Tax Structure and Economic Growth

– A Survey of Empirical Analyses –

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Abstract

The aim of this paper is to survey previous studies that empirically analyzed the relationship between tax structures and economic growth. We systematically organize analytical methods and results of previous studies in preparation for an examination of this relationship in Japan.

Key words: Tax structure, Economic growth.

JEL Classification Codes: E62; H20; O40.

1. Introduction

This paper will survey prior studies that have empirically analyzed the relationship between tax structures and economic growth as an introductory work for empirically examining the ideal tax structure for Japan's economic growth. Is there a relationship between the tax structure and economic growth? If there is a relationship, what kind of tax structure is desirable for economic growth? The above questions form the underlying issues of this paper.

The survey of prior research relating to tax structures and economic growth can be classified into two groups, those that take a general view of theoretical research and those that focus on organized empirical research.

Myles(2009a) and Johansson, et al.(2008), and OECD (2010) are examples of the former. Myles (2009a) surveys theoretical research relating to the effect of tax policy on economic growth. Myles (2009a) points out that 'in an endogenous growth model that incorporates human capital, the relative dependence on income taxes is lowered and the resulting increase of dependence on consumption taxes is connected to the promotion of economic growth.[1] Johansson et al. (2008) and OECD (2010) consider growth-orientated tax reform. From the viewpoint of the tax structure, corporate income taxes, personal income taxes, consumption taxes, and recurrent taxes on immovable property are the greatest impediments to economic growth, in that order. It is clear that policies that include a reduction in the rate of taxation and a broadening of the taxation base (BBLR: Broad Base-Low Rate Approach) as well as policies that rectify externalities (e.g. assistance from the taxation system for investment in research and development) promote growth.

Myles (2009b), Prammer (2011), and McBride (2012) are examples of the latter. Myles (2009b) focuses on research relating to a regression analysis of the relationship between the level of tax burden and the tax structure on the one hand and economic growth on the other. Kneller et al.(1999), Bleaney et al.(2001), and Widmalm (2001) are introduced for the relationship between the tax structure and economic growth. Surveying empirical research (simulations based on a macroeconomic model and regression analysis), Prammer (2011) explains theoretically how tax, interfering with the decision-making of economic agents, affects economic growth. In relation to simulations based on a macroeconomic model, the estimates of the European Commission (European Commission (2008; 2010)) are introduced and the regression

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[1] Myles (2009a), p. 43 and p. 44.

analysis of the tax structure and economic growth by Arnold (2008), Johansen et al. (2008), Arnold et al. (2011) and Xing (2011) are taken up. McBride (2012) surveys research that has empirically analyzed the effect of tax policy on economic growth. Of the 26 research papers dating from 1983, five relating to the tax structure and economic growth are taken up (Gemmell et al. (2011), Arnold et al. (2011), Bleaney et al. (2001), Kneller et al. (1999), Mendoza et al. (1997)).

This paper will explain the research trend of empirical research relating to the tax structure and economic growth in a more detailed manner than that of the above prior research. The form of this paper is as follows. First, the distinctive features of the prior research will be made clear from the viewpoint of an analytical method. Furthermore, the prior research will be classified based on government budget constraints, and the results of the analysis will be studied.

2. Analytical method

2.1. Data and object of estimation

For the most part, the analysis used cross-country panel data. Furthermore, the main objects of the analysis are countries of the OECD. However, in part, analysis including developing countries can also be evidenced (Miller and Russek (1993; 1997), Lee and Gordon (2005), Jorge et al. (2009), Santiago and Yoo (2012)).

2.2. Explained variables

The following are adopted as explained variables of growth regressions: GDP per capita growth rate (Kneller et al.(1998; 1999), Bleaney et al.(2001), Mercedes and Mehrez(2004), Angelopoulos et al. (2006)), real GDP per capita growth rate (Mendoza et al. (1995; 1997), Miller and Russek (1993; 1997), Widmalm (2001), Lee and Gordon (2005), European Commission (2006), Jorge et al. (2009)), real GDP per capita growth rate as a trend (Shinohara(2012)) , changes in real GDP per head of the working-age population (Arnold(2008), Arnold et al.(2011), Xing (2011; 2012)), changes in the GDP growth rate (Gemmell et al.(2007; 2011)) and changes in the GDP per capita growth rate (Santiago and Yoo (2012)).

2.3. Explanatory variables

2.3.1. Classification of the tax structure

Explanatory variables can be categorized into financial variables and variables other than financial variables. Financial variables are separated into annual revenue (tax revenue and revenue other than tax revenue), annual expenditure, and financial surplus. The tax burden and tax structure are included in tax revenue.

The method of classification of the tax structure in prior research divided the tax system into five broad categories: (1) income taxes, consumption taxes, and property taxes; (2) direct taxes and indirect taxes; (3) labor income taxes, capital income taxes, and consumption taxes; (4) distortionary taxation and non-distortionary taxation; (5) other forms of taxation. The numbers of classification correspond to those of the OECD Revenue Statistics (as below).

