EJEM
Econ. J. Emerg. Mark.

Economic Journal of Emerging Markets
Available at http://journal.uii.ac.id/index.php/jep

Government fiscal policy impact analysis in infrastructure sector and education sector to improve public welfare

Mustafa Edwin Nasution[1], Imam Wahyudi[2*]

[1)] Department of Economics, Faculty of Economics and Business, University of Indonesia, Indonesia
[2)] Department of Management, Faculty of Economics and Business, University of Indonesia, Indonesia
[*] Corresponding author. E-mail: i_wahyu@ui.ac.id

Article Info

Article history:
Received : 1 October 2016
Accepted : 12 March 2017
Published : 1 April 2017

Keywords:
government, education, infrastructure, growth

JEL Classification:
C14, C34, G38, H54

DOI:
10.20885/ejem.vol9.iss1.art6

Abstract

This study aimed to conduct a study and analysis of government fiscal policies related to the components of revenue (taxes) and some components of spending (education/human resources and infrastructure sectors). Issues regarding the effectiveness of the allocation of government budgets, particularly for human resources and infrastructure sectors, is an important issue that is very interesting to discuss. Especially if associated with their impact on improving people's welfare. With a limited income, the government must make a choice to prioritize the education/human resources sector or infrastructure sector.

Abstrak

Penelitian ini bertujuan untuk melakukan studi dan analisis kebijakan fiskal terkait dengan komponen pendapatan (pajak) dan beberapa komponen pengeluaran (pendidikan/sumber daya manusia dan infrastruktur). Isu mengenai efektivitas alokasi anggaran pemerintah, terutama untuk sumber daya manusia dan infrastruktur, merupakan masalah penting yang sangat menarik untuk dibahas. Apalagi jika dikaitkan dengan dampaknya pada peningkatan kesejahteraan rakyat. Dengan pendapatan yang terbatas, penelitian ini merekomendasikan pemerintah harus membuat pilihan untuk memprioritaskan sektor pendidikan/sumber daya manusia atau sektor infrastruktur.

Introduction

The issue of poverty is a common problem in developing countries, including Indonesia. In accordance with Article 34 of the UUD 45 (constitution mandate of 1945) that the poor and abandoned children cared by the state. The task in this article should be understood not only passive means, namely preserve, but also significantly active that in the long term reduce the poverty rate in Indonesia. Government as part of a country and as well as economic agents implement mandate of the UUD 45 in the form of macroeconomic policies, both monetary and fiscal policy. In the Indonesian, these policies is held by two different institutions as the implementation of the independence of central bank (namely Bank of Indonesia) as the holder of the monetary policy authority and Ministry of Finance (government) as the fiscal authority. The main focus in this study is fiscal policy.

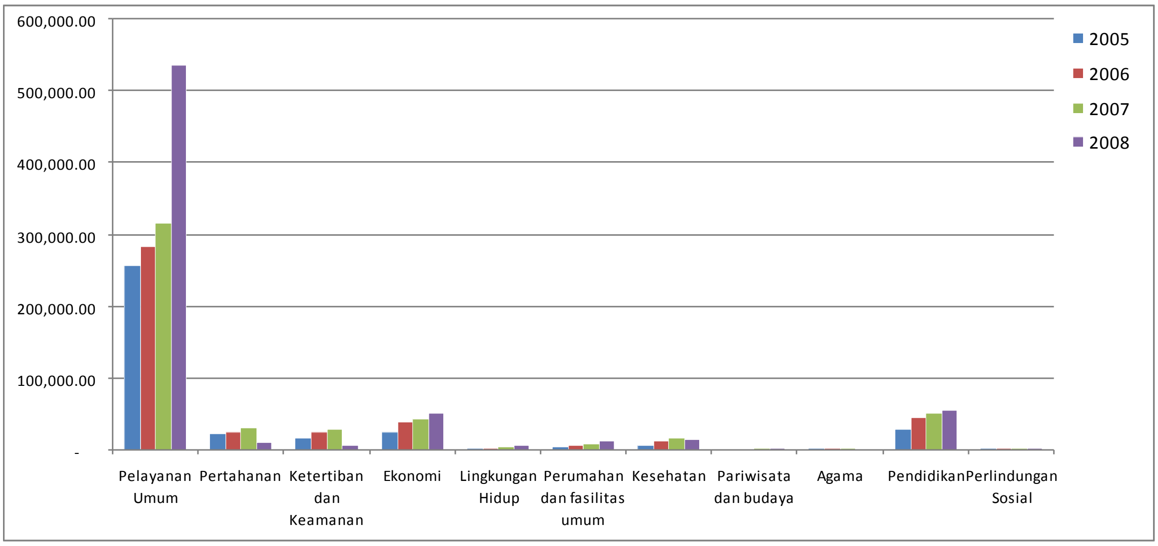
As stated by Mishkin (2004) that the ultimate goals of macroeconomic policies are price level stability, high employment levels, long-term economic growth, and exchange rate stability. Any economic policies that do (i.e. monetary policy, fiscal, trade, labour, etc.) eventual goal is to achieve the social welfare of Indonesian society. To achieve this objective, Bank Indonesia has made the stability of the Rupiah as a single destination as stated in UU No. 23 of 1999 about Bank Indonesia, as amended in UU No. 3 of 2004 Article 7. While the Directorate General of Budget, Indonesian Ministry of Finance (2009) stated that fiscal policy objective is to achieve the welfare of the community through the efforts of (i) promote economic growth, (ii) expanding employment in order to reduce unemployment and alleviate poverty, and (iii) to stabilize the prices of goods, especially to overcome inflation.

Government's fiscal policy is reflected in the current Budget, where there are two important components of the tax (namely tax rate) and the composition of government spending (government spending). Poverty alleviation policy that became a central issue in achieving the welfare of society can be divided into 2 stages. First policy to ensure stay alive (as feasible) in the short term, such as direct subsidies. Second policy tend to be long-term oriented policy to alleviate poverty, through job creation and public education. Both policies must go in a line and dynamic follow the development of society living stage and conditions of the nation's economy at that time.

In a closed economic system, where there is only households, firms and governments as economic actors, the economic policies and activities that carried out each will affect the others (Mishkin, 2004; Mankiew, 2006). Society (namely household) is a supplier of human resources as input of company's production process, which at the same time is the end consumer of company's product. Household poverty will cause a decline in purchasing power of society and the demand for final goods, on the other side of the poverty caused a decline in the quality of human resources due to (i) the lack of nutrient intake and (ii) the decrease in labour education. Both of these will impact on the company's production capabilities in the future. Similarly, for the government, poverty causes reduced government tax revenue. Sluggish economy due to lower private consumption and investment activities cause economic growth target burden is on the government through expenditure policy. Deficit budget policy to shore up the economy will impact on the accumulated burden of the budget deficit (through debt to the society) and the increasing rate of inflation (further discussion about impact assessment of unsynchronized macroeconomic policy management, see Ratnawaty, 2003).

Opposite effect, that through the mechanism of fiscal policy with budget deficit approach (such is in Indonesia), the government can stimulate the corporate sector through a policy of investment expenditure in physical infrastructure or through a subsidy mechanism. Likewise, the household, with the construction of the education system and education subsidies, the government can increase the capacity and capability of qualified human resources that lead to increased productivity in the enterprise sector. Even with the allocation for education in the composition of government expenditure, it can naturally increase the level of wages and even able to create their own jobs through self-employed (namely entrepreneurship).

Monteiro & Turnovsky (2008) explains that the question about optimal allocation for the two expenditure posts that previously had been tried answered in microeconomic and macroeconomic disciplines. The problem of allocation is more easily answered through a microeconomic perspective. In a microeconomic perspective, the increase in government spending (on both the post) will lead to positive effects for other components in the economy. For example, increasing the capacity of electrical energy in a region will increase company productivity, learning time students, and the use of technology to find the sources of knowledge. Simply answer the problem in microeconomic is they due to not consider any constraints on government spending. The opposite occurs when using a macroeconomic viewpoint. With a limited budget that haven, the government is often difficult to determine where the expenditure items that should be a priority in the allocation of government expenditures. The Government should consider the impact (such as productivity, long-term growth, and welfare of the community) from the allocation in both these expenditure items.



