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Local Government Forestry Expenditure and Forest Land Cover: A Preliminary Lesson from Decentralized Indonesia

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Abstract

Even though government of Indonesia invests billions of rupiah to tackle deforestation, its effectiveness has been questionable. This study analyses changes in rates of forest cover in Indonesia and their association with forestry expenditures (FE) spent by the provincial governments. Based on 2007 to 2010 data, linear multiple regression results indicate that FE is not enough to tackle the negative change in forest land cover that could represent deforestation. Moreover, it was found that FE have negative association with forest land cover and therefore, can be associated to deforestation. This negative association remains when other factors that affect forest land cover such as wood extraction, agriculture outcome, forestry outcome, population growth and population density and initial environmental conditions have been controlled.
Keywords: Deforestation; Tropical Forest; Population; Forest Cover; Reforestation Expenditure

Abstrak

Walaupun pemerintah Indonesia telah menginvestasikan trilyunan rupiah untuk mengurangi deforestasi, akan tetapi efektifitasnya dipertanyakan. Penelitian ini menganalisa tingkat perubahan luasan tutupan hutan di Indonesia and asosiasinya dengan Pengeluaran Sektor Kehutanan (PSK) yang dibelanjakan oleh pemerintah provinsi. Berdasar data tahun 2007 sampai 2010, hasil regresi multiple linier mengindikasikan bahwa PSK tidak cukup untuk mengurangi akibat negatif dalam perubahan hutan dan lahan yang dapat mngakibatkan deforestasi. Lebih lanjut, ditemukan bahwa PSK berhubungan erat pengurangan luasan hutan, yang dapat dikaitkan dengan deforestasi. Asososiasi yang negatif ini tetap terjadi walaupun faktor lain yang memengaruhi tutupan hutan seperti penebangan kayu, hasil pertanian, hasil kehutanan, pertumbuhan populasi dan kepadatan populasi dan kondisi awal lingkungan telah dikontrol.
Kata kunci: *Deforestasi, Hutan Tropis; Populasi Penduduk; Tutupan Hutan; Pengeluaran untuk Reboisasi Hutan*

JEL classifications: E62; Q58; H76

1. Introduction

The high density of forest cover, high average rainfall and high varieties of vegetation in rainforests have given tropical forests, including Indonesia's forests, a crucial function in providing carbon storage and climate control for the rest of the world. An alarming rate of forest cover loss in all tropical forests in the past 3 to 5 decades (Benhin 2006) of 13.5 million ha each year (Kobayashi 2004) has encouraged researchers and institutions to try to find ways to reduce forest cover loss. Although many factors have been found to affect the deforestation rate, government policies are crucial in controlling the deforestation rate, especially when a new type of decentralization governance has been introduced (Agrawal & Ribot 1999).

As one of the tropical forest countries, Indonesia meets several criteria for selection as an interesting location to study reforestation efforts. This coun-

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try has experienced rapid decentralization since 2001 (World Bank 2003). In addition, Indonesia is a country with the third largest amount of rainforest in the world (Rieley et al. 2008). The decentralization in government should result in very extensive government policies focusing on local issues such as reforestation. Yet, deforestation rates in the country remain alarmingly high. Indonesia is the world's highest emitter of Greenhouse Gases (GHG), especially from land use change, in terms of deforestation (Rieley et al. 2008).

Therefore, this study will assess the impact of government policies on deforestation. In particularly, it will conduct a preliminary analysis of the effect of Indonesia sub national government forestry expenditure (FE) as policy component by evaluating its relationship to the deforestation rate represented by the change in forest land cover. The outline of this study is as follows. The first section contains the introduction. The second section presents current conditions of forest use and economic development in Indonesia. The third section discusses the forest management policies and practices. The fourth section conducts a brief review of the literature on factors which determine the effect of government programs against deforestation. The fifth section describes the data on Indonesian sub national government forest expenditure and the methodology used to examine its impact. The sixth section presents the results of the analysis. The seventh section discusses conclusions and suggestions for further research.

2. Forest Contribution to Social and Economic Development in Indonesia

Historically, across total land uses in Indonesia, the larger percentage consisted of forest cover. In 1950, 84 percent of the total of 193.6 million hectares of land was covered by forest and the remaining percentage was agriculture. Although the data on forest cover included crop plantations, this portion of crop plantation was nonetheless small (Nawir, Murniati, & Rumboko 2008), so it is assumed that forest products made only a small contribution to economic growth. This situation began to change around 1970, when industrial plantations began to develop, though data on these changes was not comprehensive. During the 'Soeharto' regime (1965 to 1998), Indonesia used a centralised approach to direct rapid growth in the export of timber and non-timber-forest-products. This implied a crucial contribution of forests to economic development. The importance of forests to economic growth was best described by Government regulation 21/1970 on Forest Utilization Rights and Forest Products Fees where timber concessions may be withdrawn if the concessionaires did not establish timber manufacturing industries. With cheap labour costs and low technological use, many people depended on these industries.

