



## **The Driving Forces of Economic Growth before and after the 2008 Global Financial Crisis**

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### **ABSTRACT**

This paper investigates the determinants of economic growth in two different periods, 2002-2008 and 2008-2013. As national output can be determined by the functions of production and consumption, the explanatory variables consist of growth rates of investment, labor, household consumption, government spending and exports. Analyzing the data of 129 countries, this paper has four main findings: (i) Investment and exports have positive impacts on economic growth; (ii) labor has significant positive impact if we investigate the period from 2002 to 2013 as a whole. The effect is only positive in the first period with low statistical significance while remains unclear in the second period; (iii) household consumption has ambiguous impact on economic growth. There exists some evidences (with 90% confidence level) that household consumption might produce a minor adverse effect on economic growth; (iv) the relationship between economic growth and government spending is positive in the first period and negative in the second.

**Keywords:** Determinants of Economic Growth, Global Financial Crisis, Public Expenditure

**JEL Classifications:** A12, G01, F43, A12

### **1. INTRODUCTION**

Economic growth is a topic attracting much of attention from both policy makers and macroeconomists. Some economic theories explain why economic growth rates are different across countries. For example, classical macroeconomic theory argues that the long-run output is determined by capital, labor and technology, expressed by a production function. Meanwhile, Keynes believes that short-run output is influenced by aggregate demand including household consumption, investment, public expenditure and net exports. This means that the determinants of economic growth in the short-run are different from that in the long-run.

There is a vast body of literature investigating the impact of these factors on economic growth. For example, Solow (1957) and Mofrad (2012) study the important role of capital in production. Pye (2012), Schultz (1961), Grossman (1972), and DeVol and Bedroussian (2007) focus on labor, including both quantity and quality. Pakko (2002), among others, examines the contribution of total factor productivity (TFP). Duesenberry and Income (1949), Veblen (2007) and Karim et al. (2010) evaluate the impact of

household consumption. Khan and Reinhart (1990) and Poirson (1998) investigate the contribution of private investment to national output, while Barro (1990) and Devarajan et al. (1996) focus on public expenditure. In addition, there are many articles discussing the important role of exports. However, all of the literature mentioned above do not discuss the determinants of economic growth in the period of global financial crisis, particularly the periods before and after year 2008 (as we will see below, this task is the first contribution of this paper).

Besides, this paper also focuses on the relationship between public expenditure and economic growth. Many economists are interested in the direction of this relationship, positive or negative, while the others consider the causal relationship between these variables. The story of "Chicken and egg," whether public expenditure impact on economic growth, or conversely, economic growth drives public expenditure, are sometime raised. However, the findings from the existing literature are inconsistent and controversial.

There are some articles attempt to figure out and to explain the consistency and the differences of the previous findings by

making a literature survey. Nijkamp and Poot (2004), for example, synthesize 93 articles discussing the impact of fiscal policies (including public expenditure, tax rate, education spending, defense and infrastructure expenditure) on economic growth. In which, 41 articles provide empirical findings on the impact of total public expenditure: 29% of the total agree that expanding government expenditure slows down economic growth, 17% believe the opposite direction, and more than half of the literature cannot conclude the relationship between these variables. This controversial could be caused by the difference in the research scopes. Some researches focus on the high income countries while the rest do not do so. The findings of the studies focusing on a specific group of countries seem to be consistent. This is because of the similarity of the countries, such as development level, political issues, institution, and geography. While the impact of public expenditure on economic growth is controversial, the impacts of the other factors (tax rate, education spending, defense and infrastructure expenditure) are quite consistent. Although the study of Nijkamp and Poot (2004) is meticulous, it is still criticized about the non-random sampling which might leads to bias results.

Similarly, Bergh and Henrekson (2011) also review many articles examining the negative relationship between public expenditure and economic growth in the high income countries. The authors study public expenditure as a whole rather than some specific ones. The notable point in this study is the explanation of the causal relationship between public expenditure and economic growth. More specifically, tax and fees are important funds for public expenditure however they are also the burdens for economic agents. Therefore, some researches find the positive impact of public expenditure, while the others find the negative. There is also an opposite relationship that economic growth drives public expenditure. For example, an increasing unemployment in the recession periods leads to a high fraction of government budget spending for social issues. As there are many controversial explanations for the causal relationship, rarely researchers come up with a unique conclusion.