Source: Indonesian Ministry of Finance (2009).

Figure 1. Allocation of budget for various sectors

In Indonesia, the infrastructure/public services and education/human resources is still very dominated the allocation of Indonesian government expenditure in the year 2005 - 2008 (see Figure 1). If the two sectors are compared, it was clear that the allocation of expenditure for infrastructure/public services are still far greater than the expenditure for education/HR sector. Although the budget allocation for education continues to increase from year to year, but the government still makes public service/infrastructure as a priority in disbursement of government budget. Thus, the government must know the effects of fiscal policy is to increase public welfare. If the policy of budgetary allocation has been done proved no great impact on improving people's welfare, the government needs to change the pattern of budget policy in the future so that the increasing public welfare objectives can be achieved.

The rest of the paper is organized as follows. Section 2 provides a literature review. Section 3 details the data and the methodology. Section 4 analyses the results. Section 5 conclude and examines the implication of our results.

An economic system is said closed if it does not involve international economic activity, ie exports and imports, so that the activities of production, consumption, and distribution both in the market for resources and goods/services involved only the domestic component, namely households, firms and government. In general, a closed economic system can be shown in Figure 2.

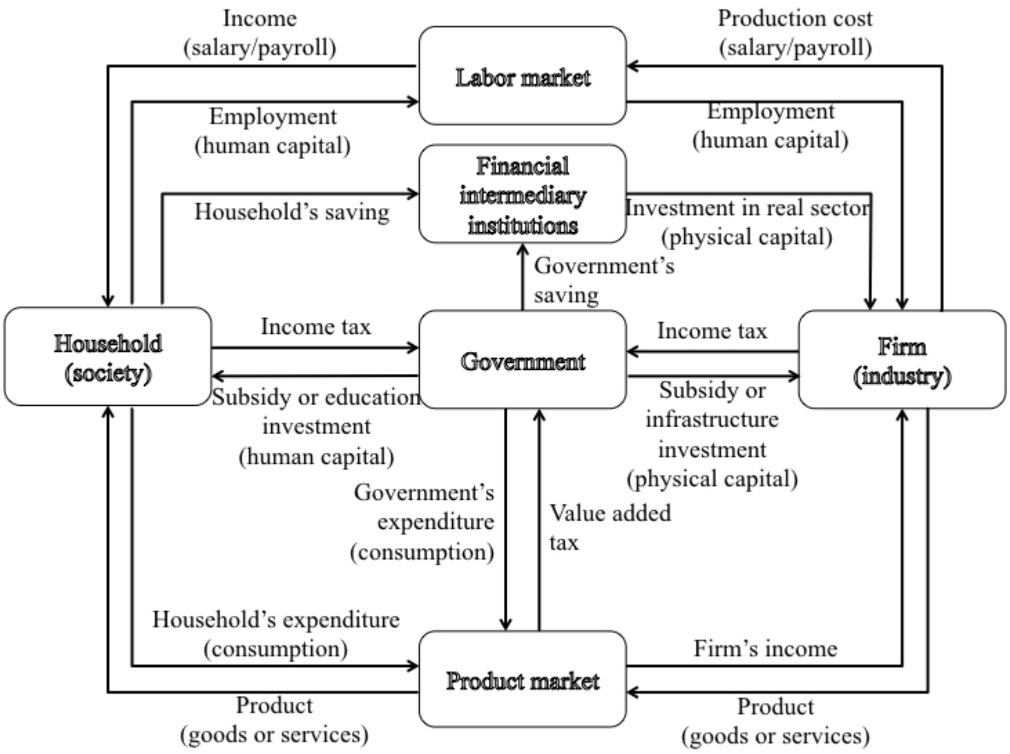


Figure 2: Closed economic system

Closed economic system as shown in Figure 2 can be defined (represented) by the following general equilibrium function (Mishkin, 2004; Mankiw, 2006):

$$Y = C + G + I \qquad (1)$$

Where: $C = C_0 + bY_d$, $Y_d = Y(1 - t)$, Y is a country's aggregate expenditures, C is society consumption, C_0 is autonomous consumption, G is government spending, I is investment, Y_d is disposable income, b is the marginal propensity to consume, and t is the rate of income tax.

From the economic model above, it can be said that an economic system consists of components of households, industries (firms), and the government. Each component of this economy have one common purpose, namely to maximize the level of satisfaction with various limitations that exist. In this session, we will be described how the relationship between fiscal policy and unemployment reduction objectives, how the components of the economy define their satisfaction functions, as well as how the economic equilibrium is formed (further discussion see Mankiw, 2006; Monteiro & Turnovsky, 2008).

Fiscal policy and unemployment rate

Mankiw (2006) described the relationship between fiscal policy and unemployment from the Keynesian's view. In making fiscal policy, government often regulates the amount of expenditures in each period. Fiscal policies adopted by government will have an impact on the output of goods/services market. The increase in government spending at a certain period will have an impact on increasing society's income. Often, the government increased spending by increasing public infrastructure development that involves a lot of labor. Infrastructure development projects are expected to absorb many workers who in turn will increase society's income.

On the other hand, if the government increases spending by increasing expenditure allocations for education sector, then this can also increase society's income. Investment in education sector in the long term will increase the workforce with better quality (educated). Such labor is generally required by the company's more than unskilled labor. In the end, an increase in overall government spending (which are infrastructure and education sectors) is expected to be able to increase the number of national output in the goods/services market.

Satisfaction level of households, firms and government

Household as a representation of society is the consumer of the products that produced by the firm (as representation of the industry) on the goods market and is also a supplier of labor to the firm on the labor market. With aggregating number of households as a whole, implies that per capita value of each variable represents the aggregate value. According to Monteiro & Turnovsky (2008), we assume that the population growth rate is stable, household as consumer will try to maximize the following intertemporal isoelastic satisfaction function:

$$\Omega(C)=\int_0^{\infty}\frac{C^{\gamma}}{\gamma}e^{-\rho t}dt,\ -\infty<\gamma<1 \tag{2}$$

where C is consumption, ρ is the discount rate, and $1/(1-\gamma)$ is the intertemporal elasticity of consumption substitution.

The company as a manufacturer also requires various resources to convert into a product as its output, such as labor, capital, energy, raw materials, etc. (Buffa & Sarin, 1987). In the Cobb-Douglas production model, simplified corporate input only physical capital (K) and human capital/labor (H). Both resources are consequent to the budget (because of the rental fee) and can be allocated to produce the final product, X, or produce new human capital through education. This implies that both inputs can go directly to the company at this time to produce the final product or allocated to educating the human resources today to get increased productivity and efficiency in the future.

Production of final products, X, formulated in the Cobb-Douglas production function follows:

$$X=AK_X^{\alpha_1}H_X^{\alpha_2}G_X^{1-\alpha_1-\alpha_2},\ A>0,\ 0<\alpha_i<1,\ i=1,2 \tag{3a}$$

Where K_X, H_X and G_X are allocation of physical capital, human capital, and current government expenditure to produce the final product.

As explained earlier that the two inputs (K and H) also can be used to generate a new H in the future, so the investment in H implies a cumulative effect on H itself. Accumulation of H can be shown in the following production function:

$$\dot{H}=BK_Y^{\beta_1}H_Y^{\beta_2}G_Y^{1-\beta_1-\beta_2},\ B>0,\ 0<\beta_i<1,\ i=1,2 \tag{3b}$$

where K_Y, H_Y, and G_Y is the allocation of physical capital, human capital, and government spending to produce human capital (through education).

