Agriculture and regional economic growth in Indonesia

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Abstract. The Republic of Indonesia consists of 34 provinces in 514 districts with diverse economic characteristics. The objective of this research is to analyze the association between agriculture sector and regional economic growth in Indonesia. The data source was from the Indonesia Database for Policy and Economic Research (INDO-DAPOER) of the World Bank. The study covered the period between 2001 and 2008. The province total gross domestic product (GDP) excluding oil and gas was used as the outcome variable. The covariates were grouped into agricultural and development variables. The agricultural variables were total agricultural credit, number of people employed in agriculture, forestry and fishery, and agriculture function expenditure. Meanwhile, the development variables were percentage of household with access to safe water and literacy rate for population age 15 and over. The data analysis method was the generalized least square multiple regression with random effects. The results of the study indicate that the Indonesia's province GDP increased every year. In addition, higher economic growth was associated with higher total agriculture credit, larger number of people employed in agriculture, forestry and fishery, higher agricultural function expenditure, higher percentage of household with access to safe water, and higher literacy rate for population age 15 and over.

1 Introduction

The Republic of Indonesia comprises 34 provinces and 514 districts with diverse economic characteristics. In 2020, Indonesia's economic structure was spatially still dominated by provinces in Java Island that contributed 58.8% of Indonesia's gross domestic product (GDP). Meanwhile, Sumatra Island contributed 21.4%, Kalimantan Island 7.9%, Sulawesi Island 6.7%, Bali and Nusa Tenggara Island 2.9%, and Maluku and Papua Island 2.4%. Indonesia's GDP (current price) in 2020 reached Rp.15,434.2 trillion and GDP per capita reached Rp.56.9 million or US$3,911.7 [1].

Indonesia's economic growth declined by 2.07% compared to the country's economy in 2019. The largest decline occurred in transportation and warehousing sector by 15.04%. About 63.7% of Indonesia's GDP in 2020 came from industry, agriculture, trade, construction, and mining sector. Indonesia still can be considered as an agricultural country

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from economy sector side. This study is aimed to analyze the role of agricultural sector in regional economic growth in Indonesia.

Agricultural sector has impacts on all aspects of human life throughout civilization history including demographic dividends [2]. In economy there is a number of economic linkages and trade off that should be taken into account when designing policies and assessing their impacts. The Millennium Declaration set time target 2015 to eliminate half of population who lived in extreme poverty [3,4]. Low agricultural growth was associated with low growth in combating poverty in Mozambique [5]. In this case, agricultural sector productivity should be taken into account so that poverty can be overcome better.

Agricultural sector is the backbone of agricultural economy because it is the main source of food, such as in Pakistan [6] and also in Indonesia. Food production in agricultural economy needs ample resources, but credit is a factor that helps most in avoiding and managing risks. One main problem faced by farmers in developing regions is scarcity of credit. Institutional agricultural credit significantly supported Pakistan in eradicating food insecurity and later had positive impacts on this country's economic growth.Credit provision in agricultural sector boosts GDP through food price inflation control and also by reducing export and import [7]. Food export is a contributor of high price, while food import and credit in agricultural sector reduce food price in the long run.

The second largest contributor of GDP in Nigeria is agricultural sector. Ogbonna, Osondu, & Emerole (2016)employing ordinary least square regression estimation showed that total government expenditure in agricultural sector, interest rate, and total credit accessed by farmers were associated positively with Nigeria's GDP. The government should provide a number of agricultural credits to promote the innovativeness of farmers and efficiency and also to minimize a number of monopoly risks in farmer's credit supply. Expanding financial market will improve competition, reduce interest cost, and consequently increase agricultural contribution to GDP [8,9,10].

