BILAL MEHMOOD (*)(°) - ABIDA RAMZAN (*)

HOW MUCH MONEY GROWS ON TREES: CASE OF ASIAN REGION

(*) GC University, Lahore, Pakistan.
(°) Corresponding Author; dr.bilalmehmood@gcu.edu.pk

Growth Empirics use novel factors of growth in latest research. We used such a factor in forestry. We investigated the causal relationship between forestry and economic growth for a sample of selected Asian countries. We used data on forest products and other relevant variables for the time period 2000-2012 using homogeneous slope panel data model system GMM estimator. Results show the presence of such causal relationship between forestry and economic growth. Existence of causality is also checked using Panel Granger causality between concerned variables.

Key words: forestry products; forest exports, timber; system GMM; panel Granger causality; sustainable forest management.
Parole chiave: prodotti forestali; export forestale; legno; sistema GMM; Test di causalità di Granger; gestione forestale sostenibile.

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1. INTRODUCTION

Agriculture is considered as the backbone of an economy. Forestry is one of the sub-sectors of agricultural sector. Forests support agriculture by providing materials for farm implements, harvesting and transportation equipment, crop storage containers and dryers as well as fuel for crop processing (SOFO, 1995)[1].Forests are the long-standing asset, which having the capability of jointly producing the financial and non-financial benefits from time to time for society. Forests are recognized as an integral part of economies, providing employment, tourism, foreign exchange from forest-products' exports, forest products including timber, paper, wood-energy, and furniture etc. They also make available streams of vital public goods, identified in economic literature as 'amenities' or 'non-timber' goods like biodiversity, means of hunting and fishing, medicines (natural herbs), and wild-life lodging, preserve from floods, prevent soil erosion, landscape aesthetics, and control for carbon-dioxide con-

[1] SOFO: State of World's Forests, FAO reports on forests.

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fiscation etc. (Amacher *et al.*, 2009 & Ciccarese *et al.*, 2014). Forestry has linkages with other sectors like health, water and energy. Moreover, forests play a major role in the Earth's carbon cycle.[2]

There is wide acceptance for forests as productive capital stocks and also as components of public infrastructure systems. Forests not only provide a wide range of products and services but they also have the power to assist rural well-being and capacity to encourage industrial opportunities. Forestry plays a role in helping economy to set up path towards development by expanding the economic base through providing a platform for trade and manufacturing. For instance in Canada and Sweden, industrialization was launched by the forestry and platform was built for diversification into other industries (Bethlehem & Dlomo, 2003). There are several forests-based industries offering lots of special items. They provide a broad range of products that flow into various sectors of the economy as both consumption goods and intermediate goods, and their demand increase as economic growth rises. Three sub-sectors of forests-based industries are forest activities, the wood industry and the paper and pulp industry.

Forest area provides the first indication of the relative importance of forests in a country. Timber is the most important forest product which has been considered as strategic resource. As one of the major forest product, timber has multiple uses for domestic and industrial purposes and it is most important for furniture industry. Timber is a very supportive hand for the energy sector in form of wood charcoal and wood fuel. At domestic level wood energy is used for cooking and heating. The industrial and commercial use of wood charcoal is a major driver of its demand and along production chains is a source of income generation. It is also used in infrastructure e.g. constructing bridges and for railways etc. The development of timber markets is often said to be crucial for reducing deforestation and establishing secure land-use practices (Amacher *et al.*, 2009). Timber trade accounts for a large proportion of total agricultural share of international economics which contributes to socio-economic development (Toledo, 2006). This has imperative implications for economic growth and development, since it favorably influences the terms of trade. The productive use of forest resources is a pillar of sustainable management (Corona & Berti, 2010).

Apart from such a versatile product as timber there are other products known as amenities, mentioned above are also very important in daily life and for the economy as well. These are known as non-timber forest products (NTFPs)[3] and consist of naturally grown stocks of forest resources which could be processed either for household consumption or for local and external trade by the forest users. Johnson (2000) pointed out that other non-timber

[2] The biomass contained in our forests and other green vegetation affects the carbon cycle by removing carbon from the atmosphere through the photosynthesis process.