Key points from the production structure is that the output in each sector is determined by the level of constant returns to technology scale of the three inputs used in the production process. This condition is a requirement the existence of long-term equilibrium with a stable growth rate. The fact that resource availability is constrained by the budgets of the two inputs (K and H) makes the process of optimization equations (3a) and (3b) is limited by the following constraint function:

$$K=K_X+K_Y \tag{4a}$$

$$H=H_X+H_Y \tag{4b}$$

Logical consequence of equations (3a) and (3b) is the contribution of government spending (in the case of Indonesia is based on the draft of annual national budget/RAPBN) to productive capacity. This condition can easily be understood because with the allocation of government expenditure will increase the required infrastructure by industry, industrial subsidies, and/or development of better education facilities and infrastructure. By linking between the company and the government through final tax, in the case of Indonesia is the value added tax/VAT, at each final product produced by the rate τ, can be obtained the following relationship:

$$G=G_X+G_Y=\tau X \tag{5a}$$

$$G_X=\theta\tau X \tag{5b}$$

$$G_Y=(1-\theta)\tau X \tag{5c}$$

where $0<\theta<1$ is the proportion of government expenditure allocated to produce the final product.

In equation (5a), (5b), and (5c), there are 2 parameters that characterize the government's fiscal policy, namely (1) the proportional tax rate τ and (2) the composition of government spending θ. By using equation (5a) and the fact that the final product may be consumed (purchased) by the government or raise capital (K), then the goods market equilibrium can be formulated as follows:

$$\dot{K}=(1-\tau)AK_X^{\alpha_1}H_X^{\alpha_2}G_X^{1-\alpha_1-\alpha_2}-C \tag{6}$$

Government as an economic agent, their optimal decisions lie in the selection of consumption level, C, capital allocation, K_X, K_Y, H_X and H_Y, and the rate of capital accumulation, K and H, in order to maximize intertemporal iso-elastic satisfaction function of household/society in equation (2) with the constraint equations (3) to (6) and initial capital K_0 and H_0. This relationship can be understood that the source of government revenue as capital to make expenditure is from taxes, τ. The government spending includes procurement the final product, C, the development of industrial infrastructure and education, and providing subsidies to both.

To achieve optimal conditions in equation (2), a derivative process is carried out with the Lagrangian method and obtained optimal conditions with reference to $C(t)$, $K_X(t)$, $K_Y(t)$, $H_X(t)$, and $H_Y(t)$ following:

$$C^{\gamma-1}=\lambda_1 \tag{7a}$$

$$\begin{aligned} r_K(1-\tau) &\equiv \alpha_1(1-\tau)AK_X^{\alpha_1-1}H_X^{\alpha_2}G_X^{1-\alpha_1-\alpha_2} \\ &=\alpha_1(1-\tau)\frac{X}{K_X}=\frac{\upsilon_1}{\lambda_1}=\frac{\lambda_2}{\lambda_1}\beta_1\frac{Y}{K_Y} \end{aligned} \tag{7b}$$

$$\begin{aligned} r_H(1-\tau) &\equiv \alpha_2(1-\tau)AK_X^{\alpha_1}H_X^{\alpha_2-1}G_X^{1-\alpha_1-\alpha_2} \\ &=\alpha_1(1-\tau)\frac{X}{\mathrm{H_X}}=\frac{\upsilon_2}{\lambda_1}=\frac{\lambda_2}{\lambda_1}\beta_2\frac{Y}{H_Y} \end{aligned} \tag{7c}$$

Where λ_1 and λ_2 are the shadow value of physical capital and human resources, and $\upsilon 1$ and $\upsilon 2$ is the Lagrange multiplier of the constraint equations (4a) and (4b). Equation (7a) is a standard condition that equates the marginal utility of consumption to the shadow value of capital. Equation (7b) and (7c) equate the after-tax marginal return of the two types of capital in both sectors (K and H). Quantity r_K and r_H define the rate of return before tax of physical capital (K) and human capital (H) that measured in terms of final product.

In addition, the intertemporal efficiency condition affect to:

$$r_K(1-\tau)=\rho-\frac{\dot{\lambda}_1}{\lambda_1} \tag{8a}$$

$$\frac{r_H(1-\tau)}{q}=\rho-\frac{\dot{\lambda}_2}{\lambda_2} \tag{8b}$$

Equations above equate the return on the consumption of K and H on the rate of after tax return on K and H. Thus, following transversality conditions, to ensure intertemporal solvency, must satisfy:

$$lim_{t\to\infty}\lambda_1 Ke^{-\rho t}=0 \text{ and } lim_{t\to\infty}\lambda_2 He^{-\rho t}=0 \tag{8c}$$

Condition in macroeconomic equilibrium

If the equation (7a) derived with respect to time and then combine it with equation (8a), implies that consumption grows at rate:

$$\frac{\dot{C}}{C} = \frac{(1-\tau)r_K-\rho}{1-\gamma} = \varphi(t) \tag{9}$$

Where φ(t) varies over time, as the rate of capital return during the transition period.

Macrodynamic equilibrium can be shown by the three derivation equations in (*i*) $q \equiv \lambda_2/\lambda_1$, the relative price of human capital to physical capital, (*ii*) $k \equiv K/H$, the ratio of physical capital to human capital, and (*iii*) $c \equiv C/H$, the ratio of consumption to human capital. Derivatives of macroeconomic equilibrium are done through two stages. First, the determination of static allocation of initial capital in each sector (*K* and *H*). Second, focus on dynamic processes of the macroeconomic equilibrium. As a consequence of the possibility of productive government spending into two sectors (*K* and *H*), making the relative price of human capital to physical capital depends on the relative capital stock. This differs from the traditional model of growth in two sectors that make the relative price of human capital to physical capital does not change independently to dynamic quantities (Bond, Wang, & Yip, 1996; Shioji, 2001).

Static allocation condition

Under static allocation conditions, suppose that $\omega \equiv K_X/H_X$ is the ratio of physical capital to human capital in the final product sector. By dividing equation (7b) with equation (7c), obtained results:

$$\omega \equiv \frac{K_X}{H_X} = \left(\frac{\beta_2}{\beta_1}\right)\left(\frac{\alpha_2}{\alpha_1}\right)\left(\frac{K_Y}{H_Y}\right) \tag{10}$$

Equation (10) above implies that the capital intensity in both sectors move proportionally. Equation (5c) can be rewritten as:

$$G_Y = (1-\theta)\tau X$$

Substituting equation (5b) into (3a), then value of X can be obtained as follows:

$$X = \left[A(\tau\theta)^{1-\alpha}\right]^{\frac{1}{\alpha}}\left[K_X^{\alpha_1} H_X^{\alpha_2}\right]^{\frac{1}{\alpha}} \tag{11}$$

Substituting equation (11) into the equation (5c) and using the definition $\omega \equiv K_X/H_X$, obtained the following results:

$$G_Y = (1-\theta)\,\tau\left[A(\tau\theta)^{1-\alpha}\right]^{\frac{1}{\alpha}}\omega^{\frac{-\alpha_2}{\alpha}}K_X \tag{12}$$

Substituting G_Y from equation (12) above into equation (3b) and dividing them by K_Y, obtained results:

$$\frac{Y}{K_Y} = BK_Y^{\beta_1-1}H_Y^{\beta_2}\left[(1-\theta)\,\tau\right]^{1-\beta}\left\{\left[A(\tau\theta)^{1-\alpha}\right]^{\frac{1}{\alpha}}\right\}^{1-\beta}\omega^{\frac{-\alpha_2(1-\beta)}{\alpha}}K_X^{1-\beta} \tag{13}$$

By using equation (7b), obtained:

$$\frac{Y}{K_Y} = \frac{\alpha_1(1-\tau)}{q\beta_1}\frac{X}{K_X} = \frac{\alpha_1(1-\tau)}{q\beta_1}\left[A(\tau\theta)^{1-\alpha}\right]^{\frac{1}{\alpha}}\omega^{\frac{-\alpha_2}{\alpha}} \tag{14}$$

