries was collected for 15 years (1999 to 2013) using 3 years' average values time-period, reduced to 5; the data was taken from WDI and FAO. Selection of countries is based on equalizing the two sources of data used and availability of values of variables for the countries. The data set is classified into developing and developed (DCs) countries, since people of LDCs are more dependent on forests as compare to DCs. The classification is based on the report of world economic outlook by IMF, April 2014 and WB data. The model is proposed to expose contribution of forests in the process of economic growth of countries.[4] Dynamic panel data model is used to test empirically the proposed relationship given as under:[5]

Estimated Model

$$GDP_{i,t} = \alpha_i + \lambda GDP_{i,t-1} + \beta_1 FA_{i,t} + \beta_2 FE_{i,t} + \beta_3 TOUR_{i,t} + \beta_4 RW_{i,t} + \varepsilon_{i,t} \quad (1)$$

Model with First Difference Transformation

$$\Delta GDP_{i,t} = \lambda \Delta GDP_{i,t-1} + \beta_1 \Delta FA_{i,t} + \beta_2 \Delta FE_{i,t} + \beta_3 \Delta TOUR_{i,t} + \beta_4 \Delta RW_{i,t} + \Delta \varepsilon_{i,t}$$

[4] The model assumes that forestry contributes to economic growth of a country the mechanism of which is portrayed in Figure 1. It is also assumed that forests have the tendency of attracting tourists. It also contributes to economic growth of the country.

[5] Among the advantages of using panel data an important advantage is to use information about the intertemporal dynamics and individual as it is possible to control the effects of missing variables and unobserved factors [Brañas-Garza, et. al, (2011)]. For the purpose of dealing consistently with lagged endogenous variable in modern growth literature System GMM technique developed by Blundell and Bond (1998) is the most suitable one. As an additional advantage of using this technique the estimates are no longer biased by time-invariant omitted variables [Felbermayr, (2005)].

where

$GDP_{i,t}$: GDP (constant 2005 US$),

$GDP_{i,t-1}$: Lagged value of GDP,

$FA_{i,t}$: Forest area (km^2),

$FE_{i,t}$: Forest exports [export value of total forest-products (1000 US$)],

$TOUR_{i,t}$: Tourism (International tourism, number of arrivals),

$RW_{i,t}$: Roundwood (proxy for timber),

$\varepsilon_{i,t}$: Error term.

Forest area gives the first signal of proportionate worth of forests for the countries as it is the spatial product of forestry and with this a lot of environmental, social and economic benefits are connected. The value of forest-products export is positively related to the economic growth. When there is more export of forest products then it will be a sign of healthy forest sector for the country, which means that forest product is performing its potential role for growth of economy and contributing positively in the economic growth by expanding the industrial and trade-base. The value earned by exports of forest products can be used for up lifting the forestry further, and also for import of machinery for development of the economy. In exporting forest products China (having the highest percentage), Thailand and Indonesia are among major exporters of wood-based panels and, Japan, Indonesia and China are among major exporters of recovered paper, pulp for paper and paper board over the worldwide. Exports of forest products facilitate the imports of raw material and capital inputs (particularly machines) required by other industries to be affected [Riihinen (1981)].

Timber is heterogeneous in nature and has versatile use as it encourages new industrial activities in any economy. Its enterprises are also capable to induce expanded investment in other branches of production [Badejo (2008)]. Timber markets are also very important; their development is considered vital for reduction of deforestation and setting up more safe and sound land-use practice [Amacher, et al. (2009)]. This industry is also linked with paper industry, as timber is the basic source for production of paper. The commercial commodity of timber is the most important product obtained from forest and is considered as strategic resource. As discussed earlier, there are number of allied industries to timber, and along with them it also plays an important role in the form of providing wood-energy. Therefore, variable labeled as round-wood (timber production) is a whole sum category which involves wood fuel, including wood for charcoal, saw logs and veneer logs (used for furniture), pulpwood, round and split, and other industrial round-wood. All these categories are widely and extensively used in our daily life for various purposes and at various levels, providing the platform to forestry to improve the level of economic and social well-being of people; and providing strength to the environment.

