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The Causes of Deforestation: An Empirical Study of Pakistan

Kalsoom Zulfiqar
Department of Economics, University of the Punjab, Lahore, Pakistan.

Atif Khan Jadoon
Department of Economics, University of the Punjab, Lahore, Pakistan.

Abstract
This paper investigates the impact of population, technology (tractor, tube well), and agricultural land square km on deforestation using the time series data from 1972 to 2016. For tractor and tube-well, we use an index of technology and take the log of total population. Deforestation increases rapidly which has an adverse impact on environment degradation. Autoregressive distributed lag model (ARDL) is used to check the Co integration among population, technology, and agricultural land square km on deforestation. The result of my study confirm that the population has a cause of deforestation and give the positive and significant result. Agricultural square land km has a negative and significant result. Technology has a positive and insignificant result. Only population has a positive and significant impact on deforestation population increase deforestation also increase and the agricultural land has a significant but negative impact on deforestation. Therefore, model is lower moderate good.

Keywords: population, agricultural land, technology
JEL Codes: P23, Q15

I. Introduction

Deforestation has been increased as rapidly without any accurate measure such as reforestation. Deforestation has an issue of global environment; it affects climate into silent ways. When deforestation increases, it increases the emission of CO2 and negative impact on human lives. Importance of forest was acknowledged after the largest flood in 1992. During the 1980s about 15.4 million hectares of tropical forests were lost each year, according to estimates by the United Nations Food and Agriculture Organization (FAO 1992). Forest is used for defense, and stop for flood. Instance this paper is deforestation is described the long run removal of trees. In this paper, we discuss the social and macroeconomic variable to check the causes of deforestation. One cause of deforestation is a population, Pakistan population increase very rapidly and its birth rate increase in death rate. When population increases more rapidly for completing the necessities is one source of deforestation. Removal of forest increases because population uses wood for fire and for agricultural process. The government and horticultural department are interested in increasing growing trees and decreasing deforestation, which increase our national income. When trees are cut the land is converted into agricultural land. There is a question that this agricultural land is best or not. This paper is based on both theoretical as well as empirical part. For the empirical analysis, we use data from 1972 to 2016. Data take from world development indicator and economic survey. This type of study is done in case of Pakistan because Pakistan faces serious problems of environmental degradation. In this study, we use, deforestation as dependent variable and the independent variable index of technology this index include (number of tractors and number of tube well), total population, Gross National Income, and agriculture square land km for the estimation and check the impact we use the ARDL test because there are mixed order of integration if these independent variable increases then the impact of deforestation is positive and significant like deforestation increase or vice versa.

II. Literature Review

Angelsen and Kaimowitz (1999) examine more than 140 economic model of the causes of deforestation. More roads, higher agricultural prices, lower wages, and less off farm employment generally lead to more deforestation. The macroeconomic factors such as population growth, poverty reduction, national income, economic growth, and foreign debt are also uncertainty. This study finds that policy reforms included in current economic liberalization and adjustment efforts may increase the pressure on forests. Many studies include regional dummies, but this approach allows only point intercepts to vary across regions, rather than the slopes. This problem can be solved by multiplying regional dummy variables by the global variables to create separate explanatory variables, but only at the expense of considerable degrees of freedom (Mainardi 1996; Kant and Redantz 1997)

Houghton (2005) analyses tropical deforestation, including both the permanent conversion of forests to croplands and pastures and the temporary or partial removal of forest for shifting cultivation. The magnitude of emissions depends on the rates of deforestation. One considers the emissions of methane, nitrous oxide, and other chemically reactive gases, which are 25% of anthropogenic emission of greenhouse gases. If current trends continue, tropical deforestation will release about 50% as much carbon to the atmosphere. The potential for avoiding deforestation to reduce future emissions of greenhouse gases is significant.

Rudel et al., (2009) examine that the past 50 years, human agents of deforestation have changed in ways that have potentially important implications for conservation efforts. From the 1960s to the 1980s, small-scale farmers, with state assistance, deforested large areas of tropical forest in Southeast Asia and Latin America. As our meta-analysis suggests smallholder deforestation and enterprise driven deforestation vary in their applicability both regionally and historically. This shift in the drivers of deforestation has created new opportunities for conserving tropical forest. More generally, this emerging dynamic underlines that a growing potential for environmental certification to reduce corporate impacts on tropical forests. Governments can play a vital role in bringing about these negotiations by mobilizing disparate groups and facilitating interactions between them.

Fearnside and Laurance (2004) examine that a recent study in 2002 has concluded that the rates of tropical deforestation and atmospheric carbon emissions in 1990-1997 interval were less than previously suggested. The impact of tropical deforestation on greenhouse gas emissions and global warming is significant. In Brazilian Amazonia examine that the net impact of tropical deforestation on global warming may be more than double that estimated in the recent study. Moreover, this value unofficially refuses the effect of forest degradation. When there are choices of which factors to include and which to omit lead to an underestimate of this magnitude, it carries an implicit policy message that mitigation efforts for slowing tropical deforest.

Gullison and Losos (1999) examine that Latin America may contribute to deforestation, but not enhance export of timber and beef in response to rising debt. External debt has contributed to economic sluggishness. While debt payments have probably led to government budget cutback in environmental spending. We conclude that the role of debt in causing deforestation has been overstated. Deforestation through debt has small evidence. On the positive side following debt related measurement has been taken debt purchased from secondary market has been exchanged for land for national parks and for environmental programs in innovative debt for nature swaps. Debt reduction could be reformed of sectoral policies, debt reduction is one cause of deforestation.