Combining equation (14) with (13), obtained results:

$$BK_Y^{\beta_1-1}H_Y^{\beta_2}\left[(1-\theta)\,\tau\right]^{1-\beta}\left\{\left[A(\tau\theta)^{1-\alpha}\right]^{\frac{1}{\alpha}}\right\}^{1-\frac{\beta}{\alpha}}\omega^{\frac{-\alpha_2(1-\beta)}{\alpha}}K_X^{1-\beta} = (1-\tau)\frac{\alpha_1}{q\beta_1}\left[A(\tau\theta)^{1-\alpha}\right]^{\frac{1}{\alpha}}\omega^{\frac{-\alpha_2}{\alpha}} \tag{15}$$

By using equation (15), equation (2.10) can be rewritten as follows:

$$\omega^{\frac{(\alpha_1\beta_2-\alpha_2\beta_1)}{\alpha}} = Mq(1-\theta)^{1-\beta}\theta^{\frac{-(1-\alpha)\beta}{\alpha}}\tau^{\frac{(\alpha-\beta)}{\alpha}}(1-\tau)^{-1}\left[\frac{\alpha_2\beta_1\omega-\alpha_1\beta_2 k}{k-\omega}\right]^{1-\beta} \tag{16}$$

where: $k \equiv K/H$, $M \equiv BA^{-\beta/\alpha}(\alpha_1\beta_2)^{\beta 2}(\alpha_2\beta_1)^{\beta 1-1}(\beta_1/\alpha_1)$, $\alpha \equiv \alpha_1 + \alpha_2$, $\beta \equiv \beta_1 + \beta_2$, and $q \equiv \lambda_2/\lambda_1$. In this, q is the relative price of human capital to physical capital. This definition is a consequence of equation (16), that since $\omega > 0$, then the required condition sign $(k\text{-}\omega)$ = sign $(\alpha_2\beta_1\omega - \alpha_1\beta_2 k)$.

Equation (16) can be solved to find value of ω by taking the following form:

$$\omega = \omega(k, q, \tau, \theta) \tag{17}$$

At various points in a certain time, the intensity of sectoral capital depends on (i) the aggregate ratio of physical capital to human capital, k, (ii) a relative price of capital, q, and (iii) simultaneously dependent on government policy parameters τ, θ, and other technological parameters.

By reducing the equation (16), obtained by various responsive equations to ω as follows:

$$\frac{\partial\omega}{\partial k} = \frac{(1-\beta)\alpha\omega^2}{(k-\omega)(\alpha_2\beta_1\omega-\alpha_1\beta_2 k)+(1-\beta)\alpha\omega k} > 0 \tag{18a}$$

$$\frac{\partial\omega}{\partial q} = \frac{1}{q}\left\{\left[\alpha_1\beta_2-\alpha_2\beta_1\right]\left[\frac{1}{\alpha\omega}+\frac{(1-\beta)k}{(k-\omega)(\alpha_2\beta_1\omega-\alpha_1\beta_2 k)}\right]\right\}^{-1} > 0 \tag{18b}$$

$$\frac{\partial\omega}{\partial\tau} = \left[\frac{\alpha-\beta(1-\tau)}{\alpha\tau(1-\tau)(\alpha_1\beta_2-\alpha_2\beta_1)}\right]\left\{\left[\frac{1}{\alpha\omega}+\frac{(1-\beta)k}{(k-\omega)(\alpha_2\beta_1\omega-\alpha_1\beta_2 k)}\right]\right\}^{-1} > 0 \tag{18c}$$

$$\frac{\partial\omega}{\partial\vartheta} = \left[\frac{1}{\alpha_1 \beta_2-\alpha_2 \beta_1}\right]\left[\frac{1-\beta}{1-\vartheta}+\frac{(1-\alpha)\beta}{\alpha\vartheta}\right]\left\{\left[\frac{1}{\alpha\omega}+\frac{(1-\beta)k}{(k-\omega)(\alpha_2\beta_1\omega-\alpha_1\beta_2 k)}\right]\right\}^{-1} > 0 \tag{18d}$$

From equation (18), it can be concluded several implications as follows (see also Monteiro & Turnovsky, 2008): (a) from equation (18a), that increasing the ratio of physical capital to human capital have an impact on increasing the ratio of sectoral capital. This is the implication of equation (10), namely capital intensity in both sectors move proportionally, and increasing k will increase the capital intensity in both sectors; (b) all other responses (equation 18b, 18c and 18d) depend on the relative sectoral intensity, as measured by $(\alpha_1/\alpha_2 - \beta_1/\beta_2)$. Where the sign in equation (18c) also depend on $\alpha - \beta(1\text{-}\tau)$. For example, the increase in the relative price of human capital to physical capital will stimulate the transfer of resources from final product sector to human resource sector. This causes the final product cost on the product sector will increase; (c) if the final product sector is relatively more intensive in physical capital $(\alpha_1\alpha_2 > \beta_1\beta_2)$, physical capital will decline in the relative scarcity (due to the allocation shift to the human capital sector), causing the rate of return on physical capital falls and the rate of return on human capital increases. This will encourage substitution toward physical capital in both sectors; (d) conversely, if the relative sectoral capital intensity is reversed and the same argument applies to the impact of government policy. Equation (16), with the absence of factors of government spending, simplifying the solution to be $\omega = mq^{1/(\alpha 1\beta 2 - \alpha 2\beta 1)}$ with $m = [(\beta_2/\alpha_2)^{\beta 2}(\beta_1/\alpha_1)^{\beta 1}(B/A)]$, producing a simple relationship between the ratio of physical capital to human capital in the final product sector, ω, and the relative price of human capital to physical capital, q, i.e. $\omega = \omega(q)$, and independence of k.

By using equation (5b), return on capital in equation (7b and 6c) can be expressed as a function of ω, and combine it with equation (17) obtained results:

$$r_K \equiv \alpha_1\frac{X}{K_X} = \alpha_1\left[A(\tau\theta)^{1-\alpha}\right]^{\frac{1}{\alpha}}\left[\omega(k,q,\tau,\theta)\right]^{\frac{-\alpha_2}{\alpha}} \tag{19a}$$

$$r_H \equiv \alpha_2\frac{X}{H_X} = \alpha_2\left[A(\tau\theta)^{1-\alpha}\right]^{\frac{1}{\alpha}}\left[\omega(k,q,\tau,\theta)\right]^{\frac{\alpha_1}{\alpha}} \tag{19b}$$

Then by combining equations (10) with the sector allocation condition in equation (4), obtained an equation that shows the level of capital used immediately in the two sectors as follows:

$$H_X = \frac{\alpha_2\beta_1 H-\alpha_1\beta_2 K}{\omega(\alpha_2\beta_1-\alpha_1\beta_2)},\ K_X = \frac{\alpha_2\beta_1 H-\alpha_1\beta_2 K}{(\alpha_2\beta_1-\alpha_1\beta_2)} \tag{20a}$$

$$H_Y = \frac{\alpha_1\beta_2(K-\omega H)}{\omega(\alpha_2\beta_1-\alpha_1\beta_2)},\ K_Y = \frac{\alpha_2\beta_1(K-\omega H)}{(\alpha_2\beta_1-\alpha_1\beta_2)} \tag{20b}$$

The above two equations can be written in the form k, q by substituting the value of ω from equation (17).

In order to achieve non-negative constraint in sector capital allocation, sector and aggregate capital intensity must meet the following conditions:
Condition I:

$$\left(\frac{\alpha_1}{\alpha_2}>\frac{\beta_1}{\beta_2}\right)\frac{\alpha_1}{\alpha_2}\frac{r_H}{r_K}\equiv\frac{K_X}{H_X}\equiv\omega>\frac{K}{H}\equiv k>\frac{\beta_1}{\beta_2}\frac{r_H}{r_K}\equiv\frac{K_Y}{H_Y} \quad (21a)$$

Condition II:

$$\left(\frac{\alpha_1}{\alpha_2}<\frac{\beta_1}{\beta_2}\right)\frac{\alpha_1}{\alpha_2}\frac{r_H}{r_K}\equiv\frac{K_X}{H_X}\equiv\omega<\frac{K}{H}\equiv k<\frac{\beta_1}{\beta_2}\frac{r_H}{r_K}\equiv\frac{K_Y}{H_Y} \quad (21b)$$

The inequality condition in equation (21a and 21b) above defines a solution area where the aggregation ratio of K/H must be lie so that a possible equilibrium (namely feasible solution) is exist.

