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ROLE OF GOVERNMENT SPENDING IN ECONOMIC GROWTH AND COMPETITIVENESS: EVIDENCE FROM CAMBODIA

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PH.D. DISSERTATION

UNIVERSITY OF MISKOLC

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A DISSERTATION SUBMITTED TO UNIVERSITY OF MISKOLC IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF PH.D. IN ECONOMICS

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Declaration

I, Leanghak Hok, confirm that this dissertation submitted for Ph.D. in Economics is my work and is also expressed by my own words. Any uses made within it of the works of other authors in any form (e.g., equations, figures, ideas, tables, and text) are duly acknowledged. A full list of the references employed has been included.

Signed: Leanghak Hok

Miskolc, 2019

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Executive Summary

The effectiveness of fiscal policy, especially the influence of government expenditure on economic performance and trade competitiveness, has been actively debated among scholars or policymakers since the global crisis in 2008. This study focuses on the impact of government spending on private consumption, economic growth, and international competitiveness.

The result, based on the Markov-Switching Autoregressive (MSAR) model tested on Cambodia's annual data from 1987 to 2015, shows that private consumption responds positively to a rise in disposable income or a decline in saving interest rates. Inflation is statistically insignificant. The impact of government purchases on private consumption is linear, negative, and asymmetric. A non-linear effect of government investment on household consumption occurs in Cambodia during certain periods—times of political instability, which are 1994-1995, 1997-1998, and 2004-2006. This non-Keynesian effect during the period 2010-2015 occurs because of raising the level of tax revenues over this period.

The second model in this study is used to investigate the inverted-U shaped relationship between output growth and government spending (i.e., government fixed capital formation (GFCF), and government final consumption expenditure (GFCE)). Ordinary Least Squares (OLS) is employed as an approach to analyzing annual data for Cambodia obtained from 1971 to 2015. The result reveals that GFCF and GFCE have an inverted-U shaped relation with economic growth and that 5.40 percent and 7.23 percent were the optimal values of GFCF and GFCE, respectively. The labor growth rate and export growth rate contribute positively to the growth rate of output.

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The last model attempts to examine the influence of government spending (i.e., government investment and consumption) on trade competitiveness. This study adopts a new alternative measurement of trade competitiveness based upon the expansion of market size. Autoregressive Distributed Lags (ARDL) approach is used to estimate the dynamic relationship. The result based on Cambodia's annual data from 1970 to 2015 shows that Cambodia’s trade competitiveness improves in response to a rise in public investment, government purchases, or aggregate private spending.

This study contributes substantially to the research field of macroeconomics. Government spending affects macroeconomic activities like private consumption and economic growth. This study also provides an alternative perception of the efficacy of fiscal policy in international macroeconomic activities. Policymakers can potentially reap benefits from this study. That is, they can identify the characteristics creating a non-linear effect of government expenditure on private consumption, manage the level of government spending to maximize economic growth, and realize that government expenditure also contributes to trade competitiveness.

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Chapter 1 Introduction

This chapter describes the research problem and objectives, sets up the hypotheses and scope, and outlines research contributions.

1.1 Background and Rationale of Study

The most crucial goal of countries is to achieve sustainable economic growth. Economic policies highly influence the economy, people's wealth, and living standards (Ng, 2018). The exogenous models introduced by Solow (1956) and Swan (1956) only explain the favorable response of economic growth to the enhancement of capital and labor when technology is unchanged. The endogenous model developed by Barro (1990) incorporates government spending in the growth model and concludes that changes in public spending also play a crucial role in economic growth. The role of government spending is drawing the attention of scholars from both industrial and non-industrial countries. The adaptation of various policy options responds to different economic conditions. Many emerging market countries (Brazil, China, and India) has adopted an expansionary fiscal policy and attribute a part of their high economic growth in recent years to the extension of government spending. In several works in the literature, public expenditure policies play an essential role in facilitating economic growth (Aschauer, 1989; Farhadi, 2015; Kodongo & Ojah, 2016), economic development (Iheanacho, 2016; Molnar et al., 2006), competitiveness and other areas of economic activities (Chen & Liu, 2018; Ravn et al., 2012). Several European countries during the period from 2013 to 2015 were involved in contractionary fiscal policy through a reduction in government spending to handle fiscal austerity (fiscal imbalance) as a serious concern (European Parliament, 2017). Less-efficient categories of expenditure can be diverted to financing productive categories or rectifying fiscal imbalance (IMF, 1995).

When government spending is productive has been questioned. Productive government expenditure positively contributes to total factor productivity (TFP) and living standards (Bucci et al., 2012; Facchini & Seghezza, 2018). Government spending introduced to overcome market failures (e.g., collective goods, externalities, and natural monopolies) can be productive (Hansson & Henrekson, 1994). Public spending is especially essential to the output growth of developing countries (Shen et al., 2018;

Shonchoy, 2010). Sattar (1993) suggests that governments of developing countries are more effective than developed countries in managing their expenditure to correct distortions and market failures, to offer public goods and services (e.g., economic and social infrastructure), to regulate private activities producing a harmful effect to society, and to engage in highly productive activities. Developed countries mainly focus on redistribution and income security to expand their welfare. Private sectors in developed countries often have enough freedom to carry out highly productive activities (i.e., provision of a communication network, education, health, and R&D) in the market, thus leading to a smaller impact of government spending on productive activities in the market. While a large fraction of government expenditure in developing countries goes to physical and social infrastructure, this productive investment generates a close connection between government spending and productivity growth. But then governments, especially in developing countries, have to limit the level of government spending, thereby allowing their spending, which may produce economic growth (Butkiewicz & Yanikkaya, 2011).

Since the global crisis of 2008, fiscal policy has been used to make a recovery from this crisis. Some governments borrow money to finance their expenditure and bail out the banking industry, therefore rapidly accumulating public debt (e.g., Italy, Spain, the USA, and especially Greece). A result of this is that economic growth may be harmed. For example, Greece in 2010 faced a debt crisis which impinged on not only its own economy but also others, especially the European economy. Some scholars have found that economic growth responds negatively to an increase in government spending (Butkiewicz & Yanikkaya, 2011; Dar & AmirKhalkhali, 2002; Fölster & Henrekson, 2001; Hasnul, 2015; Landau, 1983). Additionally, this negative result can occur due to the inefficiency of public investment management, thereby leading to unproductive investment.

Most of the literature indicates that economic and social factors taken into account in structural models, econometric methods, the economy of each state, magnitude of government spending, and the length of data can lead to fluctuation in the estimated value of the fiscal multiplier. The estimated value of the government spending multiplier varies: 2.3 (Eggertsson, 2011), 1.8 (Gordon & Krenn, 2010), 1.6 (Romer & Bernstein, 2009), 1.5 (Erickson et al., 2015), 1.2 (Atems, 2019; Ramey, 2011a), 0.8

(Barro, 1981), and 0.6 (Guo et al., 2016). If the value of the fiscal multiplier is larger than one, government spending drives not only output but also the activities of private sectors. A value of fiscal multiplier below one indicates that a decrease in output and businesses of private sectors is the response to higher government expenditure. The reason is that a dollar of government spending generates less than a dollar for output.

The magnitude of government spending has been debated during the last decade, especially since the Greek debt crisis. Government expenditure encourages economic growth as long as financing sources of the spending come from the nation's own revenues but not from a deficit (Morozumi & Veiga, 2016). A higher ratio of government expenditure to output diminishes the value of the government expenditure multiplier (Barro, 1990; C. Chen et al., 2017). Most of the recent research has found an inverted-U shaped linkage between government spending and output growth (Altunc & Aydın, 2013; C. Chen et al., 2017; Hok et al., 2014; Makin et al., 2019). The optimal level of government spending varies according to the economy of each country, econometric methods, data set, and other factors included in the regression model.

Government intervention can have a positive or negative influence on economic performance. The direction of a reaction of output growth to public spending typically depends on several factors (e.g., magnitude and types of expenditure). A diminishing rate of economic growth in response to the higher value of public spending leads to a non-linear relation between the magnitude of government spending and economic growth. According to the main development models and experiences around the globe about fiscal policy (government spending), the extension of government expenditure is not certain to lead to economic growth. Three major research questions are raised in this study.

How does government spending affect private consumption?

How does government spending contribute to economic growth?

How does competitiveness react to the expansion of government spending?

1.2 Objectives of Study

There is uncertainty about the impact of government expenditure on economic growth and other areas of the economy, especially private consumption and international competitiveness. This study, therefore, investigates (1) the effect of government spending on private consumption (2) the contribution of government expenditure to economic growth and (3) the reaction of international competitiveness to a change in government expenditure. Three different models are used to conceptualize these three research objectives.

1.3 Hypotheses

Based on the literature review presented later in this dissertation, the three hypotheses can be formulated as follows:

Giavazzi and Pagano (1990) and Amano and Wirjanto (1998) propose a non-linear effect (i.e., the occurrence of not only Keynesian but also non-Keynesian impact in a certain period) of government spending on private consumption. The government expenditure follows the traditional Keynesian theory during the usual time, but a firm contradictory fiscal policy provoked by a high level of debt leads to the existence of a non-Keynesian effect (Giavazzi & Pagano, 1990). The first hypothesis of this study can thus be formed:

H_1: There is a non-linear impact of government spending on private consumption.

According to Barro (1990), the optimal level of government spending exists because higher fiscal adjustment reduces the influence of government expenditure on economic growth. If government spending reaches the threshold level, the further extension of government expenditure slows down output growth. The second hypothesis of this study is based on Barro's observation:

H_2: There is an inverted-U-shaped relationship between government spending and economic growth.

According to the Redux model of Obstfeld and Rogoff (1995) and the two-country model developed by Giorgio et al. (2018), expansionary fiscal policy depreciates the real exchange rate and thus boosts international competitiveness. The third hypothesis tested in this study is:

H_3: The expansion of government spending improves trade competitiveness.

Three diverse models are judiciously used to test these three hypotheses. Total government expenditure usually is split into two major types (i.e., current expenditure and capital expenditure). Current expenditure contains government final consumption expenditure and other current expenditures (transfer payment). Transfer payment can be identified as expenditure without involvement with the transition of goods and services. Capital expenditure (public investment) focuses on investment in goods and services, especially infrastructure investment (i.e., education, health, research and development, telecommunications, and transport), which generates long-run benefits. In this study, only public consumption as government final consumption expenditure (GFCE) and public investment as government fixed capital formation (GFCF) are investigated because transfer payment data are unavailable for Cambodia.

1.4 Contributions of Study

This study can be classified in the economic research field of macroeconomic policy, especially fiscal policy. Government spending plays a crucial role in not only national but also international macroeconomic activities as follows:

For the first model, an increase in the present value of taxes and political instability can prevent the efficacy of government expenditure and cause a non-linear effect of government spending (mainly public investment) on private consumption. Policymakers can identify the characteristics which engender the existence of this non-linearity and thus design a sensible policy to promote private consumption effectively.

In the case of the second model, the effect of government expenditure (i.e., public investment and consumption) on economic growth depends on the magnitude of fiscal adjustment (the adjustment of government expenditure). There is an inverted-U-shaped relationship between government expenditure and economic growth. That is, larger increases in government spending do not lead to more growth. This result allows policymakers to manage government investment and purchases to be potentially most productive.

In to the third model, this study advances a new alternative measurement of international competitiveness based on the expansion of market size. Fiscal policy, mainly government spending, plays a direct role in contributing to an international macroeconomic model through the real exchange rate as the alternative measure of global (trade) competitiveness. This outcome also provides policymakers with an evidence that fiscal policy (domestic spending) can be instrumental in global competitiveness.

1.5 Scope of Study

This study only focuses on the role of government spending in economic activities and uses empirical data from Cambodia. The annual data during the periods 1987-2015, 1971-2015, and 1970-2015 are selectively applied to analyze and to evaluate the first, second, and third hypotheses, respectively.

1.6 Organization of Study

This dissertation is organized as follows. Chapter 1 introduces the problem, purpose, and scope, and hypotheses. Chapter 2 reviews economic theories and empirical studies related to the role of government spending in the economy and other factors that determine economic growth. Chapter 3 examines the non-linear effect of government expenditure on private consumption based on Cambodian data. Chapter 4 investigates the inverted-U-shaped relationship between government spending and economic growth in Cambodia’s economy. Chapter 5 uses Cambodian data to assess how international competitiveness responds to the positive adjustment of government expenditure. Chapter 6 draws general conclusions about the role of government expenditure in Cambodia’s economy.

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Chapter 2 Literature Review

This chapter presents a comprehensive review related to economic theories on macroeconomic performance. Especially, the role of government expenditure in private consumption, economic growth, and international competitiveness is deeply reviewed because it is the main focus for this study. The last section of this chapter depicts the conceptual framework.

2.1 Economic Theories on Macroeconomic Performance

The determinants of economic growth are classified traditionally into two sides (i.e., supply-side and demand-side determinants). Supply-side determinants (i.e., inputs of production, institutional environment, and structural change) bear on the long-run growth rate of output. The production inputs include physical capital, human capital, and technology. Demand-side factors (i.e., the elements of aggregate demand) have a short-term effect on economic growth (Próchniak, 2011). Aggregate demand generally occurs in the equilibrium of investment-saving (IS)[1] and the liquidity preference money supply (LM)[2]. IS can refer to a function of the interest rate and the aggregate output subject to the significant four components in an open market, which contain private consumption, private investment, government expenditure, and net export. LM shows an association between the interest rates and the aggregate demand, which hinges on the money supply and the price level.

2.1.1 Supply-Side Determinants

The supply-side determinants explain the factors which contribute to the value of goods and services supplied in the economy. The major supply-side indicators for economic growth are described below.

2.1.1.1 Physical Capital

Solow (1956) and Swan (1956) develop an economic growth model based on the neoclassical production function, which includes three main inputs (i.e., capital, labor, and technology). The Solow–Swan model assumes technology as the constant term. The production function can be written as follows:

[1] The equilibrium of investment-saving (IS) refers to an equilibrium of the goods market.
[2] The liquidity preference money supply (LM) focuses on an equilibrium of the money market.

$$Y(t) = F\left[K(t), L(t), A(t)\right], \tag{2.1}$$

where $Y(t)$ refers to the total output produced in the economy at the time t,

$K(t)$ denotes physical capital at the time t,

$L(t)$ represents labor at the time t,

$A(t)$ stands for technology at the time t.

The scholars credit the production function model's essential elements (i.e., labor and capital) with shaping economic growth. Solow and Swan also found that less advanced economies obtain a higher marginal product of capital than advanced economies if we assume that the economy distributes the same portion income generated from capital accumulation. The Ramsey (1928), Cass (1965) and Koopmans (1965) models as complements to the Solow (1956) and Swan (1956) models is based on this fact—that is, the economy has a different portion of income for capital accumulation. Similarly, they still found that less advanced economies can gain a high marginal product of capital relative to the developed economies. Hok et al. (2014) indicated that capital and labor contribute positively to economic growth in eight Southeast Asian countries. The pool mean group (PMG) and mean group (MG) estimators were used to estimate this correlation in the period from 1995 to 2011. Baudino (2016) stated that physical capital boosts economic growth in China. Maximum-likelihood (ML) estimator was employed to run on panel data of 30 provinces from 1995 to 2013. He also expressed that physical capital accumulation in both the secondary and the tertiary sector has a significant contribution to gross domestic product (GDP) per worker.

2.1.1.2 Human Capital

Lucas (1988) and Romer (1986) criticize the Solow growth model (exogenous neo-classical model) for not complying with the endogenous neo-classical production function. By following a primary reason, each element in the production function of the Solow model is a combination of multi-tier factors (many economic factors). For instance, the endogenous neo-classical model splits the capital of the Solow model into two types (i.e., physical and human capital). The analysis of economic growth should take into account human capital and externalities. They suggested that more skilled labor creates a valuable and substantial contribution to economic growth and externality. The debate about the human capital's significance for economic growth and competitiveness of a country has often arisen during the last two decades. Human capital can be defined as a critical determinant of economic growth because an individual who obtains more education creates more innovation, which generates new products and also raises productivity (Romer, 1990; Teixeira & Fortuna, 2010). Human capital also performs the vital function of accelerating technological progress in countries through the absorption of ideas and the imported equipment from neighboring countries (Nelson & Phelps, 1966; Teixeira & Fortuna, 2010). Human capital can also be the driver of research and development (R&D). Goldin (2016) indicated that the common notion of human capital refers to the set of intangible resources inside a person (more especially in a labor force) which helps them to improve their productivity. These resources involve knowledge and skills acquired through more education and experience (Becker, 1962; Schultz, 1961). A higher level of human capital drives economic growth and development (Batten & Vo, 2009; Easterly & Levine, 1997; Fabro & Aixalá, 2012; Iqbal & Daly, 2014; Ogundari & Awokuse, 2018; Pelinescu, 2015; Temple & Wößmann, 2006; Vedia-Jerez & Chasco, 2016). These scholars appoint a number of variables (i.e. government expenditure on education, the logarithm of average attainment, secondary enrollment rate, primary and secondary enrollment rate, and human development index) as a proxy for human capital. However, Čadil et al. (2014) pointed out that more educated human capital harms sustainable economic growth, based on historical data of EU members. A high level of human capital did not help maintain economic stability or aid recovery from the crisis quickly. For example, Spain and Cyprus had high human capital (i.e. tertiary education as the percent of the population), but this caused high unemployment and slowed down economic growth due to the crowding-out effect of labor market and imbalance of labor market. In the labor market, labor can be categorized into types such as skilled labor (high education status) and unskilled labor (low education status). A number of institutions in the market are sticky, thereby leading to an unchanging level of total demand for labor. The surplus of skilled labor leads to skilled people taking jobs that only require unskilled labor, thus enlarging the number of unskilled laborers, who lose their jobs in the labor market. The crowding-out effect of the labor market can be identified as an increase in unemployment of unskilled labor in response to a rise in skilled labor.

2.1.1.3 Technology

The endogenous growth model aims to remedy the shortcomings of the exogenous growth model. The exogenous growth model takes into account technology but assumes it as a constant term. On the other hand, the endogenous growth model allows technology to make progress due to capital accumulation and other multi-tier factors. Firms' investment in capital stocks leads to improved technological progress, thereby increasing the marginal product of capital. The fundamental principle in the Romer (1990) model is that the capital stock shapes the production technology. The basic principle of endogenous neo-classical growth models indicates that technological transformation leads to a higher level of capital per person and generates more savings and investment, thus stimulating the real GDP.

For instance, the Turkish government has prioritized technological development since 2002. Notably, the 2002 act passed by the Turkish parliament focuses on the encouragement of research and development (R&D). After that, The Turkish GDP dramatically increased from 232 million USD in 2002 to 822 million USD in 2013. Adak (2015) suggested that technological progress and innovation significantly impact economic growth in the Turkish economy. Using new technologies in production drives down costs and enhances the international competitiveness of individual countries (Çalışkan, 2015). Vu (2013) examined the effect of one area of technology – information and communication technology (ICT) – on economic growth in Singapore. Data collected from 18 sectors and taken from Singapore's Input-Output Tables are during a period from 1990 to 2008 at five-year intervals. The outcome based on GMM showed that advances in ICT spurs not only value-added productivity but also labor productivity. ICT contributes significantly (approximately 1 percent) to Singapore's GDP.

2.1.1.4 Institutional Environment

According to geographic determinism theory, geographic and/or climatic conditions in the region have handicapped the economic performance of countries in the world (Diamond, 1999; Gallup et al., 1999; Lal, 1998; Landes, 1998). As a result, the varieties in the development level of different countries occur naturally. The institutional theory claims that different geographic conditions have a weak effect on income or economic development (Rodrik et al., 2004). The institutional theory focuses on the incentives for economic agents to perform their actions under specific institutional arrangements (North, 1981; North & Thomas, 1973; North & Weingast, 1989; Olson, 1996). Institutions can be rules or structures in a society which restrict and regulate human behaviors; these include economic institutions, political institutions (i.e., the distribution of political power and resource allocation), and cultural aspects (i.e. beliefs and religions) (Hodgson, 2006; Voigt, 2013; Yildirim, 2016). The institutional notion mentioned above attempts to examine how formal and informal rules operating in society form an institutional structure. Behaviors, rituals, traditions, and social habits, which are in conjunction with laws, contracts, constitution, and property rights, can be expressions of institutional structure (North, 1991).

Yildirim (2016) classifies institutional structure variables into six main groups: (1) The legal system and property rights, with five specific variables – the independence of the judiciary, the nature of legal regulations, property rights protection, military custody (political stability), and the integrity of the law system; (2) Government intervention consists of government expenditures, transfers and subsidies, and the marginal tax rate; (3) Accountability, transparency, and freedom of expression (i.e., political liberties and civil liberties); (4) Freedom in international trade contains tariffs, trade barriers related regulations, black market exchange rates, and restriction of foreign investment; (5) Market legitimating institutions and market regulations, comprised of three sub-groups: credit market regulation (e.g., the share of the private sector in banking system, private sector loans, monetary policy stability), labor market regulation (e.g., recruitment and minimum wage, hiring-dismissal regulations, and collective bargaining), and business market regulation (e.g., the cost of bureaucracy, the number of business start-up) (6) The category of institutions providing market stability contains only the inflation variable. Yildirim pointed out that institutional structure indicators such as the integrity of the law system, regulations on trade barriers, restriction of foreign investments, the share of the private sector in the banking system, and employment-dismissal variables positively influenced the macroeconomic performance of the 38 developing countries that he investigated. Conversely, other variables (i.e., independence of the judiciary, political stability, government expenditure, transfers and subsidies, civil liberties, black market exchange rates, and collective bargaining) drive down macroeconomic activities. The rest of the variables (i.e., nature of legal regulations, property rights protection, marginal tax rates, political liberties, tariffs, private sector loans, monetary policy stability, recruitment and minimum wage, cost bureaucracy, business start-up, and inflation) are statistically insignificant at the five-percent level. The analysis of these relations was based on panel data from 2000 to 2011.