The forests also held importance in providing land for a massive paddy plantation policy in 1980. Low technology use combined with a huge population provided large numbers of workers needed to convert forests into massive paddy plantations. The result was devastating, as shown from 1996 to 1999, when the first adequate data using satellite imagery was established and these data showed a loss of forest cover, on average, of 2 million ha per year (Ministry of Forestry 2003). The rapid economic development has resulted in massive deforestation. In Sumatra, Kalimantan and Papua where most land was covered by forests, the forest exploitation has been excessive since the establishment of the 5/1967 Forestry Act. (Simon (2004) in Suhardi, Faridah, & Handojo n.d.) reported that within 20 years (1970 to 1990) an estimated 64 million hectares was left severely damaged. Since 2001, the decentralization policy has significantly influenced forest contribution to social and economic development. Forest products still hold importance for social and economic growth. However, the forest-dependent-people now have a place in increasing their economic gain and social contribution. The local people or tribes have gained more access nationally and internationally to contribute to more sustainable forest management. To show how decentralization works, the following section will describe current forest management.

3. Forest Expenditure in Forest Management

Since 1999, forest management has been influenced by the introduction of a decentralized system

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of government that was increasingly implemented from 2001. In forestry, several new laws and regulations and policies regarding the management of forests introduced. These new laws and regulations and policies have been endorsed for keeping law and order in both central and local governments when adopting the new decentralization process.

Fundamental changes in the laws took place in the forestry sector. Only one year after the Soeharto regime was overturned, law 41/1999 on Forestry was enacted which explicitly stated that the management of forests, in managing the source of the wealth controlled by the government aims to provide versatile benefits for mankind. This sustainable forest management approach acknowledges community involvement in managing the forests. The law obliged the government to acknowledge not only state-owned forests but also customary and community forests. Since its independence, Indonesia has included all forest areas into state-owned forests. Previous laws did not require the government to acknowledge long established customary or traditional-community forests. The law establishes a fundamental change in forest policy.

In addition, the new government introduced new management of forestry revenues and expenditures. To boost revenues, concessionaires in timber logging, mining and plantations in forest areas have to pay certain levies for forest use. However, only one type of levy, the levy on timber logging in natural forests (which is called the reforestation fund (*Dana Reboisasi* or DR) is strictly used for forest and land rehabilitation. The government decree 32/2002 on the reforestation fund provides guidance on how to collect and use the DR. The amount of the DR is based on the number, volume, types of trees and the areas of the forest concession companies selected by the government to log timber. The amount of the DR receipt is determined by the type of timber, the value of the timber and the amount of timber which is paid in US$. The government imposes the highest payment through this levy, compared to others. The other levies, such as the one time forest use royalty and the timber logging in non-natural forest levy, can be used for other purposes. Those levies are aimed at controlling forest use while increasing local revenue.

The division of the provinces describes the importance of forest cover for ascertaining the effect of FE. The timber-producer provinces are the biggest source of revenue for FE, where these provinces have been given permission to extract timber in natural forests within specific locations or regions in these provinces. These provinces with natural forest cover should at least meet the minimum specified forest cover. In these provinces the naturally grown timber can be legally cut as a source of funds for land and forest rehabilitation in their provinces, subject to the levy which is called DR. The collection of this levy is based on: yearly government official reports on potential timber cut; concessionaires' proposals on the types, numbers and volume of trees which will be cut, and the mayor or head of district's approval of the concessionaires' proposals. These regions receive a 40 per cent portion of the DR, without any conditions. The non-timber-producer provinces are allowed to receive 60 percent of the DR along with other provinces. This allocation is aimed to help the regions cope with the major challenges in managing their forests. As logging, mining and converting forests to industrial plantations is allowed, to boost revenues from the forests, the larger natural forest cover in timber-producer provinces leads to massive deforestation. Since only the local-timber-producer provinces, as determined by the central government, are able to finance land and forest rehabilitation from their share of the DR, the non-timber-producer-provinces receive specific portions of the DR to fund land and forest rehabilitation in their regions.

In order to finance the land and forest rehabilitation at the national level, the central government allocates 60 per cent of the DR to all provinces. The 60 per cent portion is allocated in the form of a special allocation fund in forestry (*Dana Alokasi Khusus kehutanan* or *DAK kehutanan*). This *DAK kehutanan* is allocated based on the higher level of critical watersheds and any proposals on land and forest rehabilitation that have been granted. The non-timber-producer-provinces, which are characterized by higher population density, smaller areas, intensive infrastructure and limited natural resources, will receive their portion of the DR. The DR and *DAK kehutanan* play important roles as sources of revenue of forestry expenditure (FE).