Deacon (1995) analysis the impact of public policies on deforestation is assessed in a general equilibrium framework. A forest is a natural state to provide consumption benefit. The utility of consumer depends on forest left standing and on consumption, which produced non forest input only. The policy examined transportation improvement, taxes and royalties on timber harvests and employment opportunity enhancement. The policy suggests that deforestation lean on logical reasoning. Policy approaches based on the use of Pigovian taxes or marketable permits can be expected to encounter the monitoring and enforcement problem that keep the market from providing forest service's efficiently.

Angelson (2010) analyses three aims of policies first is to reduce the rent of extensive agriculture. Second is to increase extractive or protective forest rent and more importantly, create institutions or markets that enable land users to trap a larger share of the protective forest rent. The third is to decrease forest conversion directly by establishing protected areas. They examine that crop and livestock production improves by 3.3 to 3.4% per year between the periods 1985-2004. Gross annual deforestation (1990-2005) for agricultural uses represents 0.3% of the total agricultural areas. Because the productivity of cleared forest land can be expected to be well below average productivity. Stimulating agriculture in forest rich areas through, for example, better technologies, improved roads, and more secure tenure to reduce the need for new agricultural land is a highly risky conservation strategy. Agricultural policies target low forest areas or crops and production systems that are unsuitable at the agricultural frontier are more likely to reduce pressure on forests. Such policies are complementary to and will increase the effectiveness efforts that more directly target forest conservation protected areas and institutional arrangements and payment mechanisms that enable land users to capture a higher share of the local and global benefits provided by tropical forest.

Van Soest et al., (2002) analysis the impact of technological change in agriculture on forest clearing by households in developing countries. They conclude that the impact of technological change in agriculture on long run forest stocks can be positive or negative, but often they are uncertainty. There are some caveats, First they was ignored capital as a separate input, which may be an important omission if farmers need to invest in certain capital inputs to deforest additional land, as this requires households to either save or borrow money. If technological progress allows such a household to increase its savings, it facilitates enhancing further deforestation. Second, we have also ignored the risk and risk aversion, which is very important for rural households (Angelsen, 1999). The reason is that technical change will increase the household's income, which will change its attitude towards. However, we can expect that technical change in agriculture will change the level of risk that rural households bear. Technological change that reduces the risk of cropping will make cropping more attractive and therefore provide a motive force for further deforestation. They conclude that agricultural intensification is certainly not the panacea that some believe it to be. Recent empirical evidence concludes that technical change in frontier agriculture generally tends to promote forest conversion (Angelsen and Kaimowitz, 2001). An exception may be labor intensive technological change, but farmers are generally reluctant to adopt such technologies, since labor rather than land is the scarce factor.

Kindermann et al., (2008) analysis tropical deforestation is estimated to cause about one quarter of anthropogenic carbon emissions, loss of biodiversity, and other environmental services. We use three economic models, avoiding deforestation (AD) activities to reduce greenhouse gas emissions. Avoiding deforestation activities to be a competitive low-cost abatement option. Reducing emissions from deforestation a major source of CO_2 could potentially be a highly cost-effective option for climate policy. A program providing a 10% reduction in deforestation from 2005 to 2030 could provide 0. 3 to 0.6 Gt in emission reductions and would require 0.4billion $ to 1.7billion $ for 30 years. A 50% reduction in deforestation from 2005 to 2030 could provide 1.5 to 2.7 Gt in emission reductions and would require $17.2 billion to $28.0billion. These results are based on economic models that do not consider transaction costs and other institutional barriers, which raise costs in practice. However, a 10% reduction in the rate of deforestation could be feasible within the context of financial flows available through the current CDM and ODA assistance. Finally, some caveats to the analysis that could increase costs of AD programs are described.

Sinha and swaminayhan (1991) examine wheat and rice is the most important crops from the point of view of maintaining a sustainable nutrition security system for India, a country whose population may reach one billion by the year 2000. The implications of climate change deriving from tropical deforestation, with reference to the yield of wheat and rice in different parts of India. Deforestation has influenced the hydrology of the Himalayas, leading to decreased flow in rivers and recession of glaciers. Though there is some evidence to show advantageous effects of the increasing levels of carbon dioxide in the atmosphere, particularly of 600 ppm, on crop plants, it may not be realized because of the adverse impact of increasing temperature. In view of the fact that the temperature rise would be caused partly by gases other than carbon dioxide, a study of the effects of the doubling of carbon dioxide on crop productivity alone would not be adequate. Consequently, we should try to analyze the effects of increasing temperature and changes in precipitation patterns on various crops. Any positive gain achieved from increased CO2 concentration is offset by the yield decline induced by higher temperature and shorter growing period.