(a) Income taxes, consumption taxes, and property taxes

The classification method is based on the classification of the OECD Revenue Statistics. Widmalm (2001), Arnold (2008), Arnold et al. (2011), Xing (2011; 2012), Santiago and Yoo (2012) adopt this kind of classification.

The following is included within each classification: income taxes (Taxes on income, profits, and capital gains: classification numbers 1000, 2000, 3000) include personal income taxes, corporate income taxes, social security contributions, and payroll taxes (taxes on payroll and workforce); consumption taxes (Taxes on goods and services: classification number 5000) include specific consumption taxes and general consumption taxes (value added taxes and sales taxes); property taxes (Taxes on property: classification number 4000) include wealth transfer taxes (estate, inheritance and gift taxes, taxes on financial and capital transactions) and wealth holding taxes (recurrent taxes on immovable property and recurrent taxes on net wealth).

(b) Direct taxes and indirect taxes

Direct taxes include income taxes, property taxes, social security contributions, and payroll taxes. Indirect taxes include consumption taxes. Mercedes and Mehrez (2004), European Commission (2006), and Jorge et al. (2009) base their research on this kind of classification.

(c) Labor income taxes, capital income taxes, and consumption taxes

Mendoza et al. (1995; 1997) and Angelopous et al. (2006) use this method of classification. Mendoza et al. (1994) and Martinez-Mongay (2000) provide a detailed

explanation relating to the effective tax rate based on this classification.

Labor income tax is made up of taxes on income profits and capital gains of individuals (classification number 1100), social security contributions (classification number 2000), and payroll taxes (classification number 3000).

Capital income taxes include taxes on income profits, capital gains of corporations (classification number 1200), recurrent taxes on immovable property (classification number 4100), and taxes on financial and capital transactions (classification number 4400).

Consumption taxes consist of general taxes on goods and services (classification number 5110) and excises (classification number 5121).

(d) Distortionary taxation and non-distortionary taxation

Kneller et al. (1998; 1999), Bleaney et al. (2001), and Gemmell et al. (2007; 2011) adopt this method of classification.

Distortionary taxation is defined as taxation that affects economic growth by hindering the decision making of economic agents to save or invest. Income taxes, social security contributions, payroll taxes, and property taxes fall within this category.

Non-distortionary taxation is defined as taxation that does not hinder the decision making of economic agents to save or invest and does not affect economic growth.

(e) Other forms of taxation

Lee and Gordon (2005) do not follow the above classifications and instead use individual taxes, corporate taxes, value added taxes, and customs as explanatory variables for taxation. Miller and Russek (1993; 1997) use tax revenue and revenue other than tax revenue as explanatory variables. Tax revenue is classified as personal income taxes, corporate income taxes, social security contributions, domestic consumption taxes, customs, and other forms of taxation. Similarly, Shinohara (2012) conducts an analysis from the viewpoint of Revenue Mix, including the issuance of bonds and tax explanatory variables, which include personal income taxes, corporate income taxes, social security contributions, and consumption taxes.

2.3.2. Explanatory variables other than financial variables

Explanatory variables other than financial variables include, among other things, the prior period GDP per head of population (or of the working-age population), prior period GDP per capita growth rate, initial GDP per capita, physical capital, human

capital, population (or labor force population) growth rate, and trade openness (exports to GDP ratio, the total of exports and imports to GDP ratio). The other variables include investment in research and development (R & D), inflation rate, inflation volatility, terms of trade, labor market instability, purchasing power parity, aging rate, economic freedom, sovereign credit risk, and corruption and quality of the bureaucrat.

It is presumed that of the above, physical capital, human capital, trade openness, investment in research and development, conditions of trade, economic freedom, and corruption and quality of the bureaucrat have a positive correlation with the rate of economic growth.

Contrarily, it is presumed that the prior period GDP per head of population (or of the working-age population), prior period GDP per capita growth rate, initial GDP per capita, population (or labor force population) growth rate, inflation rate, inflation volatility, labor market instability, purchasing power parity, aging rate and sovereign credit risk have a negative correlation with the rate of economic growth.

2.4. Method of estimation

For the most part, the estimation model is that of the pooling regression or the fixed effects estimation. A dynamic panel model is also carried out in some research (Bleaney et al. (2001) and Gemmell et al. (2007; 2011)). The PMG (Pooled Mean Group) estimation is adopted in an analysis distinguishing short-term effects and long-term effects (Gemmell et al. (2007; 2011), Arnold (2008), Arnold et al. (2011), Xing (2011; 2012), and Santiago and Yoo (2012)).