Forestry also provide national and international tourism and recreation sources [Christie, et al. (2007), Holgén, et al. (2000), Bori-Sanz and Niskanen (2002)] but there is no such indicator, (forest-based tourism) for number of tourists attracted by forest, etc. However, there exists abundance of literature on tourism-led growth, e.g., Sequeira and Nunes (2008) Proenca and Soukiazis (2008) Cortés-Jiménez (2010) Seetanah (2011), Nissan, et al. (2011), Marrocu and Paci (2011), and Mehmood, et al., (2014) among others. Thus, the international tourism is also used as explanatory variable.

Natural logarithm is used to linearize the data and main statistical technique used in this study is the system generalized method of moments (SGMM). The data set forms a micro panel which is a suitable technique. Bond, et al. (2001), Blundell and Bond (1998), and Arellano and Bover (1995) presented the SGMM as a basic idea which is the estimation of a set of equation in the first differences, as well as in levels. Due to this reason SGMM is better than the first difference GMM. In the presence of heteroskedasticity, SGMM estimators work within countries but do not give across the consistent estimates. To tackle the endogeneity level equations instrumented by lagged first differences and similarly, lagged level values are used as instruments for the first difference equation. Even in presence of non-stationary or unit root problem SGMM perform well with its additional moment conditions. Bond, et al. (2001) suggested and proved that for growth empirics models, SGMM is more appropriate and consistent as it gives a choice of instruments. Blundell and Bond (1998) presented that with existence of country specific effects pooled, OLS provides over-estimated value; and fixed effects give under-estimated value of the lagged dependent (endogenous) variable. For consistency of estimates, Bond et al (2001) suggested that coefficient value of lagged dependent variable should lie between both the fixed effects and pooled OLS. For validity of instruments or to test the exogeneity of instruments reference is made to Sargan and Hansen test.

IV. Results and Interpretation

The empirical results are obtained for the total set of 155 countries (123 developing and 32 developed). Time-period (15 years) is used (1999 to 2013) by taking 3-years average time-period, reduced to 5 years. The results of regression estimates for overall countries are given in Table 1.

The results indicate that lagged value of GDP, forest exports and tourism have statistically significant and positive impact on GDP. The p-value of F-statistics comes out to be significance; its ensured model is a good-fit and all coefficients are different from zero. The coefficient of $GDP_{i,t-1}$ under Pooled OLS is 0.9858 and under fixed effects it is 0.8213, while ts value under System GMM results is 0.8316 which lies between both, and is neither upward biased nor downward biased; ensuring that the estimate is consistent [Blundell and Bond (1998)]. The coefficient of lagged value of GDP is 0.8316 which is less than one and thus it ensures stability of dynamic relationship of the model [Roodman (2009)]. The coefficient is statistically significant at all levels of significance, which

means that the current level of economic growth is also determined by previous year's value - its impact is positive. The coefficient of forest area comes out to be positively related and statistically significant by all four specifications used, which ensures that forests play their critical role in achieving economic growth. Forest exports also comes out to be statistically significant ensuring that through increased trade, forest products countries can make their path towards increased economic growth.[6]

TABLE 1

Regression Estimates of the Overall Countries

Dependent Variable is Gross Domestic Product $GDP_{i,t}$				
Variable	Pooled OLS	Fixed Effect	Difference GMM	System GMM
$GDP_{i,t-1}$	0.9858	0.8213	0.577	0.8316
	(0.000)	(0.000)	(0.000)	(0.000)
$FA_{i,t}$	0.0126	0.1928	0.2171	0.0350
	(0.001)	(0.000)	(0.000)	(0.012)
$FE_{i,t}$	-0.0116	-0.0222	-0.026	0.3718
	(0.294)	(0.132)	(0.690)	(0.000)
$FE_{i,t-1}$	0.0044	0.0093	0.006	-0.3258
	(0.677)	(0.454)	(0.704)	(0.000)
$RW_{i,t}$	-0.0011	0.0136	-0.0289	0.0035
	(0.776)	(0.651)	(0.761)	(0.807)
$TOUR_{i,t}$	0.0137	0.0644	0.0906	0.1157
	(0.011)	(0.002)	(0.017)	(0.000)
Constant	260.1771	136.3653	-	-
	(0.000)	(0.000)		
AR(1)	-	-	0.092	0.390
AR(2)	-	-	0.507	0.180
Sargan test	-	-	0.000	0.001
Hansen test	-	-	0.001	0.203

Notes: p-value is in parenthesis. Columns 3 and 4 report the results of two-step difference GMM Arellano and Bond (1991) and two-step system-GMM estimator Blundell and Bond (1998) with Windmeijer finite sample correction, respectively.