Mendelsohn (1994) examines reasons why wasteful deforestation may be caused by poorly defined property rights. At first model colonists can obtain property rights through private defense expenditures. In this case, real resources are lost in an effort to secure property rights. In the second model, we examine the land use choice of squatters subject to low rates of eviction. The possibility of eviction leads squatters to choose short term destructive land uses with lower present values. Unfortunately, without guaranteeing long term controls to squatter this type of progress discourages sustainable land uses and increase to the destruction of natural assets. In order to correct these problems, property rights must be secured in an efficient and prompt manner. People will then bid for the property right, allowing a transfer of resources from the successful bidder to the government. Although purchase of public lands is sometimes unfair. An efficient property rights system requires an extensive surveying project, it is important that the resulting parcels be designed with the optimal size of the best land use in mind. Ultimately deforestation will only stop when the remaining forests are more valuable than alternative uses, as is clear in the history of temperate forests in Europe and North America. Externalities like (soil, climate) will remain unabated without government controls. Secure property rights do not guarantee the long term well-being, but they do make an important contribution towards encouraging the prudent management of the world's scarce resources.

Tahir et al., (2010) examine Pakistan is facing the problem of deforestation, which lost 14.7 % of its forest habits in between 1990 to 2010. Information regarding forest consumption was collected by a manual survey of 180 brick kiln units get from an eighteen provincial unit of the country. The projected annual wood consumption and consequent deforestation due to 600 brick kilns. The combined CO2 equivalent from three principals of GHG constituents i.e., CO2, CH4 and N2O. Data generated in the present study is useful for further investigation to include other source of GHG emission in the country.

Burgess (1993) analyses that tropical forests has led to increased interest in the role of timber production and the international timber trade in promoting forest depletion and degradation in the tropics. Other factors, in particular conversion of forest land for agricultural use and harvesting of trees for fuel wood, are considered to be much more important in the process of tropical deforestation. A review of statistical analyses of the causes of deforestation provides only limited evidence of the linkages between tropical timber production, trade and deforestation. Timber trade can lead to greater return and which are used for forest production, this option more attractive than converting forest land to alternative uses. The study suggests that trade is not a major source of tropical deforestation. But an increasing proportion of tropical timber harvested in producer countries is for domestic consumption and does not enter international trade. For example, only 17% of total non coniferous tropical round wood production is used for industrial purposes. Of this, only 31% is exported in round or product form. Therefore, 6% of total tropical non coniferous round wood production enters the international trade. The volume of tropical timber production that actually enters the trade is small and declining. The statistical analyses do not support strong statements about the relationship between timber production for the trade and tropical deforestation. Therefore, an important factor in reducing timber related tropical deforestation is ensuring proper economic incentives for efficient and sustainable management of tropical production forests.

Angelsen (1999) examines four different approaches to agricultural expansion and deforestation, and explores the implications of assumptions about the household objectives, the labor market, and the property rights regime. A major distinction is made between population and market based explanations. Within a more realistic, particularly for the long term effects market approach; well intentioned policies such as agricultural intensification programs may boost deforestation. Intensification land titling and credit programs commonly suggested remedies for reducing environmental degradation may enhance deforestation. This approach also makes us face some potential and unpleasant conflicts, for example, between poverty reduction and limiting deforestation. The paper has identified two sets of policies first, both this paper and empirical evidence suggest that lower access costs (roads) fuel deforestation. Second, provision of alternative employment and income opportunities, reduce the pressure at the forest frontier. These results suggest a redirection of the focus away from ambiguous intensification programs and price policy reforms towards road building.

Hyde et al., (1996) analysis topic of deforestation is seldom examined from the perspective of prices and responses to resource scarcity. This omission creates important errors in policy. Therefore deforestation will induce price increases and investments in forestry well before deforestation attains its physical limit. These prices and costs will alter the boundaries among several important classes of forest land. Self correcting adjustments to scarcity may create two new problems, particularly for the poorest households in lower income countries. The poorest landowners may be forced into trading trees for nutrition when they give up agricultural production for trees. Landless households may suffer even more because they do not have the option of planting trees on their own lands. The alternative scenario is that some land less households will supply forest labor, and the value of their labor will increase as the value of deforestation and forest products increase. Therefore, in locations where reforestation induces large price changes, policymakers must remain attuned to the likelihood that deforestation induced changes in the prices of forest products and forest policies may cause significant shifts in the activities of the poorest people.

Cramer et al., (2004) examine carbon stocks in wet tropical forests are currently at risk because of anthropogenic deforestation. To identify the relative roles of CO2 increase, changing temperature and rainfall, and deforestation in the future, and the magnitude of their impact on atmospheric CO2 concentrations, we have applied a dynamic global vegetation model, using multiple scenarios of tropical deforestation and multiple scenarios of changing climate. Results show that deforestation will probably produce large losses of carbon, despite the uncertainty about the deforestation rates. Some climate models produce additional large fluxes due to increased drought stress caused by rising temperature and decreasing rainfall. One climate model, however, produces an additional carbon sink. In the most optimistic case this carbon flux still amounts to 100 Gt C in the course of the twenty first century the most pessimistic case gives more than 360 Gt C resulting in CO2 concentration increases above background values between 29 and 129 ppm. An evaluation of the method indicates that better estimates of tropical carbon sources and sinks require improved assessments of current and future deforestation and more consistent precipitation scenarios from climate models.

