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ABSTRACT

Resource curse literatures explain that countries abundant with natural resources tend to grow slower. This hypothesis is relevant for Indonesia as it is a country rich in natural resources. This paper tries to investigate empirically the relationship between resources abundance and its impact on economic development at the regional level using cross section regression approach. The regional financial data from ministry of finance are combined with regional specific data from BPS to seek the pattern. The paper will shed light on whether resources rich regions in Indonesia are trapped in this curse.

Keywords: Natural resource rent, resource curse hypothesis, region, Indonesia

JEL classification: Q01, Q56, R11

1. INTRODUCTION

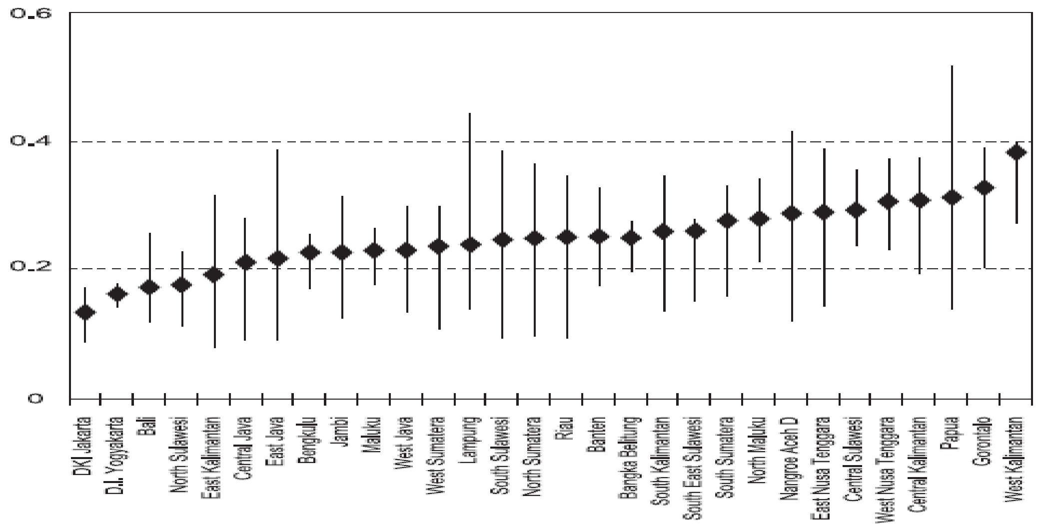
The role of oil, gas and other mineral sectors is very significant in Indonesian economics although they do not constitute the main sectors, since the structural changes at 1986. The contribution of these natural resources sector to the Indonesian economy constitutes about 27% of GDP in 1992 and has declined to less than 24% in 2005. Even though they do not constitute the main sectors of the Indonesian economy, their contribution to government revenue is still significant.

In 2005, at least Rp 110.391 billion or about 22 percent of government revenue came from non-tax natural resources revenue, making it the second most important revenue source after income tax from non oil and gas. This much money used to provide more benefits for the society. As Indonesia is a country endowed with abundant natural resources, we would expect this endowment to contribute to a significant welfare and economic improvement. However the phenomenon of natural resources abundance versus welfare and economic prosperity is not assured and is an empirical question.

The phenomenon of natural resource abundance and economic prosperity is also relevant at the micro or regional level. Such questions are also relevant for Indonesia, the country abundant with natural resources, with high disparity of development at the regional level (province or district level). Casual observation leads us to some contradictory expectation, for example based on IHDR 2004 (see figure 1), resource rich regions dominated the regions with high level of poverty rate. The picture is true at the province as well as district level within the particular province. Several examples may strengthen this observation. For example let us look at the case of Papua. Although Papua is high in natural resources endowment, it has one of the highest poverty rate at 38.69% in 2004. Another ironic example is the province of NAD, with plenty of oil and natural gas resources and yet 28.47% of its populations are poor.

The observation above has lead us to question whether natural resources endowment and revenues help the regions in their welfare and economic development. Or in other words whether natural resources have become a curse rather than a gift for regions in Indonesia. The question above has become more important in the period after decentralization in Indonesia, when regions have become more autonomous in managing their welfare and economic development. Natural resources rich region in particular are supposed to benefit with the substantial increase in their natural resources revenue sharing.