Recently, Churchill et al. (2015) review 87 empirical studies on the impact of public expenditure on economic growth. Using hierarchical meta-regression analysis, the authors show that the results found in previous studies depend on explanatory variables, analysis methods, and country development levels. Specifically, the negative effects are often found in the studies focusing on high income countries, using a proportion of gross domestic product (GDP) as public expenditure, and GDP per capita as a dependent variable. Meanwhile, the estimation results are not statistically significant for developing countries. When all countries are pooled, the correlation is insignificant in the case of total government expenditures but negative and significant in the case of government consumption. Here, the authors argue that government consumption cannot improve productivity.

It can be said that the last three studies mentioned above provide a comprehensive description of the relationship between public expenditure and economic growth. The existing articles differ in term of country sampling, time of data, variables, and methodologies. Similarly, this paper attempts to study the relationship between

public expenditure and economic growth in two sub-periods by using panel data analysis method. With the data of 129 countries during 2002-2013, this paper analyzes a fixed effect model in which investment, labor, household consumption, public expenditure and exports are explanatory variables. It shows that the sign of the relationship between public expenditure and economic growth changes over two periods (the explanation can be found in Bergh and Henrekson, 2011), while the other correlations are quite consistent. Particularly, an increase in public expenditure speeds up economic growth during 2002-2008, but slows down economic growth during 2008-2013. Investment, labor and exports have positive impact on economic growth while household consumption shows a doubt of its positive effects. In period 2002-2008, higher consumption leads to a lower economic growth (this result is significant at a level of confident 90%). The limitation of this paper is that some factors shown in Ram (1986) are omitted in the regression model, such as government size measured by a ratio of public expenditure to GDP, and thus it does not investigate the optimal level of public expenditure. This is because the variables selected in this paper are based on production and consumption function.

The remaining of this paper is structured as the following. Section 2 presents literature review on determinants of economic growth. Section 3 describes methodology and data. Section 4 discusses results and Section 5 concludes.

## 2. LITERATURE REVIEW ON DETERMINANTS OF ECONOMIC GROWTH

A common challenge in empirical studies is the selection of appropriate variables. This is a very laborious work and effort, and sometime it cannot give us desired results. The difficulties seem to be double as the dependent variable is economic growth, because it is resulted by too many variables. Sala-i-Martin et al. (2004) use a special method, called Bayesian averaging of classical estimates (BACE), to find out the most appropriate variables explaining economic growth. There are 18 variables are selected from 67 variables, for example, primary enrollment ratio, the ratio of investment to GDP, life expectancy. Notably, the public expenditure is also among 18 variables. Similarly, Bergh and Karlsson (2010) use BACE method to show that the rate of savings, annual inflation, fertility, labor force, and exports are the most important factors. Hence, depending on variable selections, the findings might differ across papers.

In this paper, the variables are selected from two basic economic functions, production and consumption. The production function shows that output is determined by capital, labor and technology. The consumption function shows that output is determined by aggregate demand consisting of household consumption, investment, public expenditure and net exports. There are various studies discussing the impact of these variables on economic growth.

### 2.1. Production Function Approach

#### 2.1.1. Capital

Solow (1957) is one of the most influential researches on the role of capital in economic growth. Using time series data of the

United States, the author showed that from 1909 to 1949, output per worker has doubled and 87.2% of that achievement came from changing technology and the rest from increasing capital. However, Solow also suggested that in the long run, it would be inefficient to depend solely on capital to stimulate growth. Specifically, since growth will reach the steady state in the long run, increasing capital is only capable of being the driving force in the short run. Mofrad (2012) used Iran's data in the period 1991-2008 to illustrate Solow's idea. The two main conclusions are: (i) Capital can contribute to the short-term increase in GDP; however (ii) in the long run, the effect might possibly change to negative.

### 2.1.2. Labor

Labor contributes to economic growth in terms of both the scale and quality. While the scale of labor can be observed easily, the quality of labor has to be assessed through many different criteria such as training level (literacy rate, high school graduation rate, trained worker rate, tertiary education rate), health (weight, height, life expectancy, diseases rate) and attitude (disciplined, diligence, creativity...). Among them, the first two criteria have been investigated and analyzed regularly by economic researchers.

