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Natural Resource Curse in Nepal with Emphasis on Deforestation and Violence

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NATURAL RESOURCE CURSE IN NEPAL WITH EMPHASIS ON DEFORESTATION AND VIOLENCE

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1.Introduction

For many decades, economists have discussed the role of agricultural productivity and natural resources in economic development. By the late 20th century, various studies showed the poor growth experience of resource-rich countries in the post- world war-II period. Doppellhofer (2000) concluded that none of the countries with extremely abundant natural resources in 1970 grew rapidly for the next 20 years, with the exception of Malaysia, Mauritius and Iceland. Other studies that yielded similar conclusions include Auty (1990), Gelb (1988), Sachs and Warner (1995, 1999), and Gylfason et al. (1999). This phenomenon of lower economic growth among resource abundant countries is known as a resource curse.

While the resource curse is generally accepted, attempts to determine its roots have so far produced four general hypotheses. The one that stands out is the *resource curse hypothesis*. According to this hypothesis, there exists a poor potential for resource-based development in inducing the economy-wide innovation necessary to sustain growth in a small open economy (Auty 1993, 1994, 1997 and 2001; Gelb 1986b and 1988; Gylfason 2001; Gylfason *et al*, 1999*;* Matsuyama 1992; Rodriguez and Sachs 1999; Ross 1999; Sachs and Warner 1995 and 2001; Stevens 2003). Matsuyama (1992) came to the conclusion that trade liberalization in a land-intensive economy could actually slow economic growth by inducing the economy to shift resources away from manufacturing (which produces learning-induced growth) towards agriculture (which does not). The adverse effects of agricultural production arise because the agricultural sector directly employs the factors of production that otherwise would be in manufacturing.

The resource curse hypothesis has also been attributed to "Dutch disease" effects. Dutch disease models demonstrate that the existence of large natural resource sectors, or booms in these natural resource sectors, will affect the distribution of employment throughout the economy, as wealth effects pull resources in and out of non-traded sectors. These sectorial shifts can affect long term growth (Matsuyama, 1992).

The second explanation suggests the *open access exploitation hypothesis*, i.e. poorly defined resource rights may actually reduce welfare in that economy (Brander and Taylor 1997 and 1998; Chichilnisky 1994; Hotte *et al.* 2000; Southey 1978). According to this hypothesis, trade liberalization may exacerbate the problems related to open access exploitation. Trade liberalization has given rise to the concern over the sustainability of major renewable resource stocks. For example, there have been widely publicized claims that forests in countries such as Brazil, Canada, and Indonesia are being harvested excessively (Brander and Taylor 1997). Moreover, the temporary gains experienced by the exporting country from selling a resource good on world markets are not re-invested in an alternative asset. These studies have pointed to the role of natural resources in fostering corruption and rent-seeking behavior.

The third explanation proposes a *factor endowment hypothesis*. This hypothesis focuses on "dualism within dualism" in an economy (*Natural Resources and Economic Development*, Barbier; 2005). The first "dualism" concerns aggregate resource use and dependency within the global economy. Most low and middle-income economies are highly dependent on the exploitation of natural resources. For many of these economies, primary product exports account for the vast majority of their export earnings, and one or two primary commodities make up the bulk of exports. Moreover, recent evidence suggests that increasing economic dependence on natural resources is negatively correlated with economic performance. The implications for low income countries is that the "take off" into sustained and structurally balanced economic growth and development is still some time away, and thus the dependence of their overall economies on natural resources will persist over the medium and long term. The second "dualism" concerns aggregate resource use and dependency within a developing economy. A substantial proportion of the population in low and middle-income countries is concentrated in marginal areas and on ecologically fragile land, such as converted forest frontier areas, poor quality uplands, converted wetlands and so forth. Households on these lands not only face problems of land degradation and low productivity but also tend to be some of the poorest in the world (Easterly and Levine, 2003).

Finally, the fourth explanation is the *social conflict hypothesis*. This theory studies the relationship between natural resources and civil war. It suggests that natural resources (like oil) increase the likelihood of conflict, particularly a separatist conflict while 'lootable' commodities (like gemstones and drugs) do not make conflict more likely to begin, but they tend to lengthen existing conflicts (Ross, 2004). According to this hypothesis, it is the civil wars that depress economic growth which places natural resources in a more indirect role. Snyder (2003) argues that the key variable is the ruler's ability to control the extraction process: lootable resources only breed disorder, he suggests, when a ruler lacks this control. Other studies have implied that local politics around the mine site - including relations between the extraction firm and local communities - determines whether or not a country's mineral wealth will lead to violence (Switzer, 2001; Swanson, 2002).

Nepal, a small mountainous country in the central Himalayas, exhibits many of the characteristics associated with the resource curse. The country is economically poor with a per capita income of around US$400. The income share held by the highest 20% of the population is above 54% while the poorest 20% share around 6% of the income (World Bank Report, 2005). Much of the income is concentrated in the hands of a limited percentage of people, and inequality of income is high. In fact Nepal ranks among one of the worst in Human Development Index, a comparative measure of life expectancy, literacy, education and standards of living for countries worldwide. The index for some of the countries around Nepal is given in Table 1. Moreover, 30-50% of the population lives on fragile lands (World Bank, World Development Report, 2003). This inequality in the distribution of income and high concentration of the population on fragile land has led to dualism within dualism within the Nepalese economy. In addition, the country has been in a state of civil war from 1996- 2007. The forest sector contributes greatly to the national economy and in 2001 alone; revenue from forest products was about US $ 6.31 million, which is 8.6% of Nepal's total revenue (Central Bureau of Statistics, 2002). The rate of forest area decrease was 1.7% per annum during 1978/79 to 1994. Since the beginning of the civil war, the annual rate of forest area depletion has been around 4.7%.

Table 1: GINI INDEX- Income and Inequality

HDI Rank	Country	1992-1997 [1]
181	Afghanistan	N/A
146	Bangladesh	31.0
132	Bhutan	46.8
134	India	36.8
95	Maldives	N/A
144	Nepal	47.3
141	Pakistan	31.2
102	Sri Lanka	41.1

Source: "World Development Indicators", Washington D.C., World Bank (2009)

Sachs and Warner (1997) study the resource curse phenomenon in Nepal using primary product exports as a measure of resource abundance. Dasgupta (1991) establishes the resource curse hypothesis in case of Nepal with the help of primary product export share and share of population on fragile lands as proxies. These studies find evidence that supports the factor endowment hypothesis. However no study has been conducted so far to the author's knowledge with regard to proxies like forestry and arable land in the case of Nepal. Increase in overall GDP from deforestation may give rise to a greater environment-poverty trap. Hence it can be argued that forest depletion, along with the environment-poverty trap reasoning, gives a good measure of economic growth.