Figure 1: Human Poverty Index by Province, 2002



Note: The diamond represents the average value for the province, while the line runs from the lowest to the highest values among the districts in that province.
Source: IHDR 2004.

This paper aims to answer the above question with the following structure. The next section takes a closer look at various literature findings of resource curse hypothesis. Section III describes the empirical analyses for the hypothesis, data and sources of data. It describes the resource curse growth model and analyzes the empirical findings of the estimation and section IV concludes.

2. LITERATURE REVIEW

The phenomenon experienced by several resources rich regions in Indonesia has attracted researcher for many years. It was observed, for example, that many resources rich countries, experienced a lower growth of income compared to those resources poor countries (especially after the first oil boom and Dutch disease). This phenomenon of slow development in the presence of resource abundance is known as the resource curse hypothesis.

Lynn (1997) explains about the existence of a paradoxical experience by natural resources rich countries. It is expected that countries rich in natural resources may be able to exploit these resources for the benefit of higher economic growth, poverty alleviation and technological transfer. Other things being equal, resource abundant countries should be able to increase their level of per capita welfare. Atkinson and Hamilton (2003) describe the advantage of natural wealth as two folds. First, the discovery and development of natural resources can lead to a short-term increase in the rate of economic growth; second, this can raise the level of income that can be sustained into the future.

Many cases contradict the fact. Natural resources wealth, if not properly managed or reinvested back, may harm economic performance and make the citizens worse off. Some countries endowed with oil and gas e.g. Iran, Venezuela and some African countries, experience a lower economic growth rate than the countries actually poor in natural resources such as Hong Kong, Japan, Singapore, and South Korea.

Many studies have been conducted to reveal the nature of this curse. One of the well known studies which generalized this finding across large samples of countries is Sachs and Warner (1995). Using the share of natural resource exports in GDP as resource abundance indicator, this study found statistically significant evidence for a negative relationship between per capita economic growth and resource abundance over 1970-1990. In this pioneering cross-country evidence there is no role for quality of institutions or bureaucracy in explaining the natural resource curse.

However not all study findings support the hypothesis. In contrast, Rosser (2004) presents evidence that the curse could not be generalized, especially for Indonesia. This finding is based on the fact that while Indonesia is blessed with natural wealth, it has been experiencing moderate economic performance. This fact could be explained from the higher economic growth during 1967 – 2000 relative to the other oil exporting countries. Rosser suggests that Indonesia's success stemmed from two factors, the policies and institutions employed by the New Order era and the nature of Indonesia's geo-political and geo-economic environment. Despite this finding at the national level, question on the resource curse hypothesis is still valid at the regional level of Indonesia.

3. EMPIRICAL ANALYSIS

3.1 Framework and Model

To test the natural resources curse hypothesis at the regional level, we start from the basic growth model that has been derived by several authors, that is:

$$\ln\left(y(T)/y(0)\right)\Big/T = \alpha_0 + \alpha_1 \ln(y(0)) + \alpha_2 Z + \varepsilon \text{ .... (1)}$$

Equation 1 is a regression model of the growth rate of GDP per capita on various explanatory variables, using cross sectional regression to test the effect of natural resources abundance and other explanatory variables. Given our interest in determining the possible effect of natural resource abundance on economic growth, we use resource rent (in total or by division) as proxy on resources abundance. Other explanatory variables are human capital measured by mean years of schooling; investment as fraction of GDP; and initial level of income. All variables are measured at the beginning year of the period, i.e. 2001, except for the growth rate of GDP which is measured using average values over the period. In addition, to control for regional factors, we add dummy variables: Sumatra, Kalimantan, Sulawesi, Papua and Other islands. Our empirical model can be written as:

$$\gamma_{y_i} = \alpha_0 + \alpha_1.\ln(gdpcap)_i + \alpha_2.edu_i + \alpha_3.invest_i + \beta_1^j.rent_i^j + \sigma_1.\varepsilon_i \text{ .... (2)}$$

$$\gamma_{y_i} = \alpha_0 + \alpha_1.\ln(gdpcap)_i + \alpha_2.edu_i + \alpha_3.invest_i + \beta_1^j.rent_i^j + \beta_2^k G_i^k + \sigma_1.\varepsilon_i \text{ ... (3)}$$

$$\gamma_{y_i} = \alpha_0 + \alpha_1.\ln(gdpcap)_i + \alpha_2.edu_i + \alpha_3.invest_i + \beta_1^j.rent_i^j + \beta_2^k G_i^k + \beta_3^{jk}(rent_i^j * G_i^k) + \sigma_1.\varepsilon_i$$
$$\text{.. (4)}$$