In both analyses, a check in relation to the selection of explanatory variables and endogeneity is carried out. In particular, Widmalm (2001) checks the robustness of the explanatory variables through a sensitivity analysis.[2]

2.5. Government budget constraints

It is possible to classify the prior research by whether or not government budget constraints were considered for the empirical research. It is also possible to classify the prior research based on the premise of government budget constraints to those that consider tax revenue neutrality, annual revenue neutrality, annual revenue, and annual expenditure simultaneously.

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[2] See Levine and Renalt (1992).

(1) No government budget constraints

Mendoza et al. (1995; 1997), Lee and Gordon (2005), Angelopoulos et al. (2006), European Commission (2006), and Jorge et al. (2009) do not consider government budget constraints.

(2) Tax revenue neutrality

Widmalm (2001), Arnold (2008), Arnold et al. (2011), Xing (2011; 2012) and Santiago and Yoo (2012) are analyses from the viewpoint of tax revenue neutrality. By adopting the hypothesis of tax revenue neutrality, the influence of the tax structure on the economic growth becomes evident.

The hypothesis of tax revenue neutrality is shown in Equation (1), where T is the total tax revenue and T_i is an individual tax of the tax revenue. When the share of each individual tax, making up the total tax revenue, is added up, the result is 1.

$$\sum_{i=1}^{n} (T_i/T) = 1 \tag{1}$$

(3) Annual revenue neutrality

Shinohara(2012) conducts an analysis focusing on the potential national burden, including public loan revenue within annual revenue. In Equation (2), G is the potential national burden and R_i is the share of public loan revenue and each individual tax making up the potential national burden.

$$\sum_{i=1}^{n} (R_i/G) \tag{2}$$

(4) Consideration of annual expenditure

Analyses considering expenditure include Miller and Russek (1993; 1997), Kneller et al. (1998; 1999), Bleaney et al. (2001), Mercedes and Mehrez (2004) and Gemmell et al. (2007; 2011). These analyses are based on the judgment that as annual revenue and annual expenditure are in a mutual relationship affecting economic growth, they should be considered simultaneously.

Government budget constraints considering annual expenditure are expressed in Equation (3). Miller and Russek (1993; 1997) maintain that so long as the relationship in Equation (3) is formed, removal of one of the three variables (annual revenue, annual expenditure, or fiscal surplus) is of no significance.

Annual Expenditure + Fiscal Surplus = Annual Revenue (3)

Furthermore, based on an endogenous growth model, Kneller, Bleaney et al. (1998;
1999) and Bleaney et al.(2001) develop a regression formula similar to that in
Equation (4). However, $g_{i,t}$ signifies GDP growth rate per capita, $Y_{i,t}$ signifies
variables other than fiscal variables and $X_{j,t}$ signifies financial variables (revenue,
expenditure, and fiscal surplus). Taking Equation (3) into account, Equation (5) is
formed from a consideration of multicollinearity. Ultimately, Equation (4) becomes
Equation (6). In the estimation, annual revenue is categorized into distortionary
taxation, non-distortionary taxation, and other; annual expenditure is categorized into
productive expenditure, non-productive expenditure, and other, based on whether or
not they are included as arguments in the private production function. The fiscal
variables excluded in Equation (6) are non-distortionary taxation and non-productive
expenditure, thought to be neutral to economic growth.

$$g_{i,t} = \alpha + \sum_{i=1}^{k} \beta_i Y_{i,t} + \sum_{j=1}^{m} \gamma_j X_{j,t} + u_{i,t}$$ (4)

$$\sum_{j=1}^{m} X_{j,t} = 0$$ (5)

$$g_{i,t} = \alpha + \sum_{i=1}^{k} \beta_i Y_{i,t} + \sum_{j=1}^{m-1} (\gamma_j - \gamma_m) X_{j,t} + u_{i,t}$$ (6)
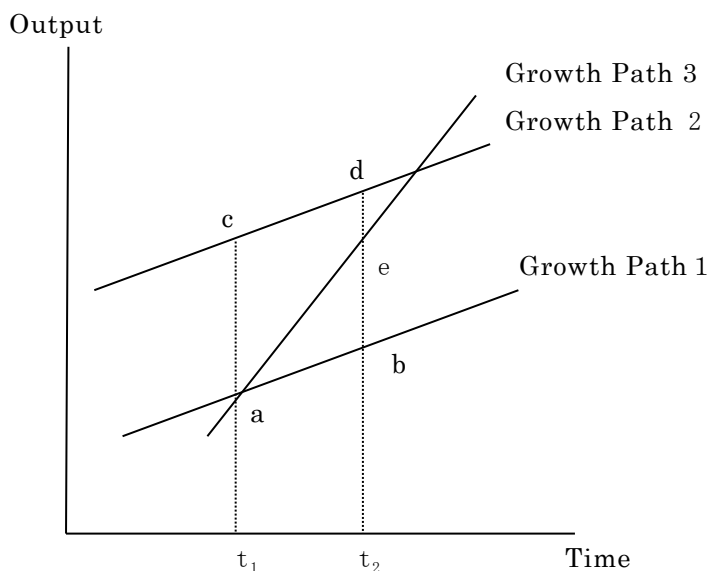
2.6. Short- and long-term effects

Fiscal policy has short- and long-term effects on economic growth. These effects are
demonstrated in Figure 1, in accordance with Myles (2009a).