[3] NTFPs include broad collection of edibles and non-edibles such as fruits, seeds, leaves, nuts, bush meat, roots, tubers, fibers, resins, latex, sticks, ropes and construction materials like bamboos and rattans and a host of others. All of these and others as well are directly obtained from forest ecosystem for the use of man. NTFPs are also utilized as fodders, fertilizers, fibers, medicinal extracts, cosmetics and cultural products, natural dyes, tannin, gums and other exudates (Akanni, 2013).

forest uses, such as recreation, tourism and biodiversity have increased importance, and they can provide alternative income and employment opportunities for local economy. People seek a variety of recreational experiences during their leisure time and forests provide a myriad of opportunities for recreation and tourism (IFA). Mountain forests and protected areas fulfill the needs of a great variety of tourists, which is one reason why mountain destinations are increasingly popular for both domestic and international tourists. It is estimated that approximately a quarter of international tourism is to the mountains (Mountain Agenda, 1999), of which almost 60-70 % could be to forest/protected areas. In Asia this figure could be anywhere between 70 and 90% if the growing number of domestic tourists are also included (Price *et al.*, 2000). According to Bori-Sanz & Niskanen (2002), forest tourism can be a source of employment for local people, generate extra revenues and enhance the quality of life. Pigram & Jenkin (1999) suggested that benefits of tourism also include local employment (direct and indirect), stimulation of profitable domestic industries, diversification of the local economy, improvement of local infrastructure and intercultural understanding. Authors dealing with natural diversity have generally focused on the recreational value of the forest (Christie *et al.*, 2007and Holgén *et al.*, 2000). Bori-Sanz & Niskanen (2002) highlighted that forests are seen to have a significant role of tourism, although it cannot be measured quantitatively, and other elements and structures apart from forests are also essential. Their results suggest that well-managed and organized tourism in forested rural areas can obviously enhance the economic, environmental and social development. Although above literature supports that presence of forest area provides source of recreation and tourism, but there is no such data available on variables like number of tourists attracted by forest or forest-based tourism ratio etc. But plenty of literature is available on tourism-led growth for countries individually and combined as a panel[4].

Paper, being a versatile material with numerous uses is broadly used in institutions most importantly for educational purposes and for official work. As a consequence, it becomes an input to human capital formation in the long run. Paper is widely used at domestic level and internationally accepted as well and pulp and paper industries also participate in economic activities. As per FAO statistics Asia in 2010 has the highest rates of production and consumption of paper and its products. Forestry and the timber economy have a considerable influence on other industries. Exports of forests products facilitate the imports of raw material and capital inputs (particularly machines) required by the other industries to be affected (Riihinen, 1980).

[4] For example, Khalil *et al.* (2007) and Hye & Khan (2013), Wang *et al.* (2012) and Yan & Wall (2002), Kim *et al* (2006), Kreishan (2011), Albqami (2004), Khan *et al.* (1990) and Heng & Low (1990), Gocovali (2010), Rashid & Bashir (2004) and Lean & Tang (2010) and Oh (2005) for Pakistan, China, Taiwan, Jordan, Saudi Arabia, Singapore, Turkey, Malaysia and Korean economy respectively examined the contribution of tourism on economic growth. On the other hand some examples of panel data are Sequeira & Nunes (2008), Proenca & Soukiazis (2008), Cortés-Jiménez (2010), Seetanah (2011), Nissan, Galindo & Mendez (2011), Marrocu & Paci (2011) etc.

Asia is the world's largest continent and has a wide diversity of forest ecosystems. At the region's geographic extremes, these ecosystems include extensive boreal forests in Siberia, moist tropical forests in southeastern Asia, subtropical forests in the mountains of southern Asia, and juniper forests on the Arabian Peninsula (SOFO, 2012). It has changed its path from net forest loss in the 1990s to net forest expansion in the following decade, with China leading the growth in planted forests. After disastrous flooding in 1998, China realized the tremendous flood control and soil protection benefits of intact forests, thus leading China to ban logging in key river basins and to begin planting trees at a rapid rate. For year 2010 Asia has the highest 120 million ha area of planted forests as compared to other regions (FRA, 2010)[5].Table 1 represents some economic contribution of forestry in Asia.

Table 1 - Economic Contribution of Forest Sector in Asia.

Employment	Gross Value Added		Primary Energy Supply from Wood		Shelter[6]
(000's)	(US$ million)	% contribution to GDP	MTOE	% of TPES	(% of total population)
6,823	2,49,222	1.1	286	4.8	23.7

Notes: MTOE: million tonnes of oil equivalent, TPES: total primary energy supply, shelter include people in home, made from forest products.
Source: SOFO, 2014.

Additionally, in Asia and Oceania, forests resources provide employment to 18.5 million employees (including formal and informal sector employment). Income generation from the sector is $US 338.8 billion and 1.4 % as percent of GDP. Total food supply from forests is 20.6 kcal/person/day.[7]

1.1. *Objective*

Forestry possess noticeably 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 concerted desire for economic development (Olopeonia, 1983). So the focus of this paper is to highlight the economic contribution of forestry. By using the data of forestry products, forest exports, tourism and two control variables, this paper is intended to explore the role of forestry in economic growth in Asian region. Hypothesis of the study is:

H_A: Forestry contributes to economic growth in Asian countries.

[5] FRA stands for forest resource assessment.
[6] At the regional level, the largest number and highest proportion of people using forest products for shelter appears in Asia and Oceania (1 billion people or about one-quarter of the population) (SOFO, 2014).
[7] Kcal: kilocalories.