The purpose of this paper is to investigate the resource curse hypothesis in context of Nepal based on the "dualism within dualism" and social conflict hypotheses. The paper will focus on the relationship between the growth of the economy and the natural resources in Nepal by statistically testing the resource curse hypothesis using three different measures of resource abundance in Nepal namely, arable land, primary product exports and net forest depletion. These results provide additional insights to the factor endowment hypothesis as it relates to dualism

[1] The Gini Index lies between 0 and 100. A value of 1 represents absolute equality and 100 absolute inequality

within dualism. The paper will also shed in some insight to violence and deforestation and study the cause-and-effect relationship between deforestation and the recent insurgency in Nepal.

2.Literature Review

The importance of natural resources as a driver for economic growth has undergone a dramatic change in the past decades. Until the 1980s, economists generally perceived an abundance of resources as advantageous. However, empirical and theoretical literature that emerged in the 1990s reached opposite conclusions. Thus, the phrase 'natural resource curse' was coined and is associated with slower economic growth, violent civil conflict, and undemocratic regime types.

Various studies have been undertaken with regard to proving the resource curse hypothesis on the global level. These include Corden (1984), Krugman (1987), Wahba (1998), and Torvik (2001). Torvik (2002) also shows how, in a rent-seeking economy with weak institutions, an unanticipated resource boom will result in more wasteful rent-seeking activity rather than greater entrepreneurship and investment in productive activities. Brander and Taylor (1997a, 1997b, 1998) have discussed the gains from trade for countries exporting products derived from renewable resources. When discussing the gains from improved terms of trade under open access, they observe that 'the only way the foreign country could take advantage of terms-of-trade effects and experience steady-state gains would be if it could specialize in the resource good' (Brander and Taylor 1998).

Sachs and Warner (1997) showed regression evidence of the curse of natural resources with as many as nine additional regressors. The list of additional variables include initial GDP, openness policy, investment rates, human capital accumulation rates, changes in the external terms of trade, government expenditure ratios, terms of trade volatility, and the efficiency of government institutions. But the study found no evidence that controlling the previous decade's growth rate altered the negative natural resource effect. This rule out the possibility that omitted geographical or climate variables explain the curse, or that there is a bias resulting from other unobserved growth deterrents. However, Sachs and Warner (2001) conclude that resource-abundant countries tend to be high-price economies since there was a positive relationship between the log of the relative price level during any year of the 1970s and natural resource intensity in 1970, after controlling for the income effect. Moreover, a strong inverse relation

across countries between the log of the export contribution to growth during the period 1970 - 1990 and the log of natural resource abundance in 1970 suggest that these countries tend to miss out on export led growth.

In the context of resource-rich societies, social exclusion and inequality might be exacerbated by insufficiently compensated land expropriation, environmental degradation, inadequate job opportunities, and labor migration (e.g., Rosser, 2006). Resource rents also provide a potential source of funding for the start-up costs associated with initiating a rebel organization. Collier and Hoeffler (1998), based on cross-section analysis, found that resource dependence had a significant curvilinear effect on both the onset and duration of war. As a measure of resources they used the ratio of primary exports to GDP—a measure also popularized by Sachs and Warner (1997) in the parallel literature focusing on the relation between resources and economic growth. In a follow-up series of papers, Collier and Hoeffler demonstrated (i) that resources have an impact on some types of wars, but not on others (see also Reynal-Querol, 2002); (ii) that resources are also significantly correlated with the onset of war in a panel-data setting (Collier and Hoeffler, 2004); and finally (iii) that the main results are robust to employing alternative measures of resource wealth (notably a measure of resource rents, see Collier and Hoeffler, 2005).

Civil wars are commonly linked to gemstones, drugs, and timber, also known as 'lootable' commodities (Le Billon, 2001; Ross, 2004 and 2006).[2] Between 1990 and 2000, civil wars occurred in five diamond-producing states, three opium-exporting states, three major cannabis-exporting states, and two leading coca-exporting states (Ross, 2004). The partial influence of these commodities on civil war is difficult to test, owing to a shortage of reliable data. However, little research has been done on the role of timber. Those case studies that were carried out suggest that timber exports may have influenced the duration (though not the initiation) of three recent civil wars: Cambodia, Liberia, and the Democratic Republic of Congo (Global Witness, 2002). Because this issue has not been explored statistically, one does not know if these are isolated cases or part of a larger pattern. However, timber had the clearest effect in Cambodia.

[2] However, this link has been disputed by Smith (2004). Lujala et al. (2005) demonstrate that there is no relation between diamonds and conflict onset. Humphreys (2005) also suggests dependence on agricultural production matters, implying that social relations co-shaped by economic structure are a driver of conflict.

Between 1989 and 1995, the rebel Khmer Rouge was able to maintain its viability as a military force owing to its sales of both timber and gemstones; when this revenue dropped off after 1995, the Khmer Rouge gradually fell apart, and by 1998 it had collapsed. The sale of timber may have lengthened the conflict by several years (Le Billon, 2000; Brown & Zasloff, 1998). In the other two civil wars, timber played at most a small role in perpetuating the conflict.

3.Resource Curse in Nepal

Nepal is largely a mountainous, landlocked South Asian country. As a developing country, Nepal exhibits many of the characteristics associated with the resource curse. The total area of the country is 147181sq. km and the total population is 29 million with a 2.2% annual growth rate. The population density is about 190 people per sq. km., among which 30-50% of the population live on fragile lands. Around 80% of the people are engaged in agricultural activities, contributing 34% to GDP. Moreover, about 25% of the population still lives below absolute poverty.

Nepal's overall long term growth has been quite discouraging. This is presented in Table 2:

Table 2: Average Annual Growth Rates (%) of Gross Domestic Product (GDP), Population, and Per-capita GDP

Periods	GDP	Population	Per-capita GDP
1965-1980	1.9	2.4	-0.5
1980-1990	4.6	2.6	2.0
1990-2000	4.8	2.4	2.4
2000-2005	2.6	2.1	0.5
2005-2009	4.0	2.2	1.8

Source: Economic Surveys, Ministry of Finance and Central Bureau of Statistics, Government of Nepal.

Nepal has so far launched eleven development plans. These were all 5-year plans with the exception of two 3-year plans. However there were no plans in 1961 and 1991 due to political changes. The above table clearly indicates that even after almost sixty years of planned development, there has not been any substantial change in the economic status of the people. The economic growth rate has not been encouraging during the entire period under study. When considering the population growth rate it may be considered as dismal.