Where:

γ_y = average growth over the period,

gdpcap = initial level of income per capita,

edu = mean years schooling at initial years,

invest = investment ratio in 2001,

rent = share of resource rents in GDP in 2001,

G = share of government expenditure (consumption and investment) in GDP in 2001,

i = district index,

j = resource rent index (forest, mining, oil and gas sector, and total resource rent), and

k =policy related variables index (Government consumption and Government investment).

In equation (3), we include a range of policy related variables which are the share of government consumption and share of government investment. Equation (4) incorporates the interaction term between natural resources and policy related variables. This term allows us to test whether the negative effect of natural resources on the rate of growth decreases as policy related variables increases, as implied in our model.

3.2. Data and Scope of Analysis

We estimate the empirical model using cross sectional analysis. The data used in the regressions cover the period of 2001 until 2004, consisting of initial period data for all explanatory variables and period average data for the dependent variable.

The dependent variable, γ_y, is the average rate of growth of GRDP per capita at constant 2000 prices. The data for this variable are taken from BPS (2006) that covers 438 districts. This variable is measured as period 2001 until 2004 average.

Due to lack of human capital data for all districts in 2001, we use the data of mean years of schooling for the year 2002 instead. This data is taken from IHDR 2004 and covers only 340 districts. The share of gross capital formation in GDP 2001 at the province level are used as proxy for investment variable, therefore assuming the same level of investment for districts within the same province.

Institutional variables introduced in our second stage regression consist of two variables. First, government consumption measured as the share of government routine expenditure in GRDP 2001. Second, government investment measured as the share of development expenditure in GRDP 2001. Both routine expense and (development expenditure) are taken from the 2001 district government budget (APBD) published by the ministry of finance.

Measuring Natural Resources Abundance

There are many proxies that have been employed by scholars to measure the abundance of natural resources, such as share of mining production in GDP, land per capita, share of natural resources export in GDP, share of labor force in the primary sector and mining employment. Each proxy has its own advantages and disadvantages. Following Atkinson and Hamilton (2004), share of resource rents in GDP constitute the preferred measurement of natural resources abundance for this study.

Total resource rent for each resource is defined as the product of a given resource's unit rent (its world price minus country-specific extraction costs) and total units or quantity extracted (or harvested). Sometimes it is very difficult to get the extraction cost (marginal cost). To solve this problem, in practice it is common to use average cost. Even though this approach has simplified the measurement, however it still impossible to attaint the average cost at district level. The average cost and extracted quantity of natural resources are usually available at the national level. The lack of these data has challenged us to find the best available proxy. We have derived natural resources revenue for each region through their share in natural resources revenue sharing.

Total resource rent is estimated from the natural resources revenue sharing for each district. Besides the total rent, we also estimate major natural resources by type such as mining sector (land rent and royalty), oil and natural gas sector, forestry sector, and (forest product royalty/ IHH, forest concession license fee/ IHPH and reforestation fund).

Figure 2 describes the flow that we followed to get resources rent from natural resources revenue sharing data. First, the natural resources revenue sharing data were split into three parts. The first part consists only of the sectors that are shared by the producing district (mining land rent and forestry license concession fee). The second part consists of sectors that are shared with the producing district as well as with the other districts in relevan province for mining royalty and forest product royalty. The last part consists of sectors that were shared with the producing district as well as with the other districts in the relevan province for the oil and natural gas sector. We split the oil and natural gas sector from mining royalty since it consists not only of the revenue sharing between central and local government but also between the contractor and central government.