FE is budgeted to finance land and forest rehabilitation activities. The expenditure is determined by the value of forest cover and critical land. The importance of forest cover in Indonesia is crucial, as timber production and mining are mainly located in forests. These mining and logging activities have

caused some portions of land to become critical, in terms of the land's capacity to preserve the natural environment from floods, erosions and droughts and preserve food for humans and animals. The FE is used to finance land and forest rehabilitation in areas which have been degraded, to maintain the sustainability of forest development. The local governments are allowed to manage their expenditure based on their local needs. This philosophy allows a variety of activities to be funded by FE. In timber-producer provinces, the majority of FE expenditure is used to fund projects within forest areas (i.e. forest rangers, forest planting and plantation maintenance). The possibility of large amount of illegal logging requires more forest rangers to protect the timber resources. In non-timber producer provinces, the majority of FE expenditure is used to fund projects outside forest areas (plantations alongside roads, community plantations and city forests). The success of community plantations is relatively higher in these provinces because the larger population provides a source of labour for community forest plantations. On population, the three most populated provinces of West Java, East Java and Central Java accounted for 48 per cent of total population (109,225,285 people out of 226,587,447 people) in Indonesia (recalculated from National Statistics 2010).

To better capture the decentralization process, a new budget report style was introduced in 2007 to shape further accountability and transparency (Barr et al. 2010). There are two aspects which distinguish the old and new budget report styles. The first distinction is coverage of the report. The previous budget reports included twenty departments under twenty ministries and one administrative function. The new budget report acknowledges all government functions including fourteen administrative functions at the local government level (i.e., citizen records, statistics, land administration and spatial planning). The second difference is style. The old reports had one type of budget, which is in one sector. This old style report covered twenty-one sectors where forestry was included in one sector along with estate plantations. The new report has two types of budget report, which are functions and affairs. The affairs reports cover all revenue and expenditure of thirty five ministries and departments. As one of the ministries and departments, forestry revenue and expenditure is reported in forestry affairs. The function reports cover all revenues and expenditures in nine major functions: general services, order and peace, economy, environment, housing and public facilities, health, tourism and culture, education and social protection. All of the operational costs (e.g., protection officers' wages, meetings and training) and non-operational costs (i.e., land and forest rehabilitation and forest fire management) are funded.

Since the beginning of decentralisation significant amounts of FE have been raised and expanded. Therefore, it is reasonable to ask the main research question of this study: whether the FE has positive impact on the forest land cover and hence, slowing or reversing of deforestation trends in Indonesia.

Regardless of the changes in several aspects of governance, many researchers question the effectiveness of FE to combat deforestation. There are a number of difficult challenges to be faced. The embedded culture of the top down approach used for 53 years hampers the chances of implementing increased local involvement. The preservation of unsustainable management of forests which resulted from the existence of selected timber, mining and industrial plantation concessions based on connections with Soeharto's relatives and families adds to the difficulties in sustainable forest management (Barr et al. 2010). The existing timber concessionaires who hold political and economic power have affected the unfair structure of industrial timber production (Barr et al. 2010). As a result, the current forestry rehabilitation has so far failed to achieve its goal because central government objectives still prioritize timber logging instead of forest rehabilitation (Barr et al. 2010). The greater authority which has been given to the local administrative apparatus is proven to lead to leverage to misuse timber permits for individual benefit (Burgess et al. 2012). Open access to forests provides greater opportunities for illegal timber logging to large but illegal companies. Without proper controls on timber logging and enforcement of re-plantation to concession holders, deforestation will be more likely to continue.

4. A Brief Overview of the Literature on the Factors that Affect Deforestation

Any government policy to address deforestation must, of necessity, have multiple foci. Given the

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large amounts of money involved, it is very important to assess the effect of such spending. The fact that a forest fails to be self-regenerating has motivated development of various types of restoration programs (Putz et al. 2001). As early as 1990, with increasing awareness of the negative and severe impacts of forest degradation on global climate, many institutions focused on monitoring and evaluating the uses of money for forest conservation (Ferraro & Pattanayak 2006). According to Ferraro & Pattanayak (2006), there should be a crucial point in forestry evaluation where focusing on "outcomes" produced directly from conservation investments (e.g., species and habitats), rather than focusing on "inputs" (e.g., investment dollars) and "outputs" (e.g., training) is more appropriate to evaluate the effect of the fund. However, there are many causes of deforestation. Geist & Lambin (2002) categorized these multiple causes into demographics, agriculture expansion, economics, wood extraction, infrastructure expansion, technological use, culture, policies and institutional and other factors.