First of all, regarding the size of labor force, Pye (2012) suggested that large population might contribute to growth through large market size as well as abundant input for production. Using Australian data from 1980 to 2011, the author successfully identified a positive relationship between labor size and GDP growth. However, he also gave a warning signal on some unexpected negative consequences of labor-dependent growth. Specifically, if labor productivity remains unchanged, relying too heavily on labor force expansion to replace capital might cause wage costs to increase.

Regarding the quality of labor, Schultz (1961) argued that education is not only the output but also the input of the growth process. To illustrate the idea, he has investigated the data and found that investing in human capital development would bring significant benefits to the society. Recently, Kiani and Jumani (2010) also studied the effect of education on economic growth in Pakistan and showed that real GDP would increase by 2.67% and 2.8% for every 1% increase in the primary and secondary school enrolment rate, respectively. These results have provided clear evidences of the sensitivity to change of economic growth due to potential change in education indexes.

Besides education, the effect of labor force's overall health condition on economic growth has also attracted the attention of many researchers. Grossman (1972) considered health not only as a significant factor towards personal welfare but also as an input for production. Moreover, employee's health condition might have an indirect impact on the productivity of family members besides its direct impact on the productivity of the patient (DeVol and Bedroussian, 2007).

### 2.1.3. TFP

Due to rising competitiveness and resources scarcity, improving productivity has proved to be one of the most prioritized issues for many sectors, regions and nations. The history of world's

economic development has witnessed continuous improvement in labor productivity over time while consistently considered it to be a good representative for general productivity. However, a skillful and healthy worker without the support of machinery and capital might still has lower productivity than the inferior ones with full support of necessary technology and sufficient capital.

Therefore, labor productivity might not be comprehensive and suitable in explaining economic growth and thus the concept of TFP is formed. In general, TFP measures the relationship between output and aggregate inputs (including qualitative factors such as technology, management capabilities, business environment...). Over time, more and more countries have chosen TFP to represent productivity. It can be said that discussing the role of TFP in economic growth is equivalent to discussing the change in technology and efficient use of resources. Pakko (2002) analyzed the US data from 1954 to 2000 to conclude that technology is an important driving force which accounts for approximately 60% of the US economic growth. Based on these findings, the author suggested that investing on research and development for new technology is extremely crucial in improving productivity.

## 2.2. The Consumption Function Approach

When calculate GDP using the consumption approach, we often refer to the expenditures of the economic agents including household consumption, firm investment, government spending, and net exports. Theoretically, increasing these expenditures has some massive impacts on aggregate demand as well as economic growth.

### 2.2.1. Household consumption

Many studies have demonstrated that the role of consumption in economic growth is relatively clear. For example, Duesenberry and Income (1949) and Veblen (2007) suggested that rising consumption reduces savings and possibly increases output. In contrast, Harbaugh (1996) did not consider consumption to be beneficial for economic growth because it might lead to increased savings. It seems a bit confusing but he explained that along with rising income, demand for individual savings also rise, possibly to take into account the future consumption (e.g. retirement). This might lead to higher savings and lower social investment than before, thereby contracting growth. The debate on this topic did not stop there. Research by Karim et al. (2010) on the relationship between consumption and economic growth in Malaysia showed that increased consumption stimulates production and increases output through changing the aggregate demand. However it is only the case in the short run. In the long run, economic growth also affects individuals considerably thus consumption stimulation policies which only change individual consumers are not capable of promoting long-term growth.

### 2.2.2. Private investment

In order to investigate the impact of private investment on economic growth, Khan and Reinhart (1990) has extended the Solow (1957)'s theoretical framework on the determinants of economic growth. Using data from 24 developing countries, they found that investment of the private sector has a positive and direct impact on economic growth. Particularly, it is significantly stronger

than the effect of the public sector's investment. Similarly, Poirson (1998) analyzed data from 53 developing countries in 1980 and recognized the importance of private investment in contributing to the development of these countries. In other words, the role of private investment is undoubtedly crucial, and even more crucial than the public investment. Therefore, recognizing and ensuring a comfortable investment environment for the development of private sector should be considered as an important goal for many countries, especially the developing ones.