Agriculture is an important sector in Turkey's economy from population side and employment opportunity, nutrition, agricultural production, domestic consumption, and contribution to industry, national income, and payment balance [11]. The agricultural sector share in Turkey's national economy was 9% and in employment was 23.6% in 2016. During the 1900s Turkey experienced decline in GDP growth rate, but the growth rate of agricultural sector rose. Machine technological progress in agricultural sector fostered agricultural labor wage and consequently promote GDP growth. Worker's productivity, employment opportunity, and GDP in agricultural sector reciprocally connected [12]. The increase of agricultural labor productivity is the important requirement to improve agricultural sector productivity which is part of GDP from agricultural sector [13].

Budget expenditures is a main instrument in allocation function implementation in public policy for agricultural and rural development because its impacts on agricultural resources and socioeconomic process in rural areas [14,15]. Allocative effects of the growth of budget expenditure contribute to the improvement of economic factors in agricultural sectors, including the improvement of land productivity and work profitability. Policy to increase agriculture function expenditure positively influences economic growth.

Some of the targets of the Millennium Development Goals (MDGs) that was set by the United Nations had not been achieved and need improvement of living standard and health condition among rural communities in Sub-Saharan Africa (SSA). Water as one of important daily commodities has long been an emergency situation in SSA countries. In 2015 less than 17% of rural population in all SSA communities had access to basic hand washing facilities and sanitation system [16, 17]. Difficulty in accessing clean water has impacts on poverty. Development in health is associated positively with economic growth. Access to clean water is a determinant of population health and consequently economic growth.

Development promotes economic growth, including health infrastructure development, such as access to safe water. Some studies have been carried out to investigate the relationships between access to safe water and economic growth. A study in 176 countries found that access to safe water and GDP and found thatpopulation health, access to safe water, and governance influence GDP [18]. Meanwhile, [19] carried out a study on the impacts of access to safe water on productivity among population in Surabaya, East Java, Indonesia. He found that poor safe water could cause diseases in particular diarrhea. He argued that diarrhea caused the lost of working time and productivity decline.

Further, [20] conducted a study in Nigeria on the impacts of sanitation and health on economy. Their study that used data from 1990–2015 found that better health and access to safe water and sanitation promoted economic growth in Nigeria. Furthermore, safe water is a main energy production source in Pakistan [21].Access to safe drinking water was still a main problem in this country that had caused health and child mortality were still a major issue in this country in particular in rural area. This situation might cause the slowdown of economic growth.

Education achievement in particular literacy generally associates positively with economic growth through agricultural sector [22, 23, 24].The study by [22] found that in South Africa there was a long run relationship between agricultural production (GDP) with literacy rate. Meanwhile, a study in Indonesia by [25] found that literacy rate had positive impacts on Indonesia's GDP. Further, [24] analyzed the linkage between human capital, especially life expectancy, literacy, and GDP Bangladesh, India, Nepal, Pakistan, and Sri Lanka during 2000–2016. He found that GDP,life expectancy, and literacy rate had long and short run association. Furthermore, [23] found that literacy rate positively affected GDP per capita and promoted income per capita that caused literacy rate increased through increase in education expenditure.

Based on the above discussion, the objective of this study is to investigate the effects of agricultural, health, and education development on regional economic growth in Indonesia. It is hypothesized that agricultural, health, and education development is positively associated with regional economic growth in Indonesia.

2 Research Methods

The data source in this study were from the Indonesia Database for Policy and Economic Research (INDO-DAPOER) of the World Bank [26]. The dependent variable was the province total GDP excluding oil and gas (in millionIndonesian rupiah (IDR)) at constant price. The independent variables were grouped into agricultural and development variables. The agricultural variables were province agricultural total credit (in millionIDR), number of people employed in agriculture, forestry and fishery, and agriculture function expenditure (in IDR). Meanwhile, the development variables were the percentage of household with access to safe water and literacy rate for population age 15 and over. The study covered 32 provinces during 2001 to 2008 since two provinces, West Sulawesi and North Kalimantan, were not established during the study period.

Two methods were employed to analyze the data. Firstly, a time trend analysis was carried out to examine the trends of regional economic growth by time. The second analysis was to analyze the effects of agricultural and development determinants on regional economic growth in Indonesia. For this purpose, a generalized least squares multiple regression with random effects analysis was carried out.