Many studies have examined various factors that determine the deforestation rate. The most cited category is demography, especially in terms of population growth and density. It is widely believed that high population will create massive demand of land such as for residential need or agricultural expansion that leads to deforestation. This has been supported by studies which identify population growth as a major driver of extensive agriculture and shifting cultivation, that, in turn, is one of the main causes of tropical deforestation (Allen & Barnes 1985; Barbier 1997; Benhin 2006; Carr 2004; Deacon 1995; DeFries et al. 2010; Etter et al. 2006; Fargione, Plevin, & Hill 2010; Kobayashi 2001, 2004; Rudel et al. 2005; Vandermeer & Perfecto 2007). Until recently, this preposition has dominated the research on causes of deforestation. However, Boserup (1965) has proposed an antithesis where population could result in either deforestation or reforestation. Increasing population could lead to massive re-plantation because population provides cheap labour as a source of forest re-plantation.

Despite the plantation, agricultural is the factor most cited as a direct cause of deforestation. Conversion of forest into agriculture areas have caused deforestation in many countries (Abdullah & Nakagoshi 2008; Carreño, Frank & Viglizzo 2012; Grau, Grasparri, & Aide 2005, 2008; Morton et al. 2006). The expansion that is driven by the increasing of demand for agriculture products has led to rapid forest conversion into agriculture areas. Usually agriculture expansion and wood extraction have been studied as combined factors that cause deforestation.

Wood extraction is another factor most cited as a direct cause of deforestation. Burgess et al. (2012), Kobayashi (2001), Palmer (2001), Meyfroidt & Lambin (2009), and Nogueira et al. (2007) have identified wood extraction asa direct key link with deforestation. Those studies confirm that massive timber logging especially to accommodate industrial demand has significantly contributed to severe degradation. Burgess et al. (2012) and Meyfroidt & Lambin (2009) even strongly indicate that illegal logging is the main cause of deforestation, because there is no control over the use of timber.

Infrastructure extension is also believed to directly cause deforestation (Chomitz & Gray 1996; Fearnside 2005; Reid & De Sousa 2005; Swenson et al. 2011). Those studies are based on the view that the need for infrastructure extension to provide economic growth, especially in remote areas, increases flood and deforestation.

Besides the direct factor above, several studies have a look at policies and institutions as the indirect factors influencing deforestation (Alston, Libecap, & Mueller 2000; Deacon 1994; Deacon & Mueller 2004; Fearnside 2005; Laurance et al. 2002; Nepstad et al. 2001, 2009). These studies found that the governments have a strong influence on the deforestation rate especially in regard to property rights, agriculture related subsidies, forest fires management, clearing licences, inspections and fines. Government policy is a strong instrument to manage the environment and natural resources. Currently, many rainforest countries are experiencing a transition from centralist to decentralist approaches in forest management. Therefore, forest use has become heavily determined by local government policies.

Other researchers have studied different variables by intertwining demography and socio-economic and environmental characteristics with deforestation. Several factors such as socio-economic dimensions (Garcia, Soares-Filho, & Sawyer 2007; Scriceu 2007), soil quality and climate (Islam & Weil 2000; Islam et al. 2001; Betts, Sanderson, & Woodward 2008) and immigration pathways play a role (Carr, Suter, & Barbieri 2005; Carr 2009; Fearnside, 2008). These studies found that good quality soil,

higher rainfall rates, rural immigration and economic structure contribute to the increase in deforestation.

Most studies look at not only a single cause but also consider how multiple factors interact to influence deforestation. These studies generally found that infrastructure extension, agriculture expansion, wood extraction, and demographic, economic, technological, policy, institutional, cultural and other trends have a combined effect stronger than any single cause considered in isolation (Allen & Barnes 1985; Angelsen & Kaimowitz D 1999; Burns et al. 1994; Geist & Lambin 2002; DeFries et al. 2010; Kaimowitz et al. 2002; Pfaff 1999). Geist & Lambin (2002) have also indicated that different regions or countries have different combinations of factors that drive deforestation.

5. Methodology and Data in Preliminary Assessment

5.1. Method

The general aim of this study is to see wheter forest expenditure can reduce deforestation in Indonesia. Therefore, this study looks at the relationship between Indonesian forest expenditure and its association with the trend of deforestation proxied by the changes in the forest land cover. Given the various factors that affect deforestation mentioned above, direct correlation between the two will not be able to give a full picture. Therefore, this study controls these other factors that driving deforestation. In addition, the initial condition of forest land cover are added to see whether the reduction of land cover is the function of their availability in the initial condition. The majority of studies in deforestation literature are based on cross-national statistical analyses (Allen & Barnes 1985; Brown & Pearce 1994; Culas 2007; Ehrhardt-Martinez 1998; Geist & Lambin 2002; Jogerson 2006; Rudel & Roper, 1997; Shandra 2007). This study focuses on one country, Indonesia, and conducts disaggregated analysis at the level of 30 provinces. Because all data are in continuous form, linear multiple regression is used as a means of drawing a relationship between the continuous dependent variable of deforestation and several independent variables (Pallant 2007).