2. LITERATURE REVIEW

Theoretical literature on economics of forests is rather not new in economics but empirical literature on it is limited. We have reviewed the relevant literature to find missing gaps and contribute to literature. For instance, Riihinen (1981) took into account the functioning of forestry and the forest industries in equating or differentiating economic growth. He considered various aspects of forestry and emphasized the substantial potential of forestry development, subject to its full utilization. Pearce (2001) presented the economic value of forest ecosystem and put forward that all ecological functions performed by forests are also economic functions. According to Godoy *et al.* (2002) estimation, on average, 17-45% of household earnings across four Amerindian villages in the Bolivian lowlands and Eastern Honduras are generated from forest activities. Similarly, Foster & Rosenzweig (2003) studied the linkages between income changes and forest growth. They investigated the hypothesis, using the context of general equilibrium framework that increase in the demand for the forest products is associated with the population and income growth leads to forest growth. Further, Aoyagi & Managi (2004) empirically tested the influence of subsidies on forestry production and efficiency of Japan by using time series data for the time period 1975 to 2000. They concluded that there is an adverse impact of government subsidies on the economic performance of forestry sector, increased level of subsidies reduces the efficiency level significantly.

Zhu & Zhang (2006) explored the relationship between urban forests presence, income of households and population density for the nine Southeastern United States using 149 cities that have population over 40,000. Their empirical findings concluded that improved economic welfare will assist the people in affording to have more urban forests and other green spaces. Furthermore, Mamo *et al.* (2007) by collecting primary data of rural households in Chilimo and Ethiopia observed the dependence on forests resources. They concluded that forest resources have the valuable potential in equalizing income among the rural household.

Kalu & Okojie (2009) examined the impact of forestry on gross domestic product (GDP) of Nigerian economy using time-series data from 1970 to 2000. Taking forest product output, price index of timber and timber export and exchange rate and inflation as explanatory variables and GDP as controlled variable they used the ordinary least square (OLS) and exact AR (1) inverse interpolation methods. The results specify that forestry sector should not be ignored to sustain economic growth and development indefinitely.

Forests constitute a significant part of rural areas and in many cases income derived from forestry is vital to maintain land management in rural areas (Rametsteiner, 2000). Forestry is an important source of rural development either by afforestation of abandoned agricultural land or by employing existing forests for more than just timber production (Koch & Rasmussen 2000). Similarly, Babulo *et al.* (2009) examined the role and significance of forest environ-

mental products in household income, rural poverty and income inequality in Tigary, Northern Ethiopia. However, number of studies show that products from forest environmental sources contribute significantly to rural households' economic wellbeing (Reardon & Vosti, 1995; Reddy & Chakravarty, 1999; Cavendish, 1999, 2000; Vedeld *et al*., 2004; Fisher, 2004 and Getachew Mamo *et al*., 2007).

A principal economic issue in the earliest literature on forestry concerned the determination of the optimum harvest period under sustained-yield rotation; see, for example, Pearse (1967). And deforestation has been studied universally in literature for example Scrieciu (2007), Angelsen & Kaimowitz (1999). Amacher *et al*. (2009) presented 'dynamic models of forest resources' which further include Faustmann Hartman interpretations, old-growth forest interpretations, and land-use interpretations. But forestry is not yet included in growth empirics. The empirical analysis on the role of forestry in economic growth is limited only Kalu & Okojie (2009) have studied such sort of relationship with only one country.

3. DATA AND METHODOLOGY

The data used for the analysis is panel data of Asian economies (list of countries is given in appendix) from time period 2000 to 2012. The data has been taken from Food and Agriculture Organization (FAO) United Nations and World Development Indicators (WDI). Data include 47 countries indexed by 'i' and time-period of thirteen years 2000-2012 indexed by 't'. The data set forms a micro panel since country dimension (N) is large and time dimension (T) is small. The model of the study is intended to specify the contribution of forestry to economic growth. The proxy used for economic growth is gross domestic product (GDP). GDP is taken as dependent variable while explanatory variables include export of forest products, tourism, timber production, paper production, population and capital[8].

In this analysis, paper production include packaging, wrapping, paper boards, recovered papers, printing and writing papers including newspapers as well. Timber is a whole sum category which incorporated 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 extensively used in our daily life for various purposes and at various levels, providing the platform to forestry to enhance the economic and social wellbeing of countries and it is also proved on empirical ground. Paper and paper products that are rigorously used in all fields, comes out to be positively related with GDP and hence add in it. Since exports generally have the tendency to positively enhance the growth of the economy, that's why in this analysis we

[8] All the variables used in this analysis are in natural logarithmic form (to make data normal there is need to take natural logarithm of all the variables).

intended to analyse the impact of exports values of forests products on the economic growth.