3 Results and Discussion

Summary statistics, that is the number of observations, mean, standard deviation, minimum, and maximum of variables in the study were presented in Table 1. It can be seen that during 2001–2008 the total GDP excluding oil and gas at constant price ranged from 1.5 trillion IDR to 3.5 trillion IDR, agricultural total credit varied between 1,1 million IDR and 31 trillion IDR, number of people employed in agriculture, forestry, and fishery differed between 1,986.6 and 8.4 million, agriculture function expenditure ranged from 1.99 trillion IDR to 827 trillion IDR, percentage of households with access to safe water varied between 13.5 and 87.8, and literacy rate for population age 15 and over differed between 68.5% and 99.2%.

The results of time trend analysis for GDP by province during 2001–2008 were given in Table 2. It can be seen that regional GDP in Indonesia increased during 2001–2008 to 4.4 trillion IDR in 2002, to 6.4 trillion IDR in 2003, to 8.6 trillion IDR in 2004, to 11.4 trillion IDR in 2005, to 14.3 trillion IDR in 2006, to 17.6 trillion IDR in 2007, and 20.9 trillion IDR in 2008. In addition, with Bali province as reference, it can be seen some provinces experienced lower economic growth and some provinces experience higher economic growth than Bali province. For example, gross regional domestic product (GRDP) in Banten province was 4.7 trillion IDR higher than GRDP in Bali, while GRDP in North Maluku province was 8.2 trillion IDR lower than GRDP in Bali.

Table 1. Variables, Observation, Mean, Standard Deviation, Minimum, and Maximum (Source: [26] (Author's compilation). IDR = Indonesian Rupiah).

Variables	Observation	Mean	Standard Deviation	Minimum	Maximum
Total GDP excluding Oil and Gas (in IDR Million), Constant Price	256	4.73e+07	7.37e+07	1,554,972	3.53e+08
Total Credit by Sector: Agriculture (province level, in IDR Million)	256	1,191,464	3,205,162	1,106	3.07e+07
Number of people employed in agriculture, forestry and fishery	256	1,286,569	1,730,946	1,986.6	8,391,655
Agriculture function expenditure (in IDR)	256	7.36e+10	8.37e+10	1.77e+09	8.27e+11
Household Access to Safe Water (in % of total household)	256	45.88789	13.43202	13.5	87.8
Literacy Rate for Population age 15 and over (in % of total population)	256	91.09258	6.600759	68.5	99.2

Table 2. Time, Province, Coefficient, Standard Error, z, and p-value.

Variable		Coefficient	Standard Error	z	*p*-value
Year	2001	-	-	-	-
	2002	4,368,023	2,278,176	1.92	0.055
	2003	6,413,891	2,278,176	2.82	0.005
	2004	8,646,188	2,278,176	3.80	<0.001
	2005	1.14e+07	2,278,176	5.02	<0.001