2.1.1.5 Structural Change

Structural change refers to the allocation of productive resources among sectors in the economy and is also a valuable contributor to productivity and economic growth (Kuznets & Murphy, 1966; Lewis, 1954; Lin, 2011; Syrquin, 1988; Vu, 2017). The shift of inputs from lower to higher productivity sectors stimulates aggregate production. According to Lewis (1954), in the classical scheme of a dual economy, the transference of labor surplus from agriculture to new sectors (i.e., industrial or service sector) enhances productivity per worker, aggregate productivity of a country, and output per capita. Sectorial composition change has a significant effect on generating healthy economic growth based on general equilibrium methods and simulation techniques (Echevarria, 1997). Ark and Timmer (2003) indicated that the reallocation of resources from the agricultural sector to modern sectors (i.e., industry and services) generates more potential sources for economic growth in less developed countries. Also, in the case of higher developed countries, the transference of labor from agriculture to the service sector, especially the financial sector, fosters the growth of aggregate productivity. Urquhart (1984) investigated the distribution of labor in the USA during the period from 1950 to 1982. The distribution of labor is divided into three sectors (i.e., agriculture, goods-producing, and service). He stated that a rise in labor in service sector reacts to a fall in the employment level in the goods-producing sector rather than the agricultural sector. Vu (2017) pointed out that an effective structure reform (ESC) index introduced to measure structural change is more effective in monitoring growth than the norm of absolute values (NAV) index. He also found that ESC acted positively on the growth of labor productivity, total factor productivity (TFP), GDP per capita, GDP, and wages in 19 Asian economies between 1970 and 2012. If scarce physical resources and limited labor (i.e., without immigration labor from other countries) are available for the country, Lewis (1954) suggests that the growth rate is optimal until the labor surplus is exhausted. After that, wages should be increased, thereby making it difficult to achieve a higher growth rate than the optimal growth rate due to more challenges, especially a rise in prices. A decline in household consumption in response to inflation of prices encroaches on economic growth.

On the other hand, structural change does not always contribute positively to productivity growth. Negative influence of structural change on productivity growth occurred in Latin America during the period from 1995 to 2005 and in Africa during the period from 1990 to 2000, but not in Asia (McMillan et al., 2014). The transference of an input factor from a sector with higher and explosive productivity growth toward another with lower and sluggish productivity provokes diminishing total productivity growth rate subject to ceteris paribus (Baumol, 1967). A new piece of evidence in the USA demonstrates that the increasing employment level in the service sector slows down productivity (Baumol et al., 1985). Ngai and Pissarides (2007) examine the effect of structural change on economic growth and employ the analysis of a multi-sector model subject to theoretical approach and a fundamental assumption of constant elasticity of substitution (CES) of the utility function with two independent variables (i.e., preferences and technologies). They reflected uncertainty (i.e., either positive or negative) about the influence of structural change on economic growth. The sectoral composition forms the substance of economic growth but offers no feedback on growth patterns (Meckl, 2002). In the study of Fagerberg (2000) about sectorial level, the structural change did not stimulate productivity growth based on the manufacturing industries from 39 countries and during the period from 1973 to 1990. Timmer and Szirmai (2000) also concluded that a negative effect of structural change on productivity growth exists in Asian manufacturing.

2.1.2 Demand-Side Determinants

Demand-side determinants can be defined as contributors to aggregate demand. Each component of GDP calculated under the expenditure approach powerfully shapes aggregate demand. Fiscal and monetary policy generates a change in aggregate demand spontaneously. The economic conditions and price level (inflation) conclusively determine consumption, investment and net export (Mankiw, 2004). The equilibrium of the goods market and the money market at a given price establishes aggregate demand for the economy (Musgrave et al., 2012). Current literature mostly focuses on the effect of supply-side determinants on long-term productivity growth. Millemaci and Ofria (2016) indicate that demand-side determinants also play a crucial role in economic growth. Theoretical approaches in line with evolutionary economics express that demand-side factors have to take into account the analysis of economic growth (Dietrich, 2012; Metcalfe et al., 2006; Teixeira & Queirós, 2016; Witt, 2001). The potential demand-side factors are explained as follows:

2.1.2.1 Money Supply

Monetary policy refers to the manipulation of the money supply, which contributes directly and indirectly to macroeconomic outcomes (i.e., GDP growth, inflation, unemployment, and exchange rates). The role of money supply in the economy has been debated at length. Monetarists maintain that money supply impacts on prices but not the real GDP and unemployment in the long term. In the case of the short run, money supply materially affects economic output. However, Keynesians credit money supply with a significant contribution to the real GDP and prices in the short and long term. Some empirical studies highlight that money supply (M1) spurred economic growth in the Asian Economy Community (AEC) (Chaitip et al., 2015). The monetary aggregate (M3) contributes substantially to real GDP in Romania, and the Dynamic Vector Autoregressive (DVAR) model is the best model to explain this co-integration (Zapodeanu & Cociuba, 2010). Nowadays monetary policy can be a so-called interest rate policy. Policymakers also need concentration on money in the market but treat monetary policy with a change in interest rate. Central banks actively uses the management of short-term nominal interest rates to control economic activities and inflation while money (printing out banknotes) plays a tertiary role in monetary policy (Thornton, 2014). According to the evidence from Turkey during the period from December 2001 to April 2016, a change in Borsa Istanbul (BIST) overnight interest rates acts decisively on Turkish economic performance (Varlik & Berument, 2017). Higher credit interest rates in response to an increase in overnight interest rates negatively affect private consumption because households commonly get involved in the financial market to smooth their consumption and intend to save rather than to consume. Hhigh interest rates also create a disincentive to invest in production and reduce confidence in investment risk-taking, thereby cutting down the capacity utilization rate. The capacity utilization rate on aggregate output can be defined as the ratio of produced output to the potential output of the economy (Morrison, 1988). A fall in a capacity utilization rate indicates that actual output is less than potential output. As a result, weak demand leads to a decline in the price level. Western and non-western economies are operating the mechanism (i.e., elastic interest rates in market typically rely on a change in a base rate set by the central bank), thereby affecting the financial condition and decision making of each agent in the economy (Fernald et al., 2014).

2.1.2.2 Inflation

The vital goal of macroeconomic policies remains sustainable economic growth and moderate inflation. The price level can be defined as a significant factor in controlling economic growth. The monetary policy framed by the national bank of each country plays an essential role in the active combat against inflation. The effect of inflation on economic output has been thoroughly debated among policymakers and researchers. Economists and policymakers are concerned with economic downturns and upturns (the business cycle) in response to weighing actual output against potential output (i.e., the optimum amount of goods and services) of the economy. Jahan and Mahmud (2013) indicate that the output gap refers to a difference between actual productivity and the production capacity of the economy. An output gap indicates that the economy is operating under inefficient resources (i.e., overworking or underworking). Demand pressure in the market leads to a positive output gap, but weak demand results in a negative output gap. Policymakers frequently cite potential output as a level of output in association with flexible prices and as a measure of inflation. In this phenomenon, the output gap serves as a summary indicator for relative demand and supply components of the economy. As a result, the output gap gauges a level of inflationary pressure and produces a co-movement between the real economy, which provides goods and services, and inflation. In terms of ceteris paribus conditions, an increase in prices reacts to high demand in the market if the current output is above potential output over time. If a negative output gap exists, prices fall in response to weak demand. While GDP increases or decreases, the output gap can turn into negative and positive as well. Neither is ideal. According to the output gap theory, long-term growth is optimal if a price level is constant.

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Tobin (1965) suggested that inflation has a positive influence on economic growth. He also pointed out that higher inflation generates a higher rate of return on money and capital because transfer from money to financial assets brings down interest rates. Inflation provokes a higher ratio of the money stock and capital stock. As a result, the heightened economic activity in response to more money demand leads to the improvement of the growth rate of output. Shi (1999) also stated that there is a positive relationship between inflation and economic growth. The primary reason is that the increased growth rate of money expands trades due to the growing amounts of agents (i.e., buyers and sellers) in the market. The increasing number of buyers or sellers leads to the wide gap between the yield of money and capital and result from higher inflation, which offers inducements to agents to circulate money swiftly. Temple (2000) indicated that too-low inflation drives down economic growth. The principle reason imposed by Aiyagari (1990) and Cooley and Hansen (1991) is that the costs of bringing down zero inflation are higher than the benefits.

On the other hand, a high rate and volatility of inflation cause trouble in economic performance and the welfare cost of inflation (Baharumshah et al., 2016). There is a negative relationship between inflation and growth rate of output in OECD countries because a higher inflation rate reduces investment level and efficiency in the productivity level of inputs (Andres & Hernando, 1997; Cozier & Selody, 1992). Barro (1995) found that higher inflation worsens economic performance. His large sample consists of 100 countries with the period from 1960 to 1990, and other characteristics of these countries (i.e., fertility rate, the rule of law index, democracy index, education, and public expenditure on education) are identified as ceteris paribus.conditions. He also pointed out that if inflation increases 10 percent, the drop in real GDP per capita is 0.2–0.3 percent per year while the decline in investment as a share of GDP is 0.4–0.6 percent annually.

For instance, Saaed (2007) indicated that massive inflation drove down the economy of Kuwait. In one influential study, Saaed suggest that the Consumer Price Index (CPI) is seen as a good proxy for inflation. The statistical analysis of Saaed's work conducted in the period from 1985 to 2005 also suggested that a one percent increase in the CPI causes a drop in real GDP by approximately 0.015 percent. In another causality, a one percent rise in real GDP provokes a decrease in CPI nearly

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0.047 percent. This result provides valuable information to domestic policymakers and development partners. Higher inflation indirectly affects wages and salaries, but directly reduces purchasing power and raises living costs. Based on historical data in Latin American countries during the 1980s and 1990s, Bittencourt (2012) stated that inflation plays a crucial role in economic performance but contributes negatively to economic growth. The primary reason is that this region in the second half of the '90s lacked the independence of the central bank and credibility of the fiscal authority. Political transition and tendencies of populism were taking place in the '80s. Also, printing money helped to spiral upward public transfers, especially government spending. These were cause for a sudden burst of hyperinflation during the 1980s and early 1990s. Hyperinflation leads to progressive growth in income inequality between the rich and the poor. The poor commonly face more suffering from hyperinflation than the rich. Bittencourt's statistical analysis, which covers the period from 1970 to 2007 and relies on a panel data approach, also revealed that higher inflation significantly reduces economic growth in the Latin American region.

Baglan and Yoldas (2014), Fischer (1993), Gylfason and Herbertsson (2001), Kremer et al. (2013), López-Villavicencio and Mignon (2011), Omay and Kan (2010), Sarel (1996) and Vaona and Schiavo (2007) suggested that the linkage between inflation and economic growth is non-linear. The turning point of annual inflation rate ranges from 1 to 3 percent or from 11 to 12 percent for developed and developing countries, respectively (Khan et al., 2001). Similarly, López-Villavicencio and Mignon (2011) also found that there are different threshold values of the inflation rate between non-industrialized and industrialized countries. They identified threshold values of 2.7 percent for industrialized countries and 17.5 percent for non-industrialized countries. Several other studies support these findings. Eggoh and Khan (2014) concluded that the magnitude of the effect of inflation on economic growth varies from one country to another based on its own macroeconomic development. The threshold level of the inflation rate in developed countries is lower than the threshold value in less-developed countries (Ibarra & Trupkin, 2016).

Regional studies add further data. Seleteng et al. (2013) investigated the non-linear effect of inflation on economic growth in the Southern African Development Community (SADC) region for the period from 1980 to 2008. Panel Smooth Transition

Regression (PSTR) was used to tackle endogeneity and heterogeneity. They found that a non-linear relationship between inflation and economic performance exists, and the threshold level of the inflation rate is approximately 18.9 percent for the SADC region. A higher inflation rate leads to deteriorating economic performance if it is above the threshold value of inflation. Aydın et al. (2016) stated that inflationary environments cause difficulty in generating prospective saving, investment, production, and consumption decisions and thus uncertainty in maintaining economic growth. They also found that the connection between inflation and economic growth was non-linear for five Turkish Republics (i.e., Azerbaijan, Kazakhstan, Kyrgyzstan, Uzbekistan, and Turkmenistan). The threshold value of the inflation rate was 7.97 percent. An inflation rate which is lower than the threshold value leads to the positive impact of inflation on economic growth. Conversely, an inflation rate above the threshold level slows economic growth.

2.1.2.3 Exports

The influence of exports on the growth rate of output can be the export-led growth (ELG), and a new phenomenon may call scholars' attention to this relationship. Export growth is a critical instrument to stimulate economic performance in developing countries (Gabriele, 2006). Based on the Harrod-Domar growth model, Kindleberger (1961) states that an increase in export enhances the income level. In the case of full-employment economy, innovation development in the home country, which drives down production costs, and a rise in overseas demand lead to the augmentation of exports subject to the improvement of trade volume and more gains from the trade, thus encouraging savings, investment, and economic performances in the home country. Sunde (2017) found that export has a positive relation to economic growth in South Africa. The variation in comparative advantages across the country, the achievement of economies of scale, and lower costs of exporting firms based on foreign competition are the result of the exploitation of more efficient production accelerated by export activity. Gokmenoglu et al. (2015) examine whether the ELG hypothesis is valid for Costa Rica. using the annual data in the period from 1980 to 2013. Their outcome based on the Johansen co-integration test showed that long-run co-integration between exports and economic growth took place in Costa Rica. Also, the result of the Granger Causality test confirms the uni-direction from economic growth to export. That is, economic stability plays a crucial role in accelerating export growth in Costa Rica, but making policies to improve exports does not enhance economic growth in Costa Rica. Shafiullah et al. (2017) investigated ELG at the sectorial level in Australia and its regions (i.e., New South Wales, the Northern Territory, Queensland, South Australia, Tasmania, Victoria and Western Australia). The four export sectors categorized in their study are agriculture, mining and fuels, manufacturing, and other. ARDL bounds test and the Granger Causality test were run on quarterly data during the period from 1990:Q3 to 2013:Q2. They found that there is long-run co-integration between the four export sectors and economic growth at the national level and for some Australian regions (i.e., New South Wales, Queensland, and Western Australia). Other Australian regions (i.e., Northern Territory, South Australia, Tasmania, and Victoria) have no long-run co-integration between those export sectors and final demand. ELG for all four export sectors exists at the national level of Australia and New South Wales. ELG is valid for manufacturing export and mining and fuels export in Queensland, while mining and fuels and other exports foster economic growth in Western Australia.

2.1.2.4 Private Investment

Investment can be classified into three types: private domestic investment (private investment), state-owned units' investment (public investment), and foreign domestic investment (FDI) (H. Chen et al., 2017). Khan and Reinhart (1990) stated that private sectors undertake activities of private investment. An average growth rate of real GDP against an average ratio of private investment to total investment from countries (i.e., Argentina, Barbados, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Guatemala, Haiti, Honduras, Indonesia, Malaysia, Mexico, Panama, Paraguay, Singapore, South Korea, Sri Lanka, Thailand, Turkey, Trinidad and Tobago, and Venezuela) is put into scatter plot in the period from 1971 to 1979. Their scatter plot indicates that an average ratio of private investment to total investment has a positive impact on the growth rate of GDP. They found that a higher level of private investment significantly enhances economic growth. The contribution of private investment to the average growth rate of GDP is approximately 43 percent. A higher average ratio of the private investment to total investment leads to a higher average growth rate of GDP. Sensible policies designed to attract more private investment contribute positively to economic performance and living standards. Firms continue to invest in new machines and equipment for production, thereby facilitating technological progress through a learning-by-doing process (Arrow, 1962; Boucekkine et al., 1998). H. Chen et al. (2017) studied the effect of investment on technological change for 29 provinces in China and used the panel stochastic frontier model. Their result, based on annual data from 1989 to 2014, showed that a rise in private investment improved technological progress in China. Hong (2017) examined the causality between investment in Research and Development (R&D) of the Information and Communication Technology (ICT) industry and the growth rate of income in the Republic of Korea. The ICT R&D investment is split into two types (i.e., private and public ICT R&D investment). Annual data from 1998 to 2013 were applied for Granger-causality analysis. He found that bi-causality between total ICT R&D investment and economic growth takes place in the Republic of Korea. That is, the encouragement of total ICT R&D investment increases output growth. In the opposite causality to them, an increase in economic growth also spurs the total ICT R&D investment in the Republic of Korea. The result also pinpoints bi-directional causality between private and public ICT R&D investment. That is, the stimulation of private ICT R&D investment drives public ICT R&D investment, and public ICT R&D investment offers a positive inducement to private ICT R&D investment in the Republic of Korea. The private ICT R&D investment is a larger contributor to economic growth than the public ICT R&D investment.

2.1.2.5 Private Consumption

Private consumption can be identified as the value of the consumption goods and services that households acquire and consume. Household behavior plays a vital role in examining economic performance because consumption can serve the critical function of households in the economy (Verter & Osakwe, 2014). Varlamova and Larionova (2015) suggest that the level of household consumption determines the level of economic development in a country. They also investigate the effect of macroeconomic determinants (i.e., government consumption, household disposable income, import, inflation, interest rate, and taxation) on household consumption in OECD countries. The results, based on the period from 1970 to 2013, showed that government consumption, import, and taxation each have a negative impact on household expenditure. On the contrary, household spending reacts positively to the increase in household disposable

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income, inflation, or interest rate. A higher tax on goods and services reduces household consumption. The primary reason is that a tax rise pushes up the ultimate costs because households spend more money for a bought item. Higher short-term interest rates (i.e., an instrument of monetary policy) encourage household expenditure. Policymakers have to take this positive effect into account when making the public policies. More imports slow down household spending. It can be explained that more market competition boosted by foreign firms leads to a reduction in prices. As a result, some domestic firms can go bankrupt—that is, more laborers lose their jobs. Eventually, households cut down on their expenditures. A higher inflation rate promotes household spending because households increase their expenditures to acquire a similar basket of consumer goods, according to the nature of consumer behavior. Sun and Deng (2013) examined the influence of household consumption on national income growth in Hubei Province, China. A Johansen co-integration test and Granger causality test were run on annual data in the period from 1980 to 2010. They found that household consumption contributed positively to economic growth in Hubei Province.

2.1.2.6 Fiscal Policy

Fiscal policy can be defined as an effective strategy (adjusted government expenditure and/or taxation) to achieve and to monitor a wide-ranging stable path of economic growth across nations (Muinelo-Gallo & Roca-Sagalés, 2013). Differences in economic and political interests among social groups lead to variation in designing public policies across countries. Fiscal policy plays an essential role in encouraging economic activities via fiscal policy’s two instruments (i.e., taxation and government expenditure). This section only explains the effect of taxation on economic growth.

Aghion et al. (2015) point out that a higher level of taxation can hurt economic growth. The high taxation lowers incentives to both endogenous innovation development in entrepreneurial sectors and investment, thereby slowing down economic growth. According to this view, reduction of the tax burden improves innovation processes in entrepreneurial sectors, thereby increasing investments in the economy as well. To investigate the reaction of economic growth to distortionary taxation, the economic and institutional environment (i.e., public goods and services) should also be taken into account. Taxation is needed to provide public goods and services (i.e., education and schools, infrastructure, legal systems, and the like) because the tax revenues are used to finance those public goods and services. Entrepreneurs and innovators can benefit from public goods because the government funds high-quality public goods and services as a result of the high level of taxation, thus encouraging economic growth. The overall response of economic growth to distortionary taxation relies on weighing the level of disincentive from a high tax against the level of benefits from public goods and services. The effect of distortionary taxation on economic growth is likely to be non-linear and also shrinks in response to a higher tax rate. Aghion et al. use empirical data to find the connection between taxation and economic growth. A fixed-effect estimator was applied to estimate the reaction of economic growth to distortionary taxation in the USA during the period from 1983 to 2007. The result, based on panel data from 46 states, showed that the relationship between taxation and economic growth is an inverted-U shape. The optimal rate of taxation is approximately 42 percent.

2.2 Role of Government Expenditure

This section focuses on the role of government expenditure as the heart of this study. Government spending is a part of economic determinants. Government expenditure, especially for non-industrialized countries, plays a vital role in establishing channels for stimulating economic growth (Shonchoy, 2010), the development of a country (Iheanacho, 2016), and raising competitiveness and yielding positive benefits to the rest of economic activities (e.g., private consumption and investment) (Palei, 2015). Total government expenditure has main three components: government investment (i.e., expenditure on infrastructure including education, and research development, roads, and telecommunications produces long-run benefits), public consumption (i.e., spending relates to government agencies' operating costs such as purchases in consumer goods and service or salaries) and transfer payment (i.e., expenditure does not involve the transition of goods and services). However, the current study concentrates mainly on two types of government spending –public investment (government fixed capital formation) and public consumption (government final consumption expenditure) – because Cambodia's transfer payment data is not available.

The three instrumental roles of government expenditure can be defined as follows:

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2.2.1 Government Expenditure and Private Consumption

Scholars have debated the multiplier effect of fiscal policy (i.e., a change in output with some value of multiplication in response to an increase or a decline in government spending (Jahan et al., 2014)) over a lengthy period. Keynesian theory, under the assumption of rigid wages and prices, suggests that a significant fraction of the population is liquidity constrained (i.e., a positive change in personal income raises consumption rather than savings (Beznoska & Ochmann, 2012; Hayashi, 1982)) or short-sighted, having a high marginal propensity to consume (MPC)—that is, if they earn extra amount of disposable income, households expend those amount of money rather than save. In terms of initially underemployed economic resources, an increase in national income creates a second round of effects popularized as the Keynesian multiplier (i.e., the value of the multiplier effect of government spending on output is higher than one). The incremental income of workers also follows these rounds of effects, thus promoting consumption with an immense value of multiplication.

