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Nonlinear Relation between Government Spending and Education: Theoretical and Empirical Evidence from Districts in Indonesia

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Abstract

The Government of Indonesia has fully committed to allocating 20 percent of its budget to education since 2009. This paper aims to examine the impact of government spending on the enrollment ratio of basic education at the district level in Indonesia after 2009. This paper theoretically shows a nonlinear pattern between government spending and education by applying the endogenous growth theory. Moreover, this paper portrays empirical evidence from the district level in Indonesia that combining central and local government educational spending has no significant impact on the enrollment ratio of education. However, disaggregating the spending shows that the local government spending has a negative impact, whereas the central government spending has a positive and nonlinear impact.

Keywords: government spending, education, human capital, district, Indonesia

1. Introduction

Indonesia is among the developing countries that have allocated a significant share of their government budget to education. In 2015, Indonesia allotted 20.5 percent of its total government expenditure to education, nearly the same percentage as that allotted by neighboring countries. For example, in 2013, Malaysia allocated 19.7 percent, Thailand 18.9 percent, and Vietnam 18.5 percent of their national budget to education. However, in terms of Gross Domestic Product (GDP), the Indonesian government's spending represented only 3.6 percent of GDP in 2015; in the same year, Malaysia allocated approximately 4.8 percent of GDP to education, Thailand allocated 4.1 percent in 2013, and Vietnam allocated 4.3 percent in 2016. In terms of educational outcomes, Indonesia still lags behind its neighbors. The net enrollment rate for primary education in Indonesia was 89.7 percent in 2015, whereas it was 98.9 percent and 90.76 percent for Malaysia and Thailand, respectively. The difference is even more apparent in junior secondary education. In 2014, the net enrollment for junior secondary education in Indonesia was 72.8 percent compared to 89.5 percent in Malaysia and 81.2 percent in Thailand (http://databank.worldbank.org/data).

In Indonesia, public education dominates basic education (six years of primary and three years of junior secondary level). According to the Ministry of Education and Culture of Indonesia (MoEC) in 2019, as many as 88.2 percent of schools at the primary level were public schools, and 85.8 percent of students at the primary level were enrolled in public schools (https://npd.kemdikbud.go.id). These figures are lower for junior secondary level, with 59.6 percent of schools being public and 74.5 percent of students enrolled in the public schools. Government education spending is biased toward basic education managed by local governments at the district level. Therefore, local governments must manage their educational spending efficiently.

One significant milestone for the Indonesian education system has been the implementation of nine-year basic compulsory education, as well as the allocation of 20 percent of central and local governments budget to edu-

cation, as stated in the 2003 Law of National Education System. By allocating 20 percent of the government budget, access to public education is universal for basic and secondary education. Due to local government decentralization in 2001, the implementation of basic and secondary education has been under the authority of district governments. By 2015, the implementation of secondary education had been shifted to the provincial government, whereas basic education remains under the authority of the district government. The Indonesian government has managed to fully allocate 20 percent of its budget to education since 2009. From 2010 to 2019, the central government education budget has more than doubled, and approximately 60 percent of central government education spending has been transferred to district governments (http://www.data-apbn.kemenkeu.go.id). In addition, local government spending on education on a district level increased during this period.

Existing studies on the impact of Indonesian government education spending at the district level have obtained mixed results. Some studies have found that decentralization has positively impacted education services on a district level, such as Kristiansen and Pratikno (2006), Lewis and Pattinasarany (2009), and Simatupang (2009). However, other studies have presented discouraging evidence that shows no impact of government spending on education in Indonesia. For instance, Zufri and Oey-Gardiner (2012) found that the central government school operational assistance program positively impacted access to education on a district level, whereas local government spending had no significant impact. However, some studies have found that, despite increased access to education in Indonesia, there are still issues regarding the quality of education and the capacity of local governments in allocating resources (del Granado et al., 2007; Al-Samarrai & Cerdan-Infantes, 2013; Jasmina, 2016). Corruption on a district level and the local government's limited capacity to manage education spending may hinder the effectiveness of the local government's education spending, as argued by Suryadarma (2012) and Jasmina and Oda (2018).

Some earlier cross-country studies on the impact of government education spending have also offered contradictory results. For instance, Gloom and Ravikumar (1992, 1997), Barro (2001), and Gupta et al. (2002) conclude that government education spending positively affects educational attainment and increases human capital. The cross-country panel data analyses of Barro (2001) and Gupta et al. (2002) found that increasing school resources and public spending on education may improve educational attainment. On the other hand, some earlier empirical studies found a weak, insignificant relationship between public expenditure and education access and performance. Devarajan et al. (1996) showed that excessive government spending on education could negatively affect human capital accumulation and economic growth. Despite the positive impact of government education spending, there is a concurrent negative effect as the increase of human capital may subsequently hamper income equality.

On the other hand, other studies have found a negative insignificant relationship between government spending and education. Svensson and Reinikka (2004) argue that the negative relationship between government spending and education outcome may be attributed to the government's low efficacy in transferring funds and creating valuable educational resources. For example, other studies that have concurred with this argument include cross-country analysis by Al-Sammarai (2006) and the case of Africa by Nyamongo and Schoeman (2010). Rajkumar and Swaroop (2008) found that government education spending was likely to increase in countries with effective governance. Comprehensive empirical studies on the impact of government spending on education outcomes has found mixed results, such as Hanushek (2002, 2003), Leclercq (2005), Carnoy (2009), Glewwe et al. (2011), and Glewwe and Muralidharan (2015). The studies have found that there is limited evidence for a consistent relationship between educational resources and student performance. To enhance the quality of education, government policy indirectly allocates resources to schools and increases government expenditure. However, expanding expenditure per student does not necessarily

enhance students' performance. Glewwe and Muralidharan (2015) conducted an exhaustive study, both theoretically and empirically, on the impact of demand and supply education policies on education outcomes in developing countries. Some policies are effective and have a positive impact on education outcomes, whereas others are not. Demand-side intervention that increases school enrollment or reduces the household cost of education may effectively increase time in school and learning outcomes but varies in cost-effectiveness. On the other hand, increasing educational expenditure mostly spent on standard school inputs is unlikely to enhance learning outcomes.