Functional relation between forestry goods and services and economic growth can be viewed as:

$$GDP = f \text{ (Forest Exports, Tourism, Timber, Paper).}$$

3.1. *Panel Unit Root Tests*

Tests used to check unit-root or stationarity in the variables are Levin-Lin-Chu (2002) test, Im-Pesaran-Shin (2003) test, Phillips-Perron (1988) test and Dickey and Fuller (1979) test. Levin-Lin-Chu (2002) test assumes that all panels have same autoregressive parameter, i.e. it assumes common unit root process. Contrary to this, all other tests assume individual unit root process. Im-Pesaran-Shin (2003) test allows each panel to have a different autoregressive parameter. Whereas Dickey and Fuller (1979) and Phillips-Perron (1988) conduct unit-root tests for each panel individually, and then combine the p-values from these tests to produce an overall test. Results are reported in Table 2A in Appendix.

3.2. *Panel Causality Test*

To see the causal relationship between main variables concerned with forestry, Granger causality test formulated by Granger (1969) is used, that tests whether movements in one variable systematically precede movements in another variable. For example GDP is said to be Granger-caused by forest area if it helps in the prediction of GDP. Results for the test are reported in Table 2.

3.3. *System Generalized Method of Moments*

The proposed homogenous slope dynamic panel data model is as follows:

$$GDP_{i,t} = \alpha_i + \beta_1(GDP_{i,t-1}) + \beta_2(FEX_{i,t}) + \beta_3(TRSM_{i,t}) + \beta_4(TMBR_{i,t}) + \beta_5(PPR_{i,t}) + \beta_6(PO_{i,t}) + \beta_7(KP_{i,t}) + \varepsilon_{i,t} \quad (1)$$

Where

- $GDP_{i,t}$ = Gross Domestic Product (Constant $US);
- α_i = Intercept (that captures unobserved country-specific effects);
- $GDP_{i,t-1}$ = Lagged value of GDP;
- $FEX_{i,t}$ = Forest exports[Export value of forest products ($1000US)];
- $TRSM_{i,t}$ = Tourism (International Tourism, Number of Arrivals);
- $TMBR_{i,t}$ = Production of all wood products (Cubic Meter);
- $PPR_{i,t}$ = Production of paper products (Tonnes);
- $PO_{i,t}$ = Population (population, total);
- $KP_{i,t}$ = Gross fixed capital formation (Constant $US).

After transformation into first difference to remove the unobserved country specific effects, to see only the impact of concerned variables on the dependent variable, equation (1) becomes as follows:

$$\Delta GDP_{i,t} = \beta_1(\Delta GDP_{i,t-1}) + \beta_2(\Delta FEX_{i,t}) + \beta_3(\Delta TRSM_{i,t}) + \beta_4(\Delta TMBR_{i,t}) + \beta_5(\Delta PPR_{i,t}) + \beta_6(\Delta PO_{i,t}) + \beta_7(\Delta KP_{i,t}) + \Delta\varepsilon_{i,t} \quad (2)$$

But here $E\{(\Delta GDP_{i,t-1})\ (\Delta\varepsilon_{i,t})\} \neq 0$, that causes endogeneity problem. In such situations fixed effects or random effects cannot be used, as the estimates would be biased and inconsistent. Since our panel is short i.e. micro-panel and two series GDP and population are highly persistent (given the detail of unit root tests results in appendix: Table 2A) under such situations difference GMM has been found to have large finite sample bias and poor precision (Alonso-Borrego & Arellano (1999), so the instruments used in first difference GMM are the weak instruments for endogenous regressor (Blundell & Bond, 1998). As it use the lag levels to instrument the differenced endogenous regressor (Arellano & Bond, 1991). Further endogeneity and heteroskedasticity problems are there, in order to better deal with these problems System GMM is the most appropriate technique for short panel suggested by Arellano & Bover (1995) and Blundell & Bond (1998).

As system GMM by exploiting more moment conditions and using the instruments for lagged differences as lagged levels and using the lagged levels for lagged differences as instruments provide more consistent results under the situation of persistent series and small sample biases Blundell & Bond (1998) and Bond *et al.* (2001). Lagged GDP is an endogenous variable in this specification; therefore in system GMM this endogeneity is controlled by using internal/external instruments both lagged levels and lagged differences. Bond *et al.* (2001) suggested and proved that for growth empirics models SGMM is more appropriate and consistent as SGMM gives us choice of instruments due to this it the superior technique for dynamic model in micro panel in presence of endogeneity. System GMM estimators relies on relatively mild restrictions on the initial condition process to improve the performance of GMM estimators in the dynamic panel data context (Blundell, Bond & Windmeijer (2001). Two-step estimation with Windmeijer (2005) small-sample correction, gives quite accurate standard errors seeming modestly superior to one-step estimation. For more recent application of GMM, see Mehmood & Azim (2014).