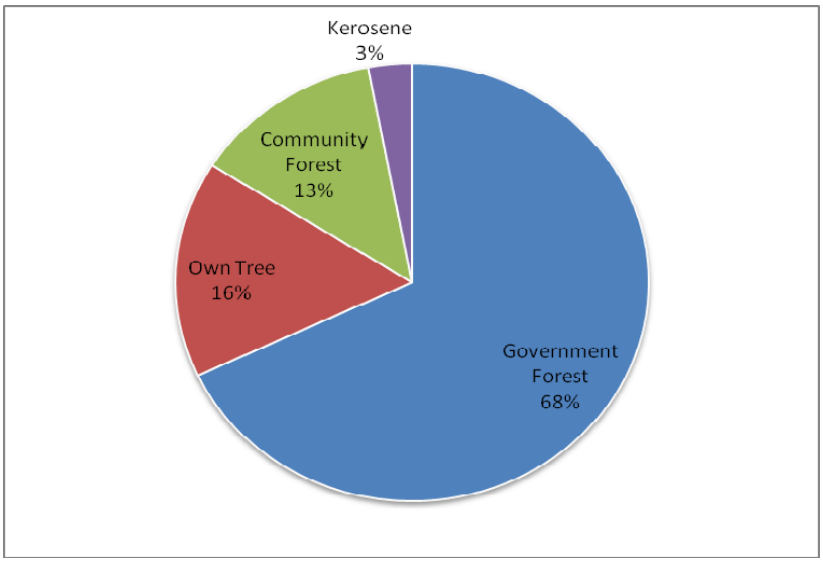
A few studies have attempted to explain this dismal economic performance. Dasgupta (1993) established a relation between rural poverty and resource degradation in order to understand why the environment-poverty "trap" is so entrenched in many poor rural areas. Unlike the resource curse hypothesis, the environment-poverty trap asserts that poverty is a major cause of environmental degradation, forming a vicious circle situation. One of the countries in his study was Nepal. He concluded that inequalities in wealth between rural households seem to have an important impact on land degradation and deforestation processes, which in turn appear to have an impact on the livelihoods of the rural poor. Thus one possible explanation, in the case of Nepal, may the complex connections between arable land, deforestation and the livelihoods of the rural poor.

Forests are one of Nepal's most important natural resources. The national forest and protected area system, which includes national parks, wildlife reserves, hunting reserves, conservation areas and buffer zone covers about 5.83 million hectares (Dept. of Forest, Research and Survey, 2005). This is about 29% of total land area of the country, down from 35% in the 1980s. 20% of this is protected as national parks. In addition to their important environmental role, forests play a vital role in economic growth. Both direct benefits (such as timber, fodder, fuel wood, etc.) and indirect benefits (such as erosion control, flood control and CO_2 sequestration etc.) are derived from forest resources at a local as well as a national level.

Duraiappah (1996) mentions logging and fuel-wood collection as main sources of deforestation worldwide and the United Nation's Food and Agriculture Organization (FAO) estimates show that 1.5 billion of the 2 billion people worldwide who rely on fuel-wood for cooking and heating are overcutting forests. Increased fuel-wood demand, burning and grazing, and weak forest protection institutions contribute to deforestation (Repetto & Gillis, 1988; Brown and Pearce, 1994). The World Resources Institute (WRI, 1994) cited increasing human and livestock populations, poverty, the demand for fuel wood and high levels of consumption by industrialized nations to be important causes of deforestation. Panayoutou (1994) identified excessive timber logging as the main cause of deforestation in Indonesia and Malaysia whereas in Nepal he found it to be due to excessive fuel-wood consumption, overgrazing and fodder

harvesting. The pie chart given below in Figure 1 indicates that 80 percent of the energy demand in Nepal is fulfilled by fuel-wood alone. This is consistent with worldwide trends.

Figure 1: Percent of households using different sources of fuel energy in Nepal



Data Source: WECS, 1996

While forests are a crucial resource for the rural poor in Nepal, deforestation also creates arable land which is another variable that is considered as a proxy for resource abundance in this study. Arable land is the land capable of being used for crop growing and, thus, has qualities including a fresh water supply and richness in nutrients, and is located where the prevailing climate is suitable (wordiq.com). About 80% of the twenty nine million people of the country live in rural areas and practice subsistence farming, and arable land is an integral part of their livelihood.

Explanatory data analysis has been performed to analyze the relationship between GDP growth, arable land and net forest depletion. The data in table 3 has been culled from various economic surveys, Department of Forestry and Central Bureau of Statistics, and runs from 1970 to 2009.

Table 3: Average Gross Domestic Product (GDP, %), Arable Land (hectares per person), and Net Forest Depletion (current US$)

Periods	GDP Growth (%)	Arable Land (hectares per person)	Net Forest Depletion (current US$, in hundreds of millions)
1970-1979	2.4	0.1621	0.5618
1980-1989	4.1	0.1367	1.0458
1990-1999	4.8	0.1089	1.5127
2000-2005	2.6	0.0914	1.8537
2006-2009	4.0	0.0825	3.6532

Source: Economic Surveys, Department of Forestry and Central Bureau of Statistics, Government of Nepal.

In Table 3, arable land has a negative relation on the growth of the country. This is because even when the measure for per-capita arable land is decreasing, the growth has been increasing. However, there might be a increase in the GDP growth as a result of increase in net forest depletion. The trend is explained later with the resource curse hypothesis regressions.

Nepal was ruled by the Rana oligarchy for over a century. The feudalistic Rana regime was overthrown by the peoples' movement in 1951. After witnessing a multi-party system for about ten years, Nepal became an absolute monarchy with a partyless political system called the panchayat for the period from 1961 – 1990. The year 1990 saw the re-emergence of democracy and reinstallation of multiparty system through the peoples' movement. Since then, the country remained under the multiparty democratic system under the Royal Action of 4th October, 2002. The emergence of the Maoists' insurgence began in 1996 and lasted for a decade. Then there was an agreement between the seven political parties opposing King's rule and Maoists, which led to the re-restoration of the Parliamentary Democratic System on April 2006, and the abolition of the monarchy thereafter. Presently the country is being governed by a caretaker Prime Minister

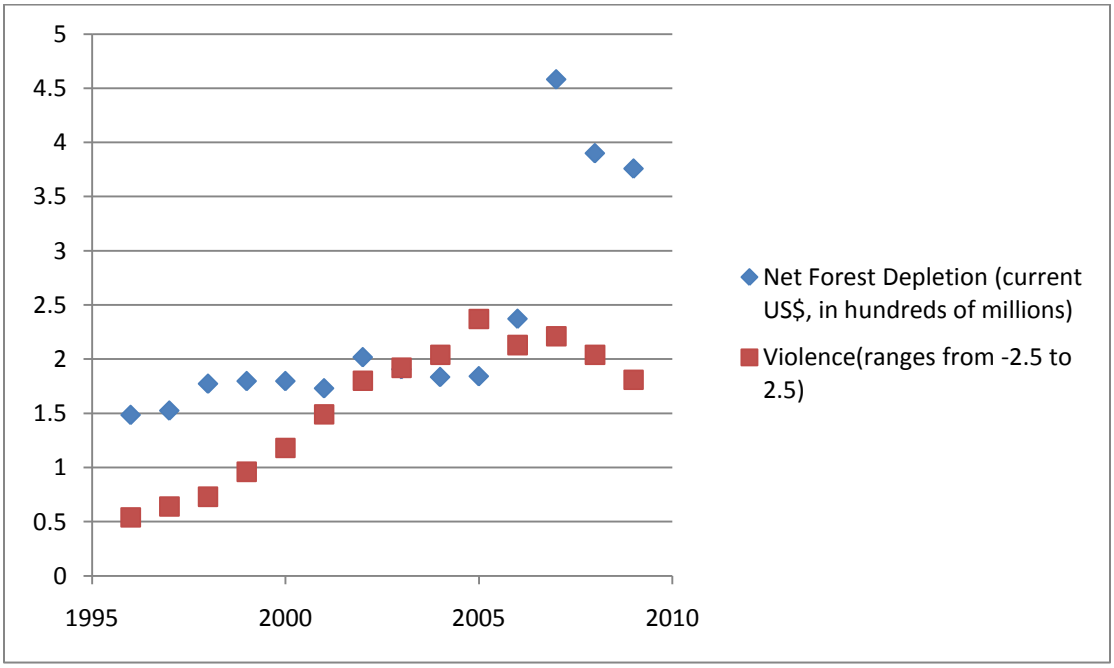
under the Interim Constitution. Political instability has remained a common phenomenon in the country since the advent of democracy in 1951. In fact the present status of economic development of Nepal can be attributed to the legacy of quasi-feudal political structure, political instability, and deteriorated law and order condition. Nepal has an ethnically and religiously diversified population, but ethnic and religious harmony has been the feature of the Nepalese society. Until the recent insurgency – led by the Communist Party of Nepal (Maoist) – broke out in the mid-1990s, Nepal was known as a peaceful country. In fact, in 1970s, the late King Birendra even declared Nepal as a ‘‘Zone of Peace,’’ perhaps to reduce the risk of military invasion from either India or China during the cold war era.