Some studies have attempted to settle these opposing results and demonstrate the plausibility of a nonlinear relation between government spending and education, such as by Gloom and Ravikumar (1997), Lin (1998), Temple (2001), and Basu and Bhattarai (2012). This paper addresses the nonlinear relation between government spending on human capital accumulation. Government spending on education may increase human capital accumulation, but it has limits. At a certain level, an increase in government education spending may lower human capital accumulation. Moreover, this paper presents empirical evidence of a nonlinear relation between government spending and educational outcomes at the district level in Indonesia, focusing on nine-year basic education. Therefore, this paper differs from previous studies by developing a conceptual framework on the impact of government education spending on human capital accumulation, i.e., education, and linking the conceptual framework to empirical data on government spending on education at a district level in Indonesia.

The structure of this paper is as follows: Section 2 briefly describes trends in government spending on education in Indonesia; Section 3 presents a theoretical framework and modeling; Section 4 describes empirical studies on Indonesia; and Section 5 concludes the paper.

2. Brief Review of Government Spending on Education in Indonesia

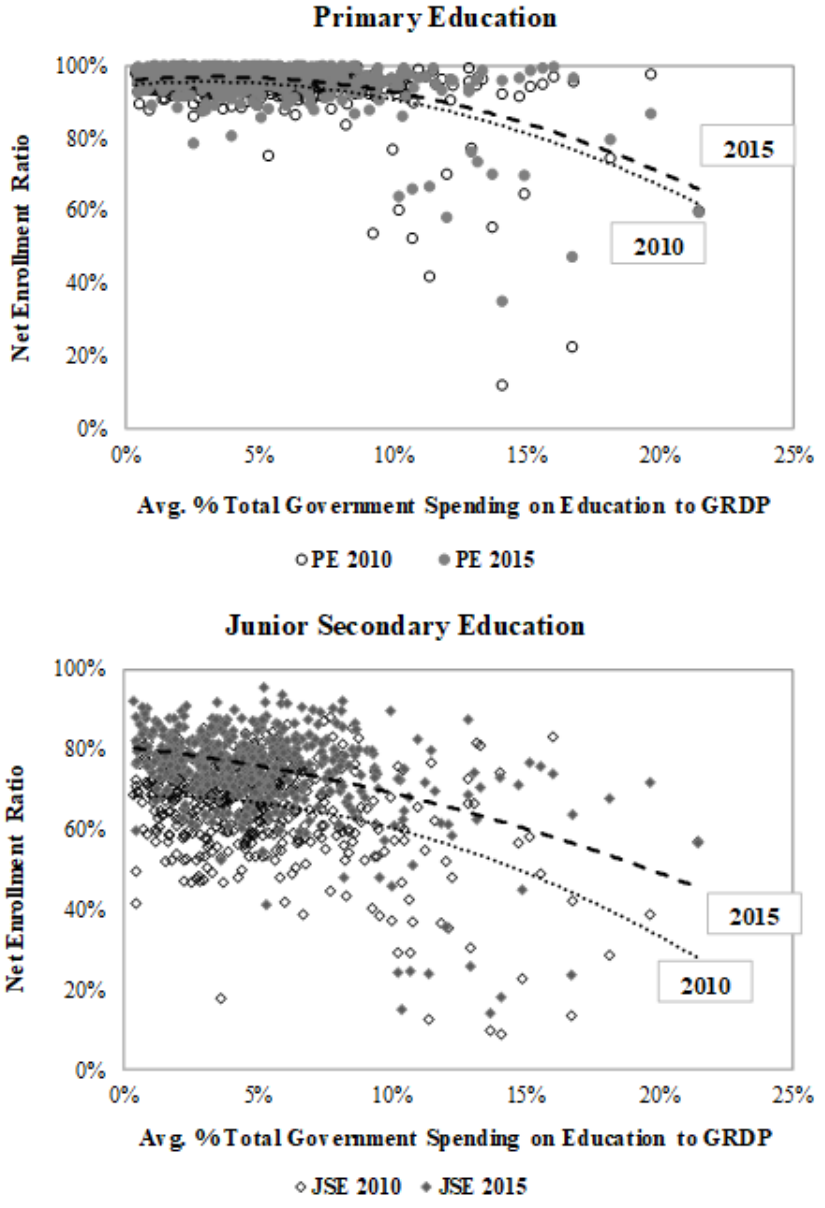
According to the Ministry of Finance (MoF) of Indonesia, from 2010 to 2019, the central government spending on education was more than

doubled from IDR 216.7 trillion to IDR 492.5 trillion, with around 60 percent of it was transferred to local governments. During the same period, local governments increased their spending on education by around 30 percent of the total government budget (www.kemenkeu.go.id). The central government spending on education is mainly in the form of (1) general allocation fund transferred from the central government to the local governments as a lump sum grant and part of local government revenue, which the local governments can spend based on the needs at the local level, such as for the salaries of local government officials, including teachers at public schools; (2) special allocation fund for education, which is a central government fund that is transferred to local district governments and can only be utilized based on specific purposes in the education sector as defined by the central government; (3) additional allowances for teachers, which is an additional incentive for certified teachers; and (4) school operational assistance program as a form of central government spending on schools at primary and secondary levels that is transferred to the local government with specific guidelines and oversight from central government.

Education outcomes in Indonesia, especially in terms of access to primary and junior secondary education, have improved significantly in the last decade. The net enrollment ratio improved from 2010 to 2019; it increased from 94.8 to 97.4 for primary education, from 67.7 to 79.4 for junior secondary education, and from 45.6 to 60.8 for senior secondary education. However, disparities in education outcomes exist across districts.[1] Figure 1 portrays the net enrollment ratios of primary and junior secondary education and the average share of total government spending on education to the gross regional domestic product of the districts in Indonesia in 2010 and 2015. On average, improvement of the net enrollment ratios at both levels of education is apparent. However, the figure shows that the districts with higher shares of government spending on education do not necessarily have higher net enrollment ratios. There is a plausibility of a nonlinear relation between government spending and the net enrollment ratios.