### 2.2.3. Net exports

According to the international trade theory, it would be much more beneficial for a country to specialize in production and exchange with other countries than to try to produce all kinds of goods. In many empirical studies on the role of trade in economic growth, the values and weights of exports or trade in GDP are commonly used. Many authors suggested that these indexes might be used to measure the openness of an economy. However, it should be useful to note that regressing total economy's output on trade only implies correlation but not causation because the set of independent variables suffers from significant multicollinearity. In general, the effect of trade on economic growth still remains controversial.

### 2.2.4. Public expenditure

The view of academic scholars around the world on the relationship between public expenditure and economic growth has been constantly changing over time. First of all, many authors, such as Barro (1990), confirmed the existence of a positive relationship. However, Barro also considered public spending as a major cause of market distortions. Therefore, it should not be a permanent stimulation of economic growth. The relationship between public spending and economic growth is non-linear and possibly U-shaped. Accordingly, in the early stages of development, public expenditure increases with total output due to the fact that the improvement of marginal productivity of capital outperforms the negative impact of tax burden. However, to a certain extent, the effect might reverse and public spending could hamper economic growth. Indeed, Devarajan et al (1996), using data from 43 developing countries over a 20 year-period (1970-1990), also suggested similar result.

In general, the impact of total public expenditure on economic growth is still a debate. There are three main findings: (1) Public expenditure speeds up economic growth, (2) public expenditure slows down economic growth; and (3) there exists an optimal level of public expenditure.

- Does public expenditure speed up economic growth? Barro (1991) studies the data of many countries in the period 1960-1985 to examine the relationship between total public expenditure and real GDP. He finds a positive and significant impact of public expenditure. However, Barro also believes that public expenditure can become a major cause of market distortions. Therefore, it is not a permanent solution for growing an economy. After Barro (1991), many researchers also show the positive impact of public spending on economic growth: For example, Alexiou (2007) studies the data of Greek; Alexiou (2009) studies 7 countries in South East Europe during 1995-2005. Most of them argue that

public expenditure increases aggregate demand, thus fosters economic growth.

- Does public expenditure slow down economic growth? The negative impact may be due to the institutions weakness leading to inefficient expenditure. This explanation seems to be appropriate for low development countries where corruption is a serious problem. Besides, the negative effect can be caused by spending for social issues rather than economic growth. Some examples can be listed as the following: Saunders (1985) analyzes the data of OECD countries; Devarajan et al. (1996) use the data from 43 developing countries over a period of 20-year (1970-1990). Most authors agree that inefficiencies in monitoring mechanisms of public expenditure lead to lower growth rates.
- Does the optimal level of public expenditure exist? Barro (1990) suggests that the relationship between public expenditure and economic growth is non-linear, expressed by the inverted U-shaped. Accordingly, public expenditure increases with output in the early stages of development. The reason is that the increase in government expenditure increases the marginal productivity of capital that dominates the negative impact of the tax burden. However, over a certain level of public expenditure, called the optimal level of public expenditure, the effect occurs in the opposite direction, i.e., public expenditure reduces economic growth.

There are many macroeconomists aiming to find the optimal public expenditure. Peden (1991), for example, analyses the data of US from 1889 to 1986 and shows that maximum output can be achieved at 20% of gross national product (GNP) as government expenditure. This means that, 35% of GNP as US government expenditure in 1986 is over the threshold. For the case of Iran, Abounoori and Nademi (2010) suggest that the optimum level is 34.7% of GDP. Of which 23.6% of GDP should be spent for consumption, the remaining is for investment. Thereby, the authors recommend that the Iran government expenditure is exceeded optimal level in the period 1969-2006. Pevcin (1996) uses panel data to analyze the case of European developing countries in the period 1950-1996. He finds a positive relationship between public expenditure and economic growth. However, he also believes that these countries are in the early stages of "inverted U curve", and the optimal level of public expenditure is from 36% to 42% of GDP.