Unlike civil war in neighboring Afghanistan, the civil unrest in Nepal is not caused by ethnic and/or religious tension as the rebellion group (Maoists) included people from all ethnic and religious backgrounds. It is not either a political war motivated by lack of freedom, because war broke out despite improvements in political rights and civil liberties with the reinstatement of democracy in the early 1990s (*Appendix 4*). So, if it is not motivated by political suppression and/or ethnic and religious tension, then what has contributed to civil unrest? According to the Maoists, social and economic injustice against the poor has given rise to inequality in the Nepalese society, particularly in rural and remote areas, and this is the reason for their fight against the government.

The resource curse in Nepal could be attributed to the Maoists insurgency that started in 1996. Environmental deprivation (i.e. deforestation, soil erosion and degradation, flooding caused by over-cropping, over-extraction of mountain resources) “coupled with demographic changes widened socio-economic disparities especially in the form of access to sufficient food and land among peoples in the Mid- and Far-western development regions of Nepal and indirectly led to the Maoist insurgency in these areas” (Bhurtel and Ali, 2003). Due to this insurgency in a rural setting, both the security personnel and the Maoists were trying to increase their power by capturing the natural resources and the income from them. The forest became a battleground for both the parties.

Most studies have measured a country's 'resource wealth' by using the ratio of its resource exports to its GDP. However, civil wars might cause resource dependence by forcing a country's manufacturing sector to flee while leaving its resource sector, which is location-specific and cannot easily move the major force in the economy by default. A challenge concerns the economic perspective on (potential) rebels as the key decision maker. Many analysts favor explanations based on politics and 'state strength' over explanations based on economics (e.g., Auty, 2004; Dunning, 2005; Humphreys, 2005; Snyder and Bhavani, 2005). According to this view, resource-rich economies tend to suffer from weak and unaccountable leadership, which is unable or unwilling to diversify the economy and deliver key public goods. Alternatively, resource riches may invite oppressive regimes, resulting in genuine grievances among a share of the population.

Figure 2: Deforestation and Violence Trend in Nepal



Source: World Bank and Worldwide Governance Indicators (Sept. 2010)

Figure 2 talks about the relation between violence and forest depletion in Nepal. The violence data is extracted from the *Worldwide Governance Indicators (2010),* while the forest depletion data is from the *World Bank* website. The violence variable captures perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism. It ranges from -2.5 to 2.5 with higher the number greater the violence in the country.

According to figure 2, the net forest depletion and violence has a slightly positive relationship. During the initial years leading up to the insurgency, as the amount of deforestation increased, the violence in Nepal rose. However, while the amount of deforestation only increased slightly from 1998 to 2005, the violence in the country accelerated. During this time, the worsening of the situation could be attributed to various factors other than deforestation. However, earlier studies that were carried out suggest that timber exports may have influenced the duration (though not the initiation) of three recent civil wars: Cambodia, Liberia, and the Democratic Republic of Congo (Global Witness, 2002; Ross 2004). While violence has slowly been decreasing after the end of the insurgency in 2006, the amount of deforestation in Nepal has increased astronomically. This could be due to the fact that it was the rebels who came to power after the war and its activists were still involved in illegal timber exports.

4.Resource Curse Hypothesis- Regression

Regression analysis is used to analyze the impact of changes in natural resources on the GDP growth in Nepal. The time series data for the study covers 1970 to 2009 and was taken from the World Bank; and Ministry of Finance, Central Bureau of Statistics. This section talks about the model and methodology on resource curse followed by its empirical results.

Following previous studies, GDP growth is regressed against resource abundance proxies and other explanatory variables. Like most of the previous studies including Dasgupta (1993), Barbier (1999), and Sachs and Warner (1997), this study will focus on primary product export as a proxy for resource abundance data. However in addition to the primary product export, other resource abundance proxies like arable land and net forest depletion will also be studied. Given the importance of agriculture, rural-living and forests in Nepal, it is expected that these proxies will be able to provide a complete picture to Nepal's resource curse situation. Also, usually mineral export is considered to be the proxy for resource abundance. However, Nepal does not have any mineral exports. A wide range of variables have been either included or considered as a part of this study. Variables such as rural to urban population ratio, forest area, degree of openness, gross domestic investment and external terms of trade did not contain adequate data. Two dummy variables "Pre Democracy" and "During War" have also been included to incorporate the effect of political changes in Nepal.

The null hypothesis is that resource abundant proxies- arable land, primary product exports and net forest depletion- doesn't affect the growth in Nepal adversely. This will make the alternative hypothesis: An increase in arable land, primary product exports and net forest depletion will depress the growth of Nepal and vice-versa, implying the resource curse.

A simple model has been used to formulate our empirical study. Annual economic growth depends on the resource abundant proxies- arable land, primary product exports and forest depletion, along with net exports, gross capital formation and two dummy variables. Arable land is the land that can be or is cultivated. The higher the share of arable land, the higher is the dependence on resource sector. Primary product exports are the share of exports of primary

products or natural resource exports in current US dollar term. Similarly, net forest depletion measures the current amount of deforestation in current US dollar term. Net export is the difference between the imports and exports in a given year. Gross capital formation consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. The two dummies are "Pre Democracy", which is the period from 1970 - 1990; and "During War", which is the period from 2001 – 2005. In the case of "Pre Democracy", all the years from 1970 to 1990 have been marked as one (1), and the remaining years as zero (0), while in the case of "During War" the period from 2001 to 2005 is marked as one (1) and the rest of the years as zero (0). The reason we included the dummy variables is to capture the discontinuous nature of the war data in Nepal and give us a clearer view of Nepal's political situation.