Woodwell et al., (1983) analysis the accumulation of CO2 in the atmosphere over the past century is cause a warming of the earth fact that more carbon is released into the atmosphere than is removed by the oceans and biota. Two sources of C02 are especially important, the combustion of fossil fuels and deforestation. In 1954 Hutchinson suggested that the net effect of the terrestrial biota was probably a release of C02 into the atmosphere. On the one hand, there may be a significant increase in the rate of release of CO2 into the atmosphere through continued deforestation. Appropriate action taken now might reduce or eliminate the problem. Stabilization of the rate of combustion of fossil fuels combined with a program of reforestation would contribute toward stabilizing the C02 content of the atmosphere. The spectacular reduction in the U.S consumption of oil since 1973 and the decline in the rate of growth in the use of fossil fuels globally offer evidence that such transitions are possible and that we need not accept as inexorable a global warming due to the accumulation of CO2 in the atmosphere.

Ahmad et al., (2014) analysis the validation of the Environmental Kuznets Curve (EKC) hypothesis for Pakistan using time series data from (1980 to 2013) with deforestation as an indicator (dependent variable) for environmental degradation, and four independent variables (economic growth, energy consumption, trade openness, and population) were also examined. The Autoregressive Distributed Lag (ARDL) bounds testing approach to cointegration and the VECM–Granger causality test was applied. The results confirm the characteristic inverted-U shaped relationship and validate the EKC hypothesis. Testing was conducted for both short run and long run paths, and the results suggest that a 1% increase in growth adds 2.782% deforestation in the short run if growth continues, the effect decreases to 0.035% in the long run. Similarly, in the short run a 1% increase in energy consumption and population contribute 2.80% and 7.948%, respectively, and in the long run, 0.039% and 1.13%, respectively. In contrast trade has little effect of deforestation in Pakistan. There was a unidirectional causality between income and energy consumption to deforestation. This study suggests that economic growth depletes forests and that energy consumption has a negative impact on the forest area of Pakistan. Trade openness does not contribute to deforestation, but population density negatively influences the forest area. The relationship between deforestation and population is particularly worrisome because wood is used as a fuel and for house construction in most rural areas. The results suggest that the continuation of the use of conventional energy sources will further worsen environmental condition.

Hofer (1993) analyses that every year during the monsoon season catastrophic flooding in the plains of the Ganges and Brahmaputra rivers is reported as a result of human activities in the Himalayan region. This study investigates hydrological changes in the catchments of the Sutlej, Beas, and Jhelum and, in greater detail, Chenab Rivers during recent decades, it seeks linkages between river discharge and climate in the mountains and flooding in the plains. Climatological data for the region are easily obtainable, but hydrological information is restricted. We argue that human activities in the mountains do not have any effect on river discharge and on flooding in the plains. Nevertheless, the Highlanders alone cannot be blamed for the catastrophic processes on the plains. These are caused by a combination of rainfall on the plains, overuse and misuse in parts of the mountains as well as on the plains giving rise to disastrous cumulative effects.

Blessing and Gitz (2008) examine a new way to account for emissions from avoiding deforestation and degradation at the United Nations Framework Convention on Climate Change (UNFCCC). He says that the feasibility of one of the Reducing Emissions from Deforestation and Degradation (REDD) mechanisms discussed, namely that of Compensated Reduction in the case of Cameroon. Here we assess the different revenues that a farmer could get from 1 ha of land out of two alternative land-uses: shifting cultivation, the traditional land-use pattern in southern Cameroon, or carbon credits as compensation for the conservation of primary forest. The breakeven price of 2.85 $/tCO2e indicates that the idea would be worth a thought indeed with carbon prices currently over 20 $/tCO2e for second period allowances on the European Trading Scheme CR would be a profitable alternative to farming. This result suggests that at current carbon prices, and independently form variations in the discount rate, it could already be more profitable to preserve the primary forest rather than to log it in order to grow crops.

Chomitz and Gray (1996) examine when roads built it increase economic development but also increase deforestation. They develop a spatially explicit model of land use and estimates probabilities of alternative land uses as a function of land characteristics and distance to market using a multinomial log its specification of this model. The controls are incorporated for the endogeneity of road placement. They are experiencing rapid expansion of both subsistence and commercial agriculture, using geographic information system techniques to select sample points at 1kilometer intervals. Market access, land quality, and tenure status affect the probability. The result suggests that the road built in poor areas with agriculturally poor soils and low population density could constitute a loose strategy, causing habitat fragmentation and providing low economic returns.

Motel et al., (2009) examine climate change mitigation would benefit from Reduced Emissions from Deforestation and Degradation (REDD) in developing countries. The REDD mechanism is in charge of of getting the benefits of forest. In other words, proposals have focused on a baseline and trade approach, which relevance is questionable because resulting financial compensations are subject to unfairness if estimations of avoided deforestation are not reliable. We argue that a REDD mechanism would gain from linking compensations to real efforts that developing countries implement for slowing deforestation rates. This would provide more efficient incentives to design and enforce suitable policies and measures. Using an econometric model our approach estimates efforts that are, independent of structural factors estimated ex post at the end of the crediting period relative to other countries. In order to illustrate the methodology, we apply the model to a panel of 48 countries and four periods between 1970 and 2005. We therefore conclude on the feasibility of an estimation of avoiding deforestation based on the estimation of the structural deforestation rate. On the contrary, it remains open to political discussion and should continuously incorporate progress in the tropical deforestation. But we argue that this list provides a better and more consensual basis to estimations of avoiding deforestation than extant predictions for baselines or politically negotiated targets.