## 3. METHODOLOGY AND DATA

### 3.1. Methodology

The main method of this research is regression analysis with panel data from 129 countries in three different periods (1) from 2002 to 2013, (2) from 2002 to 2008, and (3) from 2008 to 2013. Since each country has its unique, time-invariant characteristics, both fixed effects model (FEM) and random effects model are adopted. However, FEM might be more appropriate because its capability of solving the endogeneity problem, which is relatively common in macroeconomic research due to the fact there are many factors affecting a single macroeconomics variable. Indeed, the results of a Hausman test on the suitability of two models also confirm the superiority of FEM.

Several diagnostics test with the FEM are conducted in order to guarantee the reliability of results. Firstly, adjusted-Wald test (Green, 2000) rejected the null hypothesis of no heteroscedasticity problem in regression models for each period. As a result, robust standard errors would be used in order to overcome the problem. Secondly, Pevcin (2004) test showed that the cross-correlations between standard errors in the initial model are relatively significant. The problem should be fixed by using the Driscoll and Kraay (1998)'s method. Finally, using Wald test, it would be sensible to conclude that auto-correlation is not a problem in all three models. Final estimated results with suitable correction are presented below for analyzing and concluding.

The regression model can be expressed as below:

$$\widehat{GDPP}_{it} = \widehat{b}_0 + \widehat{b}_1 INVEST_{it} + \widehat{b}_2 LABOR_{it} + \widehat{b}_3 CONSUM_{it} + \widehat{b}_4 GOVEXP_{it} + \widehat{b}_5 EXPORT_{it}$$

Where the variables are described in Table 1.

### 3.2. Data

Our dataset, which is extracted from the world development indicators database, consists of 129 countries from 2002 to 2013. Observations are divided into two sub-periods: From 2002 to 2008 and from 2008 to 2013. By doing so, we would be able to investigate the potential changes in the contributions of all factors to economic growth due to the 2008 global financial crisis.

The set of variables, includes the growth rate of GDP per capita, investment, labor, household consumption, government expenditure and exports, comes from the theory of production function and consumption function. Descriptive statistics (mean, variance, min and max) are presented in the Appendices. In general, average GDP growth rate for all countries is approximately 5.1%, and 2.9% for the whole period, before 2008 and after 2008, respectively. This is quite a clear indication of the 2008 global financial crisis. Moreover, the growth rates of investment and government spending also decelerated after the crisis. In contrast, household consumption did increase from 0.07% to 3.05%. However, it might only be the consequence of rising overall inflation post-crisis.

## 4. RESULTS

Initial estimated results (without tests and corrections) for all three periods are recorded in Table 2. Three models have some significant properties in common. First of all, investment and exports have positive impacts on economic growth. In particular, the impact of exports is much more significant in post-crisis period than before while the impact of investment is relatively similar before and after the crisis. Secondly, there impact of labor force, household consumption and government expenditure on economic growth are inconsistent among three models. In the next part, after correcting some potential problems in the regression models, these initial results are investigated and discussed more carefully.

Estimated results after overcoming potential problems in the initial regression model are presented in Table 3 in columns FEM4,

**Table 1: Variables list**

| Variables | Description   |
|-----------|---|
| GDPP      | Growth rate of GDP per capita (annual % growth)               |
| INVEST    | Growth rate of gross capital formation (annual % growth)      |
| LABOR     | Growth rate of total labor force (annual % growth)            |
| CONSUM    | Growth rate household consumption (annual % growth)           |
| GOVEXP    | Growth rate of total government expenditure (annual % growth) |
| EXPORT    | Growth rate of exports (annual % growth)                      |

GDP: Gross domestic product

**Table 2: Initial estimated empirical results**

| Variables      | 2002-2013 (FEM1)      | 2002-2008 (FEM2)     | 2008-2013 (FEM3)      |
|----------------|-----------------------|----------------------|-----------------------|
| INVEST         | 0.0543***<br>(11.02)  | 0.0664***<br>(8.93)  | 0.0799***<br>(12.88)  |
| LABOR          | 27.60***<br>(3.33)    | 19.25+<br>(1.8)      | -6.049<br>(-0.55)     |
| CONSUM         | -0.00169*<br>(-1.96)  | -0.000693<br>(-0.84) | 0.234***<br>(14.07)   |
| GOVEXP         | -0.00803**<br>(-2.61) | 0.0639***<br>(11.93) | -0.0357***<br>(-9.41) |
| EXPORT         | 0.149***<br>(17.38)   | 0.0961***<br>(7.77)  | 0.143***<br>(16.43)   |
| _cons          | 2.335***<br>(14.22)   | 3.005***<br>(12.16)  | 1.613***<br>(8.46)    |
| N              | 1548                  | 774                  | 774                   |
| R <sup>2</sup> | 0.29                  | 0.295                | 0.6                   |

t-statistics in parentheses. +P<0.10, \*P<0.05, \*\*P<0.01, \*\*\*P<0.001

FEM6 and FEM8 for heteroscedasticity and columns FEM5, FEM7 and FEM9 for the standard errors' problem.