Dynamic equilibrium condition

By differencing the production function by using the optimal conditions in equations (5b and 5c) and the condition of static allocation as shown in equation (20a and 20b), obtained the relation that represents the final product sector equilibrium in term aggregate of stock, physical and human capitals, and return on capital as follow:

$$X=\frac{\beta_1 Hr_H-\beta_2 Kr_K}{\alpha_2\beta_1-\alpha_1\beta_2} \text{ and } Y=\frac{\alpha_2 Kr_K-\alpha_1 Hr_H}{q(\alpha_2\beta_1-\alpha_1\beta_2)}(1-\tau) \quad (22)$$

Given a linear homogeneous production function, equilibrium growth will be one for all quantities grow at a certain constant level. This makes it easy to write dynamic system in terms of stationary variables $x\equiv X/H$, $y\equiv Y/H$, and $c\equiv C/H$. So that equation (22) above can be rewritten as follows:

$$\frac{X}{H}=\frac{\beta_1 r_H-\beta_2 kr_K}{\alpha_2\beta_1-\alpha_1\beta_2}\equiv x(\omega,k) \text{ and } \frac{Y}{H}=\frac{\alpha_2 kr_K-\alpha_1 r_H}{q(\alpha_2\beta_1-\alpha_1\beta_2)}(1-\tau)\equiv y(\omega,k,q) \quad (23)$$

From before definition of q, k and c, then:

$$\frac{\dot{q}}{q}=\frac{\dot{\lambda}_2}{\lambda_2}-\frac{\dot{\lambda}_1}{\lambda_1};\ \frac{\dot{k}}{k}=\frac{\dot{K}}{K}-\frac{\dot{H}}{H};\ \frac{\dot{c}}{c}=\frac{\dot{C}}{C}-\frac{\dot{H}}{H} \quad (24)$$

Dynamic equilibrium of an economy in terms stationary variables k, q, and c can be written as follows:

$$\dot{k}=(1-\tau)x[\omega(q,k,\tau,\theta),k]-c-ky[\omega(q,k,\tau,\theta),k,q] \quad (25a)$$

$$\dot{c}=c\left[\frac{(1-\tau)r_K[\omega(q,k,\tau,\theta)]-\rho}{1-\gamma}\right]-y[\omega(q,k,\tau,\theta),k,q] \quad (25b)$$

$$\dot{q}=(1-\tau)[qr_K(q,k,\tau,\theta)]-r_H\omega[(q,k,\tau,\theta)] \quad (25c)$$

where $\omega=f(k,q,\tau,\theta)$ as defined in equation (17).

Steady state equilibrium condition

By entering the steady state condition, equation (25) and (16) can be solved to find the steady state value of the relevant variables as shown in the following equations:

$$\tilde{c}=(1-\tau)\tilde{x}(\tilde{\omega},\tilde{k})-\tilde{k}\tilde{y}(\tilde{\omega},\tilde{k},\tilde{q}) \quad (26a)$$

$$\tilde{y}(\tilde{\omega},\tilde{k},\tilde{q})=\frac{(1-\tau)r_K(\tilde{\omega})-\rho}{1-\gamma} \quad (26b)$$

$$\tilde{q}=\frac{r_H(\tilde{\omega})}{r_K(\tilde{\omega})}=\frac{\alpha_2}{\alpha_1}\tilde{\omega} \quad (26c)$$

$$\tilde{\omega}^{\frac{(\alpha_1\beta_2-\alpha_2\beta_1)}{\alpha}}=M\tilde{q}(1-\theta)^{1-\beta}\theta^{\frac{-(1-\alpha)\beta}{\alpha}}\tau^{\frac{(\alpha-\beta)}{\alpha}}(1-\tau)^{-1}\left[\frac{\alpha_2\beta_1\tilde{\omega}-\alpha_1\beta_2\tilde{k}}{\tilde{k}-\tilde{\omega}}\right]^{1-\beta} \quad (26d)$$

Where the steady state value of $\tilde{c},\tilde{k},\tilde{q}$ and $\tilde{\omega}$ determined simultaneously. Once these variables are determined, then the growth rate at steady state conditions can be calculated as:

$$\tilde{\varphi}=\frac{(1\text{-}\tau)r_K(\tilde{\omega})\text{-}\rho}{1\text{-}\gamma} \tag{26e}$$

Transitional dynamic condition

Transitional dynamics of a system can be estimated using the third-order systems are obtained by linearity dynamic system of equations (25) at steady state condition in equation (26) as follows:

$$\begin{bmatrix}\dot{k}\\ \dot{c}\\ \dot{q}\end{bmatrix}=\begin{bmatrix}\alpha_{11} & \text{-}1 & \left[(1\text{-}\tau)\frac{\partial x}{\partial \omega}\text{-}\tilde{k}\frac{\partial y}{\partial \omega}\right]\frac{\partial \omega}{\partial q}\text{-}\frac{\partial y}{\partial q}\\ \alpha_{21} & 0 & \tilde{c}\left[\frac{(1\text{-}\tau)r_K}{1\text{-}\gamma}\text{-}\frac{\partial y}{\partial \omega}\right]\frac{\partial \omega}{\partial q}\text{-}\frac{\partial y}{\partial q}\\ \alpha_{31} & 0 & (1\text{-}\tau)\left(r_K+[\tilde{q}r_K\text{-}r_H]\frac{\partial \omega}{\partial q}\right)\end{bmatrix}\begin{bmatrix}k(t)\text{-}\tilde{k}\\ c(t)\text{-}\tilde{c}\\ q(t)\text{-}\tilde{q}\end{bmatrix} \tag{27}$$

Where:

$$\alpha_{11}=\left[(1\text{-}\tau)\frac{\partial x}{\partial \omega}\text{-}\tilde{k}\frac{\partial y}{\partial \omega}\right]\frac{\partial \omega}{\partial q}+(1\text{-}\tau)\frac{\partial x}{\partial k}\text{-}\tilde{k}\frac{\partial y}{\partial k}\text{-}\tilde{y},$$

$$\alpha_{21}=\tilde{c}\left[\frac{(1\text{-}\tau)r_K}{1\text{-}\gamma}\text{-}\frac{\partial y}{\partial \omega}\right]\frac{\partial \omega}{\partial k}\text{-}\frac{\partial y}{\partial k},$$

$$\alpha_{31}=(1\text{-}\tau)[\tilde{q}r_K\text{-}r_H]\frac{\partial \omega}{\partial k}.$$

In this condition, k becomes sluggish variable whose value is difficult to change (inert), while c and q can be freely varied in value instantly. In order for this system has a unique solution (namely saddle path stable), requires a negative eigenvalues (stable) and two positive eigenvalues (unstable). The complexity of the matrix in equation (27) above, require numerical methods to solve them. Then, departing from an initial value of capital ratio, k_0, stable dynamic adjustment path is shown as follows:

$$k(t)=\tilde{k}+(k_0\text{-}\tilde{k})e^{\mu t} \tag{28a}$$

$$c(t)=\tilde{c}+\frac{\alpha_{23}\alpha_{31}+\alpha_{21}(\mu\text{-}\alpha_{33})}{(\mu\text{-}\alpha_{33})}\left[k(t)\text{-}\tilde{k}\right] \tag{28b}$$

$$q(t)=q+\frac{\alpha_{31}}{(\mu\text{-}\alpha_{33})}\left[k(t)\text{-}\tilde{k}\right] \tag{28c}$$

where the value of c(0) and q(0) determined from equation (28b and 28c).

In the absence of state government expenditure, α_{31} = 0, and relative prices, q, independently increase the stock capital. By incorporating components of government expenditure, α_{31} < 0, as k increases, then human capital will increase in relative scarcity, and the relative price of human capital, q, will also increase, in which this requires the condition $\mu < \alpha_{33}$.