Allen and Barnes (1985) analysis that less developed countries are faced with a two-edged sword in the field of energy. On the one hand, the rising price of oil has reduced the potential for fossil fuel energy and eroded foreign exchange reserves in oil importing countries. At the same time deforestation may be causing increased prices or shortages of fuels such as fuel wood and charcoal. This paper analyzes the relationship between deforestation and its probable causes. Three estimates are used for the rate of deforestation in developing countries, two estimates relate to forest and moist tropical forest and third estimate includes open woodland and regenerating forest. Deforestation from (1968 to 1978) in 39 countries in Africa, Latin America, and Asia is significantly related to the rate of population growth over the period and to wood fuels production and wood exports in 1968. Deforestation is associated with the short term with rising population and the expansion of agriculture and in the long term with wood harvesting for fuel and exports. Results indicate that in the short term deforestation is due to population growth and agricultural expansion, aggravated over the long term by wood harvesting for fuel and exports.

Martinez (1998) examines that the social forces drive deforestation. In this study theories are applied in a cross national comparison of 51 developing countries. Multiple regression is applied to estimate the rate of deforestation using the level of urbanization, economic growth rate, population growth rate, level of sectoral inequality, rate of change in primary product exports, and rate of change in tertiary education. High rates of population growth were also found to increase the rate of deforestation in developing countries, even when controlling for the level of urbanization and the rate of economic growth. When the rate of urbanization is controlling deforestation increase. The results support modernization theory indicating that the level of urbanization has a curvilinear effect on the rate of deforestation that economic growth contributes to deforestation and that sectoral inequality reduces the rate of deforestation. In support of neo Malthusian theory, population growth results in higher rates of deforestation. Tertiary education has a mild negative effect on the rate of deforestation whereas the effect of trade dependency is insignificant.

Geist (1999) examines various objectives which are, to assess the global amount of forest and woodland consumed annually for curing tobacco between 1990 and 1995 to estimate tobacco share in total deforestation to rank tobacco growing countries by the degree of impact of tobacco deforestation and to indicate environmental criticality emerging from tobacco's impact on forest resources. The result in the study, which are the hypothesis promoted by the tobacco industry that no significant negative effect such as deforestation, are attributable to curing tobacco has to be challenged. An empirical verification of the hypothetical deforestation outlined on a global scale should be undertaken. This should be done by surveying wood usage in randomly selected farms or growing areas in combination with remote sensing or geographical information systems.

Pellegrini (2007) examines corruption in the forest sector of Swat; Pakistan is weakening for sustainable management of forest. They analyze corruption against the backdrop of the reform options crime and punishment approach is not feasibly implemented if the institutional environment is weak. In this study of state and region low administrative capabilities to enforce state regulatory reform should be aiming at reducing the coercive role of state agencies. In the case of a corruption ridden centralized forest management regime institutional reform should move away from enforcement of existing institutions and promote the communal management of natural resources by locals. The question is whether it is possible to save the remaining forest of Swat through reforms in the forest sector. The argument provides support for the existence of viable alternatives to unsustainable logging, but significant changes in the way the problem is dealt with by Pakistani authorities have to take place in order to achieve them.

Cropper et al (1999) examines an equilibrium model of roads and population on deforestation in Thailand between 1976 and 1989. Population pressures were more important in the North and Northeast sections of Thailand than in the South and Central regions. The profitability of clearing land of agricultural depends upon physical Properties of land as soil quality as well as upon access to markets. With regard to physical factors suggest that steep slope and poor quality soil provide some natural protection to forest. Road building was more important in the Central region than in the rest of the country. The elasticity of forest area with respect to road density is -1.5 in the Central region, but is not statistically significant in the Northeast.

Ramankutty (2007) estimates of carbon changes associated with tropical deforestation from the last two decades are needed to balance the global carbon budget. Many studies have already estimated carbon emissions from tropical deforestation, but the estimates vary greatly and are difficult to compare due to difference in data sources assumptions and methodologies. These studies suggest that to accurately estimate carbon emissions from land cover change, it is important to consider the full land cover dynamics during and following deforestation explicitly include historical land cover change for several decades and accurately estimate the fate of cleared carbon. Our analysis indicates the importance of considering land-cover including the fluxes from relearning of secondary vegetation the decay of product and splash pools and the fluxes from regrowing forest. However, this result is highly sensitive to estimates of the partitioning of cleared carbon into instantaneous burning vs. Long timescale slash pools. We also show that carbon fluxes estimates based on committed flux calculations as used by a few studies are not comparable with the annual balance calculation method used by other studies.

Barbier and Burgess (1996) examine that agricultural land expansion and pasture formation are two major causes of forest conversion. Increase of agricultural production and pasture lead to deforestation. The population also affects both livestock and agricultural activities. They estimate the relationship of agricultural planted area and beef cattle numbers at the state in Mexico during 1870 to 1885.They believe that such an approach gives strong indication of the factor underlying forest conversion as increases in both lands under agricultural production and beef cattle numbers season to be correlated with loss of forest area.