For the first part, we employ a simple formula for revenue sharing received by each district based on sharing mechanism of Law 25/ 1999, to get the total revenue that is shared for each sector (Xp_i) from each producing district. The second part is more complicated than the first part. For the second part we should distinguish the producing district from the other districts in the relevant province that also receive the revenue sharing but not with the same percentage as the producing district. Then, we employ the second formula to get the total revenue shared for each sector (Xp_i) from each producing district. The total revenue from this part combined with the total revenue we get from the first part constitutes the total resource rent in mining and forestry sector.

The oil and natural gas revenue sharing data are extrapolated separately based on revenue sharing scheme based of Law 25/ 1999 to obtain the net operating income (NOI) for oil and gas at each producing district. These are lifting value (selling value of oil and gas) after subtracting exploration cost. In getting NOI for oil as well as natural gas, first we employ the calculation as has been discussed in part two. This number reflects the total revenue shared between central and local government not the NOI. To get the total value reflecting the total oil and gas produced by each district, then we have to divide it with the revenue sharing percentage between the contractor and the central government, (i.e. 53.4% for oil and 26.81% for natural gas). Furthermore, the oil and natural gas sector rent is the summation of both NOI of oil and natural gas sector.

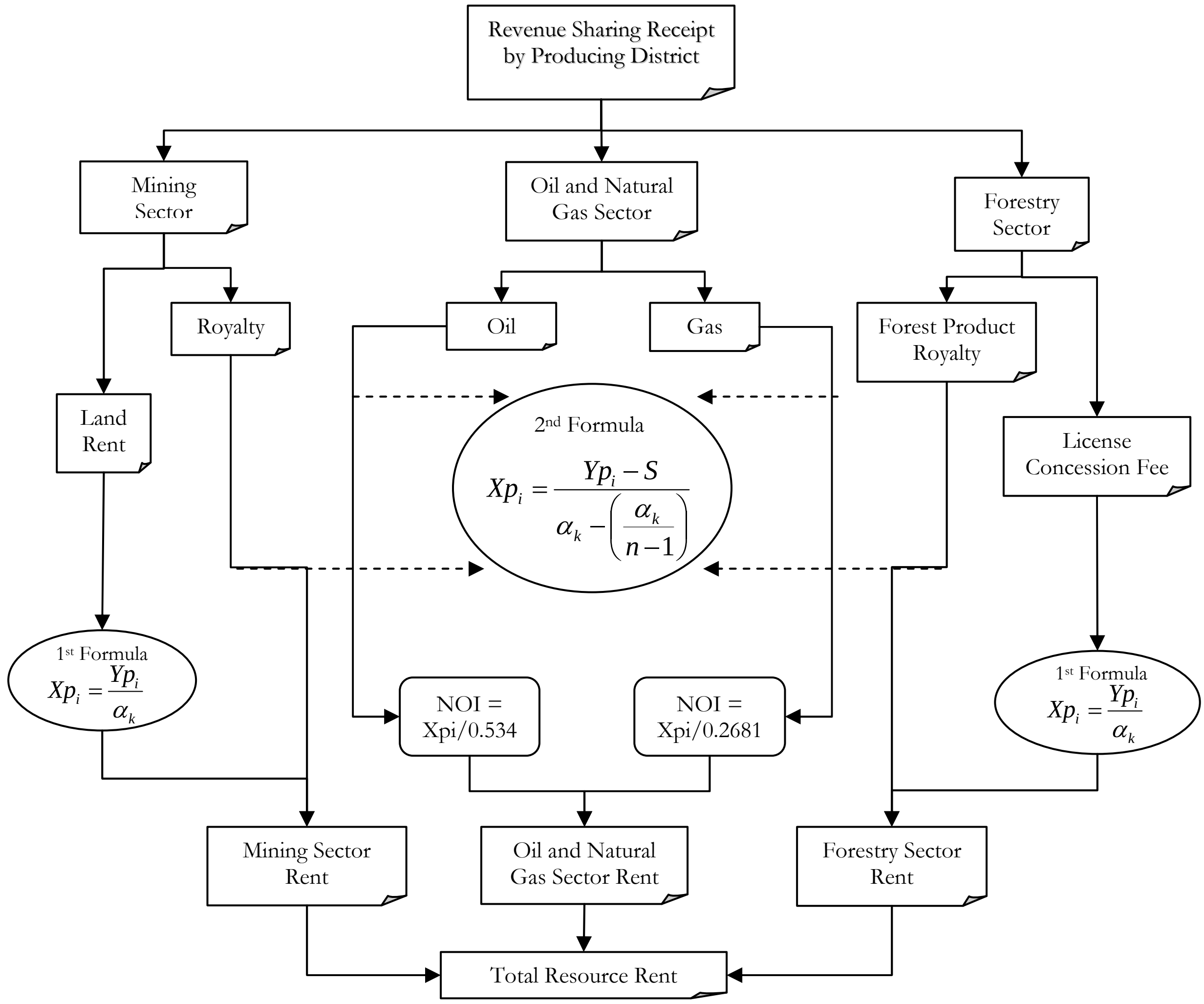
Although this proxy could explain the extent of natural resources abundance in a district, it has several weaknesses. The estimation is still rough and hence the results may underestimate the true value of resources rent. In addition, the coverage of our estimation is limited to only three major resources, without taking into account other resources that can be more abundant in some districts, such as agriculture, and fisheries.