Transitional dynamics of the growth rate of both types of capital, $\varphi_K(t)\equiv\frac{\dot{K}(t)}{K(t)}$ and $\varphi_H(t)\equiv\frac{\dot{H}(t)}{H(t)}$, shown as follows:

$$\varphi_K(t)=\frac{1}{k}\left[(1\text{-}\tau)x[\omega(k,q,\tau,\theta),k]\text{-}c\right] \tag{29a}$$

$$\varphi_H(t)=y[\omega(k,q,\tau,\theta),k,q] \tag{29b}$$

Linearized above equations in steady state growth rate conditions, $\tilde{\varphi}$, and using equation (28b and 28c), obtained results:

$$\varphi K(t)\equiv\frac{\dot{K}}{K}=\frac{1}{k}\left[(1\text{-}\tau)\left[\frac{\partial x}{\partial k}+\frac{\partial x}{\partial \omega}\left(\frac{\partial \omega}{\partial k}+\frac{\partial \omega}{\partial q}\frac{\alpha_{31}}{(\mu\text{-}\alpha_{33})}\right)\right]\text{-}\frac{\alpha_{23}\alpha_{31}+\alpha_{21}(\mu\text{-}\alpha_{33})}{(\mu\text{-}\alpha_{33})\mu}\text{-}\frac{1}{k}\left[(1\text{-}\tau)x[\omega(k,q,\tau,\theta),k]\text{-}c\right]\right]x\left[k(t)\text{-}\tilde{k}\right]+\tilde{\varphi} \tag{30a}$$

$$\varphi H(t)\equiv\frac{\dot{H}}{H}=\left[\frac{\partial y}{\partial k}+\frac{\partial x}{\partial \omega}\frac{\partial \omega}{\partial k}+\left(\frac{\partial y}{\partial q}+\frac{\partial y}{\partial \omega}\frac{\partial \omega}{\partial q}\right)\frac{\alpha_{31}}{(\mu\text{-}\alpha_{33})}\right]x\left[k(t)\text{-}\tilde{k}\right]+\tilde{\varphi} \tag{30b}$$

Equation (30a and 30b) above show the complexity of the relationship between the evolution of relative capital intensity, $k(t)$, and its effect on growth rate. While the indirect effect is operating through relative price adjustments, $q(t)$, in equation (28c), and for physical capital, the effect is operating through consumption as shown in equation (28b).

Critical determinant in the sign of relative stock capital to this factor is the sector capital intensity ($\alpha_1/\alpha_2-\beta_1/\beta_2$). If it is positive (negative), $\varphi_K(\varphi_H)$ tends to be positively (negatively) related to $[k(t)-\tilde{k}]$. If ($\alpha_1/\alpha_2-\beta_1/\beta_2$)>0, it will increase the sector capital intensity, and then tends to reduce the return on physical capital and increasing human capital. The net effect is the increase in x and decrease in y, causing increased growth rate of physical capital and decreasing in human capital (Monteiro & Turnovsky, 2008).

The previous researches in endogenous growth model

Capolupo (2000) used model that developed by Lucas (1988) and Barro (1990). He examined the long-term effects of government spending and taxes in the endogenous setting. In the model used, government spending through education influences human capital accumulation. The model showed the effect of tax rates on growth moving into two different directions. Signs ($1-\tau$) in the model represented a negative effect on the output tax, while the sign B_t showed positive effects on public education of human capital accumulation. Increasing t can reduce the K/H ratio and will increase the marginal productivity of physical capital. Government spending will contribute to human capital accumulation is a trigger growth. Increased growth will increase tax revenue, it is evident from the growth estimate could rise by between 65% -70% in the researche sample.

Canning & Pedroni (2004) used model developed by Barro (1990), ie $Y_t = A_t K_t^{\alpha} G_t^{\beta} L_t^{1-\alpha-\beta}$, where Y is total output, A is total productivity, G is infrastructure capital, K is other capital, and L is labor at time t. It is assumed that the savings rate constant, and all capital depreciates each period, then $G_{t+1} = \tau_t Y_t$ and capital investment in non-infrastructure is determined by $K_{t+1} = (1-\tau_t)sY_t$. With substituting capital accumulation from both previous equations into the production function, obtained that $(Y/L)_{t+1} = A_{t+1}s^{\alpha}(1-\tau_t)^{\alpha}\tau_t^{\beta}(Y/L)_t^{\alpha+\beta}(L/L_{t+1})^{\alpha+\beta}$. From the model it can be concluded that there is a maximum infrastructure growth model. After that maximum point, required the transfer of resources. Below this level the additional infrastructure will increase long-term income. While above that level, the increase in infrastructure will reduce long-term revenue.

Sequeira & Martins (2008) used model developed by Mauro & Carmeci (2003), in which endogenous growth is a function of physical capital and human resources as well unemployment. Levels of total human capital is defined as $H =$ h.p and Cobb-Douglas function used is $Y = K^{\alpha}L^{exp(1-\alpha)}$. From equation Mauro & Carmeci (2003), in conditions of perfect competition, obtained by equality between wages and net marginal productivity of tax, $w = (1-t)(1-\alpha)K^{\alpha}H^{1-\alpha}L^{-\alpha}$. Consumption growth rate in steady-state is: $\dot{C}/C = g_c^* = (1/\theta)[(1-\tau)\alpha^{\alpha}(1-\alpha)^{1-\alpha}(1-s)^{\alpha-1}b^{1-\alpha}(1-u)^{2(1-\alpha)} - \rho - \delta]$. Subsidy effect in steady state growth is defined as: $g_c^* = \{A(1-s)^{1-\alpha}(1-u)^{2(1-\alpha)} - [(1-\alpha s)/(1-s)]\delta - \rho\}/\{\theta + (1-\alpha)[s/(1-s)]\}$. This study shows the effects of subsidies to education. Using an endogenous growth model with variable physical capital, human capital and unemployment. From this model, we concluded that the government subsidy on education will increase economic growth, and inversely with unemployment.

Egert, Kozluk, & Sutherland (2009) used model developed by Mankiw, Romer & Weil (1992). This model explains that human capital is an addition of capital, technology and population, namely Y(t) = $K(t)^{\alpha}H(t)^{\beta}[A(t)L(t)]^{1-\alpha-\beta}$, where Y is GDP, K is total physical capital, H is human capital, A is level of technology, and L is labor. Capital accumulation function is defined as $h(t) = s^H y(t) - (n+g+\delta)h(t)$ and $k(t) = s^K y(t) - (n+g+\delta)k(t)$. The production function and capital accumulation can be derived as: $\ln(Y_t/L_t) = ln(A_0) + gt + [\alpha/(1-\alpha)]ln(s_t^K) + [\beta/(1-\alpha)]ln(h_t) - [\alpha/(1-\alpha)]ln(n_t+g+\delta)$. Assuming that human production factors as capital infrastructure, the above model can be rewritten as: $ln(Y_t/L_t) = ln(A_0) + gt + [\alpha/(1-\alpha)]ln(s_t^K) + [\beta/(1-\alpha)]ln(inf_t) - [\alpha/(1-\alpha)]ln(n_t+g+\delta)$.

Research Method

The data was taken from the database of Central Bureau of Statistics and the Ministry of Finance where expenditure data are taken from the Regional Government Budget of districts in Central Java. National Government Budget data are not used the generality in nature and can reduce any information related to changes in fiscal policy, and usually Regional Government Budget of district can better reflect the dynamic changes in the pattern of budget allocation to various functions. Regency/municipality will be selected based on data availability. In order to represent population, cluster-sampling technique will be used for each district to be included in the sample. From the results of preliminary analysis and the any considerations, concluded that all districts and municipalities in province of Central Java, which became the sample. The data used in this study include data revenue and government expenditure composition, regional output, population and labor force composition, wage structure, and other data related to socio economic, demographic and geographic. There are 28 districts and 6 municipalities include in sample.

