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Implications of Women Education and Infrastructure of Health on Quality of Baby Births in Agricultural and Non-Agricultural Regions

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***Abstract*—Demographic bonus will be a demographic disaster if the quality of human resources is not well prepared. One of the problems that can hamper the preparation of quality human resources is the problem of stunting. West Java was taken as the object of research because it is a large province but has a stunting rate approaching 30%. The purpose of this study is to identify the dominant factors that influence the occurrence of one of the causes of stunting, namely low birth weight. This result is expected to be a recommendation for decision makers in an effort to reduce the occurrence of stunting. Many aspects can be risk factors for low birth weight babies such as social demographics, behavioural factors and environmental risks. Environmental factors such as infection conditions are related to cleanliness and lifestyle. Concern for this factor is certainly inseparable from the level of education of mothers and facilities that support a healthy lifestyle/quality. The data used are secondary data with the object district/city in West Java for three years. Panel data methods, fixed effects, random effects and pooling are performed to be compared with each other. The results of the study show that agricultural areas have a greater LBW than non-agricultural regions in the 2013-2015 period. The results of regression analysis with pooling showed a significant influence on the level of maternal education, coverage of medical services and access to clean water with the number of babies' birth with LBW in West Java.**

Keywords: low birth weight, stunting, mother education, infrastructure of health

I. INTRODUCTION

Indonesia in 2030 is predicted to experience a demographic bonus, where there are conditions of greater productive age than non-productive. This of course can have a positive impact on economic growth. But demographic bonuses can be a problem if the generation that is born does not carry the potential to be productive. One potential that causes unproductive is the birth of infants below normal which is the forerunner of stunting problems.

Stunting or known as stunted body growth is one form of nutritional deficiencies. WHO determined that stunting occurred marked by height according to age under two standard deviations from the Z score (-2SD) [1]. Stunting in children is the impact of nutrient deficiency during the first thousand days of life. Stunting is the best summary indicator of the impact of nutrient deficiency in the first 1000 days [2]. Stunting children due to low birth weight compared to normal born babies, have an average IQ of 5 lower points [3].

Growth and development disorders in children due to malnutrition if not getting intervention early on will continue into adulthood [4]. The problem of stunting if not handled properly will certainly hamper the creation of a productive generation, so investment in children's education does not provide optimal returns. Because the high prevalence of stunting indicates a low level of intelligence and community productivity [5]. When adults, children who experience stunting have a 20% lower income than children who don't. Quoting the Chairperson of Bappenas in the long term stunting causes economic losses of 2% -3% of gross domestic product (GDP) per year. If Indonesia's GDP is US $ 13,000 trillion, it is estimated that potential losses due to stunting can reach US $ 260 trillion-US $ 390 trillion per year [6].

One of the risk factors that influence the incidence of stunting in children under five is a history of low birth weight (LBW). The growth of LBW babies will be disrupted, if the situation continues with inadequate feeding, frequent infections, and poor health care can cause a child to stunting. However, the incidence of stunting is also indirectly influenced by socioeconomic factors, such as education level, income, and the number of household members [6].

The incidence of stunting is very small, influenced by gene factors, less than 25%. The dominant influence comes from environmental factors (food intake and infection) especially in the first 1000 days of pregnancy [7]. Environmental factors such as infection conditions are related to cleanliness and lifestyle. Bad habits such as washing food with inadequate water, become one of the triggers for infection. Therefore the availability of access to adequate drinking water will contribute to a healthy lifestyle. This is of course also influenced by the willingness and ability of the mother factors involved directly during and after pregnancy to provide the best in babies with LBW preferences.

Previous research focused on micro data, while this study focused on macro data. Researchers want to see the amount of LBW that occurs is related to the average education in an area. The area taken as the object of research is West Java, because there are 13 districts in West Java that have quite high stunting rates. Stunting cases in West Java accounted for 29.2% or around 2.7 million children. Factors that are suspected to influence the number of stunting in addition to the level of education are health facilities (medical personnel and clean water) by controlling the types of agricultural and non-agricultural areas in the district/city.