Growth Path 1 demonstrates the growth pathway prior to the implementation of
fiscal policy. With time, output increases from 'a' to 'b'. In Growth Path 2 and Growth
Path 3, the growth pathway following the implementation of fiscal policy is
demonstrated. In Growth Path 2, there is an increase in output from 'a' to 'c' as a result
of the implementation of fiscal policy. However, the economic growth rate is no
different from before the implementation of fiscal policy. In comparison, in Growth
Path 3, the output increases from 'a' to 'e' as a result of the implementation of fiscal
policy and the long-term rise in the economic growth rate.

Growth Path 2 demonstrates the level effect of fiscal policy, whereas Growth Path 3
demonstrates the growth effect. The level effect refers to the effect of temporarily
increasing the growth rate while the economy transitions to a new steady state. The

growth rate refers to the effect of increasing the rate of growth over the long-term.

Figure.1. The short-term and long-term effects of fiscal policy

Output

Growth Path 3
Growth Path 2

d
c
e
Growth Path 1
b
a

t_1 t_2 Time

Source: Myles(2009a), p.26.

Much of the prior research does not clearly distinguish between the short- and long-term effects. The long-term growth pattern is estimated by excluding the effect of short-term economic fluctuations, based on data of a five-year mean.

In relation to this, Gemmell et al. (2007), Arnold (2008), Arnold et al. (2011), Xing (2011; 2012), and Santiago and Yoo (2012) use annual data to clearly distinguish and estimate short- and long-term effects. In recent years, the synchronicity of the economic cycle in the OECD countries has fallen apart. For this reason, Arnold (2008) doubts the method of excluding the effect of economic fluctuations from the five-year mean.[3]

In this circumstance, a PMG estimation based on the panel data error correction model is carried out. As demonstrated by Equation (7), in the error correction model the increment of output (y_t) is corrected only by a fixed proportion (λ) of the portion of separation with the steady state (y^*). Equation (8) is an example of the regression model. The brackets in first line of Equation (8) represent the long-term effect, and the second line represents the short-term effect.

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[3] Arnold (2008), p. 9.

$$\frac{dlny_t}{dt} = -\lambda(lny_t - lny^*) \tag{7}$$

$$lny_{i,t} = -\phi_i(lny_{i,t-1} - a_1 lns_{i,t}^k - a_2 lnh_{i,t} - a_3 n_{i,t} - \sum_{J=4}^{m} a_j lnV_{i,t}^j) \tag{8}$$
$$+b_{1j}\Delta lns_{i,t}^k + b_{2i}\Delta lnh_{i,t} + b_{3i}\Delta n_{i,t} + \sum_{J=4}^{m} b_{j,i}\Delta lnV_{i,t}^j$$
$$+\gamma_i t + \eta_i + \epsilon_{i,t}$$

$y_{i,t}$: output per head of the working-age population, ϕ_i : convergence parameter, $y_{i,t-1}$: prior period output per head of the working-age population, $s_{i,t}^k$: investment rate in physical capital, $h_{i,t}$: human capital stock, $n_{i,t}$: growth rate of the working-age population, $V_{i,t}^j$: tax structure, t: time effects (indicating technical progress), η_i: country-specific intercept

3. Results of analysis

3.1. Scenario without government budget constraints

(1) Mendoza et al. (1995; 1997) and Angelopoulos et al. (2006)

Based on data of the five-year mean, Mendoza et al. (1995; 1997) demonstrated that a statistically significant relationship between taxes (labor income taxes, capital income taxes, and consumption taxes) and private investment. Labor income taxes and capital income taxes harm private investment, whereas consumption taxes promote it. However, no significant relationship between taxes and economic growth was presented. There is a statistically significant scenario when analyzing the annual data. A positive correlation can be observed between consumption taxes and economic growth, and a negative correlation can be observed between labor income taxes and capital income taxes, on the one hand, and economic growth on the other.

In relation to this, Angelopoulos et al. (2006) make it clear that: (a) a negative correlation exists between labor income taxes and economic growth, and (b) while not robust, a significant positive relationship exists between the corporate income tax rate and economic growth; whereas, (c) a significant relationship between capital income taxes and consumption taxes on the one hand, and economic growth on the other, cannot be evidenced.

(2) Lee and Gordon (2005)

Lee and Gordon (2005) demonstrated that: (a) the corporate income tax rate has a negative correlation with the economic growth rate and (b) no discernable significant

relationship exists between income tax rate and the value added tax rate on the one hand, and the economic growth rate on the other.