[1] Authors' calculation based on the National Socioeconomic Survey of Indonesia-SUSENAS, Statistics of Indonesia-BPS.

Figure 1. Net Enrollment Ratio and Government Spending on Education by Districts in Indonesia, 2010 and 2015



Source: Jasmina (2017)

3. Theoretical Framework

From an economics perspective, education can be analyzed from a macro perspective of human capital accumulation and a micro perspective of educational production function and household behavior (Carnoy, 2009). This paper applies the macroeconomic perspective of human capital approach to education. An early study by Barro (1990) incorporated government spending in the endogenous growth model and showed that productive government spending could positively affect growth. Extending his earlier analysis, Barro (1991) performed a cross-country analysis of 98 countries from 1960 to 1985 with the endogenous growth model that examined the role of government spending on education as public investment in education and economic growth. He argues that human capital plays a significant role in growth, and government spending on education as a public investment can enhance productivity and promote growth.

However, as existing studies on the impact of government spending and education have obtained mixed results, several further studies have attempted to settle disputes and apply a nonlinear concave relationship between government spending and education. Theoretical research applying endogenous growth models, such as Gloom and Ravikumar (1997) and Lin (1998), have found that government spending on education could increase the time spent on human capital accumulation and lead to economic growth. Empirical cross-countries studies on the relationship between government spending and education outcomes have suggested that a nonlinear specification model may provide a more precise estimate of the impact of educational attainment on growth (Temple, 2001); an increase in government spending on education is likely to increase education outcomes in countries with good governance (Rajkumar & Swaroop, 2008). Basu and Bhattarai (2012) applied an endogenous growth model to examine a nonlinear relationship between government spending and education outcomes and showed that, in countries with a high initial share of government spending on education, increased government spending on education promoted schooling and growth.

Government spending might increase education outcomes up to a certain point, however, further increases in spending may adversely affect educational outcomes. Government spending on education could positively affect human capital and growth depending on the level of funding and conditions associated with the funding. This paper proposes an economic model to address the argument by developing an economic endogenous growth model as the foundation for further empirical analysis. This theoretical framework is based on the human capital approach developed by Mincer (1958), Schulz (1963), and Becker (1964), who have focused on individual behavior in making decisions about education. Applying the human capital approach to the endogenous growth model, Lucas (1988) and Romer (1990) argue that the accumulation of human capital enhances the productivity of both human and physical capital and promotes economic growth.

The model is set up by applying the endogenous growth model using two factors of production: physical capital (k) and human capital (h), as in Uzawa (1965) and Lucas (1988). In addition, the model refers to Barro (1990) regarding the endogenous growth model and the role of government. The model applies a representative agent model to the infinite time horizon constructed by Ramsey (1928), Cass (1965), and Koopmans (1965), as elaborated in Barro and Sala-i-Martin (2004). Individuals as representative agents in the economy maximize their intertemporal utility function (c_t) given by the following:

$$U(c_t) = \int_0^{\infty} \frac{c_t^{1-\theta} - 1}{1-\theta} e^{-\rho t} dt \qquad (1)$$

where c_t denotes consumption per capita; ρ is the discount factor of time preference for current and future consumption with $0<\rho<1$; and Θ is the degree of relative risk aversion of the utility with $0<\Theta<1$.

The agents' utility is subject to production in the goods sector with two-factor productions, physical capital and human capital, which are represented in the common Cobb Douglas production function as follows:

$$y_t = Ak_t^{\alpha}\left(\phi_t h_t\right)^{1-\alpha} \tag{2}$$

where y_t is output per capita; k_t is physical capital per capita; h_t is human capital per capita; ϕ_t is time spent on physical capital accumulation; α is a share of physical capital in the goods sector with 0<α<1; (1-α) is a share of human capital in the goods sector; and A is an exogenous constant that reflects the overall level of the production technology. For simplicity, assume zero depreciation of physical capital.

The human capital production of the agent uses human capital (Uzawa, 1965; Lucas, 1988) and per capita level of government spending on education. It is given by the following:

$$\dot{h}_t = B\left[(1-\phi_t)h_t\right]^{\beta} g_t^{1-\beta} \tag{3}$$

In this model, the agents allocate (1-ϕ) of their time for human capital accumulation, i.e., the education sector; β is a share of human capital in the education sector, with 0<β<1; and B is an exogenous constant technological parameter in the education sector. We assume zero depreciation of human capital for simplicity. The role of government in the education sector is presented by $g_{t,}$ which is defined as a per capita level of government spending on education, where its share directed toward the education sector is (1-β). The role of government in the model will be explained in the following section.

The agent faces the constraint in physical capital given by the following:

$$c_t + \dot{k}_t = (1-u)Ak_t^{\alpha}\left(\phi_t h_t\right)^{1-\alpha} \tag{4}$$

which shows that the physical capital accumulation () not only depends on per capita consumption (c_t) and per capita output ($y_{t,}$) but also on the policy variable of (1-u), which is a share of government spending on physical capital accumulation. The share of (1-u) is given accordingly because the government determines u as the share of government spending on education.

Total government spending in this model is defined by G, and it is assumed under a balanced government budget, where government spending is fully financed by government revenue from taxes (T), so that G=T. The tax revenues are determined by a proportional tax rate (τ) to output (Y), so that T= τY; hence, G = τY. The policy variable u is defined as the share of government spending on education, and it is assumed to be the same as the tax rate (τ) so that we can have τ=u. Hence, government spending on education in per capita terms is defined as the following:

$$g_t = \tau y_t = u y_t \tag{5}$$

By substituting (4) into (7) for y_t, we can find the following results:

$$g_t = \tau y_t = u y_t = u A k_t^{\alpha} \left(\phi_t h_t\right)^{1-\alpha} \tag{6}$$

where g_t is per capita government spending on education, which is determined by the share of government spending on education (u) and per capita output (y_t).