II. Literature Review

Several studies in the micro-sphere show that there is a close relationship between low infant weight and the incidence of stunting both in the case of Indonesia or other countries. The case in Lybia shows a significant relationship using logistic regression methods with bivariate and multivariate [8]. Cases in Indonesia and Bangladesh have proven the close relationship between child stunting and poor child development and increased mortality [1,9]. Some empirical evidence for cases in Indonesia in children aged 7-12 months in in the working area of the Kalasan Health Centre [10], in children aged 13-36 months in in the working area of the Sonder Community Health Centre in Minahasa District [7], children aged 6-24 months with a history of LBW have 5.6 times higher risk of stunting than children born with normal weight [11].

Compilation of various studies related to several risk factors for low birth babies shows that 11 of the 27 published articles (40.7%) dealt with sociodemographic factors, 9 (33.3%) with environmental risks, 3 (11.1%) with behavioural factors, 2 (7.4 %) with prenatal or coverage controls and 2 (7.4%) correlated to other risk factors [12].

Research results in Nigeria identify a number of maternal, socioeconomic and environmental factors that significantly influence low birth weight [13].

The results of several studies in agricultural areas show that there is a relationship between the presences of pesticides with the incidence of low birth weight with a variety of methods. The presence of pesticides in the home is a risk factor for the occurrence of low birth weight in Brebes Regency using the Chi Square method [14]. The use of logistic regression for cases in Brebes Regency results in the conclusion that low infant weight factors include pregnant women with high levels of pesticide exposure [15].

Another major concern for the causes of low birth weight factors is the condition of parents, especially mothers. The impact of parental education especially mother's education affects the incidence of low birth weight. A high level of formal maternal education reduces the prevalence of stunting [9]. Mother's formal education is needed to increase knowledge in an effort to regulate and know the nutritional needs of family members.

Mothers who have a low level of education and a low educated family background are also obstacles to good parenting, which results in stunting of children. On the other hand, highly educated mothers are easy to receive information from outside, especially the provision of nutritious food to children so as to avoid the danger of malnutrition [16].

Low education also encourages a culture for early marriage which also causes pregnancy at a young age which may not be mentally and knowledgeably ready so that it affects the conditions during pregnancy and postpartum. Research in India shows that 44% of mothers give birth at less than 19 years of age having babies with LBW [17]. The results of research in Banjarnegara show female marriage at the age of less than 20 years and some even 16 years as a cause of LBW [18].

In terms of the use of methods that have been done by previous researchers, for LBW cases there are using non-parametric statistics and multiple logistic regressions. The use of non-parametric statistical methods using the chi square test results in a close relationship between the age of pregnant women and LBW cases [17]. The use of multiple logistic regression shows the influence of the sex of the baby, the order of live births, the age of the mother, and women with less than 12 years of education on LBW [19].

Most of the previous studies used cross section data which are micro data, while the authors on this occasion will use panel data that are macro data. The data consists of several districts / cities in West Java and collected for three years. We reasoned to use panel data to find out if there were changes over time.

III. Material and Method

This research is a verification study using panel data. The researcher aims to look at the implications of the quality of maternal education and health facilities on the quality of babies born in 27 districts / cities in West Java. The quality of babies born as the dependent variable will be proxy by the number of baby shirts with Low Birth Weight (LBW). Meanwhile, health facilities are proxy by the use of household clean water coverage and the coverage of the services of medical personnel /doctors of community health centre. Average length of school is used as a proxy for the quality of mother's education. The data used are secondary data obtained from BPS and the Ministry of Health for 3 years of observation, 2013-2015.

Regencies/cities as agricultural base areas or not used as control variables. The value of the control variable is 1 for agricultural areas and 0 for non-agricultural areas. Determination of an area included in the area on an agricultural basis or not using the Location Quotient (LQ) analysis. LQ is an approach used to measure the performance of a region's economic base. Performance value is calculated by measuring the concentration of an economic sector activity in an area compared to its role in the regional economy with the role of similar economic sector activities in the regional or national economy [20].

$$LQ = \frac{y_i/y}{Y_i/Y} \quad (1)$$

Where:

- y_i: GRDP of agricultural sector/sub sector in regency/city.
- y : GRDP of agriculture sector/sub sector in the province
- Y_i: Total GRDP in regency/city
- Y : Total GRDP in the province

Criteria:

- LQ > 1, the base sector in the area is agriculture
- LQ < 1, the base sector in the area is non agriculture
- LQ =1, domestic products owned by the region are consumed by the area (self-sufficiency)

The Low Birth Weight Model using macro data is formulated as follows:

$$LBW_{it} = C + \beta_1 ALS_{it} + \beta_2 CWSC_{it} + \beta_3 CPM_{it} + \beta_3 Agri_{it} + a_i + e_{it} \quad (2)$$

Where:

- LBW = Low Birth Weight (people)
- ALS = Average length of school (years)
- CWSC = Coverage of Clean Water Service (%)
- CPM = Coverage of Puskesmas Medical Staff Services based on WHO standards (%)
- Agri = value 1 for regencies/cities based on agriculture, value 0 for regencies/ cities based on non-agriculture.