(3) European Commission (2006) and Jorge et al. (2009)

The European Commission (2006) and Jorge et al. (2009) examined the relationship of the ratio between direct and indirect taxes and economic growth.

Using the OECD countries for its analysis, the European Commission (2006) demonstrated a positive correlation between the ratio of indirect taxes and direct taxes (indirect tax revenue/direct tax revenue) and economic growth. Furthermore, Jorge et al. (2009) categorized 116 countries into the three categories of developed countries, developing countries, and all countries (developed and developing countries). Jorge et al. (2009) presented a negative correlation (in the cases of developed countries, developed, and developing countries) in the direct to indirect tax ratio and economic growth.

3.2. Scenario with government budget constraints (including annual expenditure)

(1) Miller and Russek (1993; 1997)

Miller and Russek (1993; 1997) conducted an estimation of 39 countries, dividing the countries into three groups, developed countries, developing countries, and all countries (developed and developing countries). The estimation period was from 1975 to 1984. The results are shown below.

(a) In the case of all countries, a positive correlation exists between the corporate income tax revenue to GDP ratio and economic growth. Furthermore, there was no statistically significant relationship between the domestic consumption tax revenue to GDP ratio and economic growth.

(b) In relation to developed countries, a negative correlation exists between personal income tax revenue to GDP ratio and social security contributions to GDP ratio on the one hand, and economic growth on the other.

(c) In relation to developing countries, a positive correlation between corporate income tax revenue to GDP ratio and personal income tax revenue to GDP ratio on the one hand, and economic growth on the other, could be evidenced.

(2) Kneller et al. (1998; 1999), Bleaney et al.(2001), Gemmell et al.(2007; 2011)

Kneller et al. (1998; 1999), Bleaney et al. (2001), Gemmell et al. (2007; 2011) demonstrated that distortionary taxation has a negative correlation with the economic growth rate.

(3) Mercedes and Mehrez (2004)

Mercedes and Mehrez (2004) examined what kind of effect government size, the tax structure, and the structure of government expenditure have on economic growth, private investment, and employment. As a result, Mercedes and Mehrez (2004) demonstrated that: (1) government size negatively correlates with economic growth and private investment; (2) economic growth, private investment, and employment have a positive relationship with the level of dependence on indirect taxes in the tax system; (3) the effect of corporate income taxes and social insurance contributions on economic growth is the same as that of individual income taxes.

3.3. Scenario with government budget constraints (tax revenue neutral)

(1) Widmalm (2001)

Widmalm (2001) made it clear that: (a) economic growth is constrained when the share of personal income taxes making up tax revenue increases; (b) economic growth is promoted when the share of consumption taxes making up tax revenue increases; (c) economic growth is constrained when there is a rise in the progressivity of taxation.

(2) Arnold (2008) and Arnold et al. (2011)

Arnold (2008) explains: (1) the order of taxes that have a harmful effect on the economy, starting from those with the greatest effect, are: corporate income taxes, personal income taxes, consumption taxes, and recurrent taxes on immovable property; (2) on the premise of tax revenue neutrality, economic growth is promoted when income taxes are reduced and consumption taxes and recurrent taxes on immovable property are raised. Furthermore, a theoretical explanation relating such a result is conducted (Arnold et al. (2011)).

Personal income taxes hinder economic growth more than consumption taxes. Some reasons for this are that the tax rate is progressive, double taxation of savings takes place, delivering a blow to small-middle sized companies procuring funds, and the willingness of low-income earners to work is harmed because of the high marginal tax rate of income taxes and social security contributions.

Corporate income taxes hinder capital investment and improvements in productivity,

the motivating force of economic growth. Furthermore, corporate income taxes constrain overseas investment. Additionally, for the most part, tax break measures for specific activities are not an injection of resources for companies contributing to economic growth.

Consumption taxes raise the commodity price and lowers a worker's real income. Consequently, labor supply is constrained and growth hindered. Nevertheless, savings and investments are not constrained. This is also neutral for international trade. Accordingly, the inhibitory effect on growth is small.

Wealth transfer taxes discourage real-estate transactions and hinder a reallocation to a more productive use, and distort the incentive to save. Consequently, growth is constrained.

Recurrent taxes on immovable property promotes growth by transferring investment from housing to an object of higher profitability. However, in many countries, taxes on housing have reduced and a tax increase is problematic. Accordingly, the reality is that the dependence on consumption tax will increase.

(3) Xing (2011; 2012)

Xing (2011; 2012) conducted an empirical analysis based on the error correction model, similar to the above studies of Arnold (2008) and Arnold et al. (2011). However, as the robustness check was carried out more carefully, the following conclusions Xing reached differed from that of Arnold (2008) and Arnold et al. (2011):

(a) Reducing income taxes and consumption taxes, and increasing property taxes promote economic growth.