For the level equation, differenced instruments will be used and the assumption is:

$$E(\epsilon_{i,t}\ \Delta GDP_{i,t-1}) = 0 \text{ for } i = 1, ..., N \text{ and } t = 3,4,\ldots,T$$

For the difference equation, lag level will be used as instruments and the assumption is:

$$E(GDP_{i,t-s}\ \Delta\epsilon_{i,t}) = 0 \text{ for } t=3,4,\ldots, T \text{ and } s \geq 2.$$

Further with system GMM we can check the validity of instruments used in subsets, GMM style and IV style as suggested by Mileva (2007) and Roodman (2009).

It is to be noted that forest area does not have direct impact on GDP (also proved by Granger causality test) rather indirect as it provides the base for having more forestry products which supply various economic benefits to economy. Forestry is the platform which gives various benefits to society, economy and environment. Therefore, it is used as an external instrument (Milevia, 2007)[9] into the system GMM analysis. As large the area under the forests will be the larger will be production of forest goods, tourism and forest products exports. The country that has proper management of forests and makes investment in this sector attracts more tourists from the world as greenery and areas surrounded by trees and biodiversity attract more people (SOFO, 2014).

4. RESULTS AND INTERPRETATIONS

Linear association between all the variables is measured using Pearson's correlation, which is presented by correlation matrix in appendix table 1A. In order to see the causal relationship between main variables of concern, Granger causality test is employed. Table 2 shows the Granger causality between main concerned variables.

Table 2 - Granger Causality Test Results.

Null Hypothesis	*F-Statistic*	*p-value*
Forest area does not cause GDP	0.0258	0.999
GDP does not cause Forest area	4.2306	0.000
Forest exports does not cause GDP	2.5090	0.022
GDP does not cause forest exports	4.8724	0.000
Timber does not cause GDP	0.3433	0.914
GDP does not cause timber	3.0496	0.007
Paper production does not cause GDP	0.9851	0.436
GDP does not cause paper production	3.1292	0.006
Tourism does not cause GDP	4.10598	0.001
GDP does not cause tourism	2.60405	0.018

Source*:* Authors' calculation.

According to Granger causality test results forest area, timber and paper production do not cause GDP; it is the GDP that causes these through trickle-down effect. As history suggests that as countries reach a certain level of eco-

[9] For the use of external instruments see Mileva (2007).

nomic development, they are generally able to stabilize or increase the area of their forests. There is reason for optimism in the longer term (SOFO, 2012). One possibility is that income growth leads to a greater demand for environmental amenities and direct efforts to conserve resources such as forests. When higher growth rates will not only be achieved but also maintained over time, then it will boost up the growth of forestry. When forests covered area will increase then it will ultimately lead to more production of timber and paper and all others products and benefits of forests will also be increased.

There exists bi-directional relationship between forest exports and GDP i.e. increase in forest exports will lead to increase in GDP and provide more economic benefits to economy (Riihinen, 1981). On the other hand increase in GDP will provide more platforms to enhance forestry and increase forest exports. There is bi-causal relationship between economic growth and tourism. When more people visit the country attracted by the greenery and natural beauty there, it will result in revenue generation and hence can contribute to the economic growth of the country, e.g. Mehmood *et al.*, (2014), Marrocu & Paci (2011), and Holzner, (2011). The increased GDP, in turn, can provide more opportunities for the enhancement of tourism by providing the financial assistance and proper management.

Table 3 - Two-step System GMM Results. Dependent Variable: GDP.

	Coefficient	*t-ratios*	*p-values*
GDP_{t-1}	0.8284	27.19	0.000
$Fex_{i,t}$	0.0323	2.50	0.081
$Trsm_{i,t}$	0.2674	4.54	0.000
$Timber_{i,t}$	0.2111	2.07	0.046
$Paper_{i,t}$	0.0721	1.47	0.151
$Po_{i,t}$	0.0185	0.76	0.450
$Kp_{i,t}$	0.1649	4.32	0.000
Number of observations		448	
Number of instruments		141	
Overall significance F-test: P-value		0.000	
Hansen test χ^2 (130)		31.95	1.000
Difference in Hansen tests of exogeneity of instruments subsets:			
GMM instruments: Hansen test χ^2 (62)		31.95	0.999
Difference (H_0 = exogenous) χ^2 (68)		0.00	1.000
IV: Hansen test χ^2 (123)		18.19	1.000
Difference (H_0 = exogenous) χ^2 (7)		13.76	0.056
AR (1)		-3.26	0.001
AR (2)		1.28	0.202

Source: Authors' calculation

The p-value of F-statistics comes out to be significant, it ensures model is a good-fit and all coefficients are different from zero. The test for muticollinearity i.e. variance inflation factor (VIF) detects that model is free from multicollinearity, as VIF value is 4.54, as suggested by Wetherill (1986). Values of VIF for forestry related explanatory variables and tourism is given in Appendix Table 3A. Moreover forestry related variables like timber, paper and forest exports are not used in any of the earlier studies particularly for empirical analysis so we do not have any theoretical evidence of collinearity between these variables. In addition, another advantage of using GMM is that it drops the variables if there is collinearity between variables. The value of lagged dependent variable is 0.8284, which is less than 1, which ensures the existence of dynamic stability of the model (Roodman, 2009).