The data used is panel data. Panel data is a combination of cross section data with time series data. This is necessary so that observations can be better and can know the role of time in influencing the dependent variable. The advantages of using panel data include: more informative, more varied, can avoid multicollinearity problems, cover dynamic changes, and more data so as to minimize bias when aggregating individuals [21].

The use of panel data for Equation (2) will be analysed with three alternative methods, namely fixed effect, random effect, and pooling cross section. Fixed Effect assumes that intercepts and slope (β) are considered constant between cross section units and time series units. Random effects assume errors are random and the method used is the Generalized Least Square (GLS) method. Pooling Cross section is the simplest technique in panel data analysis using the Ordinary Least Square (OLS) method. To see the impact of time and changes in intercept or slope using an additional set of time dummy variables in the equation [22].

IV. Analysis and Discussion

A. Descriptive Analysis

The contribution of the agricultural sector tends to decrease in cities and tends to increase in districts in the province of West Java. The contribution is quite large especially in the districts which reach an average of 19.7% per year. Location Quotient analysis (LQ) shows that there are 14 districts / cities (51.85%) which have LQ> 1 which means that the area is an agricultural base, where one of them is Banjar City and the rest is regency area. On the contrary, there is a district which in 2014 has changed from an agricultural to non-agricultural basis, namely Pangandaran district (see Figure 2).

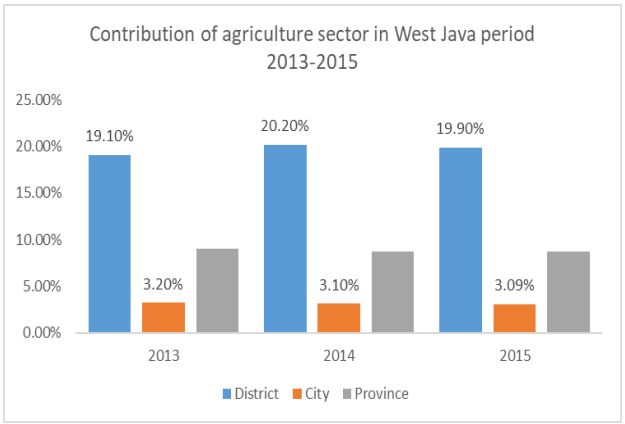

Fig. 1. Contribution of agriculture sector in West Java period 2013 -2015.

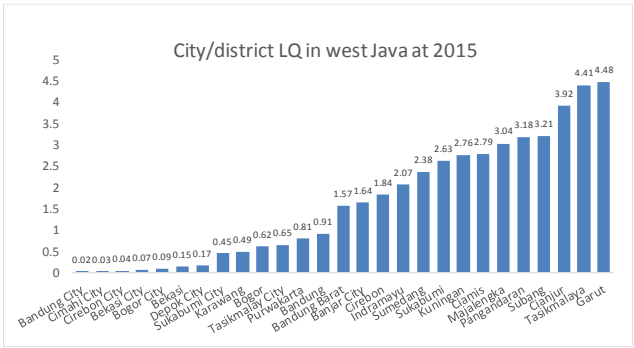

Fig. 2. City/districts LQ in West Java at 2015.

Agricultural areas are often identified with underdevelopment in a number of fields compared to non-agricultural areas including those related to the quality of human resources. This can be seen in Figures 3 and 4. Agricultural regions have a greater LBW than non-agricultural regions in the 2013-2015 periods which averaged 1.7 times (Figure 3). Likewise, the average length of schooling (ALS) especially for women, which is seen in agricultural areas, is lower than non-agriculture (Figure 4). Both of these certainly provide potential problems in the future related to the quality of human resources in the area, if not handled properly.

