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Causes for Deforestation in Indonesia: Corruption and Palm Tree Plantation

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Abstract

Indonesian biodiversity is threatened by massive deforestation. In this research paper, claims that deforestation in Indonesia is caused by corruption and supported by crude palm oil production is verified using time series analysis. Using Engel Granger cointegration test, three time series of data, specifically corruption perception index, rate of deforestation and price of crude palm oil are inspected for a long-run relationship. Test statistics suggests that there is no long-run relationship among these variables. Authors provide several explanations for this result. For example, corruption in Indonesia, as measured by CPI is still very high. This may mean that forest cover loss is possible even though there is a positive change in corruption level. According to the results, crude palm oil price has also no effect upon forest cover loss. This is likely due to very low shut-down price of crude palm oil for which production is still economical.

1. Introduction

It is estimated that that corruption in the forestry sector reached over Rp 273 trillion in 2011 in Indonesia. (Jakarta Globe 2013) Corruption by government officials linked to natural resource extraction is leading to billions of dollars in state losses annually in Indonesia (Jakarta Globe 2013). One of the most pressing environmental issues possibly related to corruption in Indonesia is deforestation. Deforested land is transformed usually to palm tree plantations. Therefore, it is necessary to examine a relationship between deforestation and palm trees plantation, respectively corruption.

1.1 Deforestation in Indonesia

Deforestation in Indonesia not only possess a significant threat to local biosphere through biodiversity reduction but also influences global climate. Tropical deforestation from developing countries, including Indonesia, contributes to emissions of greenhouse gases. (Margono et al., 2014) This is mainly carbon dioxide, the main cause of global warming. Primary forest clearing also leads to the loss of biodiversity due to the destruction of unique tropical forest habitats. (Margono et al., 2014)

Present understanding of forest change within Indonesia is unclear. A report from the United Nations Food and Agricultural Organization (UNFAO) claims that the rate of deforestation in Indonesia is approximately 0.31 million hectates per year from 2000 to 2005. Same report claims that from 2005 to 2010 roughly 0.69 millions of hectares were lost. A report from the Indonesian Ministry of Forestry provides an estimate of approximately 0.4 million hectares lost between 2009 and 2011. These estimates vary significantly and therefore a study has been conducted that uses spatial as well as temporal data of digital imaginary to show actual deforestation dynamic. A study done by Reference shows that Indonesia is a country with the highest rate of increasing forest covers loss from 2000 to 2012. (Margono et al., 2014) Deforestation is also cited by (Vidal, 2015) where two areas of the Indonesian islands of Sumatera and Kalimantan (the Indonesian part of the island of Borneo) are used as an example to show fastest forest cover losses in the humid tropics. This has according to (Vidal, 2015) implications for carbon dynamics, biodiversity conservation, and local livelihoods.

1.2 Palm Trees Plantations in Indonesia and Deforestation

Agricultural commodities, particularly energy one have gained a lot of significance in international trade (Svatos et al., 2013; Svatos & Smutka, 2012). There is an increase in aggregate global demand for palm oil. This increase

is obvious especially in the last several years. (World Watch, 2015) Palm oil is the most common, globally produced palm. Its yield belongs to one of the highest when compare to other crops. Regarding the costs of production and refining, palm oil belongs to the least expensive oils. (World Watch, 2015). Production areas devoted to palm oil belong currently to the most significant contributors of rain forest destruction in Indonesia. According to UNEP (2015), there is a possibility that no later than 2032, most rainforest in Indonesia would be irreversibly degraded. If we examine the speed and volume of deforestation in the last six years, this prediction may seem to be overly optimistic, as oil palm plantations and biodiesel refineries are getting more and more popular. Newest estimates even conclude that only 2 percent of rain forest can be preserved by 2022 with even less forest being saved in the lowlands of Indonesia. (UNEP, 2015)