Most of the explanatory variables have positive and significant impact on the GDP. Forest exports have positive and significant impact on GDP, as forest exports bring foreign exchange, and exports earnings can facilitate imports of machinery and raw material. When there are more exports of forest products, this can be a sign of healthy forest sector for the country, i.e. it is performing its potential role for the growth of the economy and contributing positively in the economic growth. China (having highest percent), Thailand and Indonesia are among the major exporters of wood-based panels and Japan and Indonesia and China are among the major exporters of recovered papers, pulp for papers and paper boards worldwide, respectively. Therefore the potential for export-led growth is present; this area should be considered for the improvement of living standard of the people who are dependent on the forestry. As explained by the causality between tourism and GDP, tourism is a source of revenue generation for the economy and also a factor of social development by the interaction of different cultures, source of foreign exchange as well. It is evident from previous studies and from empirical results that it positively adds to the economic growth to have tourism-led growth.

Timber is extensively used in our daily life for various purposes and at various levels, providing the platform for forestry to enhance the economic and social well-being of countries and it is also proved on empirical grounds. Cascading use of wood products can prove more helpful for the society and economy (Ciccarese *et al.*, 2014). Paper production lacks statistical significance; it may be due to growing trend of paperless economy around the globe after the advent of information and communication technology (ICT).

Result of Hansen test χ^2 for the exogeneity of instruments ensures the validity of instruments that instruments used are valid instruments and excluded are rightly excluded. Further subsets of instruments that are used in GMM style and external instruments (IV) resulted that instruments are also valid. AR(1) and AR(2) represent first-order and second-order serial correlation in the residuals respectively. The requirement of GMM estimators is that there exists first-order correlation [statistically significant result of AR(1)] but not the second-order correlation in the residuals [statistically insignificant result of

AR(2)] Arellano & Bond (1991). According to empirical analysis, it is proved that there exists relationship between forestry and economic growth, as forest exports, tourism, timber and paper production all have positive impact on economic growth.

5. CONCLUSION

Forests play an essential role in mitigating climate change and providing products and ecosystem services that are essential to the prosperity of mankind (SOFO, 2012).To highlight the economic contribution of forest resources we examined the relationship between forestry and economic growth for the Asian economies using dynamic panel data model for the time period 2000 to 2012. The empirical results have proved this relationship that forestry contributes to growth of the economy. Forestry enhances the quality of life and proves helpful in expansion of the economy in multiple ways e.g. by establishing timber, pulp and paper industries that disburse opportunities of income generations etc. Moreover, it improves foreign reserves through its products' exports and tourism and sets up a path towards industrialization and trade development. As a result forestry collectively contributes in economic growth.

Economic progress and human well-being are dependent on flourishing forests. Importantly, forestry is the tool for improvement of rural development and other population dependent on forests for their living, food and shelter etc. Exports earnings from forestry goods, tourism and especially timber and paper being most distinguished products of forestry, will not be achieved if there is negligence on part of us to preserve the forestry to enjoy its environmental, social and economic benefits. According to our results, contribution of forest exports in GDP is around 26% in Asia, their trends for the time period of 2000-12 is shown by scatter plot in appendix. Asian countries are among the major exporters of forestry products which is very favorable to have export-led growth if proper attention is paid to this sector.

Existing literature demonstrate that people usually visit forest attracted by their location with mountains (Mountain Agenda, 1999) and water features e.g. rivers, lakes etc. (Hill *et al*., 2003) and presence of biodiversity (Nasi *et al*., 2002). Lovers of animals, birds, and insects delve into forests to see these creatures first hand (Braatz *et al*., 2014). Hiking, bird watching, wildlife viewing and other such pursuits occur within forest stands (Nasi *et al*., 2002). Thus recreational and tourism activities offered by forests are important for providing financial benefits to the people and economies but such activities should not harm the environment therefore, for this purpose there is need to promote ecotourism.