Thus our regression equation is as follows:

$$\ln(GDP_t) = \beta_0 + \beta_1 \ln(\text{Arable Land}_t) + \beta_2 \ln(\text{Primary Exports}_t) + \beta_3 \ln(\text{Net Forest Depletion}_t) + \beta_4 \ln(\text{Net Exports}_t) + \beta_5 \ln(\text{Gross Capital Formation}_t) + \beta_6 \text{ Pre Democracy}_t + \beta_7 \text{ During War}_t + \xi_t. \quad (1)$$

where ξ_t is the residual or the error term at time t.

From Table 3 there exists the possibility of resource curse in Nepal for the two resource abundant proxies- arable land and net forest depletion. Therefore one can assume β_1 (coefficient of arable land) and β_3 (coefficient of net forest depletion) to carry a negative sign. Moreover, studies done by Sachs and Warner (1997) concluded that resource abundant tended to render the export sectors uncompetitive and as a consequence resource-abundant countries never successfully pursued export-led growth. Hence, primary product export too is assumed to carry a negative sign.

Since arable land, primary product export and net forest depletion are all resource abundant variables, there is a possibility of high correlation between the two independent regressors. Robust checks for multicollinearity will be run because if the regression models are exactly linearly related, then the models cannot be estimated. Moreover in such a scenario, the

covariance between the regression coefficients of the two variables will be very high, thus making it difficult to interpret individual coefficients. Another problem is heteroskedasticity. Heteroskedasticity simply means unequal scatter. In this case, the OLS estimators are no longer BLUE and will be inefficient. As a result, forecasts will also be inefficient. The correlation matrix was analyzed to eliminate non-significant variables that may have contributed to multicollinearity. To perform the test using heteroskedasticity or autocorrelation robust standard errors, we supply our own covariance matrix using the 'vcov' parameter (coeftest: GDPlm, vcovHC). This corrects for multicollinearity by adjusting the heteroskedasticity and autocorrelation in the matrix (see, Appendix 1). The heteroskedasticity tests adjusted the t-values, and hence helped predict the outcome of p-values more accurately. Finally, various transformations have been considered while formulating the above equation. The linear relation, log transformation, square transformation, square root transformation, and various combinations were all considered.

Empirical Findings and Results

The following observations were made about the model after running the tests. The value of R-square is 0.9864, and adjusted R-square is 0.9848.While R^2 gives the information about the goodness of fit of a model, adjusted R^2 is a modification of R^2 that adjusts for the number of explanatory terms in the model. A R^2 of 0.7354 shows that the model explains a high portion of the variability in the observed data. The residual standard error is 0.7138 on 33 degrees of freedom. The residual standard error (or residual sum of squares) is the difference between the regression sum of squares and the total sum of squares. Since the total sum of squares is the total amount of variability in the response and the residual sum of squares that still cannot be accounted for after the regression model is fitted, the regression sum of squares is the amount of variability in the response that is accounted for by the regression model. Moreover, the p-value is almost zero (less than 1.3^{-10}), which indicates the model fits the data well. Results from the regression analysis of equation 1 are shown in table 4. Scatter plots and box plots for all the variables are shown in the Appendix (2 and 3).

Table 4: Regression results for presence of resource curse in Nepal

(adjusted for Heteroskedasticity)

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	-0.0631791	6.1672852	-0.0102	0.008258**
log(Arable.Land)	-0.0044315	3.6049886	-0.0012	0.00373 **
log(Primary.Exports)	-0.0397340	0.2894288	-0.1373	3.634e-07***
log(Forest.Depletion)	0.0101762	0.0353187	0.2881	0.03624*
log(Net.Exports.Neg)	-0.0218605	0.0959848	-0.2277	0.3814
log(GCF)	0.0903599	0.1017999	0.8876	1.078e-05***
Pre.Democracy	-0.2508420	0.5911638	-0.4243	0.65423
During.War	-0.6532535	0.7661691	-0.8526	0.00471**

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.08915 on 33 degrees of freedom
Multiple R-squared: 0.7354, Adjusted R-squared: 0.7138
F-statistic: 10.27 on 4 and 33 DF, p-value: < 1.3e-10

From table 4 we see that for every 1% increase in arable land, GDP decreases by 0.44%. Similarly, an increase by 1% in primary product exports decreases the GDP by 3.97%. On the other hand, for every 1% increase in net forest depletion, GDP increases by almost 1.02%. This could be attributed to the fact that the cleared area is being used for industrial purposes. All of these variables are highly significant i.e., there is a less than 1% chance of rejecting the null hypothesis when it is true (Type I error). Also an increase in the gross capital formation by 1% increases the GDP by 9.04%, which is consistent with all macro-economic growth models. While "Pre Democracy" dummy is not significant, the war dummy is significant. It indicates that GDP growth has slowed since the re-emergence of democratic rule in 1990. This is in accordance with our initial hypothesis that war adversely impacts the economic growth (as said in Table 2 analysis).

The relation between the resource abundant proxies- arable land and primary product exports- are negative with GDP, while the relation between net forest depletion and GDP is positive. The negative relation is as per our assumption in the null hypothesis indicating the presence of a resource curse in regards to arable land and primary product exports. However, there is no evidence of a resource curse in regards to Nepal's forest. Various reasons could explain the positive relation between net forest depletion and GDP growth.

One possible explanation is the presence of spillover effects. David and Wright (1997) and Wright and Czelusta (2002) argued that it is possible for frontier expansion in a small open economy to lead to sustained long-run growth. They concluded that the key to this outcome appears to be the three conditions for "successful" resource-based development. These three conditions are first, exogenous technological change in resource use; second, complete integration between the frontier and mainstay sectors; and finally, economy-wide knowledge spillovers. According to Arrow (1962) and Romer (1986), if the resource output from the frontier serves as an input into the mainstay production sector, then this ensures that frontier resource exploitation will contribute to some capital investment by entrepreneurs in the production sector. Moreover, the presence of knowledge spillovers means that capital accumulation in resource sector contributes to the overall innovation in the economy, leading to endogenous growth.

In the case of net forest depletion the increase in GDP could be attributed to the growth in the timber export sector (staples thesis). The "staples thesis" argued that the successful development of many countries and regions in the late nineteenth and early twentieth century was led by the expansion of export sectors, and in particular, natural resource exports (Chambers and Gordon 1966; Southey 1978). However, the "unequal development" theorists were less confident about the ability of poorer economies to develop and grow by exploiting their natural resource endowments through promoting primary product exports. It could also be due to the efficiency of the labor and machinery in the forestry sector that could be due to the role of country-specific knowledge.

However in case of forestry in Nepal a crucial factor is the USAID-supported training that has helped community forestry user groups negotiate resource management dilemmas by establishing more equitable norms and increasing the participation of disadvantaged caste and ethnic groups. The program has supported the formation of 1,700 user groups that manage 163,000 hectares. This goes on to strengthen the findings of Brander and Taylor (1997, 1998), Chichilnisky (19994) and Hotte et al. (2000) that poorly defined resource rights may actually reduce welfare in the economy and vice-versa.