Source: Authors' estimation.

[6] Forests contribute significantly to export in several states. There are about 10 developing countries where forestry accounts for more than 10 per cent of the total exports, and 10 more countries where forestry makes up over 5 per cent of exports. In countries such as Cameroon, the Central African Republic and Liberia, forests contribute from nearly 30 per cent to more than 40 per cent, to national exports. Forestry contributed to exports worth US$ 3 billion in Africa, US$ 6 billion in Latin America and the Caribbean, and US$ 16 billion in the developing countries of Asia and the Pacific [Lebedys (2004), World Bank (2004a)].

Timber is a whole-sum category which incorporate wood fuel including wood for charcoal; saw logs and veneer logs (used for furniture), pulpwood, round and split, and the other industrial round-wood. All these categories are widely and extensively used in our daily life for various purposes and at various levels, providing platform to forestry, to improve the level of economic and social well-being of people, and providing strength to the environment. As one of the major products of forests, timber has multiple use for domestic and industrial purposes, most important is the furniture industry and the form of wood charcoal and wood fuel - a very supportive hand for the energy sector. At domestic level wood energy is used for cooking and heating. The industrial and commercial use of wood charcoal is a major driver of demand along production chains - a source of income generation. But it lacks statistical significance due to the reason of mismanagement of forest resources, lack of certification and illegal logging by majority of countries.

Coefficient value of tourism ensures the positive relationship of tourism and economic growth. One per cent increase in tourism (number of arrival in the host country) brings 12 per cent increase in the economic growth for overall countries, keeping other variables - constant. As forests area and greener places attract more tourism it is proved from the results that it positively adds to the economic growth. Tourism is a source of revenue generation for the economy and also it is a factor of social development by the interaction of different cultures and a source of foreign exchange.[7]

AR(1) and AR(2) represent the serial correlation in the residuals of first-order and second-order, respectively. Hansen test, following the χ^2 distribution points about validity of instruments used, since the result is insignificant in system GMM results it ensure that the instruments used are valid and the excluded are rightly excluded.

Table 2 report results of four specifications of homogeneous slope dynamic panel data model for the set of 123 developing countries. The coefficient value of lagged-level of GDP under system is 0.8448 which lies between the pooled OLS value of 0.9898 and 0.8319. Thus, the value of fixed effects ensure that estimate of lagged level of GDP is consistent and its value is 0.8448, which is less than one; thus it make sure that dynamic relationship do exist [Roodman (2009)]. Forest area also contribute significantly and positively to economic growth of developing countries who followed the resource-intensive methods in the previous decades. Therefore, they use their forests resources extensively. Moreover, majority of the people are dependent on forests for their livelihoods. Therefore, the timber production lacks statistical significance as it is almost entirely used to fulfill the consumption needs and thus, it is not used to produce more diverse and variety of products. Moreover, due to corruption, mismanagement of forest products and illegal logging of timber production has no impact of growth. Similarly, due to this reason and the lack of technological advancements in having more

[7] For example in China there have been seen a stunning improvement in forest-related tourism since 2001, attracting about 300 million visitors and US$ 3.3 billion as direct income to forest park in 2009 [SOFO (2014)].

value added products, forest exports do not have statistical significance although it is positively related to economic growth. FAO[8] also indicated that increasing trade in forest products has supported economic growth and has helped in eradication of poverty in a number of emerging countries. Coefficient of tourism is positive and statistically significant as tourism is one of the economically supporting sides for the developing countries. Due to having natural resources, and different sorts of cultures developing countries attract tourism from all over the world. According to requirement there exists AR(1) among the residuals as p-value is 0.043 but not the AR (2) as p-value is 0.431 for SGMM results [Arellano and Bond (1991)]. Since the well managed forests con-