	2006	1.43e+07	2,278,176	6.26	<0.001
	2007	1.76e+07	2,278,176	7.71	<0.001
	2008	2.09e+07	2,278,176	9.17	<0.001
Province	Bali	-	-	-	-
	Banten	4.67e+07	3,693,577	12.64	<0.001
	Bengkulu	-4,299,812	3,693,577	-1.16	0.244
	DI Yogyakarta	6,078,635	3,693,577	1.65	0.100
	DKI Jakarta	2.79e+08	3,693,577	75.61	<0.001
	Gorontalo	-8454506	3,693,577	-2.29	0.022
	Jambi	518425.6	3,693,577	0.14	0.888
	West Java	2.21e+08	3,693,577	59.89	<0.001
	Central Java	1.22e+08	3,693,577	32.95	<0.001
	East Java	2.41e+08	3,693,577	65.38	<0.001
	West Kalimantan	1.29e+07	3,693,577	3.49	<0.001
	South Kalimantan	1.21e+07	3,693,577	3.27	0.001
	Central Kalimantan	3367530	3,693,577	0.91	0.362
	East Kalimantan	3.23e+07	3,693,577	8.74	0.000
	BangkaBelitung Island	-2204621	3,693,577	-0.60	0.551
	Riau Island	1.76e+07	3,693,577	4.75	<0.001
	Lampung	1.80e+07	3,693,577	4.87	<0.001
	North Maluku	-8,224,077	3,693,577	-2.23	0.026
	Maluku	-7,234,084	3,693,577	-1.96	0.050
	Aceh	1.26e+07	3,693,577	3.40	0.001
	West Nusa T	4,506,124	3,693,577	1.22	0.222
	Papua	9,200,081	3,693,577	2.49	0.013
	Riau	2.23e+07	3,693,577	6.03	<0.001
	South Sulawesi	2.56e+07	3,693,577	6.92	<0.001
	Central Sulawesi	1,055,610	3,693,577	0.29	0.775
	Southeast Sulawesi	-2,573,543	3,693,577	-0.70	0.486
	North Sulawesi	7.59e+07	3,693,577	20.54	<0.001
	West Sumatra	1.84e+07	3,693,577	4.97	<0.001
	South Sumatra	2.54e+07	3,693,577	6.88	<0.001
	North Sumatra	2,343,628	3,693,577	0.63	0.526

The results of analysis of variance for the generalized least squares multiple regression with random effects model was provided in Table 3. It can be seen that as a whole the model was statistically significant at the less than 0.001 significance level. In addition, overall, 72.1% variation in regional GDP was explained by the model.

The results of generalized least squares multiple regression with random effects analysis was displayed in Table 2. It can be seen that all covariates had positive effects on economic growth significantly and statistically.

Other things being the same, an increase of 1 million IDR in province agricultural total credit, an increase of one worker in agriculture, forestry and fishery, an increase of one IDR in agriculture function expenditure, an increase of 1% in household with access to safe

water, and an increase of 1% literacy rate for population age 15 and over were associated with an increase in regional GDP by, respectively,4.7 million IDR, 19.3 million IDR, 0.0000373 million IDR, 258,178.2 million IDR, and 613,581.4 million IDR. Among these determinants, the agricultural total credit was the strongest factor, followed by the number of workers in agriculture, forestry and fishery, and agriculture function expenditure.

Table 3. Analysis of variation of the multiple regression model.

Random-effects GLS regression	Number of observations	256
Group variable: code	Number of groups	32
R-square	Observations per group:	
within = 0.5881	Minimum	8
between = 0.7317	Average	8.0
overall = 0.7207	Maximum	8
	Wald chi2(5)	367.08
corr(u_i, X) = 0 (assumed)	Prob > chi2	<0.0001

Table 4. Coefficients, Standard Error, z, p-value, and 95% Confidence Interval (Source: [26] (Author's compilation). IDR = Indonesian Rupiah).

Total GDP excluding Oil and Gas (in IDR Million), Constant Price	Coefficient	StandardError	*z*	*p*-value	[95% ConfidenceInterval]	
Total Credit by Sector: Agriculture (province level, in IDR Million)	4.706912	0.4236651	11.11	<0.001	3.876543	5.53728
Number of people employed in agriculture, forestry and fishery	19.2748	2.672068	7.21	<0.001	14.03764	24.51196
Agriculture function expenditure (in IDR)	0.0000373	0.0000108	3.46	0.001	0.0000162	0.0000585
Household Access to Safe Water (in % of total household)	258,178.2	94,131.32	2.74	0.006	73,684.22	442672.2
Literacy Rate for Population age 15 and over (in % of total population)	613,581.4	233,753.1	2.62	0.009	155,433.7	1,071,729
Constant	-5.36e+07	2.17e+07	-2.46	0.014	-9.62e+07	-1.09e+07

4 Conclusions

The results of this study confirm the findings from previous studies that agricultural, health, and education development are important in promoting economic growth in provinces in

Indonesia. Therefore, it is recommended to improve agricultural, health, and education development in order to boost province economic growth in provinces in Indonesia.

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