Burns (1994) analyses that deforestation is a global phenomenon that has been neglected in sociological research. We create a model for deforestation and its short-term economic effects for the entire world and also develop separate models for the core, semi periphery and periphery. We use structural equation models to identify both direct and indirect effects of deforestation. The question of how deforestation affects economic development is a critical one. They had hypothesized (H8) that deforestation in the semi periphery would lead to economic development. In fact, there is no significant relationship between deforestation and economic development in the semi periphery. Results indicate that factors lead to deforestation across world system positions. Deforestation has been most severe in the semi periphery during the past several decades and the effects of rural encroachment on deforestation have been greatest there as well. Growth in secondary education is associated with less deforestation in the semi periphery both directly and indirectly through its tendency to counteract rural encroachment. Population growth has a direct effect of deforestation only in the core, but leads to rural encroachment in all sectors. Growth in service and manufacturing, especially in the periphery has a countervailing effect of deforestation. Deforestation in turn is associated with economic decline, especially in the periphery. Results are discussed in a world system theoretic perspective.

III. The model

Following the methodologies of Ali, (2011), Ali (2015), Ali (2018), Ali and Bibi (2017), Ali and Ahmad (2014), Ali and Audi (2016), Ali and Audi (2018), Ali and Rehman (2015), Ali and Zulfiqar (2018), Haider and Ali (2015), Ali et al., (2016), Ashraf and Ali (2018), Audi and Ali (2018), Ali and Senturk (2019) and Kassem et al., (2019). The functional forms of the models become as:

$deforest_t = a + B_0\, pop_t + B_1\, tech_t + B_2 agric\text{-}\, land_t + U_t$ (1)

IV. Econometric Methodology

One of the main problems with the time series data, there may be a unit root in the data and regression results of that data become spurious (Nelson and Ploser, 1982). This study has used time series of energy consumption, financial development, economic development, population density and secondary school education as independent variables whereas environmental degradation is a dependent variable. There are a number of unit root tests available for removing non-stationary problem in time series data. In this study, we use Augmented Dickey-Fuller (ADF) (1981) without and with time trend. The possible equation of ADF is as follow:

$$\Delta X_t = \delta X_{t-1} + \sum_{j=1}^{q} \phi_j \Delta X_{t-j} + e_t \quad (2)$$

The null hypothesis in the data is non stationary.

With the help of OLS compute τ statistic of X_{t-1} and compare it with critical τ values. If calculated τ is greater the null hypothesis τ reject null hypothesis and accepts the alternative. We can conclude that the data is stationary and vice-versa is non-stationary.

IV.I. Autoregressive Distributive Lag (ARDL) Approach to Co-Integration

In applied econometrics, a large number of co-integration tests are available. Most famous and traditional co-integration tests are the residual based Engle-Granger (1987) test, Maximum Likelihood based on Johansen (1991/1992) and Johansen-Juselius (1990) tests. One thing is common in these tests, they require same order of integration for their analysis. These co-integration tests become invalid and inefficient when the variables of the model have different level of integration. Pesaran and Pesaran (1997), Pesaran and Shin (1999), Pesaran et al., (2001) has introduced, the most advance and recent method of co-integration known as the Autoregressive

Distributive Lag (ARDL) bound testing approach. The ARDL bound testing approach has numerous advantages over traditional methods of co-integration. First, ARDL can be applied regardless by following the order of integration. It can be applied I(0), purely I(1) or mix order of integration (Pesaran and Shin, 1999). Second, the ARDL bound testing approach to co-integration can be used for smaller sample sizes (Mah, 2000) rather than traditional methods. Third, this approach allows to use sufficient number of lags for capturing the data generating process in a general to the specific modelling framework (Laurenceson et al., 2003). This technique is based on Unrestricted Vector Error Correction Model (UVECM) which have better properties for short and long run equilibrium as compared to traditional techniques (Pattichis, 1999). For applying the bounds testing procedure, it is necessary to represent equation in a conditional autoregressive distributed lag model as follows:

$$\begin{aligned}\Delta \ln Y_t &= \beta_1 + \beta_2 t + \beta_3 \ln Y_{t-1} + \beta_4 \ln X_{t-1} + \beta_5 \ln Z_{t-1} + \dots \\ &+ \sum_{h=1}^{p} \beta_h \Delta \ln Y_{t-h} + \sum_{j=0}^{p} \gamma_j \Delta \ln X_{t-j} + \sum_{k=0}^{p} \phi_k \Delta \ln Z_{t-k} + \dots + u_{it}\end{aligned} \quad (5)$$

Here $\ln Y_t$ is used for different dependent t is for time of $\ln Y_{t-1}$ representing the lag of the dependent variable and $\ln X_t$ is first independent variable and $\ln Z_t$ is second independent variable and so on. Δ represents the rate of change in variables. The calculated F-Statistic is compared with the critical value tabulated by Pesaran and Pesaran (1997) or Pesaran et al., (2001) that is extended by Narayan (2005). If the F-test statistic exceeds the upper critical value, the null hypothesis of no co-integration is rejected regardless the order of integration I(0) or I(1). If the calculated F-test statistic is less than the lower critical value the null hypothesis is accepted and there is no co-integration among the variables of the model. On the base of the above equation our null and alternative hypothesis for co-integration test is as given below:

$H_0 : \beta_3 = \beta_4 = \beta_5 = 0$ (no co-integration among the variables)

$H_A : \beta_3 \neq \beta_4 \neq \beta_5 \neq 0$ (co-integration among variables)

V. Empirical Findings

This section of the paper is based on empirical results and discussion. Descriptive statistics results show in table 1. The result shows that log forest, log population are negatively skewed and index technology, agricultural land square km is positively skewed. The result of kurtosis is positive. The value of Jarque-bera is normally distributed in case of log forest, log pop and agricultural land square km is normally distributed which is checked through probability value for normally distributed the p value is greater than 10% and is not normally distributed in case of index technology (tractor and tube well) because the value is less than 10%.