In fact, our first initial observation still holds for the corrected result. Specifically, the growth rates of investment and exports do have positive impacts on economic growth. However, the impacts are stronger in the latter period. Notably, these differences are significant only for exports but not for investment. On average, 10% increase in exports led to 1% and 1.4% increase in GDP in the first and second sub-period, respectively. In other words, this result means that investment and exports play a crucial role in fostering economic growth in the short-run, especially in the post-crisis period.

Besides, Table 2 also proposes some different and interesting conclusions regarding the impacts of labor force size, household consumption and government spending on economic growth. Specifically, labor force did have significant positive impact if we investigate the period from 2002 to 2013 as a whole. In fact, the effect is only positive in the first sub-period with low statistical significance while remains unclear in the second sub-period. This result might be caused by the variable itself, i.e., growth rate of labor force generally has positive impact on output, but it is not a key factor to overcome the difficulty of global financial crisis.

**Table 3: Corrected results**

| Variables      | 2002-2013            |                     | 2002-2008             |                      | 2008-2013             |                       |
|----------------|----------------------|---------------------|-----------------------|----------------------|-----------------------|-----------------------|
|                | (FEM4)               | (FEM5)              | (FEM6)                | (FEM7)               | (FEM8)                | (FEM9)                |
| INVEST         | 0.0543*<br>(2.34)    | 0.0543*<br>(2.39)   | 0.0664**<br>(3.24)    | 0.0664***<br>(3.89)  | 0.0799***<br>(7.19)   | 0.0799***<br>(19.17)  |
| LABOR          | 27.60*<br>(2.08)     | 27.60***<br>(4)     | 19.25+<br>(1.92)      | 19.25*<br>(2.48)     | -6.049<br>(-0.34)     | -6.049<br>(-0.57)     |
| CONSUM         | -0.00169+<br>(-1.68) | -0.00169<br>(-1.64) | -0.000693+<br>(-1.93) | -0.000693<br>(-0.70) | 0.234***<br>(3.9)     | 0.234***<br>(7.93)    |
| GOVEXP         | -0.00803<br>(-0.42)  | -0.00803<br>(-0.36) | 0.0639***<br>(5.66)   | 0.0639***<br>(11.61) | -0.0357***<br>(-5.78) | -0.0357***<br>(-9.40) |
| EXPORT         | 0.149***<br>(6.45)   | 0.149***<br>(8.86)  | 0.0961**<br>(2.92)    | 0.0961***<br>(13.05) | 0.143***<br>(8.4)     | 0.143***<br>(17.55)   |
| _cons          | 2.335***<br>(10.46)  | 2.335***<br>(7.09)  | 3.005***<br>(6.84)    | 3.005***<br>(6.15)   | 1.613***<br>(5.77)    | 1.613***<br>(13.25)   |
| N              | 1548                 | 1548                | 774                   | 774                  | 774                   | 774                   |
| R <sup>2</sup> | 0.29                 |                     | 0.295                 |                      | 0.6                   |                       |

t-statistics in parentheses. +P<0.10, \*P<0.05, \*\*P<0.01, \*\*\*P<0.001

Regarding the household consumption, its impact on economic growth in the whole period 2002-2013 or in the first sub-period is still ambiguous. However, there exist some evidences (with 90% confidence level) that household consumption might produce a minor adverse effect on economic growth. Contrastingly, household consumption and growth has a positive and statistically significant relationship if only the sub-period 2008-2013 is considered. In fact, 10% increase in household consumption might contribute to approximately 2.34% in GDP. This result supports the conclusion of Harbaugh (1996) and Karim et al. (2010) that household consumption may not be an important factor for long-run growth, as it may reduce investment. Anyhow, it is the most important factor in the post-crisis period.