Given the data limitations, the model that based on the framework proposed by Geist & Lambin (2002) has been adjusted with available secondary data. In addition, the limited number of observations (30 provinces in 2007 to 2010) prevented analysis with larger variables. Therefore, this article focuses on analyses of eleven variables that represent seven broad clusters. The selected variables are: forest cover proportion, population density, population growth, mining output growth, forestry output growth, agriculture output growth, current critical land growth, current regional GDP at market price growth, DR proportion to the FE and DAK proportion to the FE.

The model above for this study (Figure 1) is adjusted from the original model proposed by Geist & Lambin (2002), which introdluded nine broad clusters: agricultural expansion, wood extraction, infrastructure extension, and demographic, economic, technological, policy, institutional, cultural and other factors. Each of the clusters consists of several variables. Infrastructure extension consisted of transport, settlement, markets, private companies and public services variables. Agricultural expansion was divided into permanent cultivation, shifting cultivation, cattle ranching, and colonization variables. Wood extraction is limited to commercial, fuel wood, pole wood and charcoal production variables. Demographic factors consist of natural increment, migration, population density, population distribution and life cycle features variables. Economic factors are composed of market growth and commercialization, economic structures, urbanization and industrialization and special variables. Technological factors are made up of agro-technical change and application in the wood sectors and agricultural production sectors. Policy and institutional factors contain formal policies, policy climate and property rights. The cultural cluster is made up of public attitudes, values and beliefs, and individual or household behaviour variables. For other factors, there are pre-disposing environmental factors, biophysical drivers and social trigger events which include several variables such as soil quality, topography, war, droughts and fires.

Figure 1 shows the regression strategy used in this study. First a bivariate regression between the forest expenditure proportion to total expenditure,and deforestation at a national level was examined to assess the effect of the government spending for forest rehabilitating effort using FE. Second, a regression was established between the change in

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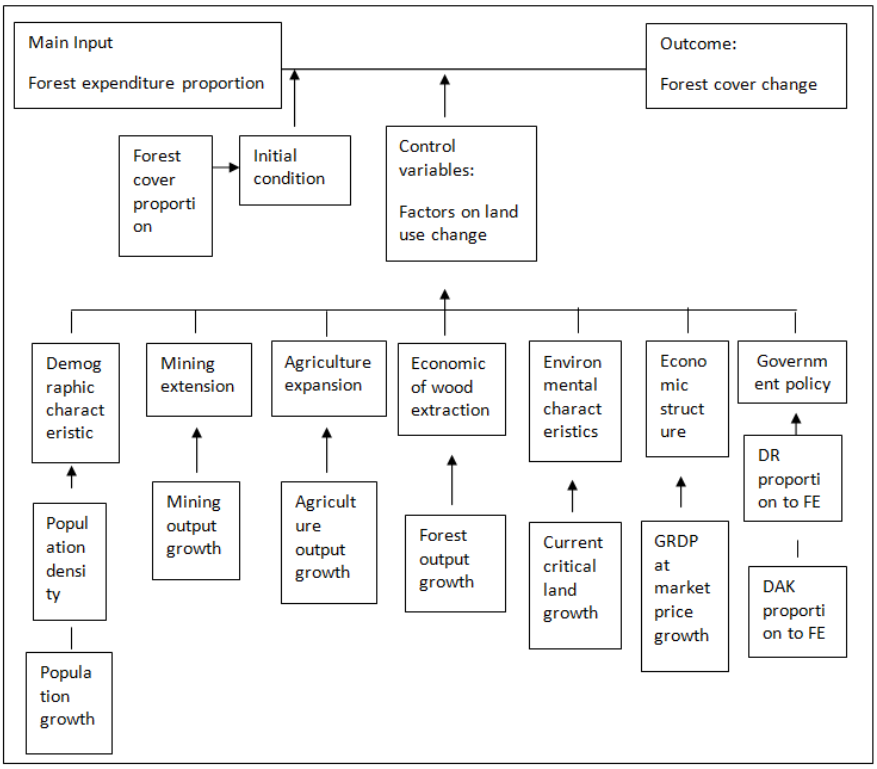

Figure 1: Framework for examining the effect of forest expenditure on forest land cover

forest cover proportion, forest expenditure proportion and the initial proportion of forest cover. The initial condition of forests cover was suspected to influence change in the forest cover because the previous forest condition often correlates with the amount of expenditure that the government need to spend for forest rehabilitation. This study then added variables to this simple model to examine how controlling other driving factors of deforestation affects the relationship between forest expenditure and the deforestation rate. Third, other control variables are added to see how the impact of FE on land forest cover if the impact of other factors has been taken into account. This can be formulated as:

$$\begin{aligned}\mathrm{LandForestCover} = {} & \alpha + \beta_1 \mathrm{ForestExpenditure} \\ & + \beta_2 \mathrm{InitialCondition} \\ & + \Sigma\beta_{\mathrm{i}} \mathrm{OtherFactors}\end{aligned} \tag{1}$$

The second endeavour was to establish similar regressions in local timber-producer provinces. This further regression was initiated to find out more detailed explanations for provinces with rich timber and mining resources. There are 22 provinces which are determined by the central government to cut timber in their natural forests – all nine provinces in Sumatra, four provinces of Kalimantan, five provinces in Sulawesi, and provinces in Maluku, Papua, and West Nusa tenggara (NTB). This leaves provinces in Java, Bali, and East Nusa tenggara (NTT) as the non-timber-producer provinces.