Forests should be seen as an increasingly valuable asset - for example, as a source of renewable energy and as a natural system providing multiple services, including the capture and storage of carbon created by the use of fossil fuels. Forestry must therefore continue to evolve and, in doing so, will have a pro-

found impact on the future global economy and environment. Reusing and recycling is the mechanism to increase the long-term value of wood products (SOFO, 2012). Carbon in wood remains stored until the wood deteriorates or is burned (Ross, 2010). For having economic, social and environmental benefits of forestry for the longer time period trees used for consumption purposes (planted forests can be used for it as they are highly productive[10]) should be immediately replaced with new planted trees. In this way, net forest area will be maintained. Plus net carbon dioxide in the atmosphere will decline as long as new trees are planted to replace those that are used. Planting new trees is often the most effective and the quickest way of producing new biomass. Investing in new carbon stocks has immense potential to make a speedy, momentous and assessable impact on climate change without requiring sweeping changes in policies, cultures or national economies. It has been demonstrated by several developing countries, particularly of Asia, that major investments in planted trees can reverse the tendency of deforestation and result in a net increase in forest area (SOFO, 2012).

The large trees in old growth forests are economically valuable, and have been subjected to aggressive logging around the world. This has led to much controversy between logging companies and environmental groups. From certain forestry perspectives, fully maintaining an old growth forest is seen as extremely economically unproductive, as timber can only be collected from falling trees, and also potentially damaging to nearby managed groves by creating environments conducive to root rot. From this view, it may be more productive to cut the old growth down and replace the forest with a younger one. On the other hand, old growth forests have significant environmental value, creating a stable ecological environment and promoting biological diversity.

Old trees also attract tourists due to their unique ecological values developed over the time. While on the other hand use of wood is also helpful for economy and environment as well. To the extent that "good wood" is used in the manufacture of higher percentages of buildings, infrastructure and other consumer products, the economy will become greener and more sustainable. For this purpose planted forests are the suitable option and tropical forests being more diverse in plant and animal species can be used to promote tourism industry if viable. As the best way of saving a forest is to manage it sustainably and to benefit from its products and ecosystem services. The need of the time is to create a balance between the different uses of forests products and services ranges from economical values to environmental values of forests.

The best way to preserve forests is sustainable forest management (SFM); this concept encourages the use of forests in a manner that maintains their

[10] Planted Forests are important sources for forest products (roundwood, fibre, fuelwood and non-wood forest products) produced within sustainable, energy-efficient and environmentally friendly contexts. They also play a major role in preserving the social and cultural values attached to forests, particularly as natural forests decrease in size through deforestation (mainly in developing countries in the tropics and subtropics) or are designated for conservation or other purposes (mainly in developed countries in temperate zones) (FAO, Planted forests in sustainable forest management - A statement of principles).

productivity, biodiversity, vitality and regeneration capacity. At the core of SFM is the simple idea that as trees are used, they are replaced by new trees. Governments can help promote certification as a voluntary instrument to encourage SFM (SOFO, 2014) this may prove a preventive measure from illegal loggings. SFM having 7 basic thematic elements is broadly recognized as being cornerstone of good forest policy. SFM evolves multidisciplinary approach to manage forests in ways that sustain a multiplicity of ecosystem services and forest goods whereas explicitly taking into account the other sectors in relation to forests, based on three interdependent pillars of sustainable development: environment, economy and society (SOFO, 2012).

RIASSUNTO

Quanto denaro cresce sugli alberi: il caso dell'Asia

Gli studi empirici sulla crescita economica si sono focalizzati recentemente su nuovi fattori di crescita. Noi abbiamo studiato la relazione causale tra settore forestale e crescita economica per un campione di Paesi asiatici. Abbiamo usato dati su prodotti forestali e altre variabili rilevanti per il periodo 2000-2012, utilizzando un modello per l'analisi di dati "panel" basato su uno stimatore GMM con intercetta omogenea. I risultati confermano la presenza di una relazione causale tra settore forestale e crescita economica. L'esistenza della causalità è confermata utilizzando il test di causalità di Granger tra le variabili in questione.

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Appendix

LIST OF COUNTRIES

Afghanistan, Armenia, Azerbaijan, Bahrain, Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Cyprus, Democratic People's Republic of Korea, Georgia, India, Indonesia, Iran, Iraq, Israel, Japan, Jordan, Kazakhstan, Kuwait, Kyrgyzstan, Lao PDR, Lebanon, Malaysia, Maldives, Mangolia, Myanmar, Nepal, Oman, Pakistan, Philippines, Qatar, Republic of Korea, Saudi Arabia, Singapore, Sri Lanka, Syrian Arab Republic, Tajikistan, Thailand, Timor Leste, Turkey, Turkmenistan, United Arab Emirates, Uzbekistan, Vietnam, Yemen.

Table 1A - Pearson's correlation coefficients.

Variable	GDP	Forest Exports	Tourism	Population	Capital	Paper	Timber
GDP	1.0000						
Forest Exports	0.7273	1.0000					
Tourism	0.7110	0.6733	1.0000				
Population	0.7258	0.6423	0.5176	1.0000			
Capital	0.9738	0.7446	0.6939	0.7585	1.0000		
Paper	0.8513	0.8038	0.6509	0.8227	0.8755	1.0000	
Timber	0.4710	0.6200	0.3133	0.7782	0.5497	0.7182	1.0000

Note: Correlation Matrix which shows the Pearson's correlation among the variables.
Source: Authors' calculation.