Regarding the government expenditure, its impact on economic growth is found to be ambiguous using data for the whole period. However, considering two sub-periods separately produces a significant difference. Specifically, the correlation between economic growth and government spending is positive in the first and negative in the second sub-period. There are many factors leading to this difference but the world's overall economic condition might be one of the most influential. Before 2008, governments around the world had the opportunities to invest in production infrastructure thanks to relatively high growth rates. On the other hand, the 2008 world financial crisis has forced governments to spend larger fraction of budget on social purposes, hence causing the negative correlation between government expenditure and economic growth. In fact, if we investigate the case more thoroughly, other factors such as the expenditure composition or efficiency might also possibly explain our finding. However, due to the limited scope of this study, we will leave them for potential future research.

### 5. CONCLUSION

To investigate the main determinants of economic growth before and after global financial crisis, this paper analyzes the data of 129 countries with fixed effect models. The results show that investment and exports has a positive relationship with economic growth. Specifically, the impact of exports on growth rate in period

2008-2013 is stronger than that in the previous period. Besides, the impact of household consumption is ambiguous, positive in the latter period, and negative in the previous one. Economic growth increases along with public expenditure during 2002-2008, but it decreases later on. Labor has a positive contribution to economic growth rate during the first period, but it has an ambiguous impact during the second one.

Although showing some significant results, this paper still has some limitations. Firstly, it omitted some variables showing in Ram (1986), the seminal article on the topic of public expenditure, such as government size measured by a ratio of public expenditure to GDP. Thus, this paper does not study the optimal level of public expenditure. Secondly, this paper uses FEM to overcome the endogenous problem statistically, i.e., 0 to deal with the problem of omitted variable, and not for other reasons of endogeneity such as (1) mutual relations between the independent and dependent variables, (2) the uncertainty in measurement, and (3) the impact of lagged dependent variable. For the future research, the government size would be taken into account and the method of two stages least square (2SLS) or generalized moment method could be applied.

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## APPENDICES

### Appendix Tables

#### Appendix 1: Statistical analysis, period 2002-2013

| Variable | Mean     | Standard deviation | Min      | Max      | Observations |
|----------|----------|--------------------|----------|----------|--------------|
| GDPP     |          |                    |          |          |              |
| Overall  | 4.006901 | 4.432958           | -36.0471 | 37.99873 | N=1548       |
| Between  |          | 2.384997           | -0.91103 | 13.28314 | n=129        |
| Within   |          | 3.742105           | -37.0003 | 33.44343 | T=12         |
| INVEST   |          |                    |          |          |              |
| Overall  | 6.383493 | 24.92102           | -64.7204 | 755.7443 | N=1548       |
| Between  |          | 8.212742           | -4.67227 | 82.99075 | n=129        |
| Within   |          | 23.53906           | -131.699 | 679.137  | T=12         |
| LABOR    |          |                    |          |          |              |
| Overall  | 0.016135 | 0.015913           | -0.10195 | 0.077116 | N=1548       |
| Between  |          | 0.012296           | -0.02504 | 0.041663 | n=129        |
| Within   |          | 0.010155           | -0.06078 | 0.072648 | T=12         |
| CONSUM   |          |                    |          |          |              |
| Overall  | 1.487246 | 101.9879           | -3984.21 | 290.1639 | N=1548       |
| Between  |          | 28.42795           | -317.749 | 13.66301 | n=129        |
| Within   |          | 97.97519           | -3664.97 | 609.4002 | T=12         |
| GOVEXP   |          |                    |          |          |              |
| Overall  | 5.468361 | 38.80492           | -77.1812 | 1378.306 | N=1548       |
| Between  |          | 10.83729           | -0.65067 | 107.7289 | n=129        |
| Within   |          | 37.27211           | -179.442 | 1276.045 | T=12         |
| EXPORT   |          |                    |          |          |              |
| Overall  | 6.236479 | 10.75969           | -45.8938 | 85.61331 | N=1548       |
| Between  |          | 4.050276           | -3.46404 | 18.13166 | n=129        |
| Within   |          | 9.974114           | -49.9521 | 76.29341 | T=12         |