In the above model, c_t and ϕ_t are control variables determined by the agents, whereas k_t and h_t are the state variables. Once the agents determine their consumption (c_t) and the time spent on physical capital (ϕ_t) or human capital (1- ϕ_t) to maximize their intertemporal utility given k(0)>0 and h(0)>0, then the level of physical capital (k_t) and the level of human capital (h_t) are given accordingly. The government's share of government spending on education (u) is fixed and determined as a policy variable. To show the relationship between the policy variable of u and the control variable of ϕ_t (ϕ_t=f(u)) and the relation between the policy variable of u with the growth rate of γ (γ = f (u, ϕ_t(u)), the model is then solved by an optimization method.

The Hamiltonian function for solving the model is as follows:

$$H = \frac{c_t^{1-\theta} - 1}{1-\theta} e^{-\rho t} + \lambda \left[(1-u) A k_t^{\alpha} \left(\phi_t h_t\right)^{1-\alpha} - c_t \right] + \mu \left\{ B \left[(1-\phi_t) h_t \right]^{\beta} g_t^{1-\beta} \right\} \tag{7}$$

where λ is the dynamic Lagrange multiplier associated with the constraint in equation (4), and μ is the multiplier associated with the constraint in equation (3). For simplicity, time subscripts in the subsequent analysis are suppressed.

Solving the first-order condition of (7) with respect to consumption (c_t), physical capital (k_t), human capital (h_t), and time spent on physical capital accumulation (ϕ_t), and applying the following transversality conditions:

$$\lim_{t\to\infty} \lambda_t k_t = 0, and \lim_{t\to\infty} \mu_t h_t = 0 \tag{8}$$

we get the following[2]:

$$\frac{\rho}{\theta} - \frac{\alpha}{\theta} A(1-u)\phi^{1-\alpha}\omega^{1-\alpha} + B(1-\phi)^{\beta}\left(uA\right)^{1-\beta}\phi^{(1-\alpha)(1-\beta)}\omega^{-\alpha(1-\beta)} = 0 \tag{9}$$

with ω, which is defined as:

$$\omega = \Omega\left(\phi^{\beta(\alpha-1)}(1-\phi)^{\beta-1}\right)^{\frac{1}{1-\alpha\beta}} \tag{10}$$

and Ω is defined as a constant of $\Omega = \left(\frac{\beta B u^{1-\beta} A^{-\beta}}{\alpha(1-u)}\right)^{\frac{1}{1-\alpha\beta}}$, which includes the policy variable *u*.

Equation (9) implicitly states a relation among the share of government spending on education (*u*), time spent on human capital accumulation (1-ϕ), i.e., the education sector, and time spent on physical capital accumulation (ϕ). The equation (9) can be numerically solved by setting fixed numbers for other parameters and observing how (1-ϕ) changes as *u* changes. Referring to Tobing (2011) and Basu and Bhattarai (2012), the share of physical capital in the goods sector (α) is set as 0.4[3], the share of human capital in the education

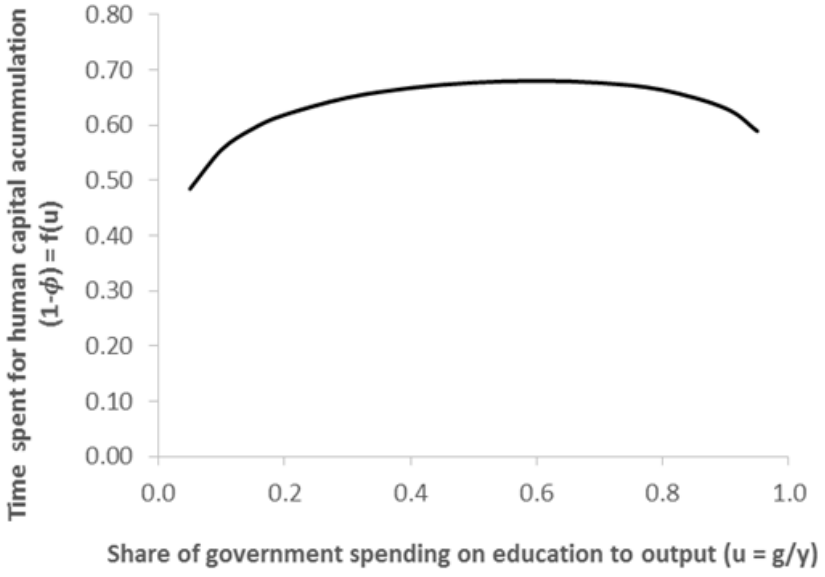
[2] The derivation of the equations (7) is available from the authors upon request.

[3] Tobing (2011) set α=0.4 based on the estimation of α in developing countries by Harisson (1996) and Collins and Bosworth (1996), and Basu and Bhattarai (2012) set α=0.36 based on Prescott (1986) for the US economy.

sector (β) is set as 0.8[4], and other parameters are set as arbitrary numbers between 0 and 1. Hence, we have fixed numbers for the following parameters: α=0.4; β=0.8; ρ=0.2; Θ=0.5; A=0.7; and B=0.7.

Figure 2 plots the changes of time spent on education (1-ϕ) as the share of government spending on education (u) changes while setting other parameters as constant. The figure shows a nonlinear concave relation between u and (1-ϕ). As the share of government spending on education increases (u), time spent on education (1-ϕ) increases. However, the condition is reversed at a higher level of government spending, as the share of government spending on education increases time spent on education decreases.

Figure 2. Government Spending on Education (u) and Time Spent on the Education Sector (1-ϕ)



Source: Authors' estimation.

[4] The closest empirical benchmark for β is the one estimated by Basu and Bhattarai (2012). They defined β as (1-η) and estimated η was between 0.057 and 0.096; hence, (1-η) is between 0.90 and 0.94. Although we are not applying their estimation here, we set β with the relatively high number of 0.8.

When the initial level of government spending on education is relatively low, if the government increases the size of education spending (u), the return on human capital production will become relatively high compared to the return on goods production. Hence, individuals will shift more of their time to the education sector. Under the government's balanced budget, to finance increased spending on education, the proportional tax rate (τ) has to increase accordingly. If the government keeps increasing its educational spending, the tax rate will significantly increase, which then leads to a decrease in after-tax output production. It also directly affects physical capital accumulation and consumption. The cost of human capital production becomes very high, and consequently, the net return on human capital accumulation becomes relatively low. Individuals then shift more of their time to goods production, and less time is allocated for the education sector.