Table 2A - Panel Unit Root Test Results.

Panel Unit Root Tests	GDP	Forest Exports	Tourism	Timber	Paper	Population	Capital
Levin, Lin & Chut	0.1231 (0.549)	-16.0715 (0.000)	-4.84065 (0.000)	4.0538 (1.000)	-0.0495 (0.4803)	17.4405 (1.000)	1.9598 (0.975)
Im, Pesaran and Shin W- stat	-0.5904 (0.2775)	-5.3208 (0.000)	-1.07293 (0.1417)	0.9185 (0.8208)	-0.4126 (0.3399)	-0.8917 (0.1862)	2.2722 (0.9885)
ADF – Fisher Chi-square	83.7449 0.6655	125.936 (0.005)	103.914 (0.1498)	73.0625 (0.9034)	83.458 (0.6171)	85.2324 (0.7295)	69.2114 (0.8777)
PP - Fisher Chi-square	82.6534 0.6961	149.471 (0.000)	122.308 (0.0133)	66.5588 (0.9697)	80.5694 (0.7006)	68.2388 (0.9791)	89.3079 (0.3255)

Note: Statistics for the tests are given and p-value are given in parentheses.
Sources: Authors' calculation

Paper, tourism and capital become stationary series after taking 2nd difference in all test reported above. Timber becomes stationary series at 2nd difference for ADF and PP test. While GDP, and population are highly persistent series that even they remain non-stationary after taking 2nd difference.

To show the changes or trend of forest exports and GDP values over the period of 2000-2012 for the 47 Asian countries, a scatter plot is presented below:

Scatter Plot: Trend of Forest Exports and GDP in Asia over the time period of 2000-2012.

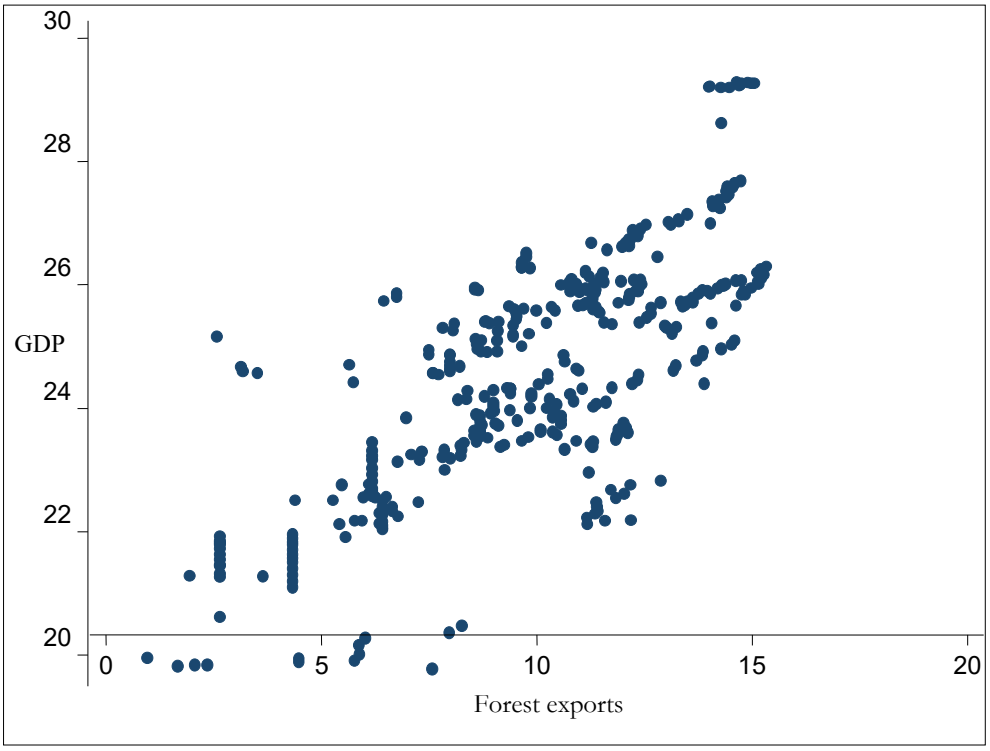

Table 3A - Results of Variance Inflation Factor (VIF) test.

Variable	VIF	1/VIF
Paper	3.98	0.251403
Timber	2.41	0.415280
Tourism	2.23	0.448563
Forest Exports	3.11	0.321151
Mean VIF	2.93	

Source: Authors' calculation.

Table 3A represents that there exists no multicollinearity among the explanatory variables concerned with forestry and tourism. Tourism, timber, paper and forests exports are not collinear.