TABLE 2

Regression Estimates of Developing Countries

Dependent Variable is Gross Domestic Product $GDP_{i,t}$				
Variable	Pooled OLS	Fixed Effect	Difference GMM	System GMM
$GDP_{i,t-1}$	0.9898	0.8319	0.5151	0.8448
	(0.000)	(0.000)	(0.000)	(0.000)
$FA_{i,t}$	0.0144	0.2183	0.2753	0.1314
	(0.001)	(0.000)	(0.000)	(0.068)
$FE_{i,t}$	-0.0171	-0.0267	-0.0182	0.0344
	(0.170)	(0.115)	(0.253)	(0.531)
$FE_{i,t-1}$	0.0087	0.0151	-0.0058	-0.0761
	(0.465)	(0.268)	(0.706)	(0.058)
$RW_{i,t}$	-0.0012	0.0047	0.0106	-0.0779
	(0.794)	(0.893)	(0.772)	(0.464)
$TOUR_{i,t}$	0.0146	0.0593	0.0633	0.2159
	(0.019)	(0.012)	(0.043)	(0.000)
Constant	262.0592	129.5979	-	-
	(0.000)	(0.001)		
AR(1)	-	-	0.092	0.043
AR(2)	-	-	0.507	0.412
Sargan test	-	-	0.000	0.000
Hansen test	-	-	0.001	0.211

Notes: p-value is in parenthesis. Columns 3 and 4 reports the results of two-step difference GMM Arellano and Bond (1991), and two-step system-GMM estimator Blundell and Bond (1998) with Windmeijer finite sample correction respectively.

Source: Authors' estimation.

[8] FAO, http://www.fao.org/forestry/trade/en/.

tribute to poverty alleviation, the protection of environment service and sustainable economic growth exists in developing and transition countries. Therefore, these countries should particularly manage their forests resources properly, and need to export value added products, as in such cases more people would become dependent on forests.

Table 3 shows the regression estimates for 32 developed countries. The value of coefficient of lagged-value of GDP under system GMM, is consistent and as discussed

TABLE 3

Regression Estimates of The Developed Countries

Dependent variable is gross domestic product $GDP_{i,t}$				
Variable	Pooled OLS	Fixed Effect	Difference GMM	System GMM
$GDP_{i,t-1}$	0.9932	0.5965	0.5664	0.9783
	(0.000)	(0.000)	(0.013)	(0.000)
$FA_{i,t}$	0.0048	0.1719	0.2167	0.0764
	(0.402)	(0.001)	(0.012)	(0.004)
$TOUR_{i,t}$	0.0814	0.0895	0.0737	0.2038
	(0.004)	(0.037)	(0.464)	(0.000)
$TOUR_{i,t-1}$	-0.0863	-0.0206	0.0948	-0.2142
	(0.002)	(0.490)	(0.313)	(0.001)
$RW_{i,t}$	0.0072	-0.0288	-0.0749	0.1430
	(0.797)	(0.499)	(0.318)	(0.028)
$RW_{i,t-1}$	-0.0189	0.0701	0.0659	-0.2151
	(0.510)	(0.007	(0.311)	(0.001)
$FE_{i,t}$	0.0905	0.048	0.037	0.1971
	(0.000)	(0.018)	(0.487)	(0.001)
$FE_{i,t-1}$	-0.0799	-0.1178	-0.1882	-0.1820
	(0.000)	(0.000)	(0.002)	(0.001)
Constant	203.81	59.1016	-	-
	(0.000)	(0.022)		
AR(1)	-	-	0.137	0.081
AR(2)	-	-	0.963	0.307
Sargan test	-	-	0.107	0.000
Hansen test	-	-	0.143	0.624

Notes: p-value is in parenthesis. Columns 3 and 4 reports the results of two-step difference GMM Arellano and Bond (1991), and two-step system-GMM estimator Blundell and Bond (1998) with Windmeijer finite sample correction, respectively.

Source: Authors' estimation.

above, ensures the existence of dynamic relationship. In terms of forest area, most developed countries (industrial countries of European and North American region) have experienced the forest transition [Perz (2007)]. Initially they first decrease their forest area and go for rapid economic development, urbanization and industrialization; and then after achieving the realized worth of forests they start increasing their forest area [Mather (1990), Mather and Needle (1998)]. In the above results forest area is positively related to economic growth. This relationship is statistically significance because of p-value under system, the difference in GMM and the fixed-effects results. Timber, forest exports (both) are positively related to GDP and thus are important in increasing the economic growth. Good wood is utilized in construction of more percentage of buildings, infrastructure and further consumer goods, and thus the economy will turn greener and more sustainable [SOFO (2012)]. Tourism and GDP also have positive and significant relationship for developed countries. Now, due to infrastructural development in developed countries, tourism industry has flourished further with more advanced technologies.