(b) When classifying property taxes as recurrent taxes on immovable property and other, the latter hinders economic growth the least.

(c) The result that, for economic growth, personal income taxes are better than corporate income taxes and consumption taxes are better than income taxes was not obtained.

(4) Santiago and Yoo (2012)

Santiago and Yoo (2012) expanded the period and countries, which were the object of the estimation, to a greater extent than Arnold (2008), Arnold et al. (2011), and Xing (2011; 2012). The analysis categorized 69 countries into high-income countries, middle-income countries, and low-income countries. The period of the estimation is from 1970 to 2009. The results of the analysis are as follows:

(a) Based on tax revenue neutrality, economic growth is hindered when consumption

taxes and property taxes are decreased and income taxes are raised.

(b) Social security contributions and personal income taxes hinder growth more than corporate income taxes.

(c) Economic growth is promoted when income taxes are reduced and property taxes are raised.

(d) Economic growth is promoted when income taxes are reduced and consumption taxes are raised. However, the effect of promoting growth is smaller than property taxes.

(e) The above results apply to high-income countries and middle-income countries, but not to low-income countries, because of the low level of tax administration in low-income countries.

3.4. Scenario with government budget constraints (annual revenue neutral)

Shinohara(2012) separated and analyzed 30 countries of the OECD and 21 countries of the OECD, similar to Arnold (2008). In the former group, it was found that fund procurement by annual revenue items, other than personal income taxes (corporate income taxes, social security contributions, and issuance of bonds), has a positive effect on economic growth. The latter group showed that, while corporate income taxes and social security contributions have a negative effect on economic growth, personal income taxes, consumption taxes, and the issuance of bonds have a positive effect on economic growth.

3.5. Short- and long-term effects

Bleaney et al. (2001) demonstrated that: (1) it is difficult to separate short- and long-term effects based on five-year data, and that estimation by a model using annual data with lags would be appropriate; (2) the desirable number of lags is eight.

In relation to short- and long-term effects, the process of converging to a steady state differs by country (in Equation (8), the convergence coefficient (ϕ_i), short-term coefficient (b), and the error term (ε) differ by country). It is assumed that, in the long term, there is no difference in the tax structure and economic growth relationship between countries (between countries the long-term coefficient (a) is homogeneous). After carrying out the Hausman test, Gemmell et al. (2007; 2011), Arnold (2008), and Santiago and Yoo (2012) maintained that the null hypothesis (the long-term coefficient (a) is homogeneous) had not been rejected. In response to this, Xing (2011; 2012)

maintained that in relation to testing the homogeneity of each explanatory variable, the Wald test is more effective than the Hausman test. According to the Wald test, the null hypothesis that all long-term coefficients are homogenous between countries is rejected.

Furthermore, Gemmell et al. (2007; 2011) elucidated that, while in the short-term, the process of dynamic adjustment differs by country, the adjustment process to a long-term equilibrium is short (a number of years, not decades).

4. Conclusion

This paper surveyed prior empirical research, the research methods used, and analytical results obtained for research on the effect of the tax structure on economic growth.

Table 1 presents the outline of analytical methods used. A number of characteristics can be highlighted.
(1) For the most part, analysis was conducted using countries of the OECD based on cross-country panel data.
(2) The growth regression model was broadly classified into two groups based on whether or not government budget constraints were imposed. Furthermore, analysis on the premise of government budget constraints can be separated into the three groups: (a) tax revenue neutral, (b) annual revenue neutral, and (c) considerations of both annual revenue and annual expenditure.
(3) The analysis moved on to separating the short- and long-term effects that fiscal policy had on economic growth. Accompanying this, the method of estimation changed from the pooling regression or the fixed effects estimation to PMG estimation.

The results indicate that while there are differences in terms of the object of the estimation, the period of estimation, the existence of government budget constraints, the following can be pointed out:
(1) The majority of the estimated results of the research suggest that the tax structure has an effect on economic growth. However, in an estimation based on five-year data, Mendoza et al. (1995; 1997) found that a significant relationship between the two could not be evidenced.
(2) It is not necessarily always the case that there will be a negative correlation between income taxes (personal income taxes, corporate income taxes, and social security contributions, and payroll taxes) and economic growth. Some research finds a positive correlation (the case of developing countries in Miller and Russek (1993; 1997)

and in the studies of Angelopoulos et al. (2006) and Shinohara (2012)).

(3) The direct to indirect tax ratio is negatively correlated with economic growth.

(4) There is a negative correlation between labor income taxes and economic growth (Angelopoulos et al. (2006)). In relation to capital income taxes and consumption taxes, some research does not present a significant relationship with economic growth (Angelopoulos et al. (2006)). However, specific cases also indicate a negative and positive correlation (Mendoza et al. (1995; 1997)).

(5) Distortionary taxation negatively correlates with economic growth.