5.Policy Recommendations

We find a negative relationship between resource abundance (deforestation) and the level of violence (Figure 2). This could probably be because by funding the war through illegal deforestation and timber exports, the rebels became more powerful. This argument is supported to some extent by the rebels coming to the power. From all the results we could say that while violence might not have led to deforestation, deforestation might help lower violence. We are however, not clear whether deforestation initiated the war or it just happened to lengthen the duration of the war. Other literature relating to the war does not credit deforestation as a reason for the start of the war and rather conclude that the war began due to political and ideological differences. The violent end of the war with the rebels emerging victorious helps us conclude that after all, deforestation played a vital role. Although it didn't initiate the war, it did make the war less violent while giving an upper hand to the rebels.

The results have some policy implications. From the study, it looks like deforestation causes less violence. Thus, one can conclude that the relationship between these two depends on who wins the war. If the rebels win, resource dependence causes a shorter war or less violence but when the government retains power, it is the other way around.

Most of the policies and incentives to reduce deforestation aim to support forest conservation and sustainable management. Few examples available are:

- Swaps (purchase of debt): In Philippines, USD 8 million during 14 years for the conservation of coastal forests
- Property rights (transfer responsibility, work if people depend on forest resources): A revolving fund for biodiversity conservation that purchases land and resells it to people interested in conservation
- Permit trading (e.g. development rights, rely on enforcement): Tradable development rights (TDR) in the US, for example, the New Jersey Pinelands

Since net forest depletion has a positive impact on GDP growth our objective is to analyze the reason and try to implement it in the arable land scenario. Now there is a training

program sponsored by USAID that helps forest users examine issues of equity and participation in resource management. USAID is promoting this good forest management within these groups by concentrating on issues of equity, participation, accountability, and technical management. Moreover there have been acts passed and permits issued to regulate deforestation in the country. This is not the case with arable land or the primary product exports.

6.CONCLUSION

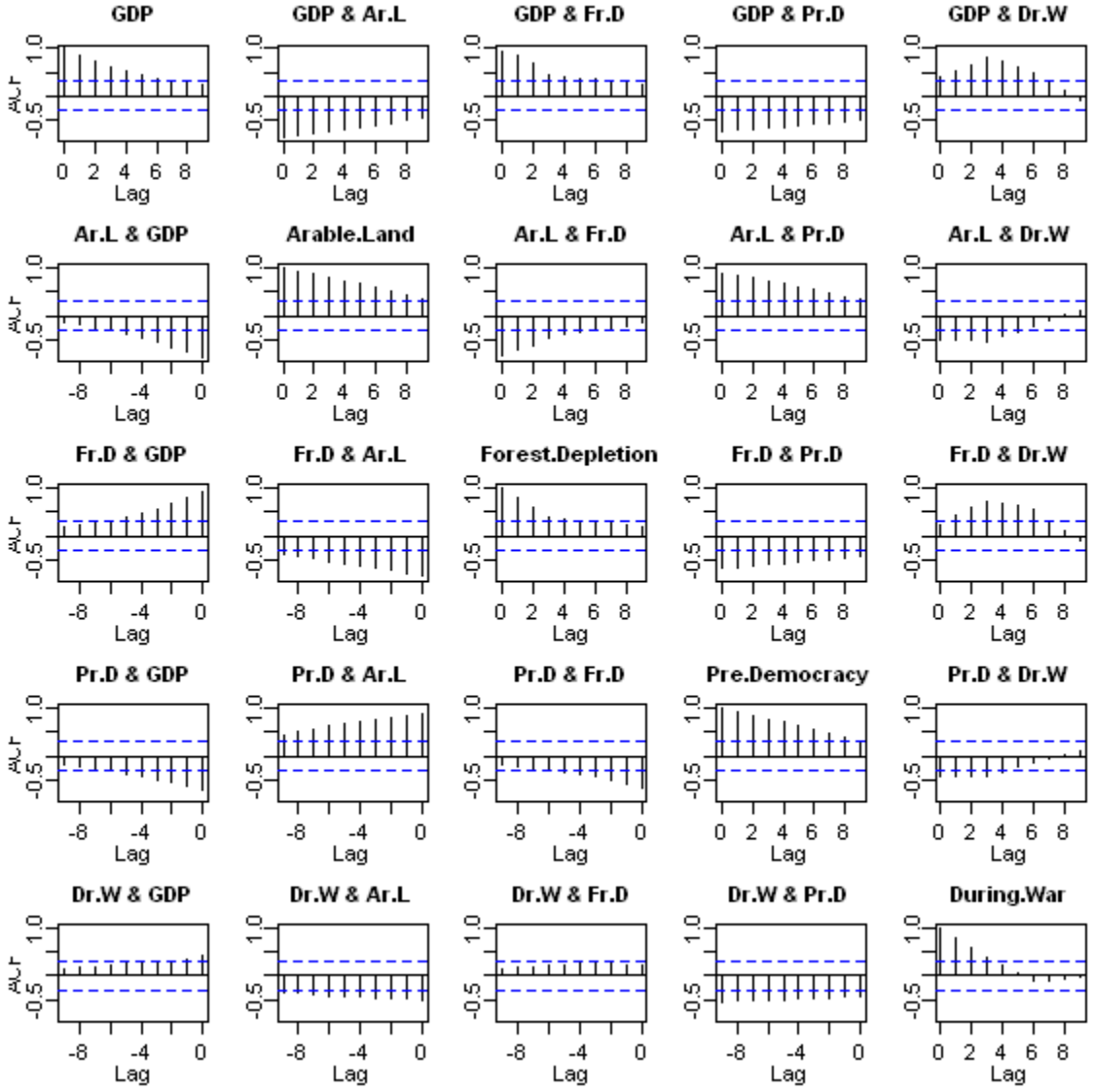
For a few decades now, various studies have been conducted to understand the reasons for slow growth in countries rich in natural resources. This paper empirically investigates this relationship by taking arable land, primary product export and net forest depletion as proxies for resource abundance. Specifically, we tested the hypothesis that an increase in arable land, primary export and net forest depletion would result in a decrease in GDP growth in Nepal, drawing on the theory of the resource curse.

The regression results, after adjusting for heteroskedasticity, show a significant relationship between the GDP growth with arable land primary product export and net forest depletion. The results reveal the resource curse theory is true in case of arable land and primary product export, thereby indicating the theories of Matsuyama (1992), and Sachs and Warner (1995, 1999) is firmly supported by the Nepalese data. We found that an increase in arable land as well as primary product export may retard growth. However, it is also possible for frontier expansion in a small open economy to lead to sustained long-run growth, as shown by our result for net forest depletion. In this case, there exist a positive relation between GDP growth and percentage increase in net forest depletion.