A broad range of recent empirical research suggests that private consumption goes up in response to the extension of government expenditure (Blanchard & Perotti, 2002; Ganelli & Tervala, 2009; Perotti, 2007; Ramey, 2011b). This notion appears consistent with some neo-Keynesian models. In line with the neoclassical model subject to imperfect competition and increasing return due to specialization and monopolistic competition, Devereux et al. (1996) investigated the contribution of a government expenditure shock to private consumption. There are two types of producers (i.e., final goods producers and intermediate goods producers) in the market subject to monopolistic competitions with free entry. The extension of government spending encourages firms to enter the market, thereby increasing the aggregate demand. In terms of a sector as a whole, the new entries (new firms) generate labor’s high productivity in response to a rise in employment because of an increase in the relative price of intermediate goods. The expansion of government spending enhances capital stock and output, thereby leading to an increasing number of hours worked in response to a rise in the capital. Under increasing return to specialization, a positive government spending shock generates an increase in both capital stock and output, which is more than a change in hours worked. As a result, we can conclude that the elasticity of hours with respect to government spending (i.e., a degree of returns to specialization) is less than one. The wage-hour locus is a curve, which implies the connection between wages and hours worked. The set of possible intersection points between labor supply and labor demand produces this curve. According to the wage-hour locus and its effect on the aggregate labor market, a sufficient degree of increasing return to specialization leads to a positive co-movement between wages and hours worked. Alternatively, an increase in capital over a positive change in hours worked must lead to the improvement of long-run real wages at any degree of increasing returns to specialization. Devereux et al., therefore, indicated that the extension of government spending raises the capital stock and aggregate productivity of the economy. Sufficient growth in real wages reacts to the improvement of aggregate productivity and generates the substitution of consumption for leisure. As a result, it is conclusive that the stimulation of government spending enhances private consumption.

Karras (1994) investigated the reaction of private consumption to an increase in government expenditure on goods and services across several countries. Annual data derived from International Financial Statistics of the IMF are unbalanced data of thirty counties from 1950 to 1987. Hall’s random walk model (i.e., maximum consumption following a random walk) was applied to estimate the linkage between government spending and private consumption in the individual countries. His research indicated that government expenditure and private consumption complement each other because a rise in government expenditure generates a higher marginal utility of private consumption. A higher value of government expenditure creates a lower degree of complementarity. The specific tests in his study also imply that there is robustness of this complementarity. It is more common for expansionary public policy to crowd in rather than to crowd out private consumption.

Bouakez and Rebei (2007) examine the elasticity of substitution between government spending and private consumption as Edgeworth complements and employ the Real Business Cycle (RBC) model subject to preferences (i.e., private consumption, public spending, and households with habit formation). Habit formation can be defined as a notion of households’ past consumption, which influences household utility generated by present consumption (Alessie & Teppa, 2010; Iwamoto, 2011). Under Edgeworth complements, a positive government spending shock improves the marginal utility of consumption, thereby enhancing motivation for households to increase hours worked. More hours worked of households, therefore, reduces the negative wealth effect. The wealth effect can be identified as more or less wealth (i.e., more encouragement or discouragement to households to consume) due to a change in the price level, interest rate, or disposable income. Consumption at equilibrium increases in response to a sufficiently strong complementarity effect. Under habit formation, the model produces an incessantly non-monotonic reaction of consumption, which is similar to consumption response in the VAR model. Maximum-likelihood (ML) was run on USA data. Bouakez and Rebei found that private consumption is strongly complementary to government spending, so private consumption increases in response to the stimulation of government spending.

Murphy (2015) designed a neoclassical model subject to key assumptions (i.e., the rigidity of real wage and price and imperfect information). The results revealed that healthy private consumption reacts to a positive government spending shock due to the perception of the improvement of permanent income levels. Based on basic conception, a subset of firms is financed through government spending and charged tax liabilities. Firm owners' expectation about an increase in permanent income significantly grows in response to expansionary government expenditure on each firm if the owners perceive that a fraction of the government spending on their firms is larger than per capita aggregate government spending. The firms' shareholders gain a higher income from the government expenditure relative to tax liabilities. If workers have imperfect information about future value of tax liabilities and a signed contract between government and firms, their desirable consumption stays constant at the given price.

Galí et al. (2007) recall the New Keynesian model, which assumes sticky prices and wages set by a union. Households intend to meet the firms' labor demand at the wage rate determined by a union. This model takes away the assumption about optimizing households. Households (non-Ricardian households), therefore, consume their current disposable income in each period. Non-Ricardian households can be defined as households who make their consumption based on current income but do not take a loan from the financial market to smooth their consumption (Céspedes et al., 2012; Coenen & Straub, 2005; Marto, 2014). In terms of price stickiness, expansionary government spending spurs aggregate demand, thereby increasing firms' labor demand. Wage rises in response to an increase in firms' labor demand under the monopolistic feature of the labor market. In terms of a sufficiently large fraction of non-Ricardian consumers, the model creates a positive reaction of private consumption (i.e., crowding-in effect) to a positive government spending shock.

Ambler et al. (2017) examined the dynamic co-movement between government spending and private consumption with a standard RBC model based on the assumption of optimizing agents (i.e., private agents and the government). An interim government optimizes the wealth of the representative private agents (i.e., firms and households) under the expansionary public spending. The optimal level of public spending relies on the dynamic inconsistency problem. The policy of government consumption and public investment has been announced without precommitment. Dynamic programming methods are applied to estimate time-consistent policies. The current economy determines the interaction between government and private agents. Markov-perfect equilibrium examines the macroeconomic equilibrium in the model. The taxes on labor and capital income are used to finance a part of government spending. Distortionary taxes and discrete lump-sum taxes balance a budget in the long run and the short run, respectively, thereby not achieving the first-best optimum. The result of vector autoregressions (VARs), which run on artificial data, shows that crowding in private consumption and real wages responds to the simulation of government spending. This impulse response function of this performed VAR highlights quantitatively and qualitatively, similarly to studies in the empirical literature.

Cooley and Dwyer (1998) apply a structural vector autoregression (SVARs) approach for the Business Cycle. This approach has two types of restrictions (i.e., atheoretical and theoretical). Atheoretical restriction refers to restrictions on structural shocks (i.e., monetary stocks and supply and demand shocks). Theoretical restriction can be identified as theories explaining those shocks. A temporary government spending shock was run with the approach mentioned above. Households' utility function depends on consumption and leisure affected by a temporary government spending shock. The production function of firms is under the condition of constant return to scale with a government spending shock. They also suggested that the real wage rises in response to a positive government spending shock. Their results are consistent with the findings of Blanchard and Quah (1989) under a different approach

(Blanchard and Quah's approach is based on the relative significance of demand and supply shocks).

On the contrary, other theories and empirical research deliver the opposite result. The new-Keynesian theory has four key assumptions. (1) Nominal wage is sticky in the short run because it slowly increases or decreases in response to a shortage in labor or a high level of unemployment, respectively. Another reason is that a significant fraction of workers have a labor contract. (2) Under monopolistic competition, private agents set a price to optimize their profits, which leads to the stickiness of the nominal prices. Some firms can be restricted in adjusting the sale prices in the current time. The adjustment of sale prices can increase the costs of some firms because there are two kinds of producers (i.e., final goods and intermediate goods producers) in the market. An increase in the price of intermediate goods harms the costs of production for final goods due to intermediate products as the input of firms that produce final products. (3) Firms and households hold rational expectations to maximize profits and utility, respectively. The present behavior influences the future environment. Households are typically involved in the credit market in order not to disrupt future consumption. (4) There is a nominal interest rate shock of monetary policy in the short run. If the model takes into account the households' feature of involvement in the credit market to smooth future consumption, expansionary government spending spurs aggregate demand and the consumption multiplier (i.e., a response of private consumption to the improvement of aggregate demand). In terms of this phenomenon, an elastic interest rate in credit market affects investment incentives. One question is raised about how many magnitudes of government spending that can drive out investment. Households take a loan to make their expenditures, thus enhancing the consumption multiplier. However, the consumption multiplier diminishes in response to a higher level of the interest rate.

Bailey (1971) highlighted a notable signal that a degree of substitutability between private consumption and government expenditure probably takes place. The extension of government expenditure crowds out private consumption. Aschauer (1985) investigated the reaction of private consumption to a positive government spending shock, based on the permanent-income approach. The quarterly data for the USA are collected during the period from 1948:Q1 to 1981:Q4. The result shows that private consumption on nondurables and services declines by 23-42 percent in response to the expansion of government spending. Notably, his finding is entirely consistent with the research conducted by Kormendi (1983). Ahmed (1986) examined the influence of the United Kingdom's (UK) government spending on household expenditures in an intertemporal substitution model during the period from 1908 to 1980. He found that private consumption is crowded out by rising government spending.

Amano and Wirjanto (1997) employed a two-good permanent-income model and relative price approach to estimate the effect of government spending on private consumption in the USA. The quarterly data from 1953Q1 to 1994Q4 are derived from Data Resources Inc. They found that the intratemporal substitution between government expenditure and private consumption is approximately 0.9. That is, the boost in government spending cuts down private consumption. Chiu (2001) investigated a dynamic co-movement between public and private consumption in Taiwan and used the same approach as Amano and Wirjanto (1997). He indicated that the intratemporal substitution between public and private consumption is approximately 1.1. It is conclusive that the improvement of public consumption crowds out private consumption.

Ho (2001) examined the impact of government spending on private consumption in 24 OECD countries and employed the panel Dynamic Ordinary Least Square (DOLS) model. The data from 1981 to 1997 are taken from AREMOS/OECD. He found that the crowding-out effect (i.e., a reduction in investment and consumption or the elimination of private sector’s spending reacts to the improvement of public spending) of government expenditure on private consumption exists. In the case of perfect knowledge and rational expectation, households reduce their spending in response to expansionary government spending because they anticipate that the government will raise the present value of taxes to finance its expenditure and intends to balance its budget. The real disposable income taken into account in the analysis leads to a significant degree of substitutability between government spending and private consumption. That is, real disposable income plays a crucial role in the specification of a regression model. RBC and new-Keynesian models cannot predict the positive effect of public spending on private consumption while the higher taxes, which are proposed to finance the higher government spending, cause a decline in private wealth and consumption (Ganelli and Tervala, 2009).

Some studies suppose that the impact of government expenditure on private consumption is non-linear. Giavazzi and Pagano (1990) highlight that Keynesian influence exists in typical times, but the non-Keynesian effect occurs in response to a high level of debt. Amano and Wirjanto (1998) follow a two-good permanent-income model to examine the impact of government expenditure on private consumption. The outcome based on the USA data and the generalized method of moments (GMM) showed that government spending and private consumption can act as complements, substitution, or show no relation—that is, there is a non-linear effect on private consumption on government spending. Alesina and Ardagna (1998)'s outcome, anchored in a probit model run on panel data of OECD countries, showed that the effect of fiscal policy on private consumption is non-linear. The two main factors (magnitude and structure of fiscal adjustment) cause the occurrence of this non-linearity.

Höppner and Wesche (2000) examined the non-linearity between government expenditure and private consumption in Germany for quarterly data during the period from 1970:Q1 to 1998:Q4. The consumption function of their study includes four independent variables (i.e., government spending, tax revenues, personal disposable income, and a lagged error correction term). The first two explanatory variables are allowed to rely on the regimes. Their result, based on the Markov-switching model, revealed that the lagged error correction term has a negative relation with private consumption. An increase in personal disposable income encourages household spending. There is a non-linear impact of government spending and tax revenue on private consumption. The non-Keynesian effect occurred during the periods 1973-1974, 1982-1983, and 1991-1992. Also, the likelihood of a non-Keynesian impact is increased in response to a soaring budget deficit.

Aarle and Garretsen (2003) studied the non-linear impact of government spending on private consumption in 14 European Union (EU) countries during the period from 1970 to 2000. The consumption function of their study relies on explanatory variables (i.e., government expenditure, direct taxes, national income, transfers, and fiscal regime indicator as dummy variables). The result, based on a panel data approach, indicated that the non-linear effect of fiscal adjustment on private consumption occurs due to the magnitude of fiscal change and the initial fiscal status. For example, high initial government spending negatively impacts household (agent) expectations because households anticipate that the government will raise future taxes to finance its expenditure. As a result, households save their money to make expenditures in the future.

Wang and Gao (2011) investigated the non-linear influence of government spending (i.e., government investment and consumption) on private consumption. The regression model takes into account five explanatory variables (i.e., disposable income, income distribution, tax revenues, government purchases, and public investment). There are only three independent variables (public investment, consumption, and tax revenues), which depend on the switching states (regimes). The data analysis of China's annual data from 1978 to 2008 is based on the Markov-switching model. They found that either high income inequality or a drop in disposable income led to lower private consumption. The tax revenues have a non-linear effect on private consumption. The impact of government investment on private consumption is linear and positive, but not symmetrical. Government purchases non-linearly influence private consumption. The periods of the occurrence of the non-Keynesian effect are 1978-1980 and 1984-1997. This non-linear impact of the fiscal policy in China is not associated with the initial fiscal status or the magnitude of fiscal consolidation, rather it is in connection with the country's own characteristics of commodity and labor markets.

2.2.2 Government Expenditure and Economic Growth

Outstanding scholars have discussed the particular role of public spending in economic growth. The Keynesian theory with a specific assumption of sticky wages and prices always explains a positive co-movement between employment and the aggregate demand. By allowing some unemployed economic resources at the beginning, expansionary government spending creates more incentive to invest, thereby increasing employment. A high level of income encourages household consumption if subject to individuals' thought is liquidity constrained (i.e., a positive change in personal income raises consumption rather than saving (Beznoska & Ochmann, 2012; Hayashi, 1982)) or short sight. Even though government expenditure is over government revenues, the extension of government spending enhances not only private consumption but also national income. Also, there is a positive reaction of capital accumulation and savings to this improvement of government expenditure. An aggregate demand reacts swiftly and sharply to a temporary cut in taxes. The government intervention in economic activities, therefore, should be made to achieve full employment and to promote an aggregate demand. In the case of an insufficient amount of money, the government should take out a loan to finance spending. Expansionary public spending leads to the stimulus to economic growth (Bose et al., 2007; Das & Ghose, 2013; Gould, 1983; Kormendi & Meguire, 1986; Lee & Lin, 1994; Ram, 1986).

On the other hand, other theories and research draw the opposite conclusion. The Ricardian doctrine indicates that the government uses two channels (lump-sum taxes or accumulation of debt) to increase the budget for financing public spending. This doctrine has confidence that consumers do not distinguish between (1) paying lower taxes and investing in a higher amount of bonds in portfolios and (2) paying higher taxes and purchasing a smaller amount of government bonds. The higher taxes in the future to pay back the outstanding bonds at the maturity date react to rising emission levels of government bonds today. For instance, taxes can be cut when the government faces a budget deficit. This phenomenon generates a short-run effect on consumption in response to an increase in permanent income. The announcement about a reduction in taxes is made immediately, and consumers anticipate this occasional reduction. On the contrary, this phenomenon creates long-run harm based on Ricardian Equivalence—that is, rational consumers notice that a widening short-run deficit causes a tax increase in the future. The consumers raise their savings to make a sufficient reserve and maintain a constant level of private consumption, even though disposable income grows in the short run. As a result, fiscal policy does not influence the aggregate consumption.

Neo-classical theory prioritizes a balanced budget in hypotheses policy and assumes fully used economic resources at general equilibrium. Neo-classical economists foresee that individuals only design their consumption plans with finite time (i.e., personal life cycle). The budget deficit extends the total life consumption due to a transfer of taxes to the next generation. In terms of completely used economic resources, the enhancement of private consumption leads to a decline in savings, raising the interest rates to balance the capital market. Unrelenting deficit drives out private capital accumulation and also the economy.

Hall (2009) applied the neoclassical model to investigate a temporary change in government purchases on output without an effect of externalities, a distortion of taxes, and unemployment. He also assumes that the government purchases do not influence households' marginal rate of substitution between current and future consumption and between consumption and work. This analysis is based on wealth analysis in the labor market to examine the effect of government purchases. He suggests that the massive extension of government purchases does not improve the significant growth of output. By relying on purely neoclassical general-equilibrium with full employment, productivity reacts positively to an increase in employment. If a reservoir of unemployed workers does not exist to keep the wage unchanged, a decline in wages responds to an increase in labor inputs, thereby reducing labor supply. The neoclassical model reasonably foresees much lower output growth and a sharp decrease in consumption. With Hall (2009) assessment, two features (a markup price over cost and elasticity of wages with respect to labor supply) determine a degree of the negative impact of large government purchases on economic growth.

Armey (2009) argues that public spending exceeds government revenues, thus harming economic activities rather than helping them. The primary reason is that the generated amount of money in the economy is smaller than the sum of money taken out. This situation destroys jobs, shrinks the rate of output growth, and stunts development. The expansion of government spending drives out economic growth (Dar & AmirKhalkhali, 2002; Engen, & Skinner, 1992; Fölster & Henrekson, 2001; Landau, 1983). The effect of government expenditure on economic growth eventually diminishes while government increases its spending progressively. High government spending creates less incentive for private investment owing to the inefficient allocation of resources. The government raises current taxes to finance its expenditure. Bureaucracy and centralization stifle creativity in private and public sectors (Hajamini & Falahi, 2018). Consequently, these factors lead to reducing the scope for creativity, creating more inefficiency, and thus slowing down economic growth.

Government intervention can produce either a positive or negative effect on economic growth. The direction of the response of economic growth to expansionary government spending typically relies on several factors (e.g., magnitude and types of expenditures). The diminishing rate of economic growth reacts to a progressive increase

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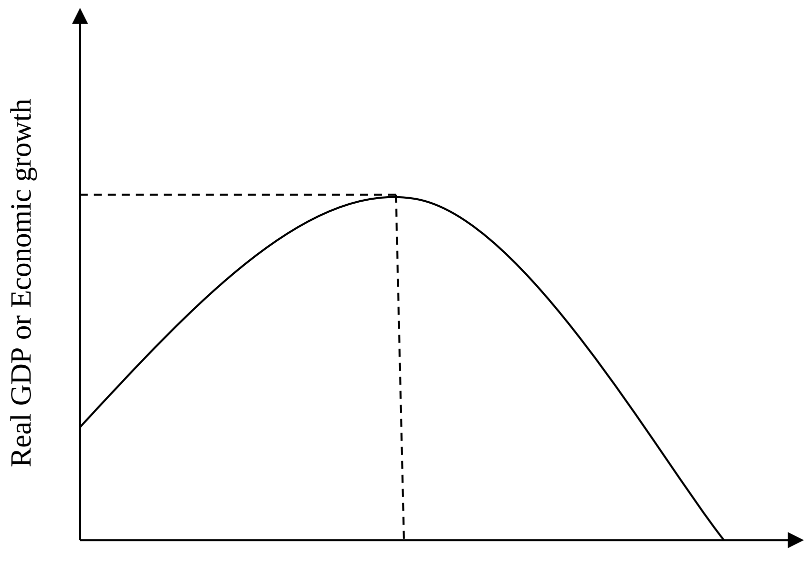
in the value of government spending, thereby generating the non-linear relationship between the magnitude of government expenditure and economic growth.

Armey (1995) employs a curve (similar to the Kuznets curve and Laffer curve) to investigate an effect of public spending as a share of GDP on economic performance and names his curve the Armey curve (seen in Figure 2.1). The Armey curve indicates the notion of the optimal magnitude of government spending (i.e., an inverted-U-shaped connection between government expenditure and output growth). If there is no government intervention, no property rights, and no rule of law to protect individuals in a society, a low level of produced output responds to a disincentive to invest and save. In the case of a small government, an increase in government spending has a tremendous positive impact on output growth. A slight increase in government spending or collective action creates a big investment incentive due to a degree of protection for private property and a reduction in trading cost in response to the improvement of infrastructure and a reliable medium of exchange. The growth-enhancing feature of public spending shrinks as the government gets larger and larger. Economic growth reaches its peak level when the marginal benefits of government spending are zero. Further government spending harms output growth because the government raises taxes to finance the expenditure or borrows money by issuing government bonds with high-interest rates. The unbalanced budget also becomes increasingly risky for productivity growth.



Government spending as a share of

Figure 2.1: Government spending and output of economy (Armey curve)

Barro (1990) introduces government expenditure into his endogenous growth model, blending the Ramsey model and the AK growth model and based on a fundamental assumption of constant return to scale for the production function. A flow of outputs (e.g., services of the highways, sewers and so forth) can be purchased from the private sector, and the government delivers them to households and producers free of charge and with no congestion effects. The capital of Barro's model blends physical capital with human capital improved by an increase in investment in education. In the case of a small government, an expansion of government expenditure boosts the marginal product of the private sectors' capital, thereby spurring the rate of output growth. The extension of government expenditure for large government (i.e., big involvement in the expansionary fiscal policy) causes a cut in productivity growth because the government increases the tax rate to finance the spending. The optimum level of government spending as a share of GDP is when the marginal product of capital is equal to one (i.e., the natural condition for productive efficiency). If the government can maintain a balanced budget, government expenditure generates sustainable growth at the same rate.

Mourmouras and Lee (1999) blend the households' utility function of Blanchard (1985) and the production function of Barro (1990) subject to finite horizons of consumers and examine the reaction of economic growth to government expenditure on infrastructure. Their result agrees with the notion of Barro (1990), but the optimal magnitude of government expenditure on infrastructure creates a low rate of economic growth in comparison with Barro's infinite horizons.