(6) Based on tax revenue neutrality, economic growth is promoted when income taxes are reduced and consumption taxes and recurrent taxes on immovable property are raised (Arnold (2008)). However, Xing (2011; 2012) is opposed to this.

(7) It is difficult to establish an order of individual taxes in relation to their effect on hindering growth. Arnold (2008) finds that the order of taxes that have a harmful effect on the economy, starting with those that have the greatest effect are: corporate income taxes, personal income taxes, consumption taxes, and recurrent taxes on immovable property. However, this differs from the conclusion of Mercedes and Mehrez (2004), Xing (2011; 2012), and Santiago and Yoo (2012).

(8) In relation to the long-term effect of tax policy, Gemmell et al. (2007; 2011), Arnold (2008), Arnold et al.(2011), and Santiago and Yoo (2012) maintain that the null hypothesis that the long-term coefficient is homogeneous between countries is not rejected by the Hausman test. However, Xing (2011; 2012) finds that this null hypothesis is not applicable.

Finally, based on the survey of prior research above, this paper concludes with the point that a topic for further research is an empirical examination into the relationship of the tax structure and economic growth in Japan.

Table 1. Outline of the Empirical Analyses Relating to the Effect of the Tax Structure on Economic Growth

	Government budget constraints (tax revenue neural)				Government budget constraints (annual revenue neutral)
	Widmalm (2001)	Arnold(2008) Arnold et al. (2011)	Xing (2011; 2012)	Santiago and Yoo(2012)	Shinohara (2012)
Type of data	Panel	Panel	Panel	Panel	Panel
Object of estimation	23 countries of the OECD	21 countries of the OECD	17 countries of the OECD	69 countries (high-income, middle-income and low income)	30 countries of the OECD 21 countries of the OECD
Period of estimation	1965-1990 (5-year average)	1971-2004	1970-2004	1970-2009	1970-2008
Econometric method	Pooling regression (2SLS)	PMG estimation	PMG estimation	PMG estimation	Fixed-effects model
Explained variable	Real GDP per capita growth rate	Changes in real GDP per head of the working-age population		Changes in real GDP per capita growth rate	Real GDP per capita growth rate as a trend
Explanatory variable Annual expenditure	−	−	−	−	−
Explanatory variable Annual revenue	・Tax burden ・Progressivity of taxation ・Personal income taxes ・Corporate income taxes ・Wage taxes (social security contributions and payroll taxes) ・Consumption taxes ・Property taxes	・Tax burden ・Income taxes (Personal income taxes, corporate income taxes, social security contributions, payroll taxes) ・Consumption taxes ・Property taxes (recurrent taxes on immovable property and others)	・Tax burden ・Income taxes (Personal income taxes, corporate income taxes, social security contributions, payroll taxes) ・Consumption taxes ・Property taxes (recurrent taxes on immovable property and others)	・Tax burden ・Income taxes (Personal income taxes, corporate income taxes) ・Social security contributions ・Consumption taxes (general consumption taxes, customs and others) ・Property taxes	・Potential national burden ・Income taxes (Personal income taxes, corporate income taxes) ・Social security contributions ・Consumption taxes ・Public loan revenue
Explanatory variable Variables other than financial variables	・Prior period real GDP per head of population ・Physical capital ・Population growth rate ・Exports ・Labor market instability market (days of employment)	・Prior period real GDP per head of the working-age population ・Physical capital ・Human capital ・Population growth rate ・Inflation rate ・Inflation volatility ・R&D	・Prior period real GDP per head of the working-age population ・Physical capital ・Human capital ・Population growth rate	・Prior period GDP growth rate per head of population ・Physical capital ・Human capital ・Population growth rate	・Prior period real GDP per head of population ・Human capital ・Purchasing power parity ・Aging rate ・Trade openness