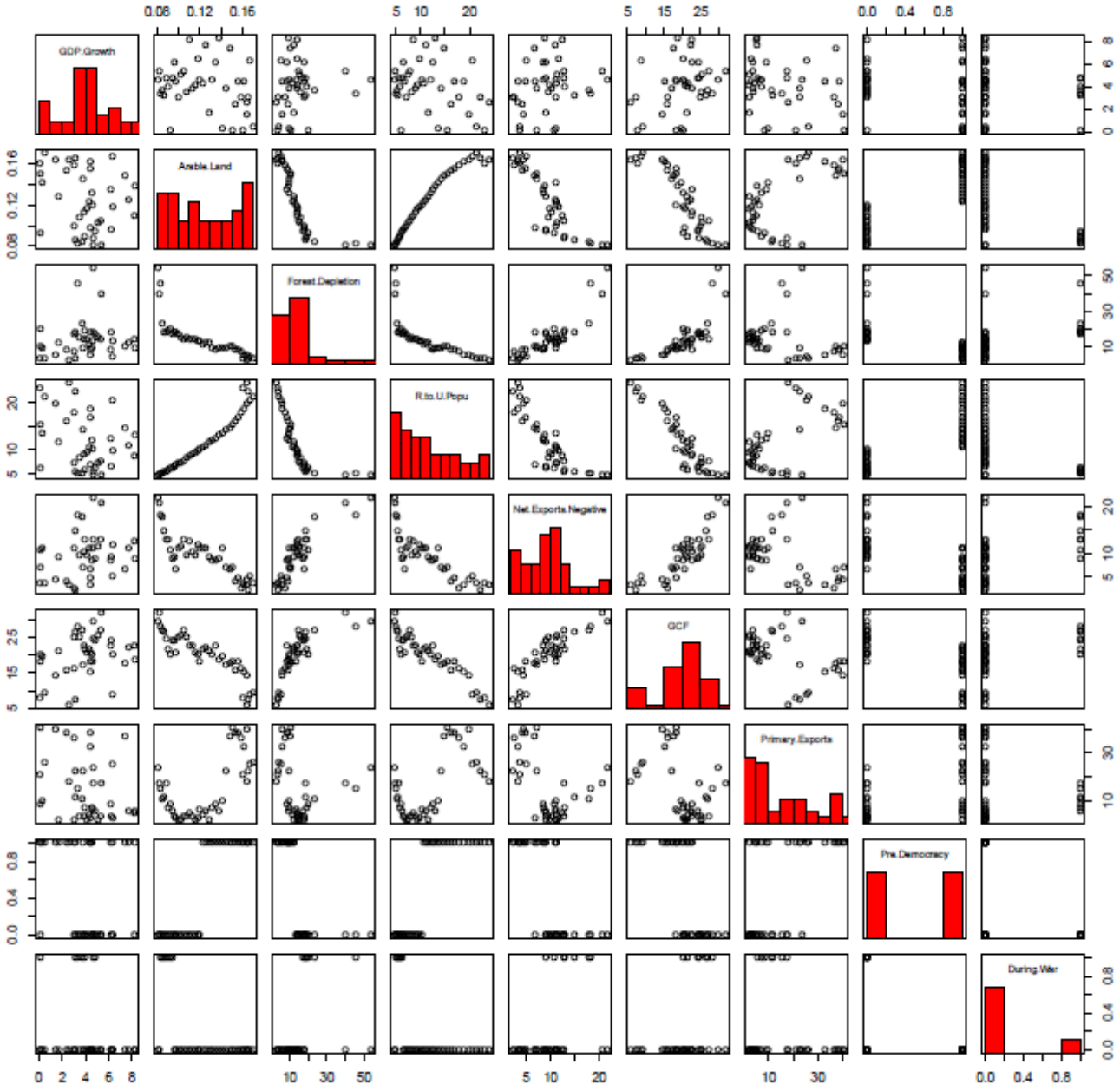
Since the positive relation between forestry and growth could be the result of strong institutional conditions in regard to a country, the paper also made an attempt to investigate the relation of forestry with regard to its governance. But in case of Nepal, development efforts the past five decades have failed to touch the poor and contributed to a rise in unemployment, poverty, and rural–urban inequality, which significantly increased frustration and resentment among, disadvantaged youth in the rural and remote areas. This enabled the Maoists to mobilize disadvantaged youth from the rural and remote areas to fight against the political and economic system, leading to the eruption of civil war since the mid-1990s. However along with the political and socio-economic reasons, one would expect the natural resources to play a role too. Economic success and peace are signaled by economic diversification and low dependence on natural resources (even if these resources are physically abundant).

There however exist few limitations in this study. Although the study does show the relation between deforestation and violence, the direction of the causation between the two variables is not clear. Did the recent insurgency force the country's manufacturing sector to flee while leaving its forestry sector, which is location-specific, the major force in the economy by default? Or was forestry used to fund the recent insurgency, thus increasing the duration of the war and Nepal's dismal economic performance? The failure to answer this question could be attributed to the fact that enough data to run for the study was not available. Analyzing all of this in more detail with a wider dataset is left for future work.