Table 4: Natural resource revenue-sharing arrangement based on Law 25/ 1999

No.	Revenue	Central	Producing Province	Producing District	Other Districts In The Relevant Province (Total)	Overall Districts (Total)
A	**Oil and natural gas sector**					
1	State revenue from oil after tax has been deducted	85%	3%	6%	6%	-
2	State revenue from natural gas after tax has been deducted	70%	6%	12%	12%	-
B	**Non oil and natural gas sector**					
1	Mining Sector					
	- Land Rent	20%	16%	64%	-	-
	- Royalty	20%	16%	32%	32%	-
2	Forestry Sector					
	- Forest product royalty (PSDH)	20%	16%	32%	32%	-
	- Forest Concession license fee (IHPH)	20%	16%	64%	-	-
	- Reforestation fund	60%	-	40%	-	-
3	Fisheries Sector	20%	-	-	-	80%

Source: Bappenas, NRM and LPEM-FEUI (2000)

Figure 2: Resource rent calculation



Notes:
- Xpi = Total revenue shared from producing district *i*
- Ypi = Total revenue sharing receipt by a producing district i
- S = Total revenue sharing receipt by other districts in relevant province
- α = Percentage of revenue-sharing for district level for natural resource k
- n = Number of district in relevant province
- k = Natural resource index
- i = District index
- NOI = net operating income
- 0.534 = percentage of oil NOI's shared to local government
- 0.2681 = percentage of natural gas NOI's shared to local government

Source: Authors calculation based on Bappenas, NRM and LPEM-FEUI (2000).

Due to data paucity for several variables in the districts level, this study could only covers 246 districts in 28 provinces. The descriptive statistics of all variables used in this model are given in table 1.

Table 1: Summary Statistics

Variable	N	Mean	Std. Dev.	Minimum	Maximum
Average Growth of GRDP per Capita 01-04	246	0.027	0.052	(0.192)	0.310
GRDP per Capita 01	246	7,710,997	20,381,628	1,355,399	275,000,000
Human Capital	246	7.242	1.602	2.200	11.100
Investment	246	0.169	0.041	0.071	0.364
Total Rent	246	0.051	0.179	0.000	1.392
Rent _mining	246	0.003	0.032	0.000	0.491
Rent_Forestry	246	0.008	0.029	0.000	0.242
Rent_Oil&Gas	246	0.040	0.175	0.000	1.387
Government Investment	246	0.043	0.056	0.001	0.456
Government Consumption	246	0.080	0.057	0.003	0.357
Jawa	86				
Sumatra	66				
Kalimantan	27				
Sulawesi	34				
Papua	10				
Others	23				

Source: Authors calculation

3.3 Results

Our first empirical estimation result is reported in Table 2. The negative coefficient on initial income (log Gdpcap) implies a rate of conditional convergence, of about 1-2% per year. Mean years of schooling have the expected positive signs and significant at 10% level. The share of gross domestic fixed capital formation as a measure of investment also has the expected positive signs, although it is not significant. The coefficient of resource abundance variable, i.e. rent_total, has positive signs but statistically not significant, even at 10% level.