Vedder and Gallaway (1998) examine the response of economic growth to the expansion of government expenditure in the USA. The Ordinary Least Squares (OLS) estimator was run on annual data from 1947 to 1997. Time trend is taken into account because an expansion of human and physical resources probably increases the real GDP. The years 1947, 1948, up to 1997 have values 1, 2, up to 51 in the time trend. They also introduce the unemployment rate into the regression because a high unemployment rate cuts down on economic growth. Real GDP and government spending as a share of GDP are appointed as proxies for economic growth and government expenditure, respectively. They found that the reaction of economic growth to the stimulation of government spending is an inverted-U shape. The optimal value of government expenditure as a share of GDP is approximately 17.5 percent. The stimulus of government spending over optimum value drives down economic growth. The improvement of human and physical resources encourages output growth, but a high unemployment rate slows down economic performance.

Chobanov and Mladenova (2009) follow the Scully model to examine an inverted-U shaped connection between total government expenditure as a share of GDP and output growth in 28 OECD countries. The panel generalized least squares (EGLS) method was run on annual data from 1970 to 2007. They showed that the optimal value of total government spending equals approximately 25 percent of GDP. Altunc and Aydın (2013) follow the Armey curve to investigate the reaction of output growth to total government expenditure. Annual data from 1995 to 2011 were collected from Bulgaria, Romania, and Turkey. A rise in physical and human capital occurs over this period, thereby introducing time trends into their analysis. In terms of time trend, 1995, 1996, up to 2011 are given the values 1, 2, up to 17, respectively. They expect that a fall in GDP responds to a high level of unemployment. Their regression also takes into account the unemployment rate. The autoregressive distributed lags (ARDL) method was used to estimate the dynamics for individual countries. They found that the inverted-U shaped linkage between total government spending and economic growth exists for all of the nations investigated. The optimum level of total government spending equals 22.5, 20.4, and 25.2 percent for Bulgaria, Romania, and Turkey, respectively. A decline in output growth, therefore, is the result of an over-expansion of total government spending. A drop in economic growth responds to a high level of unemployment for Bulgaria and Turkey, but unemployment for Romania is insignificant at 5 percent. Productivity increases in response to a rise in physical and human capital for all of the countries.

Hok et al. (2014) examined the optimum size of total government expenditure of eight countries (i.e., Brunei, Cambodia, Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam) in Southeast Asia. Annual data from 1995 to 2011 were derived from ADB, IMF WEO 2013, and World Bank databases. The regression of economic growth takes into account total government expenditure, labor force, capital, and export. Pooled mean group (PMG) and mean group (MG) were applied to the panel data from eight countries. Results indicated that the inverted-U shaped relationship between total government expenditure and output growth exists, with the optimal value of total government expenditure being approximately 28.5 percent. Over the optimal level of total government expenditure, the stimulation of government expenditure drives out economic performance. An increase in the labor force, capital, or exports improves the productivity of the economy.

Other scholars test this relationship with different types of total government spending (i.e., government consumption and public investment). The total government expenditure can be split into three components (e.g., public investment, government consumption, and exogenous components of government spending), and the exogenous components of government spending, preferences, and technology influence public investment and government consumption (Ambler et al., 2017). Chen and Lee (2005) investigated the non-linear relation between government spending and output growth in Taiwan. Annual data from 1980 to 2002 were analyzed with a bootstrapping model. In their regression, real GDP growth depends on labor force growth, private sector gross fixed capital formation as a share of GDP, real government expenditure as a share of GDP, and the multiplication of real government spending growth and real government spending as a share of GDP. Three types of government expenditure (i.e., total government spending, public investment, and government consumption) are used in their analysis. They found that all types of government spending have an inverted-U shaped relation with output growth. The optimal value of total government spending, public investment, and government consumption is 22.8 percent, 7.3 percent, and 15 percent, respectively. Over the optimal value, the extension of government spending cuts down on output growth. A rise in labor force growth and private investment stimulates productivity growth of the Taiwanese economy. The multiplication or real government expenditure growth and real government expenditure as a share of GDP negatively affects economic growth.

Asimakopoulos and Karavias (2016) investigated the optimal value of government final consumption expenditure for 129 countries (43 industrialized countries and 86 non-industrialized countries). The regression of growth rate also takes into account a lag of growth rate, gross capital formation (investment) as a share of GDP, inflation, openness to trade, and population growth. Annual data from 1980 to 2009 were obtained from World Development Indicators (WDI). A panel generalized method of movement approach was employed to study three groups of data (full samples, industrialized countries, and non-industrialized countries). They found that the inverted-U shaped relationship between government consumption and output growth exists. The optimal level of government consumption equals 18.04, 17.92, and 19.12 percent for the full sample, industrialized countries, and non-industrialized countries, respectively. The results are robust, even though the whole sample was split into two groups (industrialized countries and non-industrialized countries). Once government consumption reaches the optimum level, economic growth rate drops in response to the expansion of government consumption. The time lag in growth rate, inflation, and population growth for all groups of samples is insignificant at 5 percent. The increase in capital formation as a share of GDP encourages economic performance in full samples and industrialized countries, but is insignificant in non-industrialized countries at 5 percent. Openness to trade is insignificant in the entire sample and developed countries, but economic growth reacts positively to the improvement of the trade openness in developing counties.

Hajamini and Falahi (2018) examined the non-linear connection between government expenditure and output growth in 14 industrialized European countries (Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom). Annual data from 1995 to 2014 were taken from AMECO data set. Their analysis uses three types of government expenditure: current expenditure other than final consumption as a share of GDP (OCE), final consumption expenditure as a share of GDP (FCE), and government fixed capital formation as a share of GDP (GFCF). The regression of economic growth rate also takes into account the exports as a share of GDP, the growth rate of the labor force, the imports as a share of GDP, and private investment as a share of GDP. A panel threshold approach was applied to panel data analysis of 14 developed European countries. They found that an inverted-U shaped relation exists in the case of FCE (government consumption) and GFCF (public investment) with the optimal value being 16.63 and 2.31 percent, respectively. An increase in OCE slows down the economic growth rate due to the misallocation of the government's resources, thereby generating unproductive OCE. A rise in labor growth rate or exports as a share of GDP spurs output growth. Imports as a share of GDP or private investment as a share of GDP has an unclear impact on economic performance because some results are positive, negative, or insignificant at 5 percent.

2.2.3 Government Expenditure and Competitiveness

Competitiveness can be identified as the set of institutions (e.g., private and public institutions), policies (e.g., fiscal and monetary policy), and other economic factors (e.g., export and infrastructure) influencing the productivity in a country (Cann, 2016). A country's competitiveness is a basis for enhancing the level of well-being. The competitiveness of the economy is credited with its productivity. The elevation of productivity level reflects economic growth, which boosts the income level and therefore the level of well-being. Traditionally, one aspect of competitiveness is considered to be domestic producers' capacity relative to foreign producers in the term of substitution goods and services. Fluctuation in the nominal exchange rate of the home country and its trading partners leads to changes in trade competitiveness. The real exchange rate has been used as a measure for international competitiveness in a few studies (e.g., Makin and Ratnasiri (2015); Nagayasu (2017)).

Many economic indicators affect the competitiveness of the economy. Most countries in the world are open economies. Globalization (i.e., the interdependence between countries or the openness of the economy to the world market) leads to the integration of national economies through culture, information technology, investment, and international trade. In a globalized economy, the extension of market size through international trade can be a potential indicator of trade competitiveness. The expansion of the market for produced goods and services encourages the trade competitiveness of a country. That is, lower prices on those goods and services and a higher level of aggregate productivity react to a larger market size due to higher elasticity of demand in the market. Remarkably, the market size is a critical pillar for determining global competitiveness, according to the Global Competitiveness Report 2017-2018 (Schwab, 2017). With ceteris paribus, a change in foreign market size depends on a price level in foreign currency. If the foreign prices (prices in trading partners' currency) of goods and services produced in the home country are low relative to trading partners, the foreign market for these goods and services increases. The domestic price of products can represent the lowest cost of production at that place because producers can use

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economies of scale (i.e., a reduction in cost per unit as a response to an increase in the total output of production) to implement a low-price strategy in a competitive market (Samuelson, 1984). The domestic price measured in home currency can be expressed in a foreign currency with the help of the nominal exchange rate used to compute the real exchange rate in order to compare price levels between countries. An elastic real exchange rate creates an elastic market size and thus trade competitiveness because a change in the real exchange rate can change the prices in foreign markets relative to those of the trading partners. The real exchange rate, therefore, can also be an alternative measurement of trade competitiveness. The clear connection between prices and cost competitiveness is measured with the help of the real exchange rate (Lipschitz & McDonald, 1992). An improvement in the cost competitiveness of international airlines is the result of the depreciation of the real exchange rate in the home country (Forsyth & Dwyer, 2010). Makin and Ratnasiri (2015) and Nagayasu (2017) use the real exchange rate to measure the trade competitiveness of a country. An appreciation of the real exchange rate weakens the trade competitiveness of the economy while the devaluation of the real exchange boosts it. For example, the global competitiveness of companies from the USA improved in response to the devaluation of the US dollar between 2002 and 2008, thereby opening up education (skill development), employment, and investment opportunities (Baily & Slaughter, 2008).

Many economic indicators contribute to the competitiveness of the economy. From a macroeconomic aspect, a wide range of factors (i.e., changes in the wage level, monetary and fiscal policy intervention made by the home country or by foreign countries) influence competitiveness. Most research investigated the reaction of the real exchange rate to interest parity, interest rates, monetary policy, price level, and purchasing power rather than to fiscal variables. Paradigmatic studies conducted by Dornbusch (1975) and Monacelli and Perotti (2010) concern the influence of fiscal policy on international trade in the field of international macroeconomics and also suggest the existence of a linkage between government spending and the real exchange rate.

Obstfeld and Rogoff (1995) develop the Redux model (two-country model) based on macroeconomic dynamics of supply framework with some assumptions (e.g., monopolistic competition and price stickiness). Nominal producer prices in the short run are set in advance. Under rigid prices, output equals aggregate demand for the economy. Under monopolistic competition, producer prices are higher than the marginal cost, thus producing profits for producers. With the preset price in the home currency of the producers, the producers' output price in terms of the foreign currency fluctuates in response to a change in the exchange rate. The stimulation of home government spending generates a decline in domestic consumption relative to foreign consumption, since residents in the home country have to pay taxes used to finance government spending. The relative demand for money in the home country has higher fluctuation than the relative consumption, thus leading to the depreciation of the real exchange rate and thus the improvement of trade competitiveness.

Di Giorgio et al. (2018) developed a two-country model subject to non-Ricardian households and productive government purchases. Non-Ricardian households can be identified as households consuming based on current income and not taking out a loan to smooth their consumption (Céspedes et al., 2012; Coenen & Straub, 2005; Marto, 2014). In the case of productive government purchases, a rise in government spending causes a positive externality on the productivity of the private sector. The stimulation of government spending improves labor productivity in the private sector and influences marginal costs and inflation through demand-side and supply-side channels. In the demand-side channel, higher aggregate demand leads to inflationary pressure. In the supply-side channel, domestic inflation and marginal costs decline in response to higher productivity in the private sector. The non-Ricardian structure of this model leads to expansionary public policy with an unbalanced budget in each period. Households, therefore, arrange their savings to buy a government bond, thereby not disturbing their future consumption. With non-Ricardian households, the demand-side channel is relatively weak compared to the supply-side channel because the change in household consumption generates only a small change in aggregate demand. The final result, therefore, is a fall in domestic inflation. A decline in domestic inflation provokes a decrease in the local interest rates due to the monetary policy response, thereby depreciating the real exchange rate and enhancing trade competitiveness.

Bouakez and Eyquem (2015) investigated the response of real exchange rate to expansionary government spending for Australia, Canada, Sweden, and the United Kingdom and used a small-open-economy model with three assumptions (incomplete and imperfect international financial markets, price stickiness, and a not-too-aggressive monetary policy to fight inflation). Quarterly data from 1975Q1 to 2013Q4 are derived from Economic Outlook No.94 and the OECD Main Economic Indicators. Panel SVARs was employed to estimate this relation. They indicated that expansionary public spending depreciates the real exchange rate, which intensifies international competitiveness.

Makin and Ratnasiri (2015) studied the reaction of competitiveness to the extension of government spending in Australia. Two types of goods (tradable and non-tradable goods) are supposed in the Australian economy. The real exchange rate (i.e., the ratio of domestic currency price of non-traded to traded goods) is used to measure international competitiveness. Traded goods and services can be defined as goods and services consumed in the local economy and sold internationally (Johnson & Knight, 1996). On the other hand, non-traded goods and services (e.g., electricity supply, water supply and so forth) refer to goods and services produced only for consumption in domestic economy and without making international trade (e.g., export and import) (Baxter et al., 1998; Daschs & Larrain, 1993; Jenkins et al., 2011). Tradable sectors in Australia include higher education, manufacturing, and tourism. Their regression also takes into account the aggregate private expenditures (sum of private consumption and private investment). Vector Auto Regression (VAR) was used to run on quarterly data from 1998Q3 to 2013Q3. Notably, Australia’s exchange rate is written as a foreign currency against the home currency, thereby losing international competitiveness in response to a higher real exchange rate index. They found that the expansionary government expenditure (i.e., public investment or consumption) on non-tradable goods leads to lower productivity growth in the tradable than the non-tradable goods sector. A decrease in opportunity cost of production resources (e.g., labor and capital) in non-tradable goods sector generates a reduction in the relative price of tradable goods. Therefore, the expansion of government spending on the non-tradable goods sector appreciates the real exchange rate and thus weakens international competitiveness.

Kim (2015) investigated a reaction of real exchange rate and trade balance to the stimulation of government consumption for 18 developed counties (e.g., Australia, Belgium, Canada, Denmark, Finland, France, Germany, Iceland, Ireland, Italy, Netherlands, Norway, Portugal, Slovenia, Spain, Sweden, United Kingdom and the

United States of America). Each group of samples, which is set up according to four country characteristics (e.g., country size, exchange-rate flexibility, international capital mobility, and trade openness), contains 9 countries. Each feature generates two groups of countries (i.e., high and low level of that characteristic). Quarterly data are obtained from International Financial Statistics, OECD Economic Outlook, OECD Main Economic Indicators, OECD Quarterly National Account, National Bank of Belgium, Statistics Netherlands (CBS), Statistics Finland, and Statistics Sweden. The panel VAR model was employed to run on unbalanced panel data. He found that the stimulus to government spending leads to the depreciation of the real exchange rate, thereby boosting international competitiveness. The expansionary public policy variably influences trade balance across several groups of samples. Countries with lower international capital mobility or more exchange-rate flexibility produce quicker depreciation of real exchange rate and a more significant increase in the trade balance in response to the extension of government consumption. The positive effect of government consumption on the trade balance is more significant in countries with high trade openness.

Fleming (1962) and Mundell (1963) analyze the efficiency of monetary and fiscal policy in an open economy for competitiveness. Under a flexible exchange rate system, an expansion of monetary policy improves not only competitiveness but also the trade balance. The stimulation of fiscal policy (government spending) financed by government borrowing appreciates the real exchange rate and negatively affects the trade balance due to an increase in interest rates, thereby hurting trade competitiveness.

Mankiw (2012) discusses the notion of twin deficit. National savings decline just as government spending goes up, thus raising the real interest rates. Higher real interest rates generate more capital in the domestic capital market and therefore cause a fall in the net capital outflow. The appreciation of the real exchange rate (loss of international competitiveness) occurs in response to a decline in net capital outflow, which also has a negative effect on the trade account balance.

Chen and Liu (2018) employed a small open economy model to examine the reaction of the real exchange rate in China to expansionary government spending. Data sources are the Bank for International Settlement and CEIC database. A structural VAR

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approach is employed on quarterly data from 1995:Q1 to 2015:Q2. They found that a rise in public investment or consumption appreciates the real exchange rate, thereby deteriorating the international competitiveness and trade balance and leading to the government's twin deficit.

2.3 Conceptual Framework and Assessment

Each variable mentioned above plays a vital role in the explanation for economic growth, but Keynesian theory points out that government spending significantly contributes to economic growth and generates positive benefits for other economic factors (i.e., consumption, investment, and so forth). This study primarily concentrates on the effect of government spending on the vital economic components, especially private consumption, economic growth, and competitiveness.

Basing on the review above, we see that two well-known theories (Keynesian and neo-classical theory) debate the influence of government spending on economic growth. From my perspective, the Keynesian theory tries to deal with the short run. During an economic downturn, the government has to make expansionary public policy to enhance employment and to stabilize real wages, even though the government has a budget deficit. The government has to deal with this issue in the short run rather than wait until the recovery of the market itself over the long run. The assumption of Keynesian theory about some underemployed labor at the initial time is an appropriate phenomenon for economic recession or depression and some developing countries. During economic recession, many firms operating in the economy can reduce the number of employees or go bankrupt, thus increasing unemployed labor. Some developing countries have less incentive for investors to invest. The reason seems to be that non-industrialized countries have poor public services, especially education, health, and infrastructure. A large part of the population in some developing countries has low education status, thereby leading them to have limited capacity for thought and skilled work. If government increases its expenditure on those services, government spending will create more favorable environment for investment.

In my point of view, neo-classical theory concerns the long run because of the shift of taxes to subsequent generations if the expansion of government spending takes a hundred years, thereby leading to an increase in taxes in the future. The subsequent

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generations also have to pay for these taxes because the present generation makes a consumption plan for their personal lifespan only. The neo-classical theory assumes initially full employment, thereby seeming an appropriate phenomenon for developed countries. Following this reason, developed countries have more favorable investment environment due to the high quality of public services (i.e., education, health, and infrastructure). At the initial time, there is massive investment in the economy and abundant skilled labor with long sight.

The purpose of both Keynesian and neoclassical theory is to stabilize the macroeconomic situation. A few of the glib one-liners delivered are long run as a consequence of the short-run and waiting for recovery of market itself; the economy is dead.

We cannot cover all of the linkages between some economic factors, so the critical factors based on the review above can be sketched in Figure 2.2.

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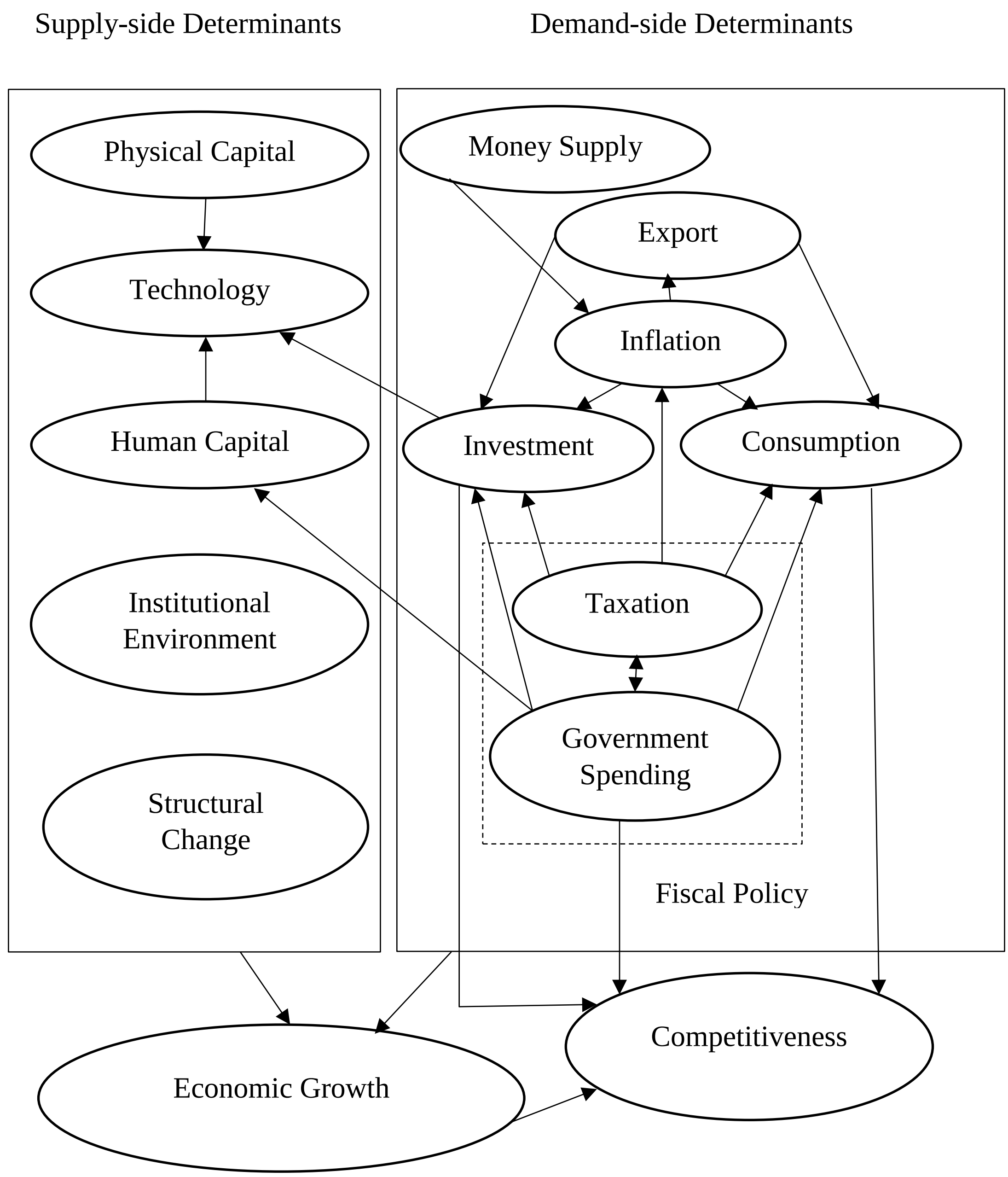

Figure 2.2: Connection between some economic factors

Source: Author's sketch

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Chapter 3 Non-linear Effect of Government Spending on Private Consumption

3.1 Introduction

The countercyclical fiscal policy used rigorously over the last decade has aroused researchers' curiosity about the impact of government expenditure on economic activities (Jha et al., 2014). In the early 2010s, Cambodia's government seemingly adopted a countercyclical fiscal policy. Notably, Cambodia's government consumption as a share of GDP progressively declined from 6.34 percent in 2010 to 5.39 percent in 2015. Public investment as a share of GDP also dropped from 8.20 percent to 5.30 percent, while the tax revenues in the same period continuously and sharply increased from 7.3 percent to 14.6 percent of GDP. This countercyclical fiscal policy can become a concern if this policy prevents the stimulation of Cambodia's private demand, especially household consumption, and the progress of economic development. Therefore, it is necessary to advance the understanding of the effect of fiscal policy on private consumption in Cambodia.