This theoretical framework has shown a nonlinear pattern between government spending on education and human capital accumulation. Government spending on education can increase human capital accumulation, but there is a limit. The following section links the theoretical framework with empirical analysis by examining the impact of central and local government spending on educational outcomes at the district level in Indonesia.

4. Empirical Analysis

4.1 Model Specification, Data, and Variables

In empirically analyzing education from an economic perspective, no single measurement can define education. Unlike other goods and services, education has multiple objectives and outputs, and several measurements may be applied (Schwartz et al., 1998). Education, as an investment in human capital, can be measured in three approaches, namely output-based, cost-based, or income-based (Kwon, 2009). The output-based approach analyzes the relationship between human capital and growth, with the most common measurements being school enrollment rates, attainment, adult literacy, and average years of schooling. The cost-based approach measures

human capital in terms of the cost invested per person, and the income-based approach measures educational investment as the return on education from a labor market, as pioneered by Mincer (1958). Hanushek (1986, 2002) categorized the measurement of education into the quantity and quality of education. The quantity of education is defined as time spent in schooling, whereas defining the quality of education is more difficult, and the most accepted concrete measurement is the result of standardized testing of academic achievement. The use of specific measurements of education for empirical analysis depends not only on the objectives and scope of the study, but also on the availability of data. This paper follows the output-based approach and uses the net enrollment ratio as the measurement of quantity education.

The empirical analysis examines the relationship between net enrollment ratio, government spending, and socioeconomic factors using available data from 490 districts in Indonesia from 2010 to 2015. As of 2015, Indonesia consists of 34 provinces and 514 districts (416 regencies and 98 cities). This paper uses the number of districts in 2010, which was 497. As the capital with six districts, Jakarta is excluded because decentralization exists on a provincial level. Due to proliferation of the districts in Indonesia, the number of districts increased from 497 in 2010 to 514 in 2015. Excluding outliers and the availability of data, the total number of districts employed in the regression of this paper is 484.

In analyzing the impact of government spending on education, this paper applies a cross-sectional regression of two-stage least square methods (2SLS) with an instrumental variable. In addition, to test the nonlinear relationship between government spending and education outcomes, a quadratic regression model is applied. The estimated regression with the subscripts i represents a district as follows:

$$\Delta NERPRIM_i = \alpha_0 + \boldsymbol{\beta}' \boldsymbol{GOV_i} + \boldsymbol{\gamma}' \boldsymbol{X_i} + \varepsilon_i \qquad (11)$$

$$\Delta NERJSE_i = \alpha_0 + \boldsymbol{\beta' GOV_i} + \boldsymbol{\gamma'} \boldsymbol{X_i} + \varepsilon_i \quad (12)$$

where the dependent variables for district i are $\Delta NERPRIM_i$ and $\Delta NERJSE_i$.

This paper examines the impact of government spending at two education levels, primary and junior secondary. Therefore, two dependent variables are applied, which are the change in the net enrollment ratio in primary education (Eq. 11) and the change in the net enrollment ratio in junior secondary education (Eq. 12). This paper uses net enrollment ratios on a district level to measure education outcome, which is similar to the approach used in a number of earlier studies (Barro, 1991; Barro & Lee, 1993; del Granado et al., 2007, Zufri & Oey-Gardiner, 2012; Suryadarma, 2012). However, this measurement focuses only on the quantity of education and does not reflect quality. Issues with the measurements of quantity and quality of education have been highlighted in several studies, such as Barro and Lee (2001), Hanushek (2002, 2013), and Rajkumar and Swaroop (2008).

The explanatory variable GOV_i is a set of variables representing government spending on education categorized into central government spending on education and local government spending on education transferred to local governments (in terms of gross regional domestic product). The government spending on education consists of the following: (1) average total government spending on education and its square; (2) average local government spending on education and its square; and (3) average central government spending on education and its square. The total government education spending is the sum of central and local government education spending. Unlike previous studies, this paper defines central government spending by applying an aggregation of prominent central government education spending transferred to district governments in the following forms: (1) school operational assistance for primary and junior secondary education; (2) a special allocation fund for education; and (3) additional allowances for

teachers. The budget allocated by the central government is used as a proxy for central government spending on education, and data are available by request from the MoEC and the MoF of Indonesia.

Local government spending on education is defined as spending over which district governments have discretion. Data are represented by local government budgets, excluding the central government transfers. The general allocation fund is included in local government spending because local governments have discretion in using it together with their own local revenue. Data are publicly available from the MoF of Indonesia. To obtain a smooth pattern of government spending and avoid annual fluctuation, this paper employs a five-year average government spending of available data from 2010 to 2014.

For each dependent variable of primary and junior secondary education, there are three sets of regressions. The first and second regressions analyze the impact of total government spending, combining both local and central governments, with the change in net enrollment ratios. Whereas the third regression analyzes the impact of local and central government spending separately on the change in net enrollment ratios.

X*i* captures a set as control variables of socioeconomic factors in 2010 and includes the following variables: poverty headcount ratio; initial net enrollment ratio in primary education; initial net enrollment ratio in junior secondary education; the share of the population under 15 years of age; and share of households living in urban areas (Gupta et al., 2002; del Granado et al., 2007; Rajkumar & Swaroop, 2008). Considering structural economic differences among districts in Indonesia, the control variable of the share of agriculture, forestry, and fisheries sector to GRDP is added.

To avoid endogeneity, this paper uses a 2SLS regression and uses the poverty ratio with instruments (del Granado et al., 2007; Suryadarma, 2012). Two explanatory variables are used as instruments of the poverty ratio, namely the share of households with electricity and a dummy for remote districts, with 1 representing districts in the remote Eastern part of Indonesia

(the provinces of East Nusa Tenggara, Maluku, North Maluku, Papua, and West Papua) and 0 representing others. There are 410 districts in the Western region of Indonesia and 80 in the Eastern region.