Table 1. Descriptive Statistics

Variables	FOREST	POP	TECHNOLOGY	LAND
Mean	8.063394	8.054789	0.506521	362025.5
Median	8.082413	8.072801	0.344711	360990.0
Maximum	8.725238	8.277335	1.269465	385090.0
Minimum	7.062304	7.787731	0.000000	352060.0
Std. Dev.	0.368152	0.148317	0.375375	6880.452
Skewness	-0.189522	-0.246356	0.728073	0.888953
Kurtosis	3.302753	1.823547	2.120224	4.316088
Jarque-Bera (prob.)	0.43144 (0.805959)	2.982479 (0.225093)	5.306339 (0.07042)	8.970565 (0.27934)
Sum	354.7893	354.4107	22.28691	15929120
Sum Sq. Dev.	5.828059	0.945905	6.058986	2.04E+09

The unit root test is used for checking the stationary which is (mean, variance and auto correlation are all constant over time). Log population is stationary at the level I (0), index technology (tractor and tube well) and agricultural both variable are not stationary at the level these variable are stationary at 1st difference I (1). There is mix order of integration therefore we use ARDL test.

Table 2. Unit Root Test

Variables	Level (t-stat)	P-value	1st Difference (t-stat)	P-value
tech	------	-------	-5.034426	0.0002
Land	------	-------	-5.239431	0.0001
deforest	-----	-------	-5.429310	0.0000
population	-5.495646	0.0000	-------	--------

Table 3. Lag Length Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-379.0328	NA	980.6204	18.23966	18.40515	18.30032
1	-140.9145	419.5417	0.025113	7.662596	8.490058	7.965894
2	-30.05028	174.2152*	0.000280*	3.145251*	4.634682*	3.691187*

Table 3. ARDL Bound Test

Test Statistic	Value	K
F-statistic	6.133475	3

Critical values Bound

Significance	I0 Bound	I1 Bound
10%	2.72	3.77
5%	3.23	4.35
2.5%	3.69	4.9
1%	4.29	5.61

ARDL test is used for co- integration between log deforestation, log population, index technology and agricultural land square km. The calculated F stat is greater than the upper bound at 5 %. The null hypothesis of no co - integration is rejected, therefore we achieve co-integration between the variable of the model.

Table 4. Long Run Coefficient using ARDL test

Dependent variable: deforestation

ARDL (1, 0, 1, 1)

Time Period (1972 to 2016)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POP	2.686965	0.7660924	3.531186	0.0012
TECHNOLOGY	0.021655	0.187116	0.115730	0.9085
LAN	-0.000012	0.000005	-2.268584	0.0298
C	-9.555422	6.465922	-1.477813	0.1487

The coefficient of the population, which we take log shows that there is a positive and significant relation between population and deforestation. The result show that 1 percent increase in population, then deforestation increase by 2.686965 percent if all other variables are constant in the long run. There is no significant result between technology and deforestation. The results show that a 1 unit increase in technology the dependent variable deforestation is increasing by 0.021655 percent if All other variables are constant in the long run. There is a negative relationship between agricultural land square and deforestation 1 unit increase by the agricultural land square, deforestation decrease by 0.000012 percent other variables are constant in the long run.

For short run analysis, we use Vector Error Correction Model we check the short run dynamic between deforestation, population, agricultural land square and technology. The short run result shows that there is positive and significant of population on deforestation. Technology has the positive and insignificant effect of deforestation. Agricultural land squares zero negative and insignificant effect on deforestation. R square shows that dependent variable explain 43%by the independent variable. The negative and significant coefficient of Coint-Eq (-1) is -0.668033 model is theoretically correct.

Table 5. Error Correction Representation

ARDL (1, 0, 1 ,1)

Dependent variable: deforestation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(POP)	334.246608	154.978270	2.156732	0.0382
POP(-1)	-304.006686	129.664416	-2.176694	0.0365
TECHNOLOGY	0.014466	0.124462	0.116230	0.9082
D(LAND)	-0.000000	0.000003	-0.077093	0.9390
CointEq(-1)	-0.668033	0.148169	-4.508579	0.0001
R-squared	0.439216		Mean dependent var	0.032858
Adjusted R-squared	0.323760		S.D. dependent var	0.151405
S.E. of regression	0.124506		Akaike info criterion	-1.159278
Sum squared resid	0.527061		Schwarz criterion	-0.828294
Log likelihood	32.34485		Hannan-Quinn criter.	-1.037959
F-statistic	3.804200		Durbin-Watson stat	2.166757
Prob(F-statistic)	0.003751			

Table 6. Diagnostic Test

Test Statistics	LM-stat	Chi Square	F-stat	Prob.
1. Heteroskedasticity	20.20010	0.5086	0.88290	0.6115
2. Auto -Correlation	2.034456	0.1638	1.679872	0.2039
3. Jarque Bera Normality	------	------	3.225960	0.199293
4. Ramsey RESET	-----	-------	1.166850	0.2879

The estimated result of diagnostic test show that there is no hetro (variance are constant). There is no serial correlation between the variable of the model and time series data are normally distributed. Ramsey Reset tests show that the model has correct functional form.