National Institute of Statistics (2017) shows that during a period from 2012 to 2015, a number of households involved with debt and liabilities range between 31 and 38 percent of total Cambodian households, according to the survey's figure conducted by Ministry of Planning. Cambodia is spited into three main areas (e.g. Phnom Penh, urban and rural). The households located in rural areas have the highest percent of experience with debt while the lowest percent is in Phnom Penh.

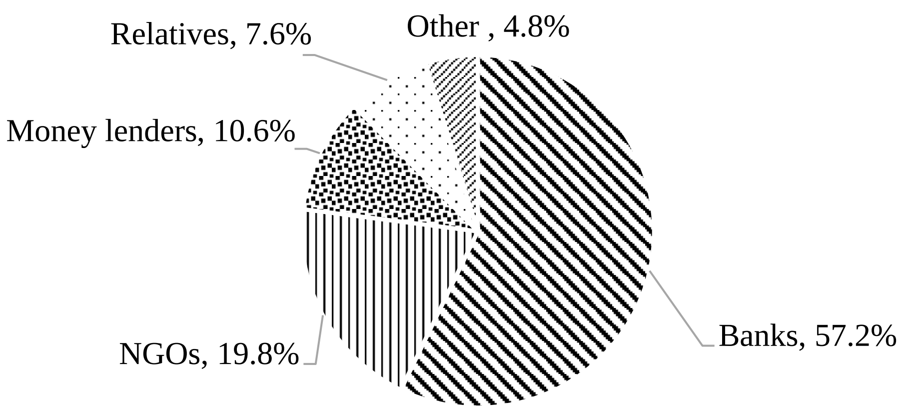

Figure 3.1: Sources of Cambodian households' outstanding loans in 2015

Source: Cambodia Socio-Economic Survey (National Institute of Statistics, 2017)

Figure 3.1 reveals that Cambodian households involved with loans take from bank approximately 57.2 percent of total outstanding loans in 2015 while NGOs' percent is proximately one-third of bank's percent. The phenomenon seems a change in interest rates of banks can influence the consumption behaviors of Cambodian households.

3.2 Methodology

3.2.1 Specific Model

Government spending can be divided into government consumption and investment. Barro (1981) introduced government consumption into the general model and investigated the consumption utility directly responds to a change in government purchases. Extensive research (seen in studies of Ahmed (1986), Karras (1994), Devereux et al. (1996), Giavazzi and Pagano (1996), and Giavazzi and Pagano (1996)) has demonstrated that government purchases play a direct role in influencing private consumption even though results vary regarding the relationship between them. Some empirical research undertaken by Wang and Gao (2011) and Ambler et al. (2017) suggests that public investment also becomes involved in the elasticity of private consumption via fluctuation in real wages.

The disposable income is not taken into account, thereby lessening the robustness of the linkage between government expenditure and private consumption (Graham, 1993). Ho (2001), Wang and Gao (2011), and Varlamova and Larionova (2015) indicate that disposable income plays a vital role in the elasticity of private consumption because the improvement of households' capability reacts to an increase in disposable income.

Based on the basic concept, the disposable income of households equals the sum of consumption and saving. Under budget constraint (no change of disposable income), a higher interest rate on savings produces more disincentive to households to make expenditures. According to new-Keynesian theory, an alternative explanation is that households usually participate in the credit market to smooth their future expenditure. The growth of interest rates leads to households to reduce the current consumption and to keep their money for spending in the future. A change in interest rates, therefore, affects household behavior towards consumption.

The fluctuation of inflation (i.e., a change in the price of commodities on a day-to-day basis) influences the cost of living and the capacity for household consumption.

Some empirical studies carried out by Varlamova and Larionova (2015) and Sulekha et al. (2019) also indicate the existence of the connection between inflation and private consumption.

In this study, public investment and consumption, disposable income, interest rates, and inflation are taken into account. Thus, the regression model of private consumption can be written as follows:

$$CC_t = \beta_{0S} + \alpha_1 DIS_t + \alpha_2 RATE_t + \alpha_3 INF_t + \beta_{1S_t} GI_t + \beta_{2S_t} GC_t + \varepsilon_t, \qquad (3.1)$$

where $t = 1987, 1988, ..., 2015$;

CC_t is private consumption as a share of GDP of Cambodia at time t;

DIS_t stands for disposable income as a share of GDP of Cambodia at time t;

$RATE_t$ refers to saving interest rate of Cambodia at time t;

INF_t represents inflation of Cambodia at time t;

GI_t is government investment as a share of GDP of Cambodia at time t;

GC_t stands for government consumption as a share of GDP of Cambodia at time t;

ε_t is residual at time t;

s as subscript of coefficient represents state (regime). If coefficients have this subscript, it means that the value of coefficients depends on regime.

3.2.2 Data Collection

Gross fixed investment as a percent of GDP can be a substitution for interest rates on savings (as seen in the studies of Solow (1956, 1957), Phelps (1961), Mankiw et al. (1992), and Hajamini and Falahi (2018)). To avoid multicollinearity between public investment and gross fixed investment, private investment as a share of GDP serves as a proxy for the interest rate on savings. Cambodian data from 1987 to 2015 equals 29 observations. Variables collected for this analysis are:

- Household final consumption expenditure (private consumption) as a share of GDP: consumption of goods and services made by resident households;

- Government final consumption expenditure (government purchases) as a share of GDP: general government consumes goods and services and spends on collective consumption services;
- Gross domestic product (GDP) at constant price 2011: total value of goods and services produced during a year;
- Government fixed capital formation (public investment) at constant price 2011: gross fixed capital formation only provided by central and subnational governments;
- Gross national saving as a percentage of GDP: the sum of savings from individuals, businesses, and government;
- Private investment at constant price 2011: infrastructure services delivered by private sectors;
- Inflation: rate of change in the general price level of goods and services sold in the country.

The three principal sources report the data of variables mentioned above:

- The United Nations Statistics Division's National Accounts Main Aggregates Database. The data of household final consumption expenditure as a share of GDP and government final consumption expenditure as a share of GDP are retrieved from the link: https://unstats.un.org/unsd/snaama/dnlList.asp
- The International Monetary Fund's (IMF) World Economic Outlook 2017 database. The link to access the data of gross national saving as a share of GDP and inflation is: http://www.imf.org/external/pubs/ft/weo/2017/02/weodata/index.aspx
- The Investment and Capital Stock Dataset of the IMF offers the data of the rest of the variables via the link: https://www.imf.org/external/np/fad/publicinvestment/

The transformation made to obtain the independent variables for this regression can be explained as follows:

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- Disposable income as a share of GDP is the sum of household final consumption expenditure as a share of GDP and gross national savings as a share of GDP,
- Government investment at a constant price 2011 and private investment at a constant price 2011 divided by GDP at a constant price 2011 is government investment as a share of GDP and private investment as a share of GDP, respectively.

The data analysis is performed in STATA 15.1.

3.2.3 Markov-Switching Autoregressive Model

Identifying and defining potential periods of the nonlinear impact of fiscal adjustment becomes a sensitive issue in testing the non-linear effect of fiscal policy (government expenditure) on private consumption[3]. Based on the empirical studies in this area, researchers usually adopt two methods. In the case of the first method, the possible periods of the nonlinear effect of fiscal adjustment are pinpointed exogenously. Some empirical studies typically use various indicators as the identification of the potential periods. Cour et al. (1996) and McDermott and Wescott (1996) consider the primary structural balance to be one of the indicators, that causes trouble with inflation and real interest rates. The second indicator is the adjustment of government debt or purchases as a percent of GDP (Bertola & Drazen, 1993; Perotti, 1999). Distinctive indicators produce different definitions of time length for expansionary or contractionary fiscal policy. A year in length is used for the fiscal policy adjustment in the study of Alesina and Ardagna (1998). To reduce the possible occurrence of fiscal adjustment lasting a year, Giavazzi and Pagano (1996) impose some stringent conditions that refer to dummy variables of the cumulative change in structural deficit (see their study for more details). The methods of exogenous identification of the potential period of nonlinear fiscal effects are seemingly no different but generate disparate empirical outcomes. Based on the study of Kamps (2001) of 14 European countries, the significant level of this nonlinearity sensitively relies on the definitions of

[3] The non-linear effect of government spending on private consumption means that there are Keynesian and non-Keynesian effects in certain period. Some years of this certain period have Keynesian effect or non-Keynesian effect. Keynesian effect indicates that the expansionary government spending encourages private consumption via the improvement of real wages. Non-Keynesian effect refers to a slowdown in private consumption in response to the extension of government spending.

time length for nonlinear fiscal effects. The endogenous identification of possible periods of nonlinear fiscal impact is another method that does not limit the number of this nonlinearity's potential periods, which are estimated based on the real dataset (Höppner & Wesche, 2000; Wang & Gao, 2011).

The method of exogenous identification can generate an excessive number of possible periods of nonlinearity or miss fiscal adjustment periods of less than a year in length. Thus, this study adopts the Markov-Switching Autoregressive (MSAR) model (see Hamilton (1989) and Chang et al. (2017)) as the method of identifying the potential periods of nonlinear fiscal effects endogenously. The MSAR model refers to a discrete-time process, which depends on two components, such as dynamics of the observed process (i.e., dependent variable's process) and hidden process (i.e., finite-state or finite-regime Markov chain). The MSAR model is also conditional upon autoregressions and classifies sample observations into a small number of homogenous groups, so-called regimes. The Markov regime-switching model with AR improves the accuracy of estimated transition probabilities and the effectiveness of parameter estimates.

In our model, we do not deal with systematic errors due to tag time series. The measurement errors can be recorded from two components (i.e., random and systematic error). We had no technical information to qualify the systematic error, so it was assumed to be null. The MSAR model in our study is a homogenous hidden Markov chain and autoregressive model. AR term in this MSAR model becomes an AR(p) process of residual time series. p denotes the number of AR. Based on the literature, scholars argue that two effects (negative or positive) of government spending on private consumption may exist in a certain period. Wang and Gao (2011) used two regimes (i.e., $s_t = 1$ and $s_t = 2$) of the Markov regime-switching model and estimated with annual data and time interval from 1978 to 2008. Thus, we propose two regimes and assume the errors to be homogenous across the regime in our analysis. The optimal lags selected by BIC (Bayesian Information Criterion developed by Schwarz (1978)) are one ($p = 1$). This study only uses the first level of AR. Therefore, equation (3.1) can be rewritten under the MSAR model with the first level of AR:

$$CC_t = \beta_{0s_t} + \alpha_1 DIS_t + \alpha_2 RATE_t + \alpha_3 INF_t + \beta_{1s_t} GI_t + \beta_{2s_t} GC_t$$

$$+\phi_{1,s_t}\left(CC_{t-1} - \beta_{0s_{t-1}} - \alpha_1 DIS_{t-1} - \alpha_2 RATE_{t-1} - \alpha_3 INF_{t-1} - \beta_{1s_{t-1}} GI_{t-1} - \beta_{2s_{t-1}} GC_{t-1}\right) + \varepsilon_{s_t}, \quad (3.2)$$

where β_{0s_t}, β_{1s_t} ,and β_{2s_t} are the parameters with characteristics of regime-switching or state-dependence. α_1, α_2, and α_3 assume no change with states (regimes) and are included in the regression model to increase the number of degrees of freedom. ϕ_{1,s_t} refers to the first AR term of state s_t. ε_{s_t} is residual with zero mean and state-dependent variance $iid(0,\sigma^2)$.

3.3 Results and Discussion

3.3.1 Estimation

It is strictly necessary to identify the natural data trend before executing the time series analysis. The unit-root test demonstrates that the time series of data consists of a deterministic trend (stationary data in order zero) or stochastic trend (stationary data in order one) (Kirchgässner et al., 2013). The Augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1979), like the famous unit-root test, is based on differencing to transform non-stationarity to stationarity. However, the ADF test heavily depends on lag length, so choosing the optimal time lag is subject to minimizing the value of Bayesian Information Criterion (BIC) proposed by Schwarz (1978). The null hypothesis of this test suggests a unit root or non-stationarity. The result of the unit-root test reported in Table 3.1 indicates that explained and explanatory variables are stationary at order zero I(0). Exceptionally, a predictor (*RATE*) is stationary at first order I(1).

Table 3.1: Unit root test

Test	Augmented Dicky-Fuller (ADF) with intercept	
	X_i	ΔX_i
CC	-2.264**	
DIS	-2.358**	
RATE	-1.208	-3.473***
INF	-1.871**	
GI	-1.671*	
GC	-3.691 ***	

Note: Δ is the first difference. * , **, and *** represent the significance level at 10, 5, and 1 percent, respectively.

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Table 3.2: Results of Markov-Switching Autoregressive model

CC_t	Coefficient	Standard Error	T-statistic
α_1	0.243***	0.025	9.59
α_2	-1.944***	0.090	-21.43
α_3	0.009	0.006	1.33
AR(1)	-0.844***	0.111	-7.55
Regime 1			
$\beta_{1s}(s_t = 1)$	0.319**	0.144	2.21
$\beta_{2s}(s_t = 1)$	-1.461***	0.123	-11.87
$\beta_{0s}(s_t = 1)$	81.901***	2.451	33.41
Regime 2			
$\beta_{1s}(s_t = 2)$	-1.735***	0.130	-13.31
$\beta_{2s}(s_t = 2)$	-2.020***	0.148	-13.56
$\beta_{0s}(s_t = 2)$	97.477***	3.482	27.99
Log-likelihood	-53.081		
sigma	0.988		

Note:. *, ** and *** indicate the significance level at 10, 5, and 1 percent, respectively.

Table 3.2 reveals the results of the Markov-Switching Autoregressive (MSAR) model subject to gradient-based optimization. The value of log-likelihood equals -53.081. All of the predictors with the exception of inflation are statistically significant at the 5 percent level. Disposable income has a positive impact on private consumption because an increase in disposable income improves the household capacity to consume. A higher saving interest rate reduces private consumption. From a fundamental perspective, household saving and expenditure are substitution goods subject to no change in disposable income. Thus, a rise in the interest rate on savings encourages households to save rather than to make expenditures. There is a linear effect of government purchases on private consumption because the result in both regimes provides the same negative sign but different values of the coefficients ($\beta_{2s}(s_t = 1)$=-1.461 and $\beta_{2s}(s_t = 2)$ =-2.020). The extension of government purchasing crowds out private consumption--that is, public consumption was a substitute for household expenditure in Cambodia. In the case of government investment, there is a different sign of coefficient in regime 1 ($\beta_{1s}(s_t = 1)$=0.319) and regime 2 ($\beta_{1s}(s_t = 2)$=-1.735). This result indicates that a non-linear effect of government investment on private consumption exists in the Cambodian economy. The main reasons for the occurrence of this nonlinearity can be explained in the part of identifying non-Keynesian years and discussion. The coefficient of AR(1) is statistically significant at 5 percent level and means that residual at the time t depends on its first lag.

Table 3.3: Regime-switching probability matrix

i / j	Regime 1	Regime 2
Regime 1	0.5819	0.4180
Regime 2	0.3645	0.6354

Note: i and j represent different regimes.

The estimated results of the regime-switching probability matrix presented in Table 3.3 offer a valuable clue to identify the average duration for the existence of the same regime. The calculation of average duration follows the formula:

$$D(s) = \frac{1}{1 - p_{ii}}, \tag{3.3}$$

where $D(s)$ stands for the average duration of the regime (state), and p_{ii} denotes regime-switching probability.

Table 3.4: Estimation of duration in each regime

	Sample size	Frequency	Average duration
Regime 1	12	0.429	2.391
Regime 2	16	0.571	2.742

Table 3.4 reports frequency and average duration for the two regimes: 57.1 percent of the total sample belongs to the regime with non-Keynesian impacts, but the rest of this sample comprises 12 observations in the regime with Keynesian effects. The average duration is 2.391 years for Keynesian impacts and 2.742 years for non-Keynesian effects.

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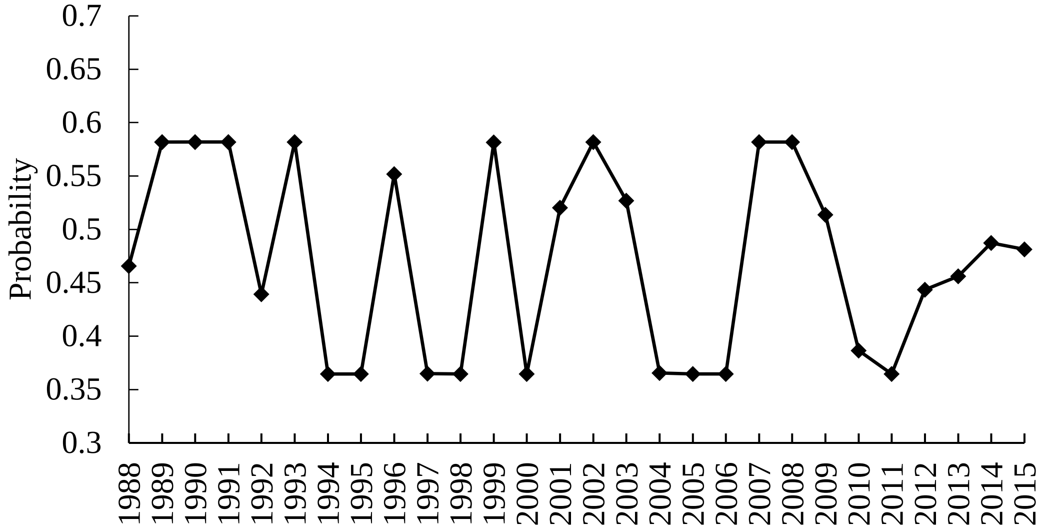

Figure 3.2: Smooth switching probability of Keynesian effect regime, 1988-2015

Source: Author’s estimation

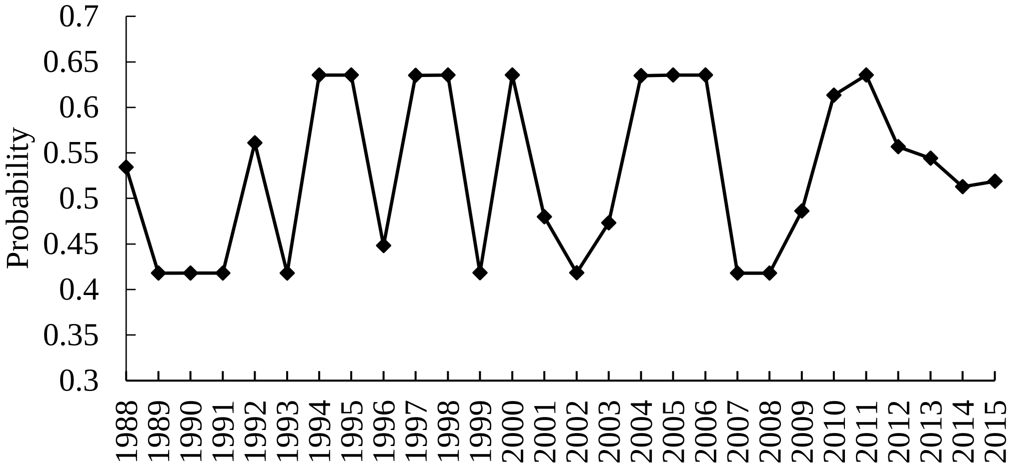

Figure 3.3: Smooth switching probability of non-Keynesian effect regime, 1988-2015

Source: Author’s estimation

Figures 3.2 and 3.3 show that some years and periods, those with the probability of Keynesian impacts more than 0.5 or close to 1 and the probability of non-Keynesian effects less than 0.5 or close to 0, lead to the existence of the Keynesian effects. However, some years and periods in the time interval of this study have the probability of non-Keynesian impacts higher than 0.5 and Keynesian effects’ probability lower than 0.5, thus generating the occurrence of non-Keynesian effects for those years and periods. As a result, there is a non-linear influence of fiscal policy, mainly public investment, on private consumption in Cambodia’s economy.

Table 3.5: Identification of regimes

	Years	Probability
Non-Keynesian regime	1988	0.5342
	1992	0.5608
	1994-1995	0.6354
	1997-1998	0.6351
	2000	0.6354
	2004-2006	06351
	2010-2015	0.5635
Keynesian regime	1989-1991	0.5819
	1993	0.5819
	1996	0.5519
	1999	0.5816
	2001-2003	0.5430
	2007-2009	0.5592

Source: Author's estimation

The precise identification of regimes shown in Table 3.5 illustrates in which periods Keynesian or non-Keynesian effects of government spending exist. The existence of the Keynesian effects in the 1989-1991, 2001-2003, and 2007-2009 periods indicates that expansionary fiscal policy enhances private consumption. However, the 1994-1995, 1997-1998, and 2004-2006 periods have non-Keynesian effects, probably because political instability discourages households from increasing their expenditures. During 1994-1995, Cambodia faced political uncertainty because the Cambodia People's Party (CPP) leaders intended to refuse to accept the election outcome. The disagreement about the national election 1993's result spun out political turmoil and led to a political impasse during 1994-1995. Before the national election of 1998 came, a political stalemate had seemingly started to increase since March 1997. After the national election in 2003, Cambodia reached political deadlock because it was unable to form the new government until July 2004. The non-Keynesian impact of government expenditure also occurs during 2010-2015 because Cambodia's government seemingly used countercyclical fiscal policy at that period. According to the ADB database, the tax revenues as a share of GDP progressively and dramatically grew from 7.3 percent in 2010 to 14.6 percent in 2015. Increasing the present value of taxes contributes negatively to the private wealth effect (i.e., a change in household consumption based on asset value via price level, disposable income, and interest rates) because a higher present value of taxes can increase the price of goods and services in the market and decrease disposable income, thereby harming household spending.