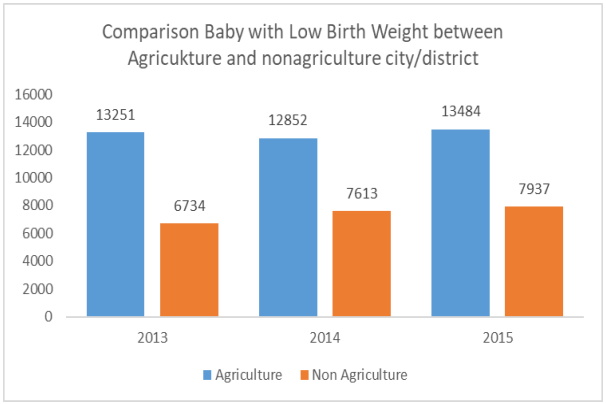

Fig. 3. Comparison baby with low birth weight between agriculture and non-agriculture city/district.

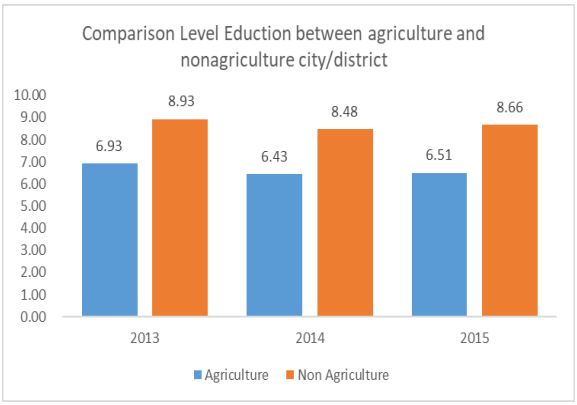

Fig. 4. Comparison level education between agriculture and nonagriculture city/district.

B. Model Analysis

The simplest model for panel data is pooling cross section. This model can be used to evaluate policy changes [22]. Other models that can be used for panel data are the fixed effects and random effects models. The random effect model uses residuals that are considered to have a relationship between time series and cross-sections [23].

Equation (2) when using the Fixed Effect model becomes:

$$LBW_{it} = \beta_1 ALS_{it} + \beta_2 CWSC_{it} + \beta_3 CPM_{it} + \beta_4 Agri_{it} + a_i + \varepsilon_{it} \quad (3)$$

For each district/city, the average equation over time becomes:

$$\overline{LBW_{it}} = \beta_1 \overline{ALS_{it}} + \beta_2 \overline{CWSC_{it}} + \beta_3 \overline{CPM_{it}} + \beta_4 \overline{Agri_{it}} + a_i + \bar{\varepsilon}_{it} \quad (4)$$

The Random Effect Model for Equation (2) becomes:

$$LBW_{it} = C + \beta_1 ALS_{it} + \beta_2 CWSC_{it} + \beta_3 CPM_{it} + \beta_4 Agri_{it} + v_{it} \quad (5)$$

The results of the analysis of all models are shown in Table 1.

TABLE I. ESTIMATED RESULTS OF FIXED EFFECT, RANDOM EFFECT AND POOLING CROSSECTION MODELS

VARIABLES: LBW	FE	RE	POOL
ALS	-35.61	-91.55**	-138.3***
	(55.28)	(45.11)	(38.03)
CWSC	-46.18	-81.36	-321.7**
	(87.36)	(87.71)	(155.4)
Agri		194.6	15.43
		(182.9)	(128.8)
CPM	362.7	133.5	-664.3***
	(244.3)	(230.8)	(224.4)
T2014			-38.47
			(110.0)
T2015			12.53
			(107.6)
Constant	953.1**	1,371***	2,227***
	(434.7)	(414.9)	(383.3)
Observations	81	81	81
R-squared	0.052	0.270	0.384
Number of Regional	27	27	
F stat	0.94		9.97***
Chi2(4)		10.69**	

Based on the results of Table 1, the Random Effect and Pooling Cross section Model shows the overall significance of the model, while the Fixed Effect is not significant. Pooling Cross section has the largest R square value.

Based on the results of the pooling cross section, the average length of school variables, clean water service coverage, and medical service coverage affect the number of LBW in an area. While the dummy variable which states as an agricultural base area has no difference with the non-agricultural base in its effect on the variable LBW number.

The average length of school has a negative and significant effect on the confidence level of 99%. If there is an increase in the average length of schooling of women it will be predicted to decrease the LBW level. With better education, it is expected to have better insights and abilities, better emotional maturity, and get married at a more ideal age so as to reduce the risk level of LBW. If women experience dropping out of school then generally enter the stage of marriage.