AR(1) and AR(2) represents the first-order and second-order serial correlation in residuals, respectively. The prerequisite of GMM estimators is that there exist the first-order correlation (significant result of AR(1), i.e., 0.081; but not the second-order correlation in the residuals (insignificant result of AR(2), i.e., 0.307 [Arellano and Bond (1991)]. This requirement is fulfilled in the SGMM results as AR(1) value is 0.81 and significant while AR(2) is 0.307, and is insignificant. Hansen test follow the χ^2 distribution which shows the validity of instruments used (since result are insignificant), i.e., p-values is 0.624 in SGMM, and the results ensure that instruments used are valid and excluded, and are rightly excluded.

V. Conclusion and Recommendations

Forests serve as an engine of growth increase propel economic activities, especially for a nation that is endowed with abundant forest resources [SOFO (1995)]. Forestry participates in a noteworthy manner for development of economies; it provides economic, non-economic and environmental benefits. The association of forestry with economic growth is empirically examined for the set of 155 economies collectively and by separately taking LDCs and DCs into consideration using dynamic panel data model for the time period 1999 to 2013. The empirical results proved the relationship that forestry is capable to make contribution in the growth of economies as forests area, forest exports, tourism and the round-wood, all having joint influence on GDP. Forest area is the spatial product, timber is physical product and forest exports are monetary products obtained from forestry. There exists large potentials in forestry for further development of value-added and high-quality products and services, along with meeting the increasing demands of the society. Economic progress and human well-being are dependent on healthy forests. Forestry deliberately enhances the expansion

of economies by setting up a path towards improvement of rural and other population dependent on forests for their living which improves foreign reserves through its products' exports and tourism promotion.

Exports earning from forestry products, tourism and especially timber being most distinguished product of forestry, will not be achieved if there is negligence to preserve the forestry to enjoy its environmental, social and economic benefits. Foreigners who are mostly attracted due to presence of natural resources and biodiversity, etc., also brings flow of foreign exchange in the host countries and thus provide economic benefits. Pre-requisite for the enhanced recognition of economic contributions of forest is better integration among the forestry and other sectors, and such incorporation be called for foremost changes in policies and institutional planning. In order to set the rules for sustainable production and trade, good governance is needed. For enjoying unlimited benefits from forestry longer trees should be used for consumption purpose and they should be replaced immediately with new plantation. Developing countries in particular, need to protect forestry since it is more important for their population as compare to developed countries. To the degree, good wood is utilized in construction of more percentages of buildings, infrastructure and further consumer goods, as the economy will turn greener and more sustainable [SOFO (2012)].

Well managed forests contribute to poverty alleviation, the protection of environment service and sustainable economic growth in developing and transition countries [Edo (2004)]. For this purpose sustainable forest management (SFM) is the suitable option. At the core of SFM, the simple idea is that trees are used and replaced by new trees. By maintaining a balance between the demands for forest products and preserving forest health, the practice aims to manage forests in a way that benefits both the consumers and the environment. Through planting trees as well as making investment in ecosystem, services bring improvement in quality and the extent of forests. For enhancing industrial and trade opportunities in forestry there is a need to promote forest-based enterprises of medium and small size; and to reuse and recycle the wood products to increase their long-term importance.

Bibliography

Amacher, G.S., M. Ollikainen and E. Koskela, 2009, Economics of forest resources, Cambridge: MIT Press.

Aoyagi S., and S. Managi, 2004, The impact of subsidies on efficiency and production: Empirical test of forestry in Japan, International Journal of Agricultural Resources, Governance and Ecology, 3(3/4): 216–230.

Arellano, M., and O. Bover, 1995, Another look at the instrumental variable estimation of error-components models, Journal of Econometrics, 68(1): 29-51.

Arellano, M., and S. Bond, 1991, Some tests of specification for panel data: Monte Carlo evidence and application to employment equations, The Review of Economic Studies 58: 277-297.

Arnold, M., B. Powell, P. Shanley and T.C.H Sundernald, 2011, Forests, biodiversity and food security, International Forestry Review, 13(3): 259–264.