The control variables that are used as shown in Figure 1 are based on many studies that have been done previously. We use population growth and population density because the demand they had on land both for residential as well as to fulfill their demand for other direct factors, such as commercial wood extraction and agriculture expansion, that drive deforestation. This is supported by Geist & Lambin (2002) who pointed out that the strongest variable of deforestation is population growth. Etter et al. (2006), DeFries et al. (2010), and Wright & Muller-Landau (2006) supported the argument that population growth and agricultural growth have been the most significant factors in driving defor-

estation. In addition, commercial wood extraction that represent wood logging was selected due to strong finding of Abate & Wright (2010) where wood extraction is one of the most crucial factors affecting deforestation in tropical forests. Furthermore, Rudel et al. (2005) suggested that the deforestation impact has mainly come from the increasing prominence of industrial or large farm holders. This can be classified as another form of agricultural expansion.

Besides agricultural expansion, mining expansion has also affected deforestation. It is not only the extraction process where the open mind would mean that the forest need to be taken from the land above but the deforestation may also come as a result of the infrastructure development. mining output growth was used in this study. This is supported by Swenson et al. (2011) who found infrastructure development related to mining activities drive deforestation. Pfaff (1999) described significant effects of increased road density in a county on higher deforestation in that county and in neighbouring counties.

On economic characteristics, the majority of research that correlates income and deforestation started with the hypothesis that higher incomes are expected to slow deforestation rates. GRDP at market price growth was used in this study to observe the economic characteristic. However, some other scholars, such as Cole (2005), Scrieciu (2007), and Culas (2007), proved otherwise even though institutional policies that support environmental management were employed. Therefore, number of current critical land growth that represents environmental management was selected to observe environmental policies.

5.2. Data and Varaibles

The availability of data is the main issue in conducting this assessment. Provinces are used as the basic spatial unit due to the availability of data at this administrative government level. The Ministry of Finance provides data on forestry expenditure, Reforestation Fund or DR in the local government budget in both provinces and districts, the lower level of government. The forestry expenditure of a province in this study is the accumulation of expenditure of that particular province and all the districts within the province. This study evaluates the FE in producer-provinces and non-local producer provinces because these provinces have different environmental, socio-economic and institutional characteristics. This study selected 2007 to 2010 as the time frame for analysis. This period has consistent and comparable budget reporting for FE in Indonesia.

In order to measure the decrease in deforestation caused by FE, determining the deforestation and source of data are important. The deforestation in this study is represented by negative changes in forest cover (abbreviated as ForCovCh). Its value is generated by subtracting the current value from the previous value and dividing it by the value of the current year. The data used in the recalculation of forest resources is calculated from satellite digital imagery, at 1:250,000 scale accuracy in 2006 and 2010. This satellite data is available in the Forestry Inventory and Mapping Centre at the Forestry Planning Agency, Ministry of Forestry. The 2010 digital data was combined with the Forest and Water Designation Map for thirty provinces, which were established from 1999 to 2005, including the five new provinces (provinces of Banten in Java, Bangka Belitung in Sumatra, Gorontalo and West Sulawesi in Sulawesi, and North Maluku). Based on these three sources, the Ministry of Forestry has classified land cover into twenty-three uses including forestry, mining, agriculture and other uses. In these recalculations, only forest areas are given a detailed classification into three functions, which consist of protection forest, conservation forest (which includes Hunting Parks), and production forest. The production forest is composed of permanent production forest, limited production forest (LPP) and LPP which has been fully converted to production forest. In 2006, reconfirmation of the data calculation was done on several pilot sites before it was published. In 2010, all the data calculation was done on the site before it was circulated.

This study looks at a macro aspect of the impact of forestry expenditure on deforestation. Nevertheless, it is based on an input-output-outcome framework. Input variables consist of all sources used to run a program such as the amount of time, personnel and resources invested in a project or task (Bowen & Riley 2003). In this study, money spent for forestry is used as input. The program outcome of this program is the deforestation rate. As mentioned earlier, deforestation has also been affected by other con-

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ditions outside the government's policy. Therefore, this study has introduced population density, population growth, mining output growth, forestry output growth, agriculture output growth, current critical land growth and current regional GDP at market price growth to control the conditions that may affect deforestation.