	Miller and Russek (1993; 1997)	Kneller et al. (1998; 1999)	Bleaney et al. (2001)	Mercedes and Mehrez (2004)	Gemmell et al. (2007; 2011)
		· Trade openness			
Separation of short-term and long-term effects	−	○	○	○	−
	Government Budget Constraints (Consideration of Annual Expenditure)				
	Miller and Russek (1993; 1997)	Kneller et al. (1998; 1999)	Bleaney et al. (2001)	Mercedes and Mehrez (2004)	Gemmell et al. (2007; 2011)
Type of data	Panel	Panel	Panel	Panel	Panel
Object of estimation	39 countries (developed and developing countries)	22 countries of the OECD	22 countries of the OECD	18 countries of the OECD	17 countries of the OECD
Period of estimation	1975-1984	1970-1995 (5-year mean)	1970-1995 (annual and 5-year mean)	1970-2001 (5-year mean)	1970-2004
Econometric method	Fixed-effects model	Fixed-effects model	· Fixed-effects model · Dynamic panel model	Fixed-effects model	· PMG estimation · Dynamic panel model
Explained variable	Real GDP per capita growth rate	GDP per capita growth rate			Changes in the GDP growth rate
Explanatory variable Annual expenditure	· Scale of annual expenditure (central government) · National defense · Education · Health · Social security and welfare · Economic services · Transport · Other	· Productive expenditure · Non-productive expenditure · Other forms of expenditure	· Productive expenditure · Non-productive expenditure · Other forms of expenditure	· Government consumption expenditure · Social security benefits · Subsidies	· Productive expenditure · Non-productive expenditure · Other forms of expenditure
Explanatory variable Annual revenue	· Scale of annual revenue (central government) · Personal income taxes · Corporate income taxes · Social security contributions · Domestic consumption taxes · Customs · Other forms of tax revenue · Revenue other than tax revenue	· Distortionary taxation · Non-distortionary taxation · Other forms of tax revenue · Revenue other than tax revenue	· Distortionary taxation · Non-distortionary taxation · Other forms of tax revenue · Revenue other than tax revenue	· Scale of annual revenue · Direct taxes (income taxes, property taxes, social security contributions and pay roll taxes) · Indirect taxes	· Distortionary taxation · Non-distortionary taxation · Other forms of tax revenue · Revenue other than tax revenue
Explanatory variable	○	○	○	○	○

Financial surplus					
Explanatory variable Variables other than financial variables	·Prior period real GDP per head of population ·Physical capital ·Population growth rate ·Inflation rate ·Trade openness	·GDP per capita of the initial period（1970, 1975, 1980, 1985,1990） ·Physical capital ·Growth rate of the labor force population	·Physical capital ·Growth rate of the labor force population	·GDP per capita of the initial period（1970, 1975, 1980, 1985,1990） ·Physical capital ·Growth rate of the labor force population ·Trade openness	·Physical capital ·Employment growth rate（growth rate of the labor force population）
Separation of short-term and long-term effects	－	－	－	－	○

	No Government Budget Constraints		
	Mendoza et al. (1995; 1997)	Angelopoulos et al. (2006)	Lee and Gordon (2005)
Type of data	Panel	Panel	Panel
Object of estimation	18 countries of the OECD	23 countries of the OECD	70 countries
Period of estimation	1966-1990 (5-year mean and annual)	1970-2000 (5-year mean)	1970-1997(annual) 1980-1997 (5-year mean)
Econometric method	Pooling regression (OLS, robust regression, instrumental variables method)	－	·Pooling regression (OLS, instrumental variables method, robust regression, median regression) ·Fixed-effects model
Explained variable	Real GDP per capita growth rate	GDP per capita growth rate	Real GDP per capita growth rate
Explanatory variable Annual expenditure	·Government consumption expenditure	·Productive expenditure	·Scale of annual expenditure
Explanatory variable Annual revenue	·Labor income taxes ·Capital income taxes ·Consumption taxes	·Labor income taxes ·Capital income taxes ·Consumption taxes	·Tax burden ·Income taxes ·Corporate taxes ·Value added taxes ·Customs
Explanatory variable Variables other than financial variables	·Initial period GDP (1965) ·Physical capital ·Human capital ·Conditions of trade	·GDP per capita of the initial period （1970, 1975, 1980, 1985, 1990, 1995） ·Labor force ·Human capital ·Investment ·Trade openness ·Birth rate ·Inflation rate	·Real GDP per capita of the initial period (1970, 1980, 1985, 1990, 1995) ·Human capital ·Population growth rate ·Trade openness ·Inflation rate ·Corruption and quality of bureaucrat
Separation of short-term and long-term effects	－	－	－

	No Government Budget Constraints	
	European Commission(2006)	Jorge et al. (2009)
Type of data	Panel	Panel
Object of estimation	OECD member countries	116 countries（developed countries, developing

estimation		countries and transitioning economies)
Period of estimation	1975-2000 (5-year mean)	1972-2005 (5-year mean)
Econometric method	Fixed-effects model	・Pooling regression (OLS, robust regression) ・Fixed-effects model
Explained variables	Real GDP per capita growth rate	
Explanatory variable 　Annual 　expenditure	・Size of government (government consumption expenditure)	－
Explanatory variable 　Annual 　revenue	・Direct taxes ・Indirect taxes	・Direct taxes ・Indirect taxes ・Corporate income tax rate
Explanatory variable 　Variables 　other than 　financial 　variables	・Initial period Real GDP per head of the working-age population（1975, 1980, 1985, 1990, 1995) ・Physical capital ・Investment in research and development ・Trade openness ・Extent of economic freedom	・GDP per capita of the initial period (1972, 1975, 1980, 1985, 1990, 1995, 2000) ・Human capital ・Population growth rate ・Inflation rate ・Trade openness ・Sovereign credit risk
Separation of short-term and long-term effects	－	－

Source: Prepared by the author.

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