**Appendix 2: Statistical analysis, period 2002-2008**

| Variable | Mean     | Standard deviation | Min      | Max      | Observations |
|----------|----------|--------------------|----------|----------|--------------|
| GDPP     |          |                    |          |          |              |
| Overall  | 5.117758 | 4.198526           | -32.8321 | 37.99873 | N=774        |
| Between  |          | 2.658228           | 0.180071 | 16.07932 | n=129        |
| Within   |          | 3.256862           | -32.5309 | 32.19377 | T=6          |
| INVEST   |          |                    |          |          |              |
| Overall  | 8.758925 | 16.20125           | -55.3892 | 152.5739 | N=774        |
| Between  |          | 6.543385           | -2.449   | 37.51054 | n=129        |
| Within   |          | 14.83043           | -72.3237 | 142.9096 | T=6          |
| LABOR    |          |                    |          |          |              |
| Overall  | 0.017615 | 0.016506           | -0.10195 | 0.077116 | N=774        |
| Between  |          | 0.013054           | -0.03657 | 0.052233 | n=129        |
| Within   |          | 0.010156           | -0.04777 | 0.074699 | T=6          |
| CONSUM   |          |                    |          |          |              |
| Overall  | -0.07159 | 144.1354           | -3984.21 | 290.1639 | N=774        |
| Between  |          | 57.17988           | -643.73  | 16.5787  | n=129        |
| Within   |          | 132.3882           | -3340.55 | 933.8219 | T=6          |
| GOVEXP   |          |                    |          |          |              |
| Overall  | 5.49864  | 22.97041           | -77.1812 | 565.5389 | N=774        |
| Between  |          | 10.74062           | -13.4173 | 108.402  | n=129        |
| Within   |          | 20.32301           | -126.83  | 462.6355 | T=6          |
| EXPORT   |          |                    |          |          |              |
| Overall  | 8.744887 | 10.18627           | -45.8938 | 85.61331 | N=774        |
| Between  |          | 5.216119           | -1.24297 | 27.53433 | n=129        |
| Within   |          | 8.759459           | -46.3185 | 69.70284 | T=6          |

**Appendix 3: Statistical analysis, period 2008-2013**

| Variable | Mean     | Standard deviation | Min      | Max      | Observations |
|----------|----------|--------------------|----------|----------|--------------|
| GDPP     |          |                    |          |          |              |
| Overall  | 2.896043 | 4.385068           | -36.0471 | 27.49896 | N=774        |
| Between  |          | 2.849411           | -4.93643 | 12.28615 | n=129        |
| Within   |          | 3.340988           | -29.5138 | 18.38134 | T=6          |
| INVEST   |          |                    |          |          |              |
| Overall  | 4.008061 | 31.13096           | -64.7204 | 755.7443 | N=774        |
| Between  |          | 13.5349            | -16.5752 | 139.9901 | n=129        |
| Within   |          | 28.05581           | -154.015 | 619.7622 | T=6          |
| LABOR    |          |                    |          |          |              |
| Overall  | 0.014656 | 0.015164           | -0.06223 | 0.061334 | N=774        |
| Between  |          | 0.013135           | -0.02284 | 0.037823 | n=129        |
| Within   |          | 0.00765            | -0.02474 | 0.044685 | T=6          |
| CONSUM   |          |                    |          |          |              |
| Overall  | 3.046079 | 6.053899           | -33.5382 | 56.00542 | N=774        |
| Between  |          | 3.042387           | -4.14974 | 10.74733 | n=129        |
| Within   |          | 5.239604           | -30.7187 | 48.30418 | T=6          |
| GOVEXP   |          |                    |          |          |              |
| Overall  | 5.438082 | 49.8593            | -29.9801 | 1378.306 | N=774        |
| Between  |          | 20.15099           | -5.46763 | 228.8752 | n=29         |
| Within   |          | 45.63457           | -251.409 | 1154.869 | T=6          |
| EXPORT   |          |                    |          |          |              |
| Overall  | 3.728071 | 10.73924           | -45.7725 | 84.44024 | N=774        |
| Between  |          | 4.084541           | -5.81099 | 25.55829 | n=129        |
| Within   |          | 9.937592           | -46.7142 | 72.46267 | T=6          |