Figure 1. Cumulative Sum of Recursive Residuals

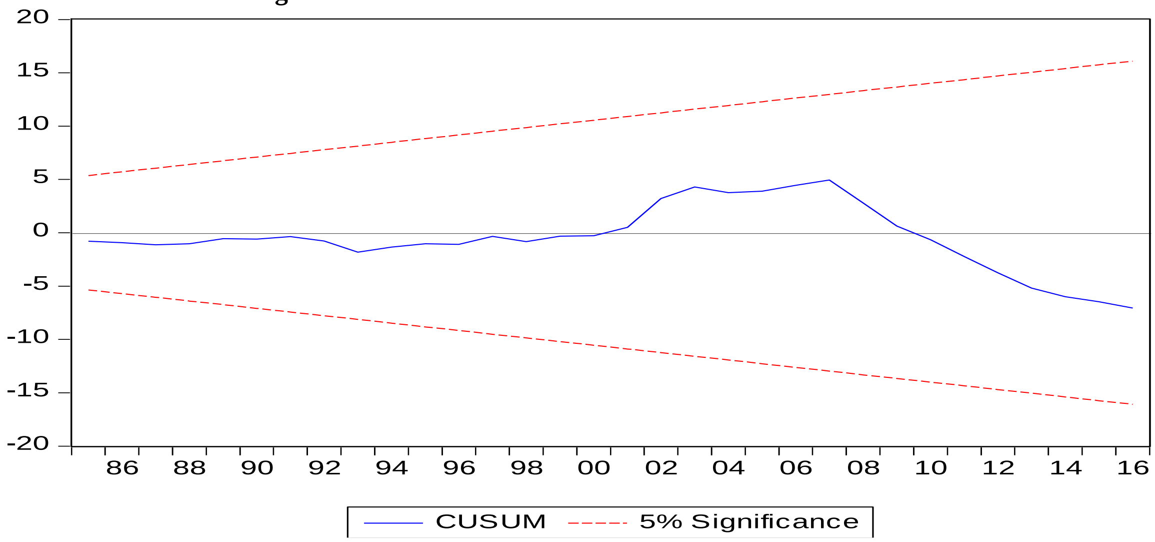
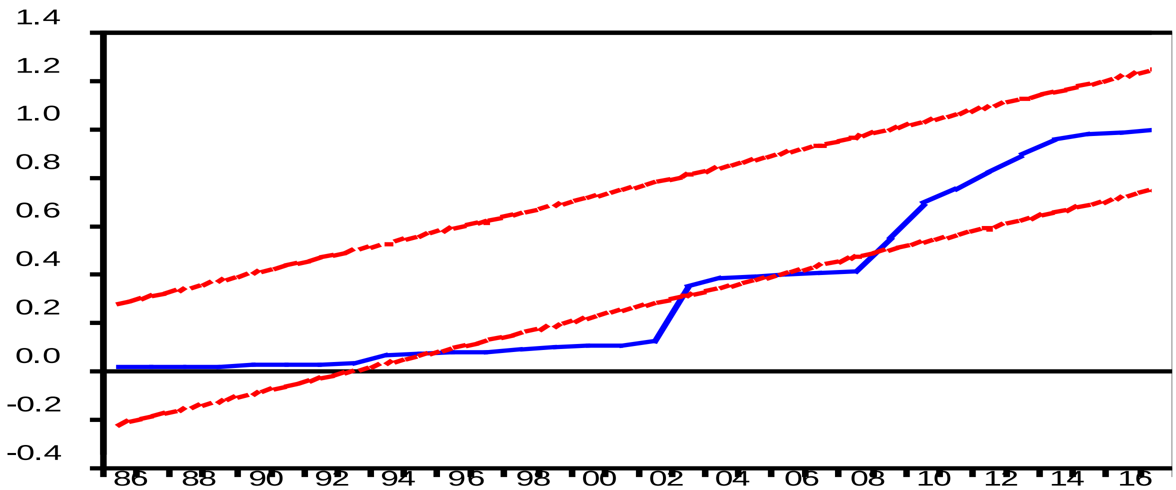


Figure 2. Cumulative Sum of Square of Recursive Residual



We report the Cumulative Sum and Cumulative sum of square the result of Cumulative Sum and Cumulative sum of squares are between two critical lines which indicate that the model is stable

VI. Conclusions

The estimation of ARDL test shows that there is Co integration between the variables of this model. The long run estimation shows that the population has a positive and significant effect of deforestation in Pakistan mean population increase deforestation also increase. The agricultural square land has a negative and significant relationship with deforestation in Pakistan mean that agricultural land increase deforestation decrease. Technology has the positive and insignificant effect of deforestation. The short run result shows that there is positive and significant of population on deforestation. Technology has the positive and insignificant effect of deforestation. Agricultural land squares zero negative and insignificant effect on deforestation. The diagnostic test show that there is no auto correlation, heteroscedasticity and model corrects functional form with normally distributed data. The study concludes that the government has to play in decreasing deforestation through making policies for reducing population and also decrease deforestation through the increasing agricultural land.

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