Definition of the variables is the following. The first step is to define the variables in the first regression which are forest expenditure proportion to total expenditure (FortExpProp) and the initial conditions of forest cover proportion (FortCovProp). Forest cover is defined as the all land area covered by forest (including natural and community forest plantations). This study does not differentiate between state forest and non-state forest. Forest cover proportion or FortCovProp represents the proportion of forest cover in each province. The value generated from forest cover is divided by the total area in each province. The forestry expenditure proportion (FortExpProp) is the budgeted government expenditure in forestry in each province. The value is generated by dividing government expenditure in forestry by the total expenditure in each province.

The next step is to define the control variables which are also described as the output of the study. On mining, agriculture and forestry, output was used to replace mining, agriculture and forestry in hectares because the advances in technological usage decrease the significance of using the hectare. Mining output growth (MiOutGr) is the growth of mining output in each province. The value of this growth was extracted by subtracting the current value from the previous value and dividing by the current value in each province. Agriculture output growth (AgriNoFortGr) represents the value of agriculture expansion. To proxy the economic value of wood extraction, forest output growth (FortOutGr) was selected. There was a similar method in calculating the growth of mining, agriculture and forestry output, which was also applied. Current critical land growth (CritLanGr) is used to proxy environmental characteristics. Critical land is defined as a land area where vegetation cover has severely decreased. On demographic characteristics, population density (Popdenst) and population growth (PopGr) were determined. On economic characteristics, growth of GDP at market price (RegGDPMGr) was selected. The market price GDP is selected in this study as we use this variable as the proxy of income and the various changes in price in different area would affect the perception of the growth of their income. In order to represent government policy in FE, DR (DRpropFE) and *DAK kehutanan* (DAKpropFE) proportions were selected. DR and DAK proportions were established by dividing each source of revenue by the total FE in each province.

6. Results and Analysis

The results of the direct regression in thirty (30) provinces showed that forestry expenditure negatively and significantly influences the rate of forest cover change. This result demonstrated that the FE has negative impact on the forest land cover and therefore, was not effective in reducing the deforestation rate and may actually increase the deforestation rate. Forest cover proportion was then added to assess whether the initial condition of a forest and the FE influences the impact of the FE. The similar results from this regression indicate that although the initial condition of the province was influential, the impact of forest expenditure was still negatively significant on forest cover. The addition of all other conditions that may affect deforestation reduces the significance of the negative impact. Nevertheless, this regression still indicated that FE has negative impact on the forest land cover. The results in all provinces in Indonesia of all three steps in the regressions are presented simultaneously in Table 1.

The addition of other control factors that have been known to affect the deforestation rate also reveal whether the negative impact of forest expenditure is due to the more "difficult" conditions in one province compared to the others. The results indicate that population growth and population density influence the increase in the deforestation rate significantly. These facts support the theory on the negative effects of population on deforestation (Geist & Lambin 2002; Etter et al. 2006; DeFries et al. 2010; Wright & Muller-Landau 2006).

Since the timber-producer-provinces have larger timber fees as one of the sources of forestry expenditure, it is important to have separate regressions in those particular provinces. Table 2 shows that separating the timber provinces from the non-timber-producer provinces confirm the negative impact of the forest expenditure on the changes in forest cover is not always significant. However, the

Table 1: Result of Regression in All Provinces

Variable	1st regression	2nd regression	3rd regression
Forest expenditure proportion (FortExpProp)	-0.4493	-0.8647	-1.3739**
Forest cover proportion (FortCovProp)		0.0499*	0.0617*
Population growth (PopGr)			-2.2812***
Population density (Popdenst)			-0.0001***
Mining output growth (MiOutGr)			-0.0090
Agriculture output growth (AgriNoFortGr)			0.0156
Forest output growth (FortOutGr)			0.0467
Regional GDP at market price (RegGDPMGr)			0.0016
Critical land growth (CritLanGr)			0.0000
DR proportion to FE (DRpropFE)			0.0233
DAK forestry proportion to FE (DAKpropFE)			0.0059
year	-0.3354	-0.3866	-0.3701
constant	6.750.687	7.764.110	7.478.094
R^2	0.0096	0.0388	0.3764
N	120	120	120

Note: *, **, and *** indicates significant at 10, 5 and 1 percent significance level, respectively

impact has become much lower. This means that the result for the overall province is somewhat biased because the timber-producer provinces have much larger rates of deforestation as well as much larger proportions of forestry expenditure.