3.3.2 Discussion

The result of this study, which highlights the nonlinear effect of government spending on private consumption, agrees with the outcomes of Giavazzi and Pagano (1990), Blanchard (1990), Alesina and Ardagna (1998), Perotti (1999), Höppner and Wesche (2000), Aarle and Garretsen (2003), and Wang and Gao (2011). However, various reasons are raised to point out the emergence of the non-Keynesian effect of government expenditure on private consumption. This study emphasizes two main reasons – political instability and increasing the present value of taxes – which causes a negative influence on the wealth effect through inflation and a reduction in disposable income. Giavazzi and Pagano (1990) spotlight the substitution between public and private consumption because government consumption, which seems to be a waste of resources, does not offer consumers any utility. They raised an example of the Danish government in 1983-84—that is, Danish private consumption increases in response to contractionary government consumption. Also, agent (household) expectations about the future policy cause the existence of non-Keynesian effects. Based on perfect knowledge and rational expectation, households cut down their expenditures in response to the extension of government expenditure because they anticipate that the government will raise the present value of taxes to finance its spending and intends to balance its budget. In term of fiscal consolidation, Ho (2001) suggests that issuing government bonds to finance its own expenditure leads to speed up increases in the interest rates, thereby slowing down household consumption as well as other components of aggregate demand. In another case, the initial value of government spending above a threshold level (optimal value) triggers the non-Keynesian effects – that is, the positive or negative influence of government expenditure relies on the magnitude of that expenditure (Bertola & Drazen, 1993). Wang and Gao (2011) propose personal characteristics (i.e., a quota restriction plan for comodities, minumum employment programes and like this) of commodities and labor market as an important reason leading to the existence of non-linear effects in China's economy. It is possible to demonstrate conclusively that the structure and magnitude of government expenditure, agent expectations, characteristics of commodities and labor market, and environment change (political instability) contribute to the occurrence of the non-linear effect of government spending on private consumption.

Most studies found that non-linearity exists on government purchases (seen in Cour et al., (1996), Perotti (1999), Aarle and Garretsen (2003), and Wang and Gao (2011)). On the other hand, the outcome of this study indicates that public investment can have a non-linear effect on private consumption. This study provides insight into the non-linear effect, which can occur in government investment as well.

3.4 Conclusions and Policy Implications

3.4.1 Conclusions

The debate about the effectiveness of public policy has been taking place since the global crisis in 2008. The government spending in this study is divided into two types (government consumption and investment) and analyzed separately in the model. The Markov-Switching Autoregressive (MSAR) model is used to estimate the non-linear impact of government expenditure on private consumption in Cambodia in the time interval from 1987 to 2015. The results indicate that non-linearity exists for Cambodia's public policy, mainly public investment. Political instability leads to the existence of the non-Keynesian effect during those periods (i.e., 1994-1995, 1997-1998, and 2004-2006). Also, the non-Keynesian impact reacts to raising the present value of taxes in the period 2010-2015. However, the linear and asymmetric effect occurs in public consumption, and government purchases are substitutes for private consumption. Private consumption negatively reacts to a decrease in disposable income and an increase in saving interest rate while inflation is statistically insignificant at 5 percent. The outcomes of this study provide a fascinating insight into the existence of the non-linear effect of fiscal policy (government spending) on private consumption. The two primary reasons (political instability and putting up the present value of taxes) contribute to the occurrence of the non-linear impact of government expenditure and private consumption.

3.4.2 Limitations

There are limited data. This study cannot cover all variables which can influence private consumption. Notably, tax revenues and income distribution suggested by Wang and Gao (2011) are not included in the regression model because the data are limited or unavailable. The disposable income is calculated based on the sum of household final consumption expenditure and gross national saving, which takes into account government saving. This computation, therefore, can produce calculated disposable income above the actual value of household disposable income. The limited data of interest rate leads to the usage of private investment as a share of GDP to be a proxy of saving interest rates. In addtion, the sample period with 28 annual observations used in the MSAR estimation is small, any empirical inference is a challenge, and results will likely be fragile.

3.4.3 Policy Implications

Since 2010, insufficient productive private consumption (household consumption) for economic growth has occurred in Cambodia's economy because household final consumption expenditure as a share of GDP dropped from 81.29 percent in 2010 to 76.80 percent in 2015. This study of the non-linear effect of government spending on private consumption can offer a reference point for Cambodia's government, which controls macro policy and advances the efficacy of fiscal policy under changing economic circumstances. The investigated non-linearity proposes a new perception on evaluation of the efficacy of government expenditure. The Cambodian government pursued a policy of raising the present value of taxes during the period 2010-2015, thereby influencing households through negative wealth effect and the existence of the non-linear effect of government expenditure on private consumption. Political instability during the 1990s can reduce the efficiency of government investment for promoting private consumption in Cambodia. This instability negatively affects household expenditures because the people intend to keep money on hand rather than to make expenditures. The government should ascertain the circumstances which produce the Keynesian and non-Keynesian impact of government expenditure, mainly public investment, and thus take proper action to promote private consumption effectively. The integration of fiscal and monetary policy may be a better idea to enhance private consumption because households very often get involved in the financial market to smooth their spending. If private consumption improves, government purchases should be reduced because there is substitution between public and private consumption.

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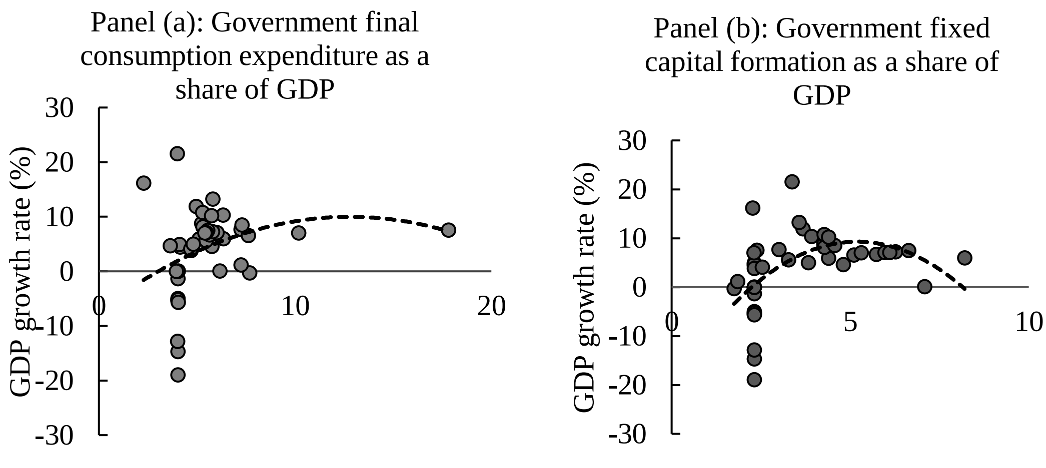
Chapter 4 Relationship between Government Expenditure and Economic Growth

4.1 Introduction

The efficacy of fiscal policy, especially government spending, has been questioned since the global crisis in 2008. Cambodia was classified as a lower-middle-income developing country in 2016 (UNDP, 2018). The Cambodian government intends to maintain economic growth, thereby converging to upper-middle-income states. Well-designed fiscal policy can contribute significantly to Cambodia's sustainable development goals (SDGs) (IMF, 2019). Cambodia faced civil wars during the 70s, 80s, and 90s, so there are some challenges (e.g., weak physical infrastructure and inadequate human capital) in Cambodia's development history (Roy, 2015). Thus, the extension of government expenditure can create more incentive and a pleasant environment for investment in Cambodia. The global crisis in 2008 also worsened Cambodia's economy because the GDP growth rate sharply dropped from 6.7 percent in 2008 to 0.1 percent in 2009. Cambodia's public investment as a share of GDP jumped from 5.73 percent in 2008 to 8.20 percent in 2010. Government consumption as a share of GDP increased by approximately 0.71 percent in the same period. After 2010, Cambodia's government raised taxes because tax revenue as a share of GDP dramatically went up from 7.3 percent in 2010 to 14.6 percent in 2015. It is necessary to understand the impact of government spending on economic growth in Cambodia.



Note: each dot and dashed line represent each year and estimated line, respectively. Cambodian annual data are from 1971 to 2015. Government final consumption expenditure as a share of GDP (GFCE) and GDP growth rate are plotted in Panel (a). Panel (b) represents plotting government fixed capital formation as a share of GDP (GFCF) and GDP growth rate.

Figure 4.1: Scatter (government spending, GDP growth rate) plot

Source: National Accounts Main Aggregates Database and IMF Database

Figure 4.1 reflects plotting two types of government expenditure (government final consumption expenditure and government fixed capital formation) and GDP growth rate in Cambodia. As seen in the figure, the connection between both types and the rate of output growth is non-linear[4]. The expansionary government spending (GFCF and GFCE) leads to either an acceleration in or a slowdown in Cambodia's GDP growth rate.

4.2 Methodology

4.2.1 Specific Model

Solow (1956) and Swan (1956) highly credit production's two inputs (labor force and capital) to enhance economic growth. An accumulation of capital can be determined by government spending. Most countries are open economies nowadays; therefore, export also plays an important role in the determination of economic growth. This paper tries to test the connection between government spending and output growth as follows:

$$GGDP_t = f\left(LAB_t, EXPO_t, GOV_t\right), \tag{4.1}$$

Armey (1995) and Barro (1990) point out the linkage between government expenditure and output growth as a quadratic function. The regression model can be written as follows:

$$GGDP_t = \beta_0 + \beta_1 LAB_t + +\beta_2 EXPO_t + \beta_3 GOV_t + \beta_4 GOV_t^2 + \varepsilon_t, \tag{4.2}$$

where t = 1971, 1972… 2015;

$GGDP_t$: GDP growth rate of Cambodia at time t;

LAB_t: labor force growth rate of Cambodia at time t;

$EXPO_t$: growth rate of export of goods and services of Cambodia at time t;

GOV_t: government spending as a share of GDP of Cambodia at time t;

GOV_t^2: square of government spending as a share of GDP of Cambodia at time t;

[4] Non-linear relationship between government spending and economic growth means that the effect size of government spending, which contributes to economic growth, diminishes if government expenditure progressively increases.

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ε_t : error term at time t .

Each component (i.e., government final consumption expenditure (GFCE) and public investment as government fixed capital formation (GFCF)) of total government spending is analyzed separately.

4.2.2 Data Collection

Cambodian data from 1971 to 2015 generates 45 observations for analysis. The list of variables is:

- Government final consumption expenditure (GFCE) as a share of GDP: the general government consumes goods and services and spends money on collective consumption services, and then this sum is divided by the GDP;
- Government fixed capital formation at a constant price 2011: disposals of produced fixed assets subtracted from the sum of acquisitions (purchase of new or second-hand assets) and specific expenditure on services adding value to non-produced assets;
- GDP at constant price 2011: the total value of goods and services produced during a year;
- The growth rate of GDP: a percentage change of the total value of goods and services produced in a nation;
- The growth rate of export of goods and services: a percentage change of the value of goods and services sold to the rest of the world;
- The population growth rate: a percentage change of people currently living in a country.

Three primary sources report the data of variables mentioned above.

- The Investment and Capital Stock Dataset of IMF offers data for GDP and government fixed capital formation at a constant price 2011 through the link: https://www.imf.org/external/np/fad/publicinvestment/
- World Bank Database provides data of population growth rate at the link: https://data.worldbank.org/country/cambodia?view=chart

- United Nations Statistics Division's National Accounts Main Aggregates Database The link to get the data of the rest of the variables mentioned above is: https://unstats.un.org/unsd/snaama/dnlList.asp

The transformation made to obtain the independent variables for the regression can be explained as follows.

- Population growth rate can be used to measure the labor force growth rate;
- Government fixed capital formation at a constant price 2011 divided by GDP at a constant price 2011 equals government fixed capital formation (GFCF) as a share of GDP.

STATA 15.1 was the software used to process the data analysis in this study.

4.2.3 Ordinary Least Square

Engle-Granger approach (Engle & Granger, 1987) or Johansen's multivariate maximum likelihood approach (Johansen, 1988; Johansen & Juselius, 1990) for co-integration demands all of the variables (i.e., explained and explanatory variables) to be integrated to order one I(1). Autoregressive distributed lags (ARDL) bound approach (Pesaran & Shin, 1998; Pesaran et al., 2001) requires explained variable as order one of integration I(1), but predictors can be pure order zero I(0), absolute order one I(1), or mixed orders (i.e., I(0) and I(1)) of integration. Therefore, these co-integration approaches can be applied if the dependent variable is integrated to order one I(1). In the case of all variables (dependent and independent variables) to be stationary at the level I(0), Ordinary Least Square (OLS) as the classical method of regression modelling can be applied for the time-series data analysis. The OLS estimate based on minimizing sum square of residuals is so-called BLUE (Best Linear Unbiased Estimate). The good-fit model is subjected to the value of R-squared (R^2). If the value of R^2 is high, it can be regarded as a good model. The error term (residuals) estimated by OLS has to be assumed to be a white-noise (homoscedasticity - constant variance, normal distribution - zero mean, and no autocorrelation).

4.2.4 Calculation of the Optimum Value of Government Spending

The optimum level of government expenditure is calculated by taking the partial derivative of $GGDP$ (equation (4.2)) with respect to GOV and setting it equal to zero.

$$\frac{\partial GGDP}{\partial GOV} = \beta_3 + 2\beta_4 GOV = 0 \Rightarrow GOV = -\frac{\beta_3}{2\beta_4},\ \beta_3 > 0, \beta_4 < 0, \tag{4.3}$$

4.3 Results and Discussion

4.3.1 Estimation

According to econometric literature of time series, the estimation with non-stationary variables produces a spurious result of the regression (Granger & Newbold, 1974); due to this, it is necessary to conduct the unit-root test, which is used to check that time-series data include a deterministic or a stochastic trend while those series transform from non-stationarity into stationarity (Kirchgässner et al., 2013). The Augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1979) as a well-known test of a unit root in time series is used to check differencing order, which leads to stationary data. The Bayesian Information Criterion (BIC) developed by Schwarz (1978) is employed to select an optimal number of lags. The null hypothesis of this test proposes a unit root or non-stationarity. The result of ADF test presented in Table 4.1 indicates that the dependent variable ($GGDP$) and predictors (LAB, $EXPO$, $GFCF$, $GFCF^2$, $GFCE$, and $GFCE^2$) are stationary at order zero I(0). Thus, the OLS is applied to estimate the connection between explained and explanatory variables.

Table 4.1: Unit root test

Test	Augmented Dicky-Fuller (ADF) with intercept	
	X_i	ΔX_i
$GGDP$	-2.521***	
LAB	-2.880***	
$EXPO$	-4.856***	
$GFCF$	-1.331*	
$GFCF^2$	-1.642*	
$GFCE$	-3.155 ***	
$GFCE^2$	-3.683***	

Note: Δ is the first difference. * , **, and *** represent the significance level at 10, 5, and 1 percent, respectively.

Table 4.2 displays the results of the OLS analysis. The first model (Model I) for GFCF and the second model (Model II) for GFCF provide an R-squared value (R^2) of 60.44 percent and 49.85 percent, respectively. The coefficients of explanatory variables in both models are statistically significant at 5 percent level. The healthy economic growth responds to the improvement of the growth rate of the labor force ($\beta_1 \rangle 0$) because more labor generates more production in the economy. An increase in the export growth rate significantly and positively influences the growth rate of output ($\beta_2 \rangle 0$). It reflects the more significant gains from international trade, thereby promoting saving, investment, and economic performance in the country. The GFCF and GFCE's hypothesis, an inverted-U-shaped relation with economic growth, is not rejected. The optimal value of GFCF and GFCE was estimated to be approximately 5.40 percent and 7.23 percent, respectively. The influence of government expenditure on economic growth shrinks while steadily increasing the value of government expenditure as a share of GDP. The government expenditure financed by raising taxes and taking out loans might drive down private investment due to creating more disincentives. The growth in public investment (GFCF) above the optimal level becomes unproductive because the allocation of this government investment might finance some inefficient projects. If GFCE passes the optimal level, there might be bureaucracy and centralization, which stifle creativity in the private and public sectors. The entire economy can be harmed by reducing the scope of creativity and creating more inefficiency.

Table 4.2: Results of OLS

GGDP	Model I (GFCF)		Model II (GFCE)	
	Coefficient	SE	Coefficient	SE
LAB	1.233**	0.478	1.134**	0.554
EXPO	0.103***	0.027	0.175***	0.040
GOV	9.155***	2.517	2.820**	1.358
GOV^2	-0.848***	0.281	-0.195**	0.072
Constant	-19.819***	4.850	-9.583*	5.074
R^2	0.6044		0.4985	
Adjusted R^2	0.5648		0.4484	
Root MSE	5.0141		5.6451	

Note: SE denotes standard error. *, ** and *** indicate the significance level at 10, 5, and 1 percent, respectively.

4.3.2 Diagnostic Tests

Diagnostic tests are required to check whether the residual (error term) of OLS meets the essential three assumptions. The Breusch-Godfrey test introduced by Breusch (1978) and Godfrey (1978) relies on the Lagrange multiplier (LM) test statistic and checks the autocorrelation (serial correlation) of the residuals. The Breusch-Godfrey test's null hypothesis proposes no autocorrelation. White (1980) introduced a heteroscedasticity-consistent variance estimator of the variance matrix, called White's test, to check the heteroscedasticity of the variance of residual. The null hypothesis of this White's test suggests no heteroscedasticity. The Jarque-Bera test developed by Jarque and Bera (1987) joins between skewness and kurtosis. This test relies on asymptotic standard error without correlation for sample size. The null hypothesis of the Jarque-Bera test suggests a normal distribution (i.e., the built model explains all trends of data). Table 4.3 shows that the null hypothesis of Breush-Godfrey LM test, White's test, and Jarque-Bera test is not rejected at 1 percent significance level. There is normality, no serial correlation, and no heteroscedasticity for the residual of OLS.

Table 4.3: Diagnostic tests for residual of OLS

ε_t	Model I	Model II
	Chi2	Chi2
Breusch-Godfrey LM test	4.805	8.198
White's test	8.84	15.46
Jarque-Bera test	6.93	8.45

Note: *,**, *** denote the significance level at 10, 5, and 1 percent, respectively.

4.3.3 Stability Test

The robustness of the models describes the regression model's parameter stability confirmed by the cumulative sum test. The cumulative sum test subjected to recursive residuals and proposed in Brown et al. (1975) is designed to detect the parameters' instability (Ploberger & Krämer, 1992). No structural breaks (constant regression coefficients over time) are proposed as the null hypothesis of the cumulative sum test. The results are presented in Table 4.4. For Model I and Model II, the null hypothesis of the test is accepted at 1 percent level of significance. The convergence of estimated long-run parameters to the zero means exists in both models. Model I and Model II, therefore, are stable and consistent models.

Table 4.4: Cumulative sum test

Model	Model I	Model II
Test statistic	0.343	0.737
Critical value 1%	1.143	1.143
Critical value 5%	0.947	0.947
Critical value 10%	0.850	0.850

Note: *, **, and *** represent the significance level at 10, 5, and 1 percent. If the test statistic is smaller than a critical value, the null hypothesis of the test is not rejected.

4.3.4 Robustness Test

The robustness of regression results of government spending (i.e., government investment and consumption) is presented in this section. The regression model takes into account more specifications (e.g., dummy variables) to shock it and is also analyzed with second-degree polynomial regression.

The ADF test as a basic test of unit root is criticized for not incorporate structural breaks in time-series data, thereby producing a misleading conclusion (Glynn et al., 2007). Cambodia's history is burdened by war, genocide, and occupation, times during which economic conditions are different than in peacetime. Thus, our dependent variable can be tested to find whether structural breaks appear in time-series data of the regressand. The Zivot-Andrews test developed by Zivot and Andrews (1992) incorporates unknown structural breaks in intercept, trend, and both. The null hypothesis of this test suggests that time-series data are non-stationary (unit root). An alternative hypothesis is trend-stationary with a single break. The results presented in Table 4.5 indicate that the null hypothesis is rejected at all levels of significance, so structural breaks should be included in the regression model.

Table 4.5: Results of Zivot-Andrews test

Test	Break of intercept		Break of trend		Break of intercept and trend	
	X_i	ΔX_i	X_i	ΔX_i	X_i	ΔX_i
GGDP	-6.008***		-6.175***		-6.546***	

Note: Δ is the first difference. * , **, and *** represent the significance level at 10, 5, and 1 percent, respectively.

Cambodia's history showed that there have been a few shocks which affect economic conditions. Four dummy variables, therefore, are incorporated in regression.

In 1973, Cambodia started a civil war between the Khmer Rouge's army led by Pol Pot and the Khmer Republic government's army with the USA's assistance led by Lon Nol. This war negatively influenced Cambodia's economy. The first dummy variable (du1) is introduced in our model. The year 1973 is given value 1, and the rest of the years are zero.

Cambodia also faced political unsettlement in 1989, thereby suddenly worsening Cambodia's economy. Our regression analysis also takes into account the second dummy variable (du2) of this political instability. The year 1989 is given value 1, and all other years are zero.

During 1994-1995, Cambodia faced political uncertainty because the Cambodia People's Party (CPP) leaders refused to accept the election outcome. The disagreement about the 1993 national election result spun out political turmoil and led to a political impasse during 1994-1995. This period is introduced as a structural break as the third dummy variable (du3). The year 1994 or 1995 is given value 1, and the rest of the years are zero.