West Java still show a large percentage where women who marry under the age of 18 years [24]. All regency categories in West Java have more than 40% who married for the first time under 18 years except Bekasi Regency. The category of cities in West Java has a percentage below 40% except the City of Banjar [25]. The data above also shows in general that districts with lower average school years compared to cities have a greater percentage of marriage ages below 18 years than cities and vice versa. This shows the need for more attention to districts to deal with LBW issues by providing educational efforts both related to reproduction and awareness to achieve better education.

Coverage of clean water services in households has a negative and significant effect on the 90% confidence level. If the service coverage in the district/city is increased, it will be

able to reduce the number of LBW. The existence of clean water, is expected to be able to improve clean lifestyles that will reduce the occurrence of infection in pregnant women, thereby reducing the level of risk of LBW.

BPPSPAM data shows the level of clean water consumption of PDAM per person per day (litres) in the category of districts in West Java which is the 3 biggest in 2016 is Karawang at 18.9l, Majalengka at 17.4 and Bogor at 17.32. Whereas in the city category in West Java, the 3 biggest cities the level of consumption per day per person are Cirebon at 20.3, Bogor at 19.09 and Bandung at 17.48 (BPPSPAM, 2019). The data above shows that districts have lower levels of clean water consumption either because of availability or awareness compared to cities, while on the other hand districts have higher LBW rates than cities. This illustrates the relationship between the availability of clean water with LBW.

According to BPPSPAM Data, the three largest levels of clean water consumption of PDAM per person per day (litres) in West Java Regency in 2016 were Karawang at 18.91, Majalengka at 17.4 and Bogor at 17.32. As for the city category of West Java, the three biggest cities the level of consumption per day per person were Cirebon at 20.3, Bogor at 19.09 and Bandung at 17.48 [26]. The data above shows that districts have lower levels of clean water consumption either because of availability or awareness compared to cities, while on the other hand districts have higher LBW rates than cities. This illustrates the relationship between the availability of clean water with LBW.

Medical service coverage uses a ratio between the number of people estimated to be served by *puskesmas* doctors based on WHO standard assumptions (2500 per doctor) and the number of people using *puskesmas* services (assumed 60% of the total population). Variable coverage of significant medical services with a significance level of 99% decreases the number of LBW, increasing the CPM ratio will decrease the number of LBW.

The agriculture variable is a dummy variable where the value is 1 for regencies / cities on an agricultural basis and 0 for non-agriculture. This dummy agriculture variable is not statistically significant, so there is no difference in the number of LBW either in areas with non-agricultural or agricultural bases. This is possible because agricultural areas still have a relatively better environment, thereby improving the quality of public health even though the average education of mothers in agricultural areas is still low. In non-agricultural base areas, the environment has been polluted so that the quality of health is declining, but accompanied by high maternal education that can better protect them. This result supports previous research that separates rural and urban areas, where the percentage of the two regions is relatively the same for parents who have been married for a long time, and there is little difference in new families [27]. Research with a case in Brebes Regency that describes agricultural areas with high levels of pesticide exposure which a factor is causing LBW [15].

V. CONCLUSION

Low Birth Weight (LBW) is one of the risk factors that influence the incidence of stunting. The existence of this stunting can hamper the achievement of quality human resources in the future. Therefore factors that can reduce the risk of LBW become the focus of attention in this study, where the results show the following:

- Based on the results of the pooling cross section, the average length of school variables, clean water service coverage, and medical service coverage significantly influence the number of LBW in an area.
- The results of the dummy variable that distinguishes between agricultural and non-agricultural areas indicate that the agricultural base area has no difference from the non-agricultural base in its effect on the variable number of LBW.
- The average length of schooling of women has a negative and significant effect on the confidence level of 99%. Increased education is predicted to be able to reduce LBW levels because of better education, is expected to have better insights and abilities, better emotional maturity, and get married at a more ideal age so as to reduce the level of risk of LBW occurrence.
- Coverage of clean water services in households has a negative and significant effect on the 90% confidence level. Increased service coverage is expected to be able to improve a clean lifestyle that will reduce the incidence of infection in pregnant women, thereby reducing the level of risk of LBW.
- Coverage of medical services has an effect with a significance level of 99% reducing the number of LBW, which can be expected to increase the CPM ratio will reduce the number of LBW because of the handling of health from the beginning well.

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