Badejo, S.O.O., R.A. Baiyewu and K.S. Aina, 2008, Wealth creation through utilization of wood wastes, in: L. popoola (ed.) Proc. of 32 Annual Conference of Forest Association of Nigeria (FAN) Umuahia: 637-648.

Bethlehem, L., M. Dlomo, 2003, Forests, economics, and the development agenda, Paper presented at the Proceedings of the 12th World Forestry Congress.

Blundell, R., and S. Bond, 1998, GMM estimation with persistent panel data: An application to production Functions, The Institute for Fiscal Studies, Working Paper Series W99/4.

Bond, S. R., A. Hoeffler, and J. Temple, 2001, GMM estimation of empirical growth models, Retrieved from: https://ora.ox.ac.uk/objects/uuid:e3c9266f-f50b-45a3-b26c-0e56faf65017.

Bori-Sanz, M., and A. Niskanen, 2002, Nature-based tourism in forests as a tool for rural development: Analysis of three study areas in North Karelia (Finland), Scotland and the Catalan Pyrenees. Finland: European Forest Institute.

Brañas-Garza, P., M. Bucheli, and T. García-Muñoz, 2011, Dynamic panel data: A useful technique in experiments, Retrieved from: http://digibug.ugr.es/bitstream/10481/31576/1/thepapers10_22.pdf.

Christie M., N. Hanley and S. Hynes, 2007, Valuing enhancements to forest recreation using choice experiment and contingent behavior methods, Journal of Forest Economics, 13: 75-102.

Cortés-Jiménez, I., 2010, Which type of tourism matters to the regional economic growth? The cases of Spain and Italy, International Journal of Tourism Research, 10: 12–139.

Edo, S.E., 2004, Financial sector performance in facilitating World economic integration: New evidence from a developing country, International Review of Economics and Business, RISEC, 5(4): 571-588.

Evans, L. T., 1998, Feeding the ten billion: Plants and population growth, Cambridge University Press.

FAO, 2010, Global forest resources assessment 2005, Progress towards sustainable forest management, Rome, Retrieved from: ftp://ftp.fao.org/docrep/fao/008/A0400E/A0400E00.pdf.

FAO, 2010, Global forest resources assessment 2010: Progress towards sustainable forest management, Rome, Retrieved from: http://www.fao.org/docrep/013/i1757e/i1757e.pdf.

FAO, 1995, State of the World's forests, Food and Agriculture Organization of the United Nations, viale delle terme di caracella, Publications Division, Rome: Italy.

FAO, Forests and poverty reduction, Retrieved from: http://www.fao.org/forestry/livelihoods/en/.

Felbermayr, G. J., 2005, Dynamic panel data evidence on the trade-income relation, Review of World Economics, 141(4): 583-611.

Forests and development: A complex relationship, online available at: http://www.odi.org.uk/opinion/7334-forests-international-development-international-day-forests.

Forests and economic development, 2013, World Bank, Retrieved from: http://www.worldbank.org/en/topic/forests/brief/forests-and-economic-development.

Foster, D. A., and M. R. Rosenzweig, 2003, Economic growth and the rise of forests, The Quarterly Journal of Economics, 118(2): 601-637.

Foster, B.C., D. Wang, W.S. Keeton, and M.S. Ashton, 2010, Implementing sustainable forest management using six concepts in an adaptive management, Journal of Sustainable Forestry, 29: 79-108.

Granger, C. W., 1969, Investigating causal relations by econometric models and cross-spectral methods, Econometrica, 424-438.

Green Facts Organization, Retrieved from: http://www.greenfacts.org/en/forests-energy/l-3/4-forests-energy-potential.htm#1p0.

Holgén P., L. Mattsson and C.Z. Li, 2000, Recreation value of boreal forest stand types and landscapes resulting from different sylvicultural systems: An economic analysis, Journal of Environmental Management, 60: 173-180.

IPCC, 2007, Climate change 2007 – The physical science basis, Contribution of Working Group, I to the Fourth Assessment, Report of the IPCC, Cambridge: Cambridge University Press, available at: www.ipcc.ch/ipccreports/ar4-wg1.htm.

IUFRO and ICSU, Integrating forests in the sustainable development goals, Alexander Buck, Michael Kleine and Hugo Pierre (eds.), International Union of Forest Research Organizations and International Council for Science, Retrieved from: https://sustainabledevelopment.un.org/getWSDoc.php?id=2935.