The major value of deforestation is in those provinces, 2.8 per cent or 906.249 hectares in 2007 alone (Ministry of Forestry data recalculated). In addition, most of the provinces in Kalimantan are historically timber provinces due to the amount of land that is still covered by forest. Therefore, the governments in these provinces need to spend higher proportions of their expenditure not just to deal with the high coverage of forest but also to handle the effects of timbering activity, including reforestation and the illegal logging that often happens in the timber production activity. If this is compared with non-timber producer provinces in Java that only need to focus on low levels of forest area and less deforestation, given that the forest is no longer able to support this activity, then the proportion of money that needs to be allocated into this activity is much lower than in the timber-producer provinces. Forest loss in non-timber-producer provinces amounted to only 0.9 per cent or 29 hectares in 2007 (Ministry of Forestry data recalculated). The result in timber-producer provinces more adequately explains why the FE does not decrease deforestation. Therefore, applying the regression for the two types of provinces at the same time would be misleading, as the correlation of expenditure and deforestation will be largely positive due to the different issues that they are facing. Nevertheless, the result of this regression still showed a negative relationship and therefore, maintained the conclusion that forestry expenditure was not effective in reducing the deforestation rate.

Although not showing any substantial changes in the assessment of the impact of FE on deforestation, the second regression result in Table 2 shows several notable differences with the result in Table 1. Interestingly, population density is no longer a cause of the increase in deforestation. The existence of the five highest populated provinces of the non-timber-producer provinces that were able to produce increases in forest cover may explain why increasing deforestation in non-timber-producer provinces is not affected by increasing population. Therefore, it can be be summarized that existence of population growth is more apparent in increasing deforestation.

One interesting result from both Tables 1 and 2 is that agricultural growth has not influenced the increase in deforestation rate. This is in contrast with the findings of Etter et al. (2006) and DeFries et al. (2010) that point at agriculture expansion as the main source of deforestation in many countries. The likely explanation is that the increase in agriculture output in Indonesia has mostly been influenced by the implementation of more efficient agricultural techniques (intensification) rather than putting more land into agricultural production (extension). Another reason is that although there have been many issues with palm oil development affecting forest cover, palm oil is not the highest activity in agriculture. Advanced technology in palm oil means that increases in output there affect a limited area. The majority of agricultural output in

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Table 2: Result of Regressions in Timber-producer-provinces

Variable	1st regression	2nd regression	3rd regression
Forest expenditure proportion (FortExpProp)	-0.267	-0.4927	-0.9219*
Forest cover proportion (FortCovProp)		0.0410	0.1612***
Population growth (PopGr)			-0.8813*
Population density (Popdenst)			0.0057***
Mining output growth (MiOutGr)			0.0037
Agriculture output growth (AgriNoFortGr)			0.0527
Forest output growth (FortOutGr)			-0.0289
Regional GDP at market price (RegGDPMGr)			-0.0142
Critical land growth (CritLanGr)			-0.0004
DR proportion to FE (DRpropFE)			0.0438
DAK forestry proportion to FE (DAKpropFE)			0.0634
year	-0.2845	-0.3211	-0.6319
constant	5.721.305	6.441.679	1.259.253
R^2	0.0057	0.0274	0.3764
N	88	88	88

Note: *, **, and *** indicates significant at 10, 5 and 1 percent significance level, respectively

Indonesia comes from paddy farming which is developed in non-forest areas.the recent rapid increase in palm oil plantation is still below the area of paddy plantation.

This exercise sheds light on the influence of various factors in affecting the changes in the deforestation rate in Indonesia. The results at the national level and in the timber-producer provinces show that forest expenditure, population density and population growth negatively influenced deforestation. The only difference observed was forest expenditure proportion. It negatively and significantly influences the deforestation rate at the national level and is even still negative in timber-producer provinces, but the value is not significant.

7. Conclusion

As changes have recently been experienced in all levels of the Indonesian government system, a sensible time frame, massive new regulations and massive administrative apparatus adjustments are required for Indonesia to achieve significant changes. A new decentralization process implemented in 2001 and further changes including embarking on new laws and regulations regarding the management of forest revenues and forest expenditures have been introduced. However, this preliminary study suggests that government forest expenditure at the provincial level is not effective in reducing deforestation.

In Indonesia, the government's forestry expenditure at the provincial level in Indonesia does not show any significant effect in reducing the rate of deforestation. There was an early sign that these government forestry expenditures may actually increase the rate of deforestation. However, this result is mainly due to the higher rate of deforestation that takes place at the same time as a large increase in the forestry expenditure.

The negative impact of the forestry expenditure is still observed even after many conditions that are known to affect the rate of deforestation are controlled. This study has tried to take into account the effect of population growth, population density, mining, agriculture and infrastructure expansion. The results indicate that population growth and population density have played a major role in the deforestation rate.

These findings provide insights for future research. One argument that can explain the negative impact of the forest expenditure at the provincial level is the transfer of authority further down to the district level in the decentralization process. Therefore, although the forestry expenditure used in this study already includes district expenditure, the more detailed district level quantitative analysis, with a longer time span and pre- and post-measurement, may result in a better understanding of how the local governments deal with the deforestation issue. In the absence of quantitative data, which is typical in the Indonesian context, interview data collection for qualitative analysis at a combined district, city and province level should also be considered. Moreover,

deep investigation of laws and regulations should enrich the information collected from secondary sources.

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