The Asian financial crisis in 1997 started in Thailand and also contributed negatively to Cambodia's economy because they are neighboring countries and trading partners. The fourth dummy variable (du4) denotes a structural break due to the Asian financial crisis in 1997. The value one represents the year 1997, and other years are zero.

These dummy variables are defined as follows:

$$du1=\begin{cases}1 & if \quad t=1973\\ 0 & if \quad t=other\ years\end{cases}, \qquad du2=\begin{cases}1 & if \quad t=1989\\ 0 & if \quad t=other\ years\end{cases},$$

$$du3=\begin{cases}1 & if \quad t=1994,1995\\ 0 & if \quad t=other\ years\end{cases}, \qquad du4=\begin{cases}1 & if \quad t=1997\\ 0 & if \quad t=other\ years\end{cases}. \tag{4.4}$$

There is a substantial correlation between a government's spending (i.e., government investment and consumption) and its power. Theoretical literature about the linkage between government expenditure and economic growth suggests that their relationship is a quadratic function. The second-degree polynomials of independent

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variables (i.e., public investment and government purchasing) are proposed in this analysis. The orthogonal polynomial terms generated by the Christoffel-Darboux recurrence formula (Abramovitz & Stegun, 1972) meets the property (i.e., quadratic trend without the constant). The equation (4.2) can be rewritten with the orthogonal polynomial terms of regressors (i.e., government investment and consumption) as follows:

$$GGDP_t = \beta_0 + \beta_1 LAB_t + \beta_2 EXPO_t + \alpha_1 PGFCF1_t + \alpha_2 PGFCF2_t$$

$$+\alpha_3 PGFCE1_t + \alpha_4 PGFCE2_t + \alpha_5 du1 + \alpha_6 du2 + \alpha_7 du3 + \alpha_8 du4 + \varepsilon_t , \qquad (4.5)$$

where $t = 1971, 1972\ldots 2015$;

$GGDP_t$: GDP growth rate of Cambodia at time t;

LAB_t: labor force growth rate of Cambodia at time t;

$EXPO_t$: growth rate of export of goods and services of Cambodia at time t;

$PGFCF1_t$: first degree of an orthogonal polynomial of government investment as a share of GDP of Cambodia at time t;

$PGFCF2_t$: second degree of an orthogonal polynomial of government investment as a share of GDP of Cambodia at time t;

$PGFCE1_t$: first degree of an orthogonal polynomial of government consumption as a share of GDP of Cambodia at time t;

$PGFCE2_t$: second degree of an orthogonal polynomial of government consumption as a share of GDP of Cambodia at time t;

$du1$: dummy variable of Cambodia's civil war in 1973;

$du2$: dummy variable of Cambodia's political instability in 1989;

$du3$: dummy variable of Cambodia's political instability during 1994-1995;

$du4$: dummy variable of the Asian financial crisis 1997;

ε_t: error term at time t.

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Table 4.6: Results of second-degree orthogonal polynomial regression

GGDP	Coefficient	Standard Error
LAB	1.390***	0.353
EXPO	0.195***	0.031
*PGFCF*1	1.427**	0.682
*PGFCF*2	-1.657***	0.581
*PGFCE*1	-2.486***	0.703
*PGFCE*2	-2.264**	0.837
*du*1	-15.653***	3.745
*du*2	-11.456**	4.565
*du*3	-10.871***	3.010
*du*4	-6.662*	3.714
Constant	-0.588	0.819
R^2	0.8330	
Adjusted R^2	0.7838	
Root MSE	3.5337	

Note: *, ** and *** indicate the significance level at 10, 5, and 1 percent, respectively.

The results presented in Table 4.6 show that the second-degree orthogonal polynomial regression provides R-squared (83.30 percent) and Root Mean Square Error (3.5337). All of the explanatory variables are statistically significant. The improvement of the labor force or growth rate of exports stimulates Cambodia's economic growth. Some shocks (i.e., a civil war in 1973, political deadlock in 1989, political instability during 1994-1995, and the Asian financial crisis in 1997) in Cambodia's history slowed down its economic growth because these shocks negatively affect household behavior regarding expenditure and investment in Cambodia. The quadratic response to government investment has an optimal value at *PGFCF* (orthogonal polynomial of *GFCF*)=$-\alpha_1/\left(2\alpha_2\right)$=0.43, which was approximately 5.20 percent on the original government investment (GFCF) scale. The inverted-U shaped relationship between government consumption and economic growth exists. The optimal level of *PGFCE* (orthogonal polynomial of GFCE) was $-\alpha_3/\left(2\alpha_4\right)$= -0.55, which was approximately

6.45 percent on the original government consumption (GFCE) scale. This optimal level of GFCF and GFCE is slightly lower than the optimal value from Model I and Model II.

Figure 4.1 also indicates that the linkage between government spending (i.e., GFCF and GFCE) and economic growth is an inverted-U shape.

4.3.5 Discussion

The finding of this study agrees with the explanations of Barro (1990), Armey (1995), and Mourmouras and Lee (1999) about the existence of an inverted-U-shaped connection between government spending and economic growth. The level of government expenditure determines whether there is a positive or negative impact, as illustrated by Keynesian theory and neo-classical theory, respectively. A rise in government spending below the optimal level improves the investment environment, employment, consumption, and therefore the economy as a whole. If it is over the threshold level, there is harm to economic performance because government spending financed by raising taxes and borrowing leads to less incentive to household consumption and investment. This finding is in line with the studies of Vedder and Gallaway (1998), Chobanov and Mladenova (2009), and Hok et al. (2014); however, they use total government expenditure as a share of GDP and various estimation methods. This result is also consistent with the outcomes of Chen and Lee (2005), Asimakopoulos and Karavias (2016) and Hajamini and Falahi (2018), who also investigated the influence of government spending's two types (e.g., government fixed capital formation and government final consumption expenditure) on output growth, although these studies provide the various threshold level (optimal value).

The optimal level of GFCE calculated in this study was approximately 7.23 percent, which is lower than the 18.04 percent, 16 percent and 15 percent yielded in the studies conducted by Asimakopoulos and Karavias (2016), Chiou-Wei et al. (2010) in the case of Taiwan, and Chen and Lee (2005), respectively. The threshold level of GFCE calculated by Chiou-Wei et al. (2010) in the case of South Korea and Thailand is also higher (11 percent) than the optimal value in this study.

The optimal value of GFCF calculated in this study equalled approximately 5.40 percent. This optimum value is higher than the threshold value (2.31 percent) reported by Hajamini and Falahi (2018), but lower than 7.3 percent estimated by Chen and Lee

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(2005) and the 13 percent by Davies (2009). The optimal level of GFCE and GFCF is different from other findings owing to Cambodia's historical data, economic situation, distinctive methods, and economic and social factors included in the model. The optimal value of government spending may be heterogeneous across countries. A large government finances its expenditures through taxation and allocates more spending into unproductive projects than a small government, thereby leading to the optimal level in developed countries being lower than in developing countries (Asimakopoulos & Karavias, 2016; Gray et al., 2007).

4.4 Conclusions and Policy Implications

4.4.1 Conclusions

Public policy has fascinated policymakers since the global crisis of 2008. Scholars have found inconsistent results, with either positive or negative impacts of government spending on output growth. The current literature also points out the non-linear relationship between them. This paper explores whether Barro (1990)'s idea about government spending is valid for components (e.g., government fixed capital formation (GFCF) and government final consumption expenditure (GFCE)) of total government expenditure. The Cambodia annual data from 1971 to 2015 are collected. OLS is used to estimate coefficients of each explanatory variable.

The result suggests for the analyzed period that a rise in the export growth rate or labor growth significantly spurs the growth rate of output in Cambodia. Remarkably, GFCF and GFCE meet Barro (1990)'s idea about an inverted-U relation with economic growth. Over the threshold level, the extension of GFCF and GFCE has detrimental effects on output growth due to a rise in taxes and a crowding-out effect (i.e., a reduction in investment and consumption or the elimination of private sector's spending reacts to the improvement of public spending). The optimal value of GFCF and GFCE as a share of GDP was estimated to be 5.40 percent and 7.23 percent, respectively. This outcome gives both scholars and policymakers a benefit (i.e., managing the government expenditure efficiently to get an improvement of economic growth in Cambodia). This study also contributes to a theoretical part through the existence of Keynesian or neo-classical concept governed by the level of government expenditure.

4.4.2 Limitations

This study has limited data. The Cambodia historical data of GFCF and GFCE from 1971 to 1986 seems unchanged. Probably some of the data are not real but were obtained through the United Nations and IMF's estimation because Cambodia was involved in a civil war during this period. Another limitation is that the quadratic function of government spending is used in this study. The calculated optimal level of FGCF and GFCE in this study, therefore, might be above or below the real optimum level. Próchniak (2011) and many others suggest that a combination of demand-side and supply-side factors dictate economic growth. However, the model in this study cannot capture all determinants from both sides, especially some of the essential supply-side factors (e.g., human capital and institutional environment). The main reason is that data of these factors are unavailable or limited for Cambodia.

4.4.3 Policy Implications

The Cambodian government still holds a Keynesian perspective (i.e., the extension of government spending improves economic performance). The government has reformed the public sector (e.g., increasing the wage bill for public employees since 2011) and the education system (e.g., secondary school exam since 2014 and improvement of the curriculum). Notably, public expenditure on education as a share of GDP from 2007 to 2016 increased by approximately two-thirds (World Bank, 2017). The investment projects carried out by the government are a road network improvement project (70 million USD), a provincial water supply and sanitation project (119.3 million USD) and the Tonle Sap poverty reduction and smallholder development project (66 million USD) (ADB, 2018b).

Nevertheless, this study also pointed out the optimal level of government spending in Cambodia. According to the findings of this study, an increase in government spending above the optimal value leads to a slowdown in economic growth. The government should adjust the level of its expenditures and save some amount of money to balance the budget or to finance productive categories of spending.

The actual GFCF as a share of GDP in 2015 equals 5.30 percent, smaller than the 5.40 percent estimated in this paper as the optimum value of GFCF. A slight increase in GFCF, productive investment, drives economic growth in Cambodia. The GFCE of 5.40

percent in 2015 has not yet exceeded the calculated optimal level (7.23 percent). Thus, the Cambodian government can apply an expansionary public policy to encourage the economy.

4.4.4 Further Studies

To compensate for limited data, quarterly (Makin & Ratnasiri, 2015) or semi-annual data could be used to expand the number of observations. Alternatively, increasing the number of data can be manipulated by using a panel approach, especially with CLMV (Cambodia, Laos, Myanmar, and Vietnam) countries, because these countries grouped into the sub-region within the ASEAN region have a similar economy. Undertaking further studies is necessary to confirm that Barro (1990)'s perspective is valid for government expenditure on agriculture, education, health, military, research, and development (R&D) and transport. If an inverted-U relation appears in these parts of government spending and if an optimal level can be determined, the level of these expenditures might be controlled more efficiently to contribute positively to economic growth.

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Chapter 5 Government Spending and Competitiveness

5.1 Introduction

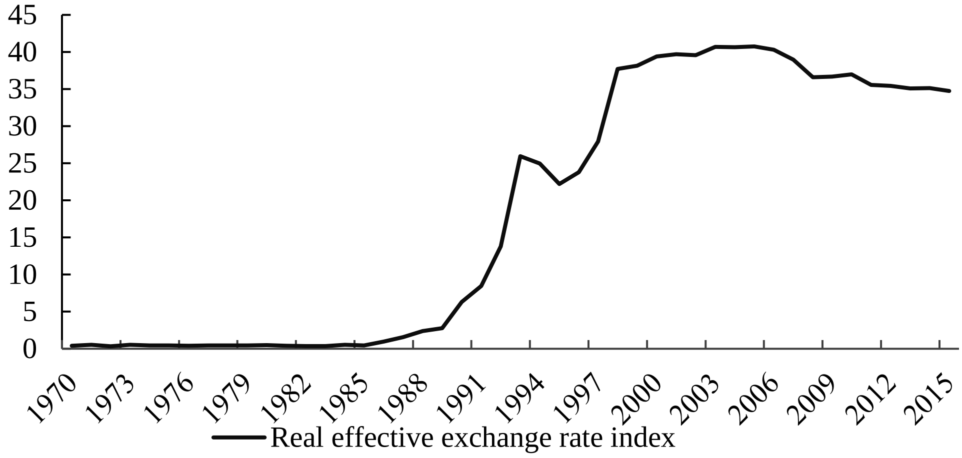

Figure 5.1: Cambodia real effective exchange rate index from 1970 to 2015

Source: Author's calculation

Figure 5.1 indicates the trend of the real effective exchange rate index over a period from 1970 to 2015. The first national election organized by the United Nations Transitional Authority in Cambodia (UNTAC) in 1993 took place after Cambodia faced civil war during the period from 1970 to 1993. Subsequently, the Cambodian government had to increase its expenditure to rebuild the infrastructure and economy destroyed by this war. The real exchange rate grows sharply from 1988 to 1993. During 1988-1991, Vietnamese were detached from Cambodia, and there was political unsettlement. The National Bank of Cambodia (NBC) therefore injected an enormous amount of money to settle the issue of the budget deficit. Notably, In the early 2010s, Cambodia's real effective exchange rate index continuously dropped. At the same time, government fixed capital formation (public investment) as a share of GDP declined from 8.20 percent in 2010 to 5.30 percent in 2015. Government final consumption expenditure as a share of GDP decreased from 6.34 percent in 2010 to 5.39 percent in 2015. The reduction of government spending during this period may have led to less incentive for investment and thus reduced private consumption in Cambodia. Household final consumption expenditure as a share of GDP went down from 81.29 percent in 2010 to 76.80 percent in 2015. This situation leads to lower relative money demand in Cambodia, thereby appreciating the real exchange rate or triggering a decline in the real

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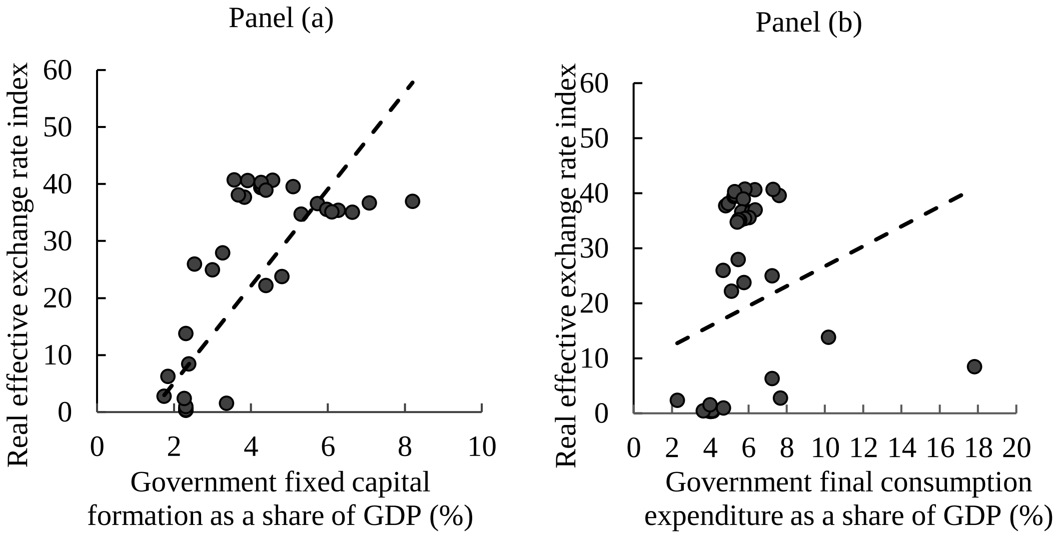
effective exchange rate index. Thus, fiscal policy in Cambodia may contribute to the real effective exchange rate index. It is necessary to know how government spending influences the real exchange rate.

Cambodia adopted the managed floating exchange rate in 1993 (NBC, 2015). The real exchange rate also plays a principal role in Cambodia's export competitiveness (World Bank, 2015). Robust exports have also supported Cambodia's strong economic growth during the last decade (ADB, 2018a).



Note: Each dot depicts each year. Dashed line represents estimated line. Cambodian annual data are from 1970 to 2015.

Figure 5.2: Scatter (government spending, real effective exchange rate index) plot

Source: National Accounts Main Aggregates Database, IMF Database, and author's calculation

As reported in panels (a) and (b) of Figure 5.2, two types of government expenditure (i.e., public investment and government consumption) seem to contribute to the real effective exchange rate index in Cambodia.

5.2 Real Effective Exchange Rate Index

The real exchange rate is used to measure trade competitiveness based on the extension of market size, especially international trade (explanation in detail in section 2.2.3 of Chapter 2). The real effective exchange rate refers to the weighted average of the home currency against a basket of primary trading partners' foreign currencies. The Asian Development Bank (ADB) reports in own database that Cambodia regularly

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exports to ten trading partners (i.e., Belgium, Canada, Hong Kong, Germany, Japan, the People's Republic of China, Spain, Thailand, the United Kingdom, and the United States of America (USA)). The export value of these ten trading partners in 2010 was approximately 78 percent of Cambodia's total export. The bilateral real exchange rate can be computed by the formula below (Catão, 2007):

$$RER_{it} = \frac{E_{it} \times P_{it}*}{P_t}, \tag{5.1}$$

where t =1970, 1971,…, 2015;

$i = 1, 2, ..., 10$ stands for trading partners;

RER_{it} denotes the bilateral real exchange rate of the Riel (Cambodia's currency) against a foreign currency i at time t;

E_{it} represents the nominal exchange rate measured by the AMA exchange rate (Riel/foreign currency i) at time t;

$P_{it}*$ stands for the price level in a foreign country i at time t;

P_t refers to the price level in Cambodia (home country) at time t.

There are only data for the nominal exchange rate of the foreign currency of the country i against the US dollar; data of the nominal exchange rate of Cambodia currency against the foreign currency of the other countries is unavailable. The transformation can be made with this formula:

$$E_{it} = \frac{E_{USA,t}}{e_{it}}, \tag{5.2}$$

where $E_{USA,t}$ denotes the nominal exchange rate of the Riel against the US dollar at time t;

e_{it} stands for the nominal exchange rate of the foreign currency i against the US dollar at time t.

The consumer price index (CPI) at 2010=100 is used as a proxy for the price level. In the case of states without available data of CPI (i.e., Cambodia, Hong Kong, and the People's Republic of China), a GDP deflator acts as a proxy for the price level.

To transform the real exchange rate into the index primarily relies on setting up the base year. Basing on the base year 2010, we get 100 as an index value of the bilateral real exchange rate in 2010. The bilateral real exchange rate index can be calculated as follows:

$$RER_{it}\ Index = \left(\frac{RER_{it}}{RER_{i,2010}} \right) \times 100, \quad (5.3)$$

where $RER_{i,2010}$ is the real exchange rate of the Riel against the foreign currency i in 2010.

These bilateral real exchange rate indices can be converted into a real effective (multilateral) exchange rate index as follows:

$$R_t = \prod_{i=1}^{10} \left(RER_{it}\ Index \right)^{w_i} = \left(RER_{it}\ Index \right)^{w_1} \times \left(RER_{it}\ Index \right)^{w_2} \times ... \times \left(RER_{it}\ Index \right)^{w_{10}}, \quad (5.4)$$

where R_t stands for the real effective exchange rate index at time t;

w_i denotes the export-weighted index for country i.

These weights based on bilateral exports as a share of total exports in 2010 are calculated to estimate Cambodia’s real effective exchange rate index. The export-weighted index can be computed as follows:

$$w_i = \frac{BE_i}{TE}, \quad (5.5)$$

where BE_i represents bilateral export between Cambodia and country i in 2010;

TE denotes Cambodia’s total export in 2010.

Cambodia’s exchange rate is written as a home currency against a foreign currency. A higher real effective exchange rate index can be interpreted as the depreciation of the real exchange rate, thereby improving trade competitiveness. The nominal exchange rate and GDP deflator at 2010=100 are taken from the National

Accounts Main Aggregates Database, United Nations. CPI at 2010=100 and export data in 2010 are retrieved from the World Bank Indicators and the ADB database, respectively.

5.3 Methodology

5.3.1 Specific Model

Household consumption and private investment play a crucial role in the fluctuation of the real exchange rate, as explained in the two-country models of Obstfeld and Rogoff (1995) and Di Giorgio et al. (2018). The recent research conducted by Makin and Ratnasiri (2015) also takes into account both the aggregate private spending and government spending in their model. Therefore, the international competitiveness function in this study can be written as follows:

$$R_t = f\left(E_t, G_t\right), \qquad (5.6)$$

where R_t stands for the real effective exchange rate index at the time t;

E_t refers to aggregate private spending (i.e., the sum of household consumption and private investment) at the time t;

G_t represents government spending at the time t.

Total government expenditure can be disaggregated into government consumption and public investment. Notably, public investment significantly affects the supply side (production) for international competitiveness. The regression for this study, therefore, can be rewritten as follows:

$$R_t = \beta_0 + \beta_1 E_t + \beta_2 GFCF_t + \beta_3 GFCE_t + \varepsilon_t, \qquad (5.7)$$

Where t = 1970, 1972… 2015;

R_t represents the real effective exchange rate index of Cambodia at the time t;

E_t denotes aggregate private spending as a share of GDP of Cambodia at the time t;

$GFCF_t$ refers to government fixed capital formation as a share of GDP of Cambodia at the time t;

$GFCE_t$ stands for government final consumption expenditure as a share of GDP of Cambodia at the time t.

5.3.2 Data Collection

Cambodia annual data obtained from1970 to 2015 create 46 observations. Variables used for this analysis are:

- Real effective exchange rate index: assessing cost competitiveness of the home country relative to the critical trading competitors;
- GDP at a constant price in 2011: the total value of goods and services produced per annum;
- Private investment at a constant price at 2011: the private sector's investment spending in infrastructure services according to Investment and Capital Stock Dataset of IMF;
- Household final consumption expenditure as a share of GDP: the consumption of goods and services made by households and enterprises in the nation;
- Government fixed capital formation at a price at 2011: acquisitions (i.e., purchase of new or second-hand assets) plus specific expenditure on services providing extra value to non-produced assets and then minus disposal of produced fixed assets;
- Government final consumption expenditure as a share of GDP: goods and services consumed by and collective consumption services offered by the general government.