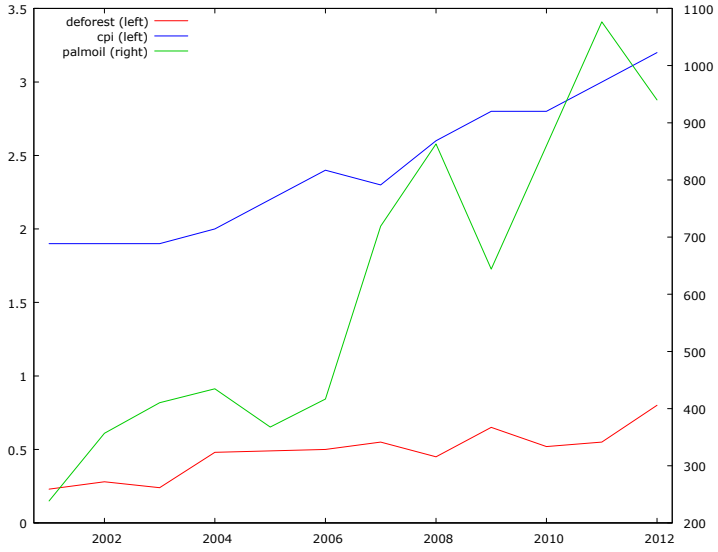
1.3 Corruption in Indonesia

Corruption linked to the forestry, plantation industries and mining leads potentially to billions of dollars in state budget losses each year in Indonesia. Natural resources are in such a way never-ending income for corrupt officials (Jakarta Globe, 2013). In this case, we are talking about systematic corruption which is created regardless who is the corrupted person. This is the number one cause of corruption in the environmental sector (Winbourne, 2002). Another cause is relatively a lot of rights issued to government representatives, lack of accountability for these representatives and also little possibility to adhere to transparency in their decisions. Private interest of such public officials in revenues that can be obtained from environmental resources is much stronger than public interests in environment. (Winbourne, 2002) Government controlled sectors in Indonesia are especially energy, road, railway and port projects. (Jakarta Globe, 2013) Total volume of corruption can be manifested by an example of Indonesian reforestation fund that lacks more than $5.2 billion that was supposedly lost in 1993 to 1997 due to bad management and fraudulent behavior, according to an audit by Ernst and Young. (E360.yale.edu 2015)

According to E360.yale.edu (2015), deforestation binge has been abetted by rampant and systemic corruption in the Indonesian government, military, and forestry sector (E360.yale.edu 2015)

2. Analysis of Deforestation Due to Palm Trees and Corruption

According to (Koyuncu & Yilmaz, 2009) corruption contributes to deforestation. Koyuncu and Yilmaz (2009) found a statistically significant strong positive relation between corruption and deforestation for different periods across different countries (Koyuncu & Yilmaz, 2009). Authors in this paper re-examine this relationship in Indonesia by utilizing time series approach of cointegration. In order to quantify corruption, a corruption perception index is used. This is based upon an assumption that a ranking of countries according to the extent corruption exist can be made. The corruption perception index was created in 1995 by Transparency International. It ranks almost 200 countries on a scale of zero to 10, with zero indicating high levels of corruption and 10 indicating low levels (Koyuncu & Yilmaz, 2009)



Source: own compilation

Figure 1. Deforestation, corruption perception index and crude palm oil price

At the same time, a second variable is added that shows influence of palm tree plantations upon deforestation. Assumption is made that as the price of crude palm oil goes up, and there is more incentive to deforest more land in Indonesia. All three variables are depicted in Figure 1. The figure shows deforestation, corruption perception index (CPI) and crude palm oil price in Indonesia between 2001 and 2012.

Data in Figure 1 show that all three time series trend upwards. This is positive in terms of CPI but quite negative in terms of forest cover loss. Price of crude oil also slopes upward which may mean that producing palm trees may be more prosperous.

2.1 Testing for Unit Root

As previously mentioned, it is obvious from the Figure 1 that all three time series are trending. This is a useful piece of information for further analysis. The entire process starts with testing individual series for existence of unit root. A null hypothesis H_o: Level series contains a unit root is tested against an alternative hypothesis H_a: Level series does not contain a unit root. This is done using Augmented Dickey-Fuller test with the contant and trend due to trending data. All time series are tested and results are presented in the following Tables 1,2 and 3. Due to relatively short time series, a lag was selected to 2.

Table 1. Augmented Dickey Fuller Test for Deforestation in Indonesia with constant and trend

Model definition: (1-L)y = b0 + b1*t + (a-1)*y(-1) + ... + e
1st-order autocorrelation coeff. for e: -0.231
lagged differences: F(2, 4) = 0.498 [0.6410]
estimated value of (a - 1): -1.50846
test statistic: tau_ct(1) = -1.95282
asymptotic p-value 0.6264

The test results presented in Table 1 show that the time series needs to be differenced one to make it stationary. The same procedure is done for the other two variables of corruption perception index and crude palm oil. Results are presented in Table 2 and Table 3 respectively.