Jamnadass, R.H., I.K. Dawson, S. Franzel, R.R.B. Leakey, D. Mithhöfer, F.K. Akinnifesi, and Z. Tchondjeu, 2011, Improving livelihoods and nutrition in sub-Saharan Africa through the promotion of indigenous and exotic fruit production in smallholders' agro forestry systems: A review, International Forestry Review, 13(3): 338–354.

Kalu, C. and C.E.E. Okojie, 2009, Economic contributions of forests in Nigeria: 1970-2000, Research Journal of Social Science, 4: 69-73.

Lebedys, A., 2004, Trends and current status of the contribution of the forestry sector to national economies, FAO Working paper on Financing Sustainable Forest Management: FSFM/ACC/07.

MacDicken, K., G. Reams, and J. de Freitas, 2015, Introduction to the changes in global forest resources from 1990 to 2015, Forest Ecology and Management, 352: 1-2.

Mamo, G., E. Sjaastad and P. Vedeld, 2007, Economic dependence on forest resources: A case from Dendi District, Ethiopia, Forest Policy and Economics, 9: 916-927.

Marrocu, E., and R. Paci, 2011, They arrive with new information, Tourism flows and production efficiency in the European regions, Tourism Management, 32: 750–758.

Mather, A. and C. Needle, 1998, The forest transition: A theoretical basis, Area, 30 (2): 117–124.

Mather, A., 1990, Global forest resources, London: Bellhaven Press.

Mehmood, B., and A. Ramzan, 2015, How much money grows on trees? Case of Asian region, Italian Journal of Forest and Mountain Environment, 70(3): 183-201.

Mehmood, B., A. Shahid, S.B. Ahsen, S.A. Sair, 2014, Tourism-headed output hypothesis: Panel effect estimation for Asian countries, Science International, 26(5): 2351-2354.

Millennium Ecosystem Assessment, 2005, Ecosystems and human well-being synthesis.

Nissan, E., M.A. Galindo, and M.T. Mendez, 2011, Relationship between tourism and economic growth, The Servic Industries Journal, 31(19): 1567–1572.

OECD, 2008, Natural resources and pro-poor growth: The Economics and Politics, Retrieved from: http://www.oecd.org/environment/environment-development/42440224.pdf.

Olopoenia, R.A., 1983, On the meaning of economic development in development economics and planning, Essays in Honour of Aboyade Ojetunji, Iz Osayiinwese (ed.), University of Ibadan Publishing Consultants.

Pearce, W.D., 2001, The economic value of forest ecosystem, Ecosystem Health, 7(4): 4284-296.

Perz, S. G., 2007, Grand theory and context specificity in the study of forest dynamics: Forest Transition Theory and Other Directions, Professional Geographer, 59(1): 105–114.

Proenca, S., and E. Soukiazis, 2008, Tourism as an economic growth factor: A case study for Southern European countries, Tourism Economics, 14(4): 791–806.

Riihinen, P., 1981, Forestry and the timber economy in economic development, Silva Fennica, 15(2): 199-207.

Roodman, D., 2009, How to do xtabond: An introduction to difference and system GMM in Stata, The Stata Journal, 9(1): 86-136.

Seetanah, B., 2011, Assessing the dynamic economic impact of tourism for island economies, Annals of Tourism Research, 38(1): 291–308.

Sequeira, T. N., and P.M. Nunes, 2008, Does tourism influence economic growth? A dynamic panel data approach, Applied Economics, 40: 2431 –2441.

State of the World's Forest (SOFO), 2014, Enhancing the socioeconomic benefits from forests, FAO, Rome.

State of the World's Forest, 2014, Enhancing the socioeconomic benefits from forests, FAO, Rome, Retrieved from: http://www.fao.org/3/a-i3710e.pdf.

State of World's Forests (SOFO), 2012, FAO, Retrieved from: http://www.fao.org/docrep/016/i3010e/i3010e.pdf.

Sunderlin, W. D., A. Angelsen, B. Belcher, P. Burgers, R. Nasi, L. Santoso, and S. Wunder, 2005, Livelihoods, forests, and conservation in developing countries: An overview, World Development, 33(9): 1383-1402.