Several studies have shown that electricity is a determinant factor of poverty. For Indonesia, an early study by Balisacan et al. (2003) in 1990 found that access to technology (including electricity) was one factor that affected poverty at the district level in Indonesia. A more recent study by Dartanto and Nurkholis (2013), applying data from 8,726 households from 2005 and 2007, found that one of the important factors of poverty dynamics in Indonesia was access to electricity. Moreover, Miranti and Resosudarmo (2005) found that poverty was significantly more prevalent in the Eastern region than in the Western region of Indonesia.

The first-stage regression shows that an increase of 1 percent in households with electricity significantly reduces the poverty ratio by 0.103 percent in the district. The poverty ratio in the Eastern region of Indonesia is significantly higher by 0.077 percent compared to the Western region.[5] Therefore, these instruments significantly correlate with the poverty ratio and can affect a change in the net enrollment ratio through the poverty ratio. Vector coefficients β' and γ' demonstrate the impact of government spending on education and of the control variables on the change in the net enrollment ratio in district *i* for each regression. Finally, the term ε_i denotes an error term in the regression, and regressions employ the same control factors as the explanatory variables. The district-level socioeconomic data are calculated from the National Socioeconomic Survey (SUSENAS) 2010-2015 and the Districts in Figures 2010-2015 from the Statistics of Indonesia. Table 1 presents summary statistics of the variables.

[5] A further statistical test shows that a null hypothesis of these instruments is weak and can be rejected with a minimum eigenvalue statistic of 39.618.

Table 1. Summary Statistics of Variables

Variables	N	Mean	Standard Deviation	Minimum	Maximum
Net enrollment ratio of primary education (2010)	490	0.941	0.075	0.118	1.000
Net enrollment ratio of primary education (2015)	490	0.956	0.061	0.350	1.000
Net enrollment ratio of junior secondary education (2010)	490	0.657	0.117	0.090	0.883
Net enrollment ratio of junior secondary education (2015)	490	0.754	0.109	0.144	0.954
Avg. of total government spending to GRDP (2010-2014)	490	0.051	0.033	0.004	0.214
Avg. of local government spending to GRDP (2010-2014)	490	0.036	0.023	0.003	0.131
Avg. of central government spending to GRDP (2010-2014)	490	0.017	0.012	0.001	0.112
Poverty headcount ratio 2010	490	0.155	0.093	0.017	0.496
Share of population below 15 years old (2010)	490	0.313	0.048	0.202	0.457
Share of households living in urban areas (2010)	490	0.363	0.311	0.000	1.000
Life expectancy ratio (2010)	485	68.234	3.856	52.650	77.370
Share of agricultural sector to GRDP (2010)	489	0.279	0.159	0.002	0.695
Share of households with electricity (2010)	490	0.853	0.203	0.000	1.000

Source: Author's calculation.

4.2. Results and Discussions

Tables 2a and 2b present the cross-section 2SLS regression results for primary and junior secondary education, respectively. The second and third columns of each table present the regression results for change in the net enrollment ratio with an average total government spending (regression 11a and 11b in Table 2a and regression 12a and 12b in Table 2b). The fourth

columns present the regression results for the change in the net enrollment ratio with the average local government spending and average central government spending (regression 11c in Table 2a and regression 12c in Table 2b).

Table 2a. Regression Results for Primary Education

Dependent Variable	**Change of NER Primary 2010 & 2015**		
Independent Variables	**Regression**		
	11a	**11b**	**11c**
Avg total government spending to GRDP	-0.007	-0.024	
	(0.071)	*(0.201)*	
[Avg total government spending to GRDP]^2	-2.079 *	-2.345	
	(1.084)	*(2.009)*	
Avg local government spending to GRDP			-0.432 ***
			(0.177)
[Avg local government spending to GRDP]^2			3.486
			(2.441)
Avg central government spending to GRDP			0.868 **
			(0.410)
[Avg central government spending to GRDP]^2			-21.813 ***
			(4.421)
Poverty headcount ratio	-0.267 ***	-0.314 ***	-0.301 ***
	(0.080)	*(0.077)*	*(0.085)*
Initial net enrollment junior secondary education	-0.479 ***	-0.486 ***	-0.490 ***
	(0.066)	*(0.076)*	*(0.066)*
Share of population below 15 years old	-0.030	-0.020	-0.027
	(0.047)	*(0.051)*	*(0.048)*
Share of households living in urban area	-0.041 ***	-0.044 ***	-0.043 ***
	(0.007)	*(0.007)*	*(0.007)*
Life expectancy ratio	-0.001	-0.001	-0.001

	(0.001)	*(0.001)*	*(0.001)*
Share of agricultural sector to GRDP	-0.005	-0.006	-0.007
	(0.011)	*(0.011)*	*(0.011)*
[Poverty] x [Avg total government spending to GRDP]		0.274	
		(1.345)	
Constant	0.595 ***	0.620 ***	0.621 ***
	(0.093)	*(0.099)*	*(0.098)*
Adj R-squared	**0.405**	**0.363**	**0.390**
Observations	**484**	**484**	**484**
Endogenous test: robust score χ^2 at 5% level	4.464	9.988	5.978
	(0.035)	*(0.007)*	*(0.015)*
Overidentifying test: score χ^2 at 5% level	0.093	2.388	0.053
	(0.760)	*(0.303)*	*(0.818)*

Note: ***, **, and * denote statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively. Standard errors in parentheses are robust standard errors. As the available data at the district level for explanatory variables is 484, hence the regressions employ 484 data instead of 490.
Source: Authors' estimation.