Table 2. Augmented Dickey Fuller Test for Corruption Perception Index in Indonesia with constant and trend

Model definition: (1-L)y = b0 + b1*t + (a-1)*y(-1) + ... + e
1st-order autocorrelation coefficient for e: -0.372
lagged differences: F(2, 4) = 3.396 [0.1374]
estimated value of (a - 1): -2.14412
test statistic: tau_ct(1) = -3.40771
asymptotic p-value 0.05028

Table 3. Augmented Dickey Fuller Test for Crude Palm Oil Price with constant and trend

Model definition: (1-L)y = b0 + b1*t + (a-1)*y(-1) + ... + e
1st-order autocorrelation coefficient for e: -0.136
lagged differences: F(2, 4) = 2.052 [0.2436]
estimated value of (a - 1): -1.44904
test statistic: tau_ct(1) = -1.59503
asymptotic p-value 0.7954

2.2 Cointegration Test

Tests presented above show that all time series have a unit root of order I(1). Now, a test for cointegration can be

conducted using Engel-Granger methodology. This is used according to original Engle and Granger (1987) article where a cointegration test is proposed. This test is made up of several sections. First, estimation of a cointegration regression is done using ordinary least squares. This involves capturing the residual error terms. Consequently a unit root test for these error terms is conducted. In order to proceed with the test, authors in their paper suggest testing the null hypothesis that the error term has a unit root against the alternative that it has a root less than unity. Since error terms are themselves estimates, new critical values have to be used. In this case, the corrected MacKinnon critical values are used for further estimation. (Empiwifo.uni-freiburg.de, 2015)

For the analysis of cointegration a regression is set so that

$y_t = \beta_1 + \beta_2 x1_t + \beta_3 x2_t + e_t$

where y_t is deforestation, $x1_t$ is corruption and $x2_t$ is price of crude palm oil. The test results are presented in the Table 4 of this paper.

Table 4. Cointegrating regression- OLS, using observations 2001-2012 (T = 12)

Dependent variable: deforest	Coefficient	Standard error	t-ratio	probability value
constant	-0.404088	0.207970	-1.943	0.0839 *
cpi	0.417674	0.129552	3.224	0.0104 **
palmoil	-0.000207925	0.000215823	-0.9634	0.3605
Mean dependent variable	0.478333	S.D. dependent var	0.166287	
Sum squared residual	0.077178	S.E. of regression	0.092603	
R-squared	0.746265	Adjusted R-squared	0.689879	
Log-likelihood	13.25204	Akaike criterion	-20.50407	
Schwarz criterion	-19.04935	Hannan-Quinn	-21.04266	
rho	-0.099565	Durbin-Watson	1.981004	
Step 2: testing for a unit root in uhat				
Augmented Dickey-Fuller test for uhat				
including one lag of (1-L)uhat				
(max was 2, criterion modified AIC)				
sample size 10				
unit-root null hypothesis: a = 1				
model definition: (1-L)y = (a-1)*y(-1) + ... + e				
1st-order autocorrelation coeff. for e: -0.056				
estimated value of (a - 1): -1.10109				
test statistic: tau_c(3) = -2.20657				

The test shows that the p-value is large so we cannot reject the null hypothesis that the series have a unit root, i.e. they are not cointegrated. This means that corruption as represented by the corruption perception index and price of crude palm oil does not have a long-run relationship with deforestation in Indonesia. There may be several reasons for this result. Authors assume that one of the reasons may be that CPI does not capture well the type of corruption behavior that enables deforestation. Other reason may be that corruption in Indonesia is still very high and even though some improvements are evident from the data, it still enables uncontrolled deforestation. The reason why crude palm oil price has no impact upon deforestation may be explained by economic feasibility of palm oil production that is large enough even with a relatively lower price of crude palm oil.

3. Conclusions

Deforestation in Indonesia is a large problem that needs to be solved. Authors in this paper try to justify claims that deforestation in Indonesia is caused by corruption and that it is supported by crude palm oil production that

has spread over the deforested area. Using cointegration approach three time series of data, specifically corruption perception index, rate of deforestation and price of crude palm oil are used to find a long-run relationship. Test results show that there is no long-run relationship among these variables. Authors acknowledge that . there may be several reasons for this result. Firstly, corruption in Indonesia, as measured by CPI is still very high. This may mean that uncontrolled deforestation is still enabled. Similarly, analysis shows that crude palm oil price has no impact upon deforestation. This is probably to very low shut-down price of crude palm oil which production is economical even at lower price levels.

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