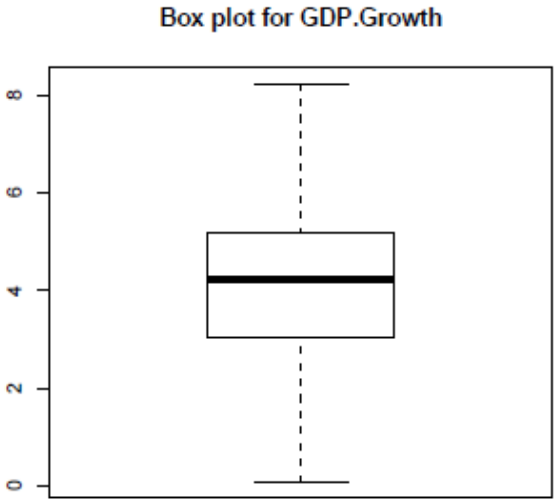
APPENDIX 1: AUTOCORRELATION RESULTS FOR RESOURCE CURSE HYPOTHESIS

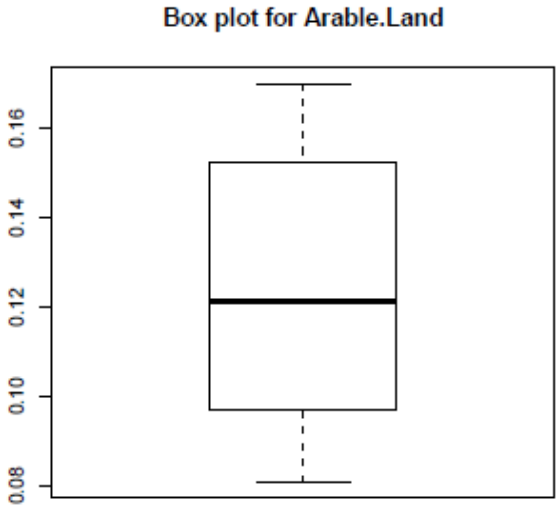


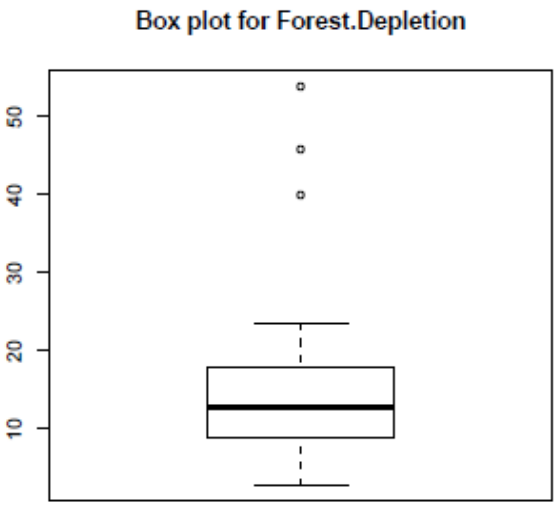
APPENDIX 2: MATRIX SCATTER PLOT ALONG WITH HISTOGRAMS

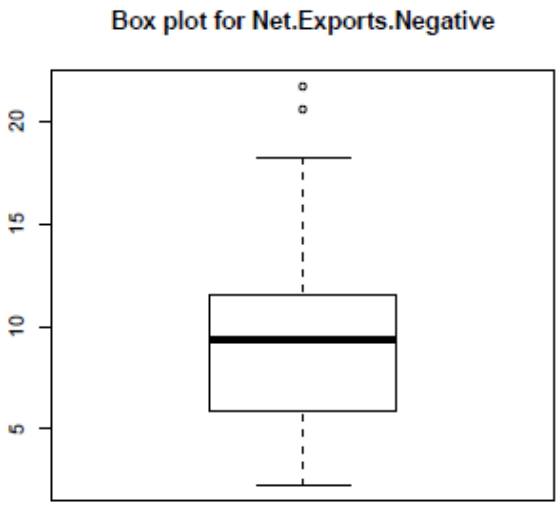


APPENDIX 3: BOX PLOTS FOR RESOURCE CURSE HYPOTHESIS

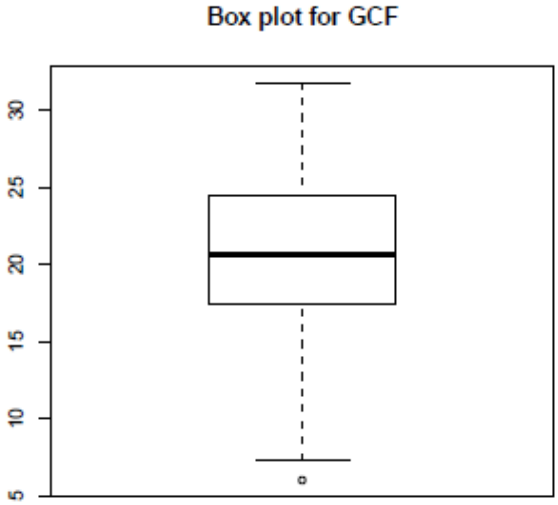


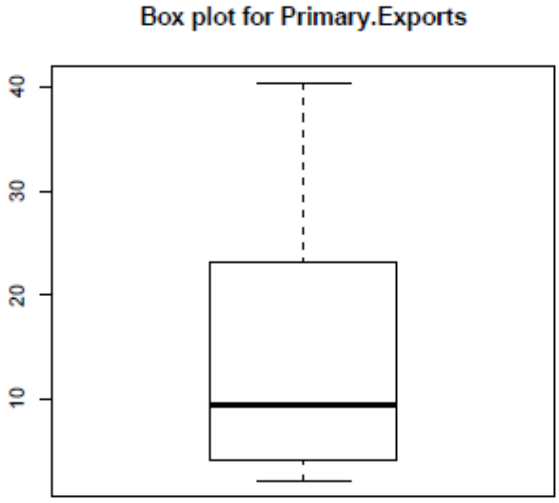


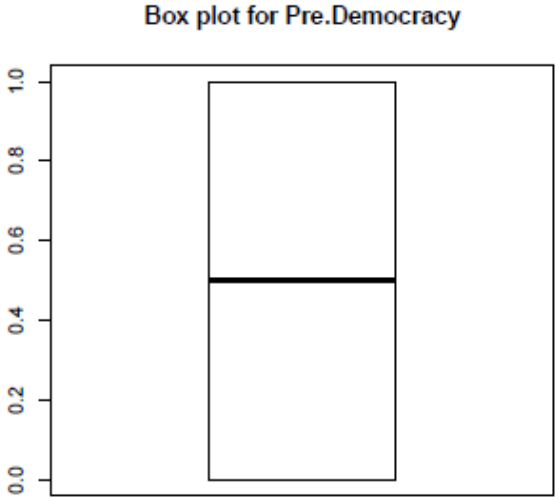


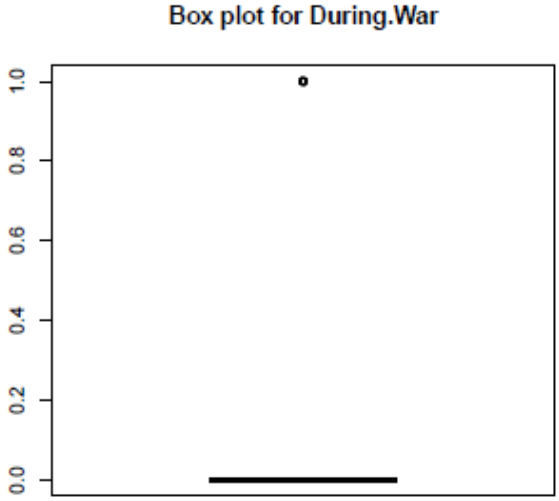


APPENDIX 3: BOX PLOTS FOR RESOURCE CURSE HYPOTHESIS (cont.)









APPENDIX 4: RATING OF POLITICAL RIGHTS AND CIVIL LIBERTIES IN NEPAL[i]

Year	Political rights[ii]	Civil liberties[iii]	Freedom status
1973	6	5	NF
1974	6	5	NF
1975	6	5	NF
1976	6	5	NF
1977	6	5	NF
1978	6	5	NF
1979	6	5	NF
1980	5	4	PF
1981	3	4	PF
1982	3	4	PF
1983	3	4	PF
1984	3	4	PF
1985	3	4	PF
1986	3	4	PF
1987	3	4	PF
1988	3	4	PF
1989	4	5	PF
1990	4	4	PF
1991	2	3	F
1992	2	3	F
1993	3	4	PF
1994	3	4	PF
1995	3	4	PF
1996	3	4	PF
1997	3	4	PF
1998	3	4	PF
1999	3	4	PF
2000	3	4	PF
2001	3	4	PF
2002	4	4	PF
2003	5	4	PF
2004	5	4	PF

Source: Freedom in the World Survey (2004).

[i] Political rights and civil liberties are measured on a one to seven scale, with one representing the highest degree of freedom and seven the lowest. When the combined average ratings for political rights and civil liberties fall between 1.0 and 2.5, then the freedom status is regarded as ‘‘free (F),’’ when they fall between 3.0 and 4.5 regarded as ‘‘partially free (PF)’’ and when they fall between 5 and 5.5 regarded as ‘‘not free (NF).’’

[ii] Political rights enable people to participate freely in the political process. This includes right to vote and compete for public office and elect representative who have a decisive role on public policies.

[iii] Civil liberties include the freedom to develop opinions, institutions, and personal autonomy without interference from the state.

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