Table 2b. Regression Results for Junior Secondary Education

Dependent Variable	**Change of NER Junior Secondary 2010 & 2015**		
Independent Variables	**Regression**		
	12a	**12b**	**12c**
Avg total government spending to GRDP	-0.091	0.863 *	
	(0.180)	*(0.454)*	
[Avg total government spending to GRDP]^2	2.058	11.202 **	
	(2.311)	*(5.041)*	
Avg local government spending to GRDP			-0.948 **
			(0.401)

[Avg local government spending to GRDP]^2			13.251 *
			(7.180)
Avg central government spending to GRDP			1.688 *
			(0.920)
[Avg central government spending to GRDP]^2			-20.078 **
			(8.849)
Poverty headcount ratio	-0.410 ***	-0.173	-0.460 ***
	(0.142)	*(0.143)*	*(0.157)*
Initial net enrollment junior secondary education	-0.480 ***	-0.514 ***	-0.479 ***
	(0.041)	*(0.036)*	*(0.042)*
Share of population below 15 years old	-0.302 ***	-0.267 ***	-0.306 ***
	(0.109)	*(0.107)*	*(0.109)*
Share of households living in urban area	-0.018	-0.003	-0.020
	(0.015)	*(0.015)*	*(0.015)*
Life expectancy ratio	-0.001	0.000	-0.002
	(0.001)	*(0.002)*	*(0.002)*
Share of agricultural sector to GRDP	-0.031	-0.040 *	-0.033
	(0.022)	*(0.022)*	*(0.022)*
[Poverty] x [Avg total government spending to GRDP]		-6.883 **	
		(2.894)	
Constant	0.668 ***	0.528 ***	0.703 ***
	(0.123)	*(0.125)*	*(0.132)*
Adj R-squared	**0.280**	**0.336**	**0.269**
Observations	**484**	**484**	**484**

Endogenous test: robust score χ^2 at 5% level	4.918 *(0.027)*	2.881 *(0.237)*	5.422 *(0.020)*
Overidentifying test: score χ^2 at 5% level	3.665 *(0.056)*	2.173 *(0.338)*	3.408 *(0.065)*

Note: ***, **, and * denote statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively. Standard errors in parentheses are robust standard errors. As the available data at the district level for explanatory variables is 484, hence the regressions employ 484 data instead of 490.
Source: Authors' estimation.

As depicted in regression 11a, at the primary level, average total government spending on education has no significant impact on the change in the net enrollment ratio. The results are more interesting when total government spending is disaggregated into local and central government spending, as in 11c. When the average total government spending is disaggregated, average local government spending has a significant negative impact on net enrollment. In contrast, average central government spending has a significant positive and nonlinear impact. For every one percent increase in average local government spending, the change of net enrollment ratio decreases by 0.432 percent, whereas the impact of central government spending on the change in the net enrollment ratio depends on the value of central government spending. The maximum change in the net enrollment ratio will be reached when the average central government spending on gross regional domestic product is 0.020.[6] At the average level of 0.017 from 2010 to 2014 (see Table 1), a one percent increase in central government spending increases the change in the net enrollment ratio by 0.117 percent.

The result implies a diminishing marginal effect of average central government spending on the change in the net enrollment ratio. At a lower level, an increase in government spending increases the net enrollment ratio change. However, the marginal effect of government spending is smaller at a higher level of government spending. In fact, after reaching a maximum level

[6] Supposing that the net enrollment ratio is y and the central government spending is x, given the nonlinear function of (as in regression 11c), the net effect of x on y is . The effect of x on y depends on the value of x and the maximum value of y that occurs at.

of government spending, an increase in government spending decreases the change in the net enrollment ratio. An increase in central government spending above this level decreases the change in the net enrollment ratio.

For junior secondary education in Table 2b, regression 12a shows that the average total government spending does not significantly impact a change in net enrollment ratio. However, disaggregating government spending, as is the case in regression 12c, shows that average local government spending has a significant negative impact on the change in net enrollment ratio, whereas average central government spending has a significant, positive, nonlinear impact. Although the squared local government spending shows a significant positive impact following the negative impact, the spending must reach a minimum average point of 0.036 to gross regional domestic product to reverse the impact, which is not practically attainable.

As one prominent control variable, the poverty ratio consistently shows a significant negative impact on the change in the net enrollment ratio in both levels of education. Suppose the share of poor people in the districts increases by one percent, regressions 11a, 11c and regressions 12a, 12c show that the change in net enrollment in primary education decreases by 0.267 percent and 0.301 percent, and for junior secondary education, 0.401 percent, and 0.460 percent respectively. To further analyze the impact of poverty to the change of net enrollment ratio, regression 11b and 12c add an interaction term between poverty ratio and total government spending for primary and junior secondary education respectively.[7]

Regression 11b shows a consistent result as regression 11a for primary education. Adding the interaction term between poverty ratio and

[7] The interaction term between poverty ratio and government spending is only applied to total government spending. This paper employs a 2SLS regression and uses the poverty ratio with two instruments. The statistical test shows that, when the poverty ratio interacts with the central and local government spending, the instruments become weak and other instruments might be needed.

total government spending has no effect on the change of net enrollment ratio. However, the result is different for junior secondary education, as shown in regression 12b of Table 2b. Adding the interaction term shows that total government spending may affect the change of net enrollment ratio, depending on the poverty ratio in the districts. At the average level total government spending of 0.051 and poverty ratio of 0.155 (see Table 1), a one percent increase in total government spending increases the change in the net enrollment ratio by 0.879 percent. However, as the poverty rate increases, the impact can be reversed. If the poverty ratio in the district is higher than 0.283, then increasing government spending may negatively affect the change of enrollment ratio of junior secondary education. The impact of the poverty ratio on the change in net enrollment ratio indicates that the poverty ratio is one factor that significantly affects the change in net enrollment ratio for both primary and junior secondary education at the district level in Indonesia.

The empirical analysis provides interesting findings on the impact of government spending on education at the district level in Indonesia. Combined local and central government spending has no significant impact on the change in the net enrollment ratio at either primary or junior secondary levels of education. When the spending is disaggregated into local and central government spending, however, local government spending has a negative impact, whereas central government spending has a positive and nonlinear impact on the change of the net enrollment ratios.

The negative impact of local government spending on the change of the net enrollment ratio for both primary and junior secondary education indicates that there are remaining issues hindering educational improvements at the district level. This paper proposes two possible issues with local government spending: the capacity and accountability of local governments in managing their financial resources to deliver better education and transforming local financial resources into resources to enhance educational outcomes.