Vinceti, B., P. Eyzaguirre, and T. Johns, 2008, The nutritional role of forest plant foods for rural communities, in: C.J.P. Colfer, (ed.), Human Health and Forests: A Global Overview of Issues, Practice and Policy. London: Earthscan, Chapter 4.

Wetherill, G., 1986, Regression analysis with applications, New York: Chapman and Hall.

World Bank, 2004, Sustaining forests: A development strategy, Washington D.C.

Zhu, P., and Y. Zhang, 2006, Demand for urban forest and economic welfare: Evidence from the Southeastern U.S. cities, Journal of Agricultural and Applied Economics, 38(2): 279-285.

APPENDIX-A

List of Countries

Albania, Algeria, Angola, Argentina, Armenia, Australia, Austria, Azerbaijan, Bahamas, Bahrain, Bangladesh, Barbados, Belarus, Belgium, Belize, Benin, Bhutan, Bolivia (Plurinational State of), Bosnia and Herzegovina, Brazil, Brunei Darussalam, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Canada, Cape Verde, Central African Republic, Chad, Chile, China, Colombia, Congo, Dem. Rep,Congo, Rep, Costa Rica, Côte d'Ivoire, Croatia, Cuba, Cyprus, Czech Republic, Denmark, Djibouti, Dominican Republic, Ecuador, Egypt, Arab Rep., El Salvador, Equatorial Guinea, Eritrea, Estonia, Ethiopia, Fiji, Finland, France, Gabon, Gambia, The, Georgia, Germany, Ghana, Greece, Guatemala, Guinea, Guinea-Bissau, Guyana, Honduras, Hungary, India, Indonesia, Iran, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Korea, Rep., Kuwait, Kyrgyzstan, Lao PDR, Latvia, Lebanon, Libya, Lithuania, Luxembourg, Madagascar, Malawi, Malaysia, Maldives, Mali, Mauritania, Mauritius, Mexico, Mongolia, Morocco, Mozambique, Namibia, Nepal, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, Norway, Pakistan, Panama, Paraguay, Peru, Philippine, Poland, Portugal, Romania, Russian Federation, Rwanda, Saudi Arabia, Senegal, Sierra Leone, Singapore, Slovakia, Slovenia, Solomon Islands, South Africa, Spain, Sri Lanka, St. Vincent and the Grenadines, Sudan, Suriname, Swaziland, Sweden, Switzerland, Syrian Arab Republic, Tajikistan, Tanzania, Thailand, Timor-Leste, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan, Uganda, Ukraine, United Arab Emirates, United Kingdom, United S. A., Uruguay, Uzbekistan, Vanuatu, Venezuela, RB, Vietnam, Yemen, Zambia, Zimbabwe.

TABLE A-1

Income Generated from Forests Globally (in million US$ at 2011 prices)

Wood-Fuel	Charcoal	Construction	Total
12060	21055	159	33274
Medicinal Plants	Animal-based NWFPs	Plant-based NWFPs	Total
697	10506	76810	88013

Note: NWFPs = Non-wood forest products.

Source: SOFO (2014).

APPENDIX-B

Contribution of Forestry in Environmental Improvement
using Panel Causality Test

Granger Causality test formulated by Granger (1969), is used to test whether movements in one variable, systematically precede movements in another variable. Environmental improvement is said to be Granger-caused by forest area if it helps in the prediction of environmental improvement. With the help of this test we can see the direction of causal relationship and means which variable causes to other variable by adding the lags of both variables.

As mentioned above forestry plays an important role in stabilizing global temperature; this fact is empirically tested by Pair-wise Granger Causality test to ensure the causal relationship between forest area and environmental improvement by using inverse proxy of CO_2 emissions. The results show that there exists uni-directional relationship between variables. Carbon dioxide is a greenhouse gas for reason of climatic change and plant biomasses and cleaning the atmosphere from this gas trim-down the global warming. Thus, by holding the large potential to relieve climate change, forests perform a major role in maintaining the balance of carbon on earth therefore forestry plays the most important role in providing a clean environment, if managed sustainably.

TABLE B-1

Pair-wise Granger Causality Test

Direction of causal relationship	F-statistic	Prob.	Remarks
Forest area does not Granger Cause environmental improvement.	3.592	0.0080	Causality
Environmental improvement does not Granger Cause Forest area.	1.405	0.2352	No Causality

Source: Authors' estimation.