If we try to explore the relationship by adding the institutional policy related variable (regression 2.2 and 2.4) and also the interaction between these variables with resource rent (regression 2.3 and 2.5), we still can not reveal the relationship between growth and resource abundance. The total resource rent coefficient has been consistently statistically insignificant. This finding at the regional level confirms observation made by Rosser (2004) of the non existence of resource curse in Indonesia.

However, different patterns emerge when we break the resource rent into its three components and redo the estimation.

Table 3 summarizes the results of growth regression in the context of the resource curse with three component of resources rent. Table 3 introduces three components of the resource curse variable: (1) the share of forest rent in GDP (Rent_forest); (2) the share of mining rent in GDP (Rent_mining); and, (3) the share of oil and gas rent in GDP (Rent_oil&gas).

The results show that human capital still has a positive sign and significant at the 10% level except in regression (3.3) and (3.5). The investment indicator is persistently statistically non significant, although it has the expected positive sign. Table 3 indicates some interesting findings for the component of resources rent.

The results for regression using on the broken-down data of resource rent show some significant effects. Regression 3.3 shows that two out of three resource rents, i.e. forest sector rent and mining sector rent are significant at 5% level. The positive and significant forest rent effect only occurs when we add government consumption variable and its interaction with forest and mining rent. The interaction variable between forest sector rent and government consumption has a negative sign and significant at 10% level. The negative sign on this variable reflect the fact that the curse will occur if the revenue from this sector is not invested appropriately for public services provision. In this regression, the mining sector rent has the opposite sign with forestry; this means that mining sector endowment will harm economic growth. However, the interaction between mining and government sector is also significant but has positive signs. This implies that the curse will be lessened if the mining sector revenues are reinvested in public services provision.

Regression 3.5 shows other interesting findings. Forest sector rent is negative, but statistically insignificant. While the mining sector rent is persistently negative and significant. However, the oil and gas sector rent becomes significant and has positive sign. The oil and gas sector rent interaction variable is both negative and significant. This implies that the contribution of this sector rent towards economic growth will be lessened because it has not been properly invested in government investment.

4 CONCLUDING REMARKS

This study has constructed a different measure of resource rent to investigate the nature of resource curse hypothesis. Total resource rent is estimated from the natural resources revenue sharing for each district. Besides the total rent, we also estimate major natural resources by type such as mining, oil and natural gas, and forestry.

The estimations show that when we use total resource rent, the results are insignificant even after we add government policy related variables. However, there appears to be resource curse when we estimate the resource rent in its three components. Forest, oil and gas sector rent have positive effect on regional economic growth. But the resource curse may occur if these resources revenues are not invested properly in public sector, either for the provision of public services or in public investment. Meanwhile, mining sector has persistently negative effect on regional economic growth. The existence of this curse will be lessened if the mining sector rent revenues are reinvested in public sector investment.

Table 2: Resource abundance and economic growth (standar errors in parentheses) #

Variables	(2.1)	(2.2)	(2.3)	(2.4)	(2.5)
Log(Gdpcap)	-0.0146	-0.0206	-0.0208	-0.0145	-0.0140
	(0.0059) **	(0.0068) ***	(0.0068) ***	(0.0062) **	(0.0062) **
Rent_total	0.0026	0.0058	0.0303	0.0025	0.0315
	(0.0208)	(0.0208)	(0.0263)	(0.0210)	(0.0275)
Edu	0.0042	0.0045	0.0045	0.0042	0.0044
	(0.0025) *	(0.0025) *	(0.0025) *	(0.0025) **	(0.0025) *
Invest	0.0658	0.0691	0.0869	0.0663	0.0803
	(0.0918)	(0.0914)	(0.0919)	(0.0934)	(0.0935)
Gcon		-0.1453	-0.1222		
		(0.0812) *	(0.0824)		
*Rent * Gcon*			-0.5892		
			(0.3880)		
Ginv				0.0026	0.0587
				(0.0835)	(0.0902)
*Rent * Ginv*					-0.7100
					(0.4394)
Sumatra	-0.0049	-0.0031	-0.0029	-0.0049	-0.0069
	(0.0089)	(0.0090)	(0.0089)	(0.0092)	(0.0093)
Kalimantan	-0.0041	0.0016	0.0022	-0.0043	-0.0063
	(0.0130)	(0.0133)	(0.0133)	(0.0140)	(0.0140)
Sulawesi	-0.0137	-0.0088	-0.0098	-0.0138	-0.0152
	(0.0105)	(0.0108)	(0.0108)	(0.0108)	(0.0108)
Papua	0.0385	0.0594	0.0653	0.0380	0.0396
	(0.0183) **	(0.0216) ***	(0.0219) ***	(0.0246)	(0.0245)
Others	-0.0086	-0.0024	-0.0041	-0.0086	-0.0107
	(0.0124)	(0.0128)	(0.0128)	(0.0127)	(0.0128)
C	0.2130	0.3108	0.3098	0.2120	0.1989
	(0.0881) **	(0.1033) ***	(0.1030) ***	(0.0937) **	(0.0938) **
R-Squared	0.0642	0.0768	0.0858	0.0643	0.0746
Adj R-Squared	0.0286	0.0376	0.0429	0.0244	0.0311
Obs	246	246	246	246	246