Observation period is 1997 to 2002, because after 2002 there is a change in Regional Government Budget format from sector-based format to be functional based format. Based on data specification in this study, we use only data with the format in 1997 – 2002. The use of period 2003 – 2008 is not possible for several reasons. First, there is a difference between the budget format before 2003 and thereafter. There is the difference that caused by the philosophy underlying the preparation of the budget and reporting are different. Second, after 2002, the districts in Central Java are no longer obligated to create reports based on past format and immediately following the new budget format. This led any difficulties, and even not possible, to make adjustments. Third, before 2003 is more appropriate format with the model specification build in this research.

Model specification

By deriving equation (26e), we obtain:

$$(1-\gamma)\frac{\partial\tilde{\varphi}}{\left[\frac{\partial\tau}{\tau}\right]}=\frac{\partial r_K(1-\tau)}{\left[\frac{\partial\tau}{\tau}\right]}=\frac{-k}{\alpha\Delta(k-\omega)(1-\tau)}\left[(1-\alpha_1)(1-\beta_2)-\beta_1\alpha_2-\tau(1-\beta_2)\right] \tag{31a}$$

$$(1-\gamma)\frac{\partial\tilde{\varphi}}{\left[\frac{\partial\theta}{\theta}\right]}=\frac{\partial r_K(1-\tau)}{\left[\frac{\partial\theta}{\theta}\right]}=\frac{k}{\alpha\Delta(k-\omega)(1-\theta)}\left[-(1-\alpha_1)(1-\beta_2)+\theta(1-\alpha_1)\beta_1\alpha_2\right] \tag{31b}$$

The influence of government policy on long-term growth reflects the behavior of after tax capital returns. So that the portion of government spending, $\hat{\tau}$, and composition of government spending, $\hat{\theta}$, $\hat{\theta}$, that will maximize long-term growth can be calculated as follows:

$$\hat{\tau}=1-\alpha_1-\frac{\beta_1\alpha_2}{1-\beta_2}=\frac{\alpha_3(\beta_1+\beta_3)+\alpha_2\beta_3}{\beta_1+\beta_3}<1 \tag{32a}$$

$$\hat{\theta}=\frac{(1-\alpha_1)(1-\beta_2)}{(1-\alpha_1)(1-\beta_2)-\beta_1\alpha_2}=\frac{\alpha_3(\beta_1+\beta_3)}{\alpha_3(\beta_1+\beta_3)+\alpha_2\beta_3}<1 \tag{32b}$$

Where $\beta_3 = 1 - \beta_1 - \beta_2$. Based on the equation (32a) and (32b), followed Monteiro & Turnovsky (2008), we proposed the following prepositions:

Preposition 1:
Increasing in the total output fraction that allocated to government spending will increase long-term equilibrium growth rate if and only if $\tau < [\alpha_3(\beta_1 + \beta_3) + \alpha_2\beta_3]/(\beta_1 + \beta_3)$ and the composition of government spending is independence.

Preposition 2:
Shifting in government expenditure allocation from physical investment to education will increase the long-term equilibrium growth rate if and only if $\theta < \{[\alpha_3(\beta_1 + \beta_3)]/[\alpha_3(\beta_1 + \beta_3) + \alpha_2\beta_3]\} < 1$ and the level of total government expenditure is independence.

To test the assumption (i) the independence between tax revenue and government expenditure composition, and (ii) independence of the government expenditure allocation (in physical investment and education) and the level of total government spending, and simultaneously identify the possible presence of implicit patterns that exist, we can use OLS regression analysis with equation: $y = f(x,z)$, where y is the allocation ratio of education expenditure to infrastructure, x is the natural logarithm of income tax for the year, and z is the natural logarithm of total budget expenditure for the year.

In addition, by evaluating the fiscal policy (namely setting tax rates and the expenditure allocation fraction), we can compare actual tax rate with the optimal tax rate that calculated as: $\tilde{\tau}=\frac{\alpha_3+\alpha_2\beta_3}{\beta_1+\beta_3}$ and the optimal composition of output and physical capital are: $\tilde{\theta}=\frac{\alpha_3(\beta_1+\beta_3)}{\alpha_3(\beta_1+\beta_3)+\alpha_2\beta_3}$. To evaluate fiscal policy in the determination of taxes, τ, and the composition of government spending, θ, on the society welfare, in which the inter-temporal welfare is achieved by calculating:

$$W=\int_0^{\infty}\left[\frac{1}{\gamma}C(t)^{\gamma}e^{-\rho t}\right]dt=\int_0^{\infty}\left[\frac{1}{\gamma}\left(c(t)H(t)\right)^{\gamma}e^{-\rho t}\right]dt \tag{33a}$$

$$H(t)=H_0 e^{\int_0^t [\rho H(s)]ds} \quad (33b)$$

Both are counted when the economy is past the point of transitional equilibrium. It is assumed that the economy is initially at an equilibrium growth path, and then grows at a constant level, φ. So along this path: $C_b = c_b H(t) = c_b H_0 e^{\varphi H t}$ and then welfare as shown in equation (33a and 33b) is evaluated as: $W = \left(\frac{1}{\gamma}\right) c^{\gamma} H_0^{\gamma} (\rho - \gamma\varphi)$. So generally, changes in welfare resulted from changes in both structural and policy changes that include: (i) welfare changes along the transitional path towards a new equilibrium, and (ii) welfare changes in the new equilibrium.

Results and Discussion

One sector equilibrium model

In early analysis, researchers will use the model framework developed by Capolupo (2000) to assess the effect of tax rates and optimal allocation of government expenditure on (society) consumption growth rate in one sector equilibrium model, i.e. the final product sector. With some assumptions, Capolupo (2000) used the Cobb Douglas model to see the linkage between expenditure in human and capital sectors to economy's output (namely *GDP)*. Cobb Douglas model can be seen in equation: $Y(t) = K(t)^{\alpha} H(t)^{1-\alpha}$. Where α is the fraction of capital expenditure, H is human capital (assumed not to follow the population growth), Y is *GDP* at current prices, and K is physical capital.

In order that parameter α in Cobb Douglas model can be estimated, researchers conducted linearization by taking logarithm in both sides of the equation. Resulting a linear regression equation as: $ln(Y_{ti}) = \alpha\ ln(K_{ti}) + (1\text{-}\alpha)\ ln(H_{ti}) + u_{ti}$. With panel model, that parameter estimated and will be used to view simulation effects in tax rate changes to consumption growth rates.

Accordance with Capulapo (2000), effect of tax rates changes on consumption growth rates can be obtained by deriving the Hamiltonian model with a variable condition, K, and one control variable, C, as follow: $H = log(C) e^{-\rho t} + \lambda\left[(1\text{-}\tau) K^{\alpha} H^{1-\alpha} \text{-} C\right]$. Where λ(t) is the covariate variable indicating shadow price of $K(t)$. The first derivative of the above model Hamiltonian is $\gamma_C \equiv \frac{\dot{C}}{C} = \left[\alpha(1\text{-}\tau)\left(\frac{K}{H}\right)^{1-\alpha} \text{-}\rho\right]$. Where γ_C is the consumption growth rate, τ is the effective tax rate, and ρ is the market interest rate.

Parameter α obtained as before and the K/H ratio is obtained from the real K/H ratio in every district during period 1997-2002. The tax rate, τ, and interest rate, ρ, are exogenous because is set directly by central and local governments. By doing a simulation on γ_C, researchers gain insight about the effect of setting the tax rate and interest rate to the consumption growth. Parameter estimation results in above equation can be seen in Table 1.

Table 1. Effect of physical and human capital allocation in restriction model

Variable	Coefficient
$Ln(K_{ti})$	0.29^{***}
	(0.05)
$Ln(H_{ti})$	0.71^{***}
	(0.05)
Constant	2.82^{***}
	(0.03)

In Table 1 above can be seen that parameter for human capital (in ln) is higher than physical capital (in ln), ie 0.29 and 0.71 and statistically significant. This means that expenditure allocation for human resources (i.e., education and technology) has affects output level greater than for physical capital (i.e., transport and housing). Parameter estimation in Table 1 can be changed, because Capulapo (2000) using a model restriction that sum of two parameters, $ln(K_{ti})$ and $ln(H_{ti})$, must be one. Effect of changes in taxes and interest rates on consumption growth rate with K/H ratio can be viewed by some simple simulations based on equation γ_C. For example, researchers wanted to see the effect of changes in tax rates by 5% and interest rates by 25 basis points (bps) to consumption growth with a given K/H ratio. The result can be seen in Table 2 below.