As basic education in Indonesia has been decentralized to local governments at a district level, local governments must have adequate

capacity and accountability in providing services. Recent empirical studies have identified issues of capacity and accountability in providing public services in Indonesia, including in education. Previous studies have found that the accountability mechanism at the district level is weak and that decentralization has not led to a significant reduction in local governments' administrative spending (Schulze & Sjahrir, 2014; Kis-Katos & Sjahrir, 2014; Sjahrir et al., 2013). Suryadarma (2012), and Jasmina and Oda (2018) suggest that local government spending can negatively affect net enrollment ratio in districts with high corruption and lack of capacity and accountability of local governments in providing basic education.

If we look closely at how local governments spend their money on education, Al-Samarrai and Cerdan-Infantes (2013) and the World Bank (2013a) found that about three-quarters of the spending is on teachers' salaries. The question is whether this spending on salaries has led to quality teaching to improve education. Unfortunately, previous studies show discouraging findings. For example, reports by the MoEC of Indonesia (2012) and the World Bank (2013b) found no relationship between spending more on teachers' salaries and educational outcomes. Studies by Pradhan and de Ree (2014) and de Ree et al. (2015) showed no relation between financial and human resources and learning outputs and find that increasing teacher salaries does not improve teachers' efforts or student learning outcomes.

Findings from a qualitative analysis by Jasmina (2017) support those previous studies and the results of this paper. Much of the local government spending on education at the district level is allocated to personnel, particularly teachers' salaries. Despite the spending on teachers' salaries, there are issues on teachers at the district level, including a mismatch between school needs and available teachers, teacher competency, and distribution of teachers among districts. Decentralization has led local governments to hire more teachers than required because their salaries as local civil servants are covered by the general allocation fund transferred by the central government. In addition, temporary teachers are recruited at a district level, which means that local governments

need to spend more money on their salaries. Since decentralization, the central government has provided no clear monitoring and evaluation mechanisms for teachers' performances at a district level. As most local government spending on education is allocated to teachers, local governments have limited fiscal capacity for educational programs across their districts.

On the other hand, this paper shows a contradictory finding on the impact of central government spending on educational outcomes at the district level. A positive nonlinear relationship is found between average central government spending and the change in net enrollment ratio for both primary and junior secondary education. Increasing central government spending on education may increase educational outcomes until a certain level. However, beyond this level, the impact is reversed. This inverted relation may imply that the central government has spent too much on education. The findings show that the average central government spending between 2010 and 2014 peaked in primary education but not junior secondary education.

The measures for central government spending on education applied in this paper consist of prominent spending transferred to the district level between 2010 and 2014 in the form of a school operational assistance program (29.5 percent), a special allocation fund for education (21.9 percent), and additional allowances for teachers (48.7 percent). Funds are transferred from the central government to the district level with a specific purpose, guidelines, and monitoring and evaluation measurements, which can apparently positively affect education outcomes. However, as there is evidence of a nonlinear relationship between central government spending and net enrollment ratio, further spending may adversely affect outcomes at a certain level. Therefore, the increase in central government education spending should be approached cautiously at a district level since it may reversely affect the impacts of spending.

This paper finds that combining local and central government spending has no significant impact on the change in net enrollment ratio in primary or junior secondary education. Despite the amount of spending, there is the possibility of an adverse impact for local and central government

spending on education outcomes. It is possible that, when combined, the negative impact of local government spending may cancel out the positive impact of central government spending.

5. Conclusion

This paper has shown a nonlinear pattern between government spending on education, human capital accumulation, and growth by adopting an endogenous growth theory. Government spending on education can increase human capital accumulation and growth, but there is a limit. An optimal level of government education spending can enhance human capital and growth, and spending more on education does not necessarily increase human capital and promote growth. Furthermore, by performing an empirical analysis of government spending on education and the enrollment ratio at the district level in Indonesia. This paper concludes that combining local and central government spending on education has no significant impact on the change in the net enrollment ratio in primary education and junior secondary education. When government spending is disaggregated, local government spending has a negative impact at the primary and junior secondary levels. On the other hand, central government spending has a significant positive and nonlinear impact on the change in the net enrollment ratio in both primary and junior secondary education.

As basic education in Indonesia is decentralized to the district level, capable local governments and adequate local fiscal capacity for productive educational spending are imperative. There is an issue concerning the capacity of local district governments to manage their financial resources to deliver better educational services and how local financial resources can be better utilized to provide resources to enhance educational outcomes at the district level. As most local government spending on education is allocated for personnel, including teachers' salaries, local governments have limited fiscal space for educational programs. Oversight from the central government and active participation of public stakeholders is important in ensuring accountability at the district level. It is not the amount of spending but whether the total government budget on

education is well spent.

The positive relationship between central government spending and the change in the net enrollment ratio in both levels shows that transferring financial resources meant for education at the district level from the central government to local governments can positively affect education outcomes, assuming specific purposes and evaluation measures are defined. However, evidence of a nonlinear relationship between central government spending and educational outcomes could indicate that central government spending on basic education is already high and thus might negatively affect the outcomes.

Based on the findings, this paper suggests policies to allow government educational spending to further enhance basic education outcomes at a district level. First, as central government spending has a positive and nonlinear impact on the net enrollment ratio of primary and junior secondary education, the central government transfer for education should be intensified. Second, the district government has the discretion to spend its money to improve school inputs in their district. The findings in this paper concur with existing studies, which have demonstrated the importance of local government capacity in managing educational spending. Enhancing local government capacity in managing educational spending and strengthening oversight on the local government spending by the central government and the public may improve educational outputs across districts. Finally, as the poverty rate and the district's remote location affect the results of government spending on education, it is recommended to intensify government educational spending in poor and remote districts.

This paper has some limitations that require further investigation. First, if data permits, applying the same method over longer analysis period may provide more firm results. Second, this paper focuses on the quantity of education by using net enrollment ratio to measure educational outcomes. The quality of education in Indonesia remains an issue, and further research should be performed to examine the impact of government spending on learning outcomes. Third, as there are different central and local government types on education in Indonesia, it may be worthwhile to further analyze how specific

government spending, either central or local, affects education outputs such as student learning performance. Finally, an analysis at district level might overlook the characteristics of households, schools, and teachers as prominent factors affecting educational outcomes. Therefore, a further micro-level analysis should be conducted.

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