#Notes: * Significant at the 10% level
** Significant at the 5% level
***Significant at the 1% level

Table 3: Resource abundance and economic growth (standar errors in parentheses) #

Variables	(3.1)	(3.2)	(3.3)	(3.4)	(3.5)
Log(Gdpcap)	-0.0151	-0.0214	-0.0181	-0.0154	-0.0141
	(0.0059) **	(0.0068) *	(0.0068) ***	(0.0062) **	(0.0060) **
Rent_forest	0.1772	0.2286	0.7520	0.1883	-0.0785
	(0.1380)	(0.1401)	(0.3262) **	(0.1515)	(0.2111)
Rent_mining	-0.2318	-0.2054	-2.5404	-0.2284	-2.3488
	(0.1075) **	(0.1079) *	(0.8854) ***	(0.1093) **	(0.6323) ***
Rent_oil&gas	0.0071	0.0092	0.0178	0.0072	0.2358
	(0.0210)	(0.0209)	(0.0300)	(0.0210)	(0.0655) ***
Edu	0.0043	0.0047	0.0036	0.0043	0.0034
	(0.0025) *	(0.0025) *	(0.0025)	(0.0025) *	(0.0024)
Invest	0.0145	0.0030	-0.0041	0.0080	0.0497
	(0.1001)	(0.0998)	(0.0990)	(0.1066)	(0.1026)
Gcon		-0.1514	-0.0981		
		(0.0824) *	(0.0839)		
Rent_forest * Gcon			-4.1643		
			(2.1207) *		
Rent_mining * Gcon			9.5363		
			(3.5836) ***		
Rent_oil&gas * Gcon			-0.4311		
			(0.6305)		
Ginv				-0.0163	-0.0334
				(0.0913)	(0.0997)
Rent_forest * Ginv					1.9390
					(1.4737)
Rent_mining * Ginv					7.8515
					(2.2991) ***
Rent_oil&gas * Ginv					-6.9951
					(1.8639) ***
Sumatra	-0.0057	-0.0039	-0.0023	-0.0053	0.0003
	(0.0089)	(0.0089)	(0.0089)	(0.0092)	(0.0089)
Kalimantan	-0.0068	-0.0020	0.0063	-0.0061	0.0050
	(0.0133)	(0.0135)	(0.0138)	(0.0139)	(0.0139)
Sulawesi	-0.0134	-0.0083	-0.0080	-0.0129	-0.0098
	(0.0104)	(0.0107)	(0.0106)	(0.0107)	(0.0103)
Papua	0.0485	0.0687 ***	0.0654	0.0515	0.0376
	(0.0189) **	(0.0218)	(0.0216) ***	(0.0251) **	(0.0241)
Others	-0.0080	-0.0014	-0.0040	-0.0074	-0.0074
	(0.0123)	(0.0128)	(0.0126)	(0.0128)	(0.0122)
C	0.2278	0.3318	0.2870	0.2345	0.2148
	(0.0876) ***	(0.1039) ***	(0.1045) ***	(0.0954) **	(0.0917) **
R-squared	0.0901	0.1031	0.1438	0.0902	0.1873
Adjusted R-squared	0.0473	0.0569	0.0880	0.0433	0.1343
Obs	246	246	246	246	246

#Notes: * Significant at the 10% level
** Significant at the 5% level
***Significant at the 1% level

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