Table 2. Simulation results with changes in tax rate and interest rate

Tax rate	Interest rate	K/H ratio	Consumption growth	Δ Growth
10.00%	6.50%	4.12	3.18%	n.a
15.00%	6.75%	0.34	47.03%	43.84%
20.00%	7.00%	1.64	9.52%	-37.50%
25.00%	7.25%	1.47	9.49%	-0.03%
30.00%	7.50%	1.31	9.42%	-0.06%
35.00%	7.75%	3.61	-0.08%	-9.50%

According to Table 2, consumption growth rate will be decline if tax rates and interest rates have increased. The effect will be greater if government give greater budget allocations to human resource sector (i.e. education and technology). With a parameter of 0.71, the multiplier effect of investment will be much more pronounced for more allocation to human resources sector. For example, if K/H ratio is 0.34 (i.e., expenditures for human resources is greater than for capital), consumption growth can reach a fairly high level, amounting to 47.02% in taxes and interest rates increased from the previous year. If the taxes and interest rates continue to increase (i.e. 5.00% for tax and 25 bps for market interest rate) and K/H ratio > 1, regional consumption growth rate will be negative.

From Table 2, it can be concluded that increasing tax rates and interest rates will adversely affect economic growth. In theory, the government would make contraction fiscal policy by increasing tax rates to slow economic growth and vice versa. In regard to monetary policy, the central bank will conduct contraction monetary policy by raising interest rates to slow the economic growth rate. But stimulating the economic growth rate by changing tax rates and interest rates are not enough. Government needs to consider determining which sectors should be prioritized in the expenditure allocation each year. Policy in determining expenditure allocation priorities will determine how big the multiplier effect resulted from government spending for economic growth. Government spending on infrastructure will improve economic growth because of the distribution of goods and services will get better, increase production capacity, jobs increasing rapidly, and so forth. On the other hand, government spending to increase human resource capacity through education will also be able to increase economic growth. Government expenditure for capacity building of human resources will improve the quality of manpower so that the number of educated labor will increase, the company will be able to produce more because they are supported by qualified human resources, and educated labor will get much better salary than non-educated labor so the society purchasing power will increase.

Thus, government spending for these two sectors will be able to increase economic growth, and need to determine which the sector that more effective in stimulating regional economic growth. In the case of Central Java, local budget allocations for human resource sector (i.e. education and technology) proved to have a greater multiplier effect than for physical capital. If local governments want to increase the economic growth rate in the future, the government should increase budget allocations to improve the quality of human resources through education and technology. Shift in regional spending allocations can be done gradually by reducing the allocation for infrastructure and slowly improve human resource allocation.

Unrestricted endogenous growth model

Table 2 shows that with model restriction, value of parameter estimation for human resources is greater than for infrastructure. Different results would be obtained if the restriction on the previous equation is removed as shown in Table 3 below.

Table 3. Estimation results of unrestricted model

Variable	Coefficient
$Ln(K_{ti})$	0.15^{***}
	(0.04)
$Ln(H_{ti})$	0.10^{*}
	(0.06)
Constant	5.45^{***}
	(0.21)

Based on Table 3, parameter value is larger for physical capital (i.e. 0.15) than for human resources (i.e. 0.10). This means that the multiplier effect of physical capital is greater than human resources. Parameter values for both variables are included in equation γ_C to obtain the simulation results the effect of changes in tax rates and interest rates on consumption growth rate. The result can be seen in Table 4.

Table 4. Simulation results with changes in tax and interest rates with unrestricted budget allocation

Tax rate	Interest rate	K/H ratio	Consumption growth	Δ Growth
10.00%	6.50%	4.12	5.16%	
15.00%	6.75%	0.34	7.48%	2.32%
20.00%	7.00%	1.64	4.39%	-3.09%
25.00%	7.25%	1.47	3.55%	-0.84%
30.00%	7.50%	1.31	2.70%	-0.85%
35.00%	7.75%	3.61	0.79%	-1.91%

Results obtained from Table 4 do not differ much with Table 2 (where the parameters obtained from regression with a restriction). The consumption growth rate will be smaller if the government increases the tax rate and the central bank increases interest rates. What is interesting to note is that although the parameter value for capital is greater than to human resources, the effect on the consumption growth will be greater if K/H < 1. For example in Table 4, the highest consumption growth rate, namely 7.98%, is achieved when K/H ratio at 0.34 while the lowest consumption growth rate occurs when K/H ratio is 4.12. Thus, the human resources sector is a sector that has a greater positive effect on consumption growth compared to the physical capital sector (i.e. infrastructure).

Conclusion

Government spending and tax rate may have positive impact on growth rate, but in other direction also have a negative impact. The higher tax rate would distort resource allocation, K/H ratio will increase, and growth rate will fall (Capolupo, 2000). Barro (1990) and Sala-i Martin (1992) described a non-monotonic relationship between growth rates and taxes, where they link it with other inefficiency factor (Capolupo, 2000). However, in this model, the researchers only study monotonous effects of these factors.

References

Barro, R. (1990). Government spending in a simple model of endogenous growth. *Journal of Political Economy*, *98*(55), 103-125. http://doi.org/10.1086/261726.

Bond, E.W., Wang, P., & Yip, C.K. (1996). A general two sector model of endogenous growth with human and physical capital. *Journal of Economic Theory*, *68*(1), 149-173. http://doi.org/10.1006/jeth.1996.0008.

Buffa, E.S., & Sarin, R.K. (1987). *Modern production/operation management*. Singapura: John Wiley & Sons, Inc.

Canning, D., & Pedroni, P. (2004.) *The effect of infrastructure on long run economic growth*. Working Paper. Harvard University, USA. Retrieved from https://ideas.repec.org/p/wil/wileco/2004-04.html.

Capolupo, R. (2000). *Output taxation, human capital and gowth*. Working Paper. Manchester School, UK. http://doi.org/10.1111/1467-9957.00188.

Egert, B., Kozluk, T., & Sutherland, D. (2009). *Infrastructure and growth: Empirical evidence*. William Davidson Institute Working Paper Number 957. Retrieved from: http://econpapers.repec.org/paper/wdipapers/2009-957.htm.

Lucas, R. (1988). On the mechanics of economic development. *Journal of Monetary Economics*, *22*(1), 3-42. http://doi.org/10.1016/0304-3932(88)90168-7.

Mankiw, N.G. (2006). *Priciples of economics*. Cincinnati, USA: South-Western College Pub.

Mankiw, G.N., Romer, D., & Weil, D.N. (1992). A contribution to the empirics of economic growth. *The Quarterly Journal of Economics*, *107*(2), 407-437. http://doi.org/10.2307/2118477.

Mishkin, F.S. (2004). *The economics of money, banking, and financial markets*, USA: Pearson Addison Wesley.

Mauro, L., & Carmeci, G. (2003). Long run growth and investment in education: Does unemployment matter. *Journal of Macroeconomics*, *25*(1), 123–137. http://doi.org/10.1016/S0164-0704(03)00010-7.

Monteiro, G., & Turnovsky, S.J. (2008). The composition of productive government expenditure: consequences for economic growth and welfare. *Indian Growth and Development Review*, *1*(1), 57-83. http://doi.org/10.1108/17538250810868134.

Ratnawaty, A. (2003). Review: Indonesian macroeconomics policies. *Agrimedia*, *8*(2), 58-61.

Sequeira, T.N., & Martins, E.V. (2008). Education public financing and economic growth: An endogenous growth model versus evidence. *Empirical Economics*, *35*(2), 361-377. http://doi.org/10.1007/s00181-007-0162-1.

Shioji, E. (2001). Public capital and economic growth: A convergence approach. *Journal of Economic Growth*, *6*(3), 205-227. http://doi.org/10.1023/A:1011395732433.