The data for these variables are derived from two primary sources: the Investment and Capital Stock Dataset of the IMF and the National Accounts Main Aggregate Database of the United Nations. The link to obtain the data of GDP, government fixed capital formation, and private investment at a constant price at 2011 is:

https://www.imf.org/external/np/fad/publicinvestment/

For the rest of the variables mentioned above, data are accessed through the link below:

https://unstats.un.org/unsd/snaama/dnlList.asp

The conversions to receive explanatory variables for the regression are:

- Private investment and government fixed capital formation at a constant price 2011 divided by GDP at a constant price 2011 is equal to private investment as a share of GDP and government fixed capital formation as a share of GDP, respectively.
- Aggregate private spending as a share of GDP is the sum of household final consumption expenditure as a share of GDP and private investment as a share of GDP.

The data analysis is conducted in STATA 15.1 software.

5.3.3 Autoregressive Distributed Lags Approach

The Engle–Granger approach (Engle & Granger, 1987) or Johansen's multivariate maximum likelihood approach for co-integration (Johansen, 1988; Johansen & Juselius, 1990) requires all of the variables (i.e., dependent and independent variables) integrated to be order one I(1). The autoregressive distributed lags (ARDL) bound approach introduced by Pesaran and Shin (1998) and Pesaran et al. (2001) has several advantages over other traditional co-integration approaches. First, the ARDL model credibly deals with regressors with the existence of mutually integrated orders (zero I(0) and first I(1)) while the regressand is integrated of order one I(1) (Nkoro & Uko, 2016). Next, the ARDL model tests the existence of co-integration based on the standard F-test and estimates short-run and long-run relationships among explained and explanatory variables. Last, the ARDL approach also copes with the endogeneity problem by adding lags of explained and/or explanatory variables. Optimal lag lengths for ARDL bound test are selected under the minimum value of the Akaike Information Criterion (AIC) developed by Akaike (1977). The bound testing approach, based on the standard F-test with two sets of critical value (i.e., lower bound I(0) and upper bound I(1)), justifies the existence of long-run co-integration. If the F-statistic estimated from the ARDL bound model is higher than the upper bound I(1), the null hypothesis, no co-integration, is rejected. In the case of an F-statistic between the lower and upper bound, no conclusion can be confirmed. An F-statistic lower than lower bound leads to the conclusion that long-run co-integration does not exist. If there is a long-run co-integration relationship among dependent and independent variables, a causal relationship exists, at least in one direction. We assumed unrestricted intercept and no trend in the equation of the ARDL bound test. The ARDL bound model of this study can be written as follows:

$$\Delta R_t = \beta_0 + \beta_1 E_t + \beta_2 GFCF_t + \beta_3 GFCE_t + \lambda_R ECT_{t-1} \\ + \sum_{j=1}^{p} \theta_j \Delta R_{t-j} + \sum_{j=1}^{k} \alpha_j \Delta E_{t-j} + \sum_{j=1}^{l} \varphi_j \Delta GFCF_{t-j} + \sum_{j=1}^{k} \rho_j \Delta GFCE_{t-j} + \varepsilon_t, \quad (5.8)$$

where Δ represents the first difference, λ_R stands for the speed of adjustment, and ECT_{t-1} (error correction term) denotes disequilibrium. The coefficient of the error correction term indicates the speed to adjust disequilibrium due to short-run shocks to long-run equilibrium (Shahbaz et al., 2013). If this coefficient is statistically significant and negative, it depicts the existence of this adjustment. p, k, l, and m refer to lags of ΔR, ΔE, $\Delta GFCF$, and $\Delta GFCE$, respectively. The selected value of p, k, l, and m is based on AIC. ε_t represents the error term. This study deals only with the long-run relationship between explained and explanatory variables and the effects of E_t, $GFCF_t$, and $GFCE_t$ on R_t.

5.4 Results and Discussion

5.4.1 Estimation

The analysis (e.g., OLS and ARDL approach) with the variables, non-stationarity after first differencing or without co-integration, generates a spurious result, thus demanding that a unit root test (stationary test) and co-integration test be conducted before running a regression (Granger & Newbold, 1974). The unit root test can be performed to reveal whether the time series has a deterministic trend (i.e., constant covariance, mean, and variance over time) or a stochastic trend (i.e., containing random walk) (Kirchgässner et al., 2013). If the unit-root exists, the variables have a stochastic trend. This study employs two well-known unit root tests (i.e., Augmented-Dicky–Fuller suggested by Dickey and Fuller (1979) and Philips-Perron developed by Philips and Perron (1988)). The null hypothesis of both tests is unit-root (non-stationarity). The

Augmented-Dicky–Fuller (ADF) test relies heavily on the length of lags, therefore selecting the optimal lags based on the Bayesian Information Criterion (BIC) proposed by Schwarz (1978). The result of unit-root tests (ADF and Philips–Perron) seen in Table 5.1 reveals that the explained variable (R_t) is integrated of order one I(1). The explanatory variable ($GFCF_t$) has integration of order one I(1), but the other explanatory variables (E_t and $GFCE_t$) are stationary at level I(0).

Table 5.1: Unit root tests

Test	Augmented-Dicky-Fuller (ADF) with intercept		Philips-Perron (PP) with intercept	
	X_i	ΔX_i	X_i	ΔX_i
R_t	-0.794	-3.161***	-0.699	-4.520***
E_t	-2.820***		-3.202**	
$GFCF_t$	-1.325*	-5.297***	-1.233	-6.604***
$GFCE_t$	-3.168***		-3.944***	

Note: Δ donotes the first difference. * , **, and *** represent the significance level at 10, 5, and 1 percent, respectively. If both tests express stationarity, the variable is concluded as stationarity.

The optimal lags chosen by AIC are 6 for the ARDL bound test. AIC also indicates 6, 5, 4, and 6 as the value of p, k, l, and m, respectively. The F-statistics shown in Table 5.2 are above the critical value of the upper bound at a significance level of 1 percent. The null hypothesis of no co-integration, therefore, is rejected at these levels. There is co-integration among these variables, so a causal relationship occurs in at least one direction.

Table 5.2: ARDL (6, 5, 4, 6) bound test for co-integration

	Dependent variable (R_t)	
F Statistics	30.1126	
Test critical value	I(0)	I(1)
1 percent level	4.29	5.61
5 percent level	3.23	4.35
10 percent level	2.72	3.77

Note: If F statistics is greater than the critical value of upper bound I(1), the null hypothesis is rejected.

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Table 5.3: Regression results from ARDL approach

ΔR_t	ARDL (6, 5, 4, 6)	
	Coefficient	Standard Error
Long-run		
E_t	7.546***	0.450
$GFCF_t$	17.208***	0.682
$GFCE_t$	17.483***	0.860
Short-run		
ECT_{t-1}	-0.334***	0.031
ΔR_{t-1}	-0.726***	0.128
ΔR_{t-2}	-0.411***	0.090
ΔR_{t-3}	-0.182**	0.081
ΔR_{t-4}	-0.286***	0.065
ΔR_{t-5}	-0.267**	0.095
ΔE_t	-2.506***	0.275
ΔE_{t-1}	-2.751***	0.260
ΔE_{t-2}	-2.546***	0.283
ΔE_{t-3}	-1.630***	0.209
ΔE_{t-4}	-0.558***	0.126
$\Delta GFCF_t$	-4.988***	0.560
$\Delta GFCF_{t-1}$	-3.729***	0.436
$\Delta GFCF_{t-2}$	-2.515***	0.314
$\Delta GFCF_{t-3}$	-0.876**	0.301
$\Delta GFCE_t$	-5.755***	0.565
$\Delta GFCE_{t-1}$	-5.738***	0.540
$\Delta GFCE_{t-2}$	-4.342***	0.565
$\Delta GFCE_{t-3}$	-1.741***	0.367
$\Delta GFCE_{t-4}$	0.345	0.216
$\Delta GFCE_{t-5}$	0.540***	0.138
Constant	-285.156***	30.615

Note: Δ denotes the first differences. *, ** and *** indicate the significance level at 10, 5, and 1 percent, respectively.

The focus point of this study lies in the long-run relationship between government spending (i.e., public investment and consumption) and trade competitiveness. The long-run elasticity of the explained variable with respect to explanatory variables is reported in Table 5.3. E_t, $GFCF_t$, and $GFCE_t$ are positive and statistically significant at these levels. The extension of aggregate private spending, public investment, or government consumption depreciates the real effective exchange rate, thereby gaining more trade competitiveness. The coefficient of error correction term (ECT_{t-1}) is negative and significant at these levels. The error-correction coefficient ($\lambda_R = -0.334$) indicates that the speed of adjustment– the period needed to return to the long-run equilibrium after disequilibrium in the short run – is approximately 33.4 percent.

The estimated result of the short-run implication is also presented in Table 5.3. R_t also reacts to its lags at a 1 percent significance level. A negative response of R_t to an increase of aggregate private spending, public investment, or government consumption is found in the short run, and these three variables are highly significant at these levels.

5.4.2 Diagnostic Tests

The key ARDL assumptions about the error term (residual) checked with diagnostic tests are no serial correlation, homoscedasticity, and normal distribution. A residual has a serial correlation (i.e., the residual at time t correlates to the residual at the previous time), thus impacting the volume of t-statistics, standard error, and confident interval. Heteroscedasticity (i.e., the residual's variance is not constant) implies that this built model does not explain the explained variable. If the residual is not a normal distribution, this model does not describe all trends of data. The Durbin–Watson test suggested by Durbin and Watson (1950) is carried out to check the residual. The null hypothesis is no serial correlation. The Breusch–Pagan test is used to confirm the residual with no heteroscedasticity as the test's null hypothesis (Breusch & Pagan, 1979). The Jarque–Bera test introduced by Jarque and Bera (1987) joins between Skewness and Kurtosis. This test relies on asymptotic standard error without correlation for sample size. The normal distribution is proposed as the null hypothesis of the Jarque–Bera test. The three tests presented in Table 5.4 indicate that the null hypothesis of each test cannot be rejected at these levels. The residual of ARDL (6, 5, 4, 6) has no serial correlation, no heteroscedasticity, and normal distribution.

Table 5.4: Diagnostic tests of ARDL (6, 5, 4, 6)

ε_t	Chi2
Durbin-Watson test	0.446
Breusch-Pagan test	2.21
Jarque-Bera test	4.45

Note: *, **, and *** denotes the significance level at 10, 5, and 1 percent, respectively.

5.4.3 Stability Test

The robustness of models can be checked with the cumulative sum test to confirm the parameter stability for the regression model. The cumulative sum test propounded in Brown et al. (1975) and based on recursive residuals is potentially designed to detect instability of parameters (Ploberger & Krämer, 1992). The null hypothesis of the cumulative sum test is no structural breaks (no change of regression coefficients over time). The result shown in Table 5.5 reveals the null hypothesis is not rejected at these levels of significance. The estimated long-run parameters converge to the zero means, thereby leading to the existence of a stable and consistent model.

Table 5.5: Cumulative sum test

Model	ARDL (6, 5, 4, 6)
Test statistic	0.230
Critical value 1 percent	1.143
Critical value 5 percent	0.947
Critical value 10 percent	0.850

Note: *, **, and *** represent the significance level at 10, 5, and 1 percent, respectively.

5.4.4 Causality Test

The ARDL bound estimation does not disclose causality (i.e., cause and effect) among the considered variables. The Modified Wald test (MWALD) proposed by Toda and Yamamoto (1995) is carried out in this study to understand the directional causality relationship between government spending (i.e., public investment and consumption) and trade competitiveness. The MWALD, the so-called Toda–Yamamoto causality test, can manage problems (i.e., any possible non-stationarity or co-integration among variables) which the original Granger causality ignores (Wolde-Rufael, 2005). For the Toda and Yamamoto (1995) approach, a standard vector autoregressive (VAR) model is applied to the level of variables rather than the first differences in the traditional

Granger causality test, thus lessening the risks of wrongly identifying the integrated order of series (Mavrotas & Kelly, 2001). The null hypothesis of the Toda–Yamamoto causality test is no effect of a variable on another variable. The kaleidoscopic result of Toda–Yamamoto causality test is presented in Table 5.6. The bi-directional causality relationship between three explanatory variables (i.e., aggregate private spending, public investment, and government consumption) and trade competitiveness is observed in this analysis.

Table 5.6: Toda-Yamamoto causality test result

Cause	→	Effect	Wald Statistics	P-value
E_t	→	R_t	5824.80***	0.000
R_t	→	E_t	163.58***	0.000
$GFCF_t$	→	R_t	2401***	0.000
R_t	→	$GFCF_t$	97.983***	0.000
$GFCE_t$	→	R_t	8502.6***	0.000
R_t	→	$GFCE_t$	131.89***	0.000

Note: * , ** and *** indicate the significance level at 10, 5 and 1 percent, respectively.

5.4.5 Discussion

The results of public investment and government consumption in this study coincide precisely with the explanations of Obstfeld and Rogoff (1995) and Di Giorgio et al. (2018) based on the two-country model, that is to say, an increase in government spending improves trade competitiveness through depreciation of the real exchange rate as a measurement of trade competitiveness. This finding also agrees with the result of Bouakez and Eyquem (2015), who indicated that the response to the extension of public spending is the depreciation of the real exchange rate, which intensified international competitiveness in four developed countries. The result of this study is consonant with the result of Kim (2015), who suggested that the extension of government consumption in 18 industrialized countries enhanced trade competitiveness owing to the improvement of the market size in response to the depreciation of the real exchange rate. Thus, the extension of the market size in the time of globalization can be an effective channel for the improvement of trade competitiveness for developed and also developing countries (e.g., Cambodia). The extension of government spending can encourage a level of productivity that generates low production costs and high relative money demand in the home country, so it is a benefit in expanding the market size and therefore increasing trade competitiveness.

The results of this study are inconsistent with the outcome of Makin and Ratnasiri (2015) due to the different baseline for reflecting the real exchange rate as the measurement of trade competitiveness. In their study, they find that the real exchange rate is the proportion of the domestic currency price of non-traded to traded goods. The improvement of the real exchange rate index appreciates Australia's currency and thus reduces the international competitiveness owing to Australia’s exchange rate written as a foreign currency against the home currency. In the case of expansionary public policy (i.e., public investment and government purchase) on non-traded goods, real exchange rate appreciation responds to the growth in the relative price of non-traded goods (i.e., an increase in opportunity cost of tapping production resources in tradable goods sector) due to faster productivity growth in non-traded than traded goods sector. As a result, the extension of government expenditure on non-tradable goods sector decreases Australian international competitiveness. The findings of this study are also not in line with Chen and Liu (2018), who pointed out that the enhancement of public investment or government consumption worsens the trade competitiveness due to the existence of the government’s twin deficit. While there is an increase in government expenditure and a decrease in national savings, the real interest rates grow. More capital in the domestic capital market reacts to higher real interest rates, thus reducing the net capital outflow. A decline in net capital outflow decreases trade competitiveness via the appreciation of the real exchange rate and disrupts the trade account balance as well.

5.5 Conclusions and Policy Implications

5.5.1 Conclusions

The influence of public policy on trade competitiveness is still a debated issue. This paper rigorously examines the reaction of trade competitiveness to the expansion of government spending (i.e., public investment and government consumption). The ARDL approach is employed to estimate dynamic relationships based on annual data from 1970 to 2015 from Cambodia. The results of this paper suggest that the extension

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of public investment or government purchases promotes trade competitiveness due to the devaluation of the real exchange rate. The result of aggregate private spending is the same as the result of public investment or government purchases.

This study makes two contributions to the international macroeconomic literature. Firstly, in terms of the extension of market size, it indicates how a change in domestic spending impacts an opened economy's competitiveness through the real exchange rate. Lastly, international competitiveness based on the principle mentioned above is applied to the Cambodian experience, thus revealing that a drop in Cambodia's trade competitiveness over the period from 2011 to 2015 was a response to a reduction in government spending.

5.5.2 Limitations

This study faces the problem of limited data. Cambodia's historical data on public investment (GFCF) and government consumption (GFCE) from 1971 to 1986 show few changes. Cambodia was involved in a civil war during that period, so some of the data are the results of estimations by the United Nations and the IMF. Another limitation is that this study only deals with one aspect of Cambodia's trade competitiveness and is not a complex aspect of competitiveness. Monetary policy also contributes to price level, the nominal exchange rate and thus the real exchange rate. However, our model does not take into account this into account because the data of Cambodia's money supply are limited.

Making use of quarterly (Makin & Ratnasiri, 2015) and semi-annual data can eliminate the effect of limited data. Alternatively, the panel data approach over ten countries in ASEAN is a solution for limited data.

5.5.3 Policy Implications

The Cambodian government is making an effort to improve international competitiveness through the extension of market size, and thus Cambodia joined the World Trade Organization (WTO) in 2004. The outcome of this study demonstrates the efficacy of fiscal policy for Cambodia's international macroeconomic activities via the real effective exchange rate. The expansion of government spending creates more incentive to invest in Cambodia and also enhances productivity via the improvement of labor productivity in the private sector. It can bring down the marginal cost of production and encourage private consumption in Cambodia. As a result, a high relative demand for money emerges in Cambodia, thus leading to a depreciation of the real exchange rate and improving trade competitiveness. According to the results of this study, the Cambodian government can improve trade competitiveness through an expansionary fiscal policy (i.e., public investment and government purchases).

However, the efficacy of government spending may decrease if management of public investment is inefficient. Dabla-Norris et al. (2012) find that Cambodia's PIMI (Public investment management index) is 1.57. PIMI can be defined as the multi-dimension index of the efficiency and quality of public investment management process. The value of PIMI ranges between zero and four, and public investment is fully efficient when PIMI equals to 4. The Cambodia value (1.57) of this index means that a US dollar of public investment translates to approximately 0.4 US dollars of capital in Cambodia. The Cambodia corruption perception index has been about 21 in the last six years (Quality of Government Institute, 2019) on a scale from 0 to 100, where 0 indicates the highest corruption and 100 means the perception is that there is no corruption in the public sector. Therefore, the government should take the initiative to improve the PIMI and the corruption perception indexes, thereby not offsetting the efficient and positive impact of government spending on trade competitiveness. The possibility for designing expansionary fiscal policy can be seen if there are high values of consolidated fiscal balance and low national debt. Cambodia's consolidated fiscal balance as a share of GDP based on the CEIC database declined from -7.65 percent in 2011 to -2.66 percent in 2015. As reported by IMF's database, Cambodia's national debt as a share of GDP in the same period slightly increased from 30.30 percent to 32.54 percent.

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Chapter 6 General Conclusions

This study provides potential evidence that the role of government spending is integral to the economy (i.e., national and international macroeconomic activities). For domestic macro activities, the contribution of government expenditure, mainly public investment, to private consumption is non-linear because a rise in the present value of taxes creates a negative wealth effect via a decline in disposable income and an increase in price levels. Another important reason is that political instability produces an unhealthy influence on household behavior, thus reducing the effectiveness of government spending on private consumption. Moreover, the healthy level of economic growth diminishes in response to a higher level of government expenditure. The optimal magnitude in Cambodia's economy was found to be 5.40 percent for public investment (GFCF) and 7.23 percent for public consumption (GFCE). In the case of international macro activities, an expansionary fiscal policy (i.e., government investment and purchases) is instrumental in the enhancement of Cambodia's trade competitiveness via the depreciation of the real exchange rate as its alternative measurement.

However, this study suggests that high interest rates also contribute negatively to private consumption as the essential function of households in economic activity. The principal reason is that an increase in interest rates encourages households to save rather than spend because saving and spending are substitution products. Alternatively, households reduce their expenditures if they usually use the financial market to smooth their future consumption – that is, they have difficulties in repaying their loans in response to high interest rates. The household consumption is also one of the key components to calculate GDP based on demand-side. That is, a drop in household expenditure slows down economic growth. This study also points to trade competitiveness loss in response to a reduction in aggregate private spending as the sum of private consumption and investment. Thus, a decrease in household spending leads to worsening trade competitiveness. This is conclusive evidence that the government should use the integration of fiscal and monetary policy, thereby being able to achieve sustainable economic growth, improvement of international competitiveness, and development for Cambodia.

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The result of the optimal level of government spending based on this time series analysis can be robust for three years from the analyzed period from 1971 to 2015. For a period of more than three years, the optimal value may change because the economic environment – especially the activities of the private sector in Cambodia's economy – has been undergoing significant changes. Thus, he threshold levels in this analysis might not be robust after the COVID-19 period, because it is farther away from this studied period.

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Appendices

Appendix 1: Non-linear effect of government spending on private consumption

Appendix 1.1: Dataset

Time	CC	GI	GC	DIS	INF	RATE
1987	96.76385348	3.368888447	3.981505657	97.21285348	-31.248	4.774492372
1988	98.19436931	2.267412747	2.279208851	98.79436931	23	3.213447059
1989	88.61022212	1.74680995	7.669285913	89.96522212	63.8	2.475632683
1990	90.42623564	1.845187481	7.231940612	95.76423564	141.8	2.615056258
1991	74.25379949	2.38147881	17.81479796	81.99879949	191	3.375104995
1992	82.3923445	2.306097709	10.16746411	92.9403445	75	3.268272683
1993	102.8076411	2.535310686	4.675276257	112.1636411	114.319	5.368888953
1994	96.13246285	3.003432562	7.232400166	107.3584629	10.44	3.80002149
1995	90.91210601	4.392383193	5.096243472	100.832106	10.077	5.69474862
1996	98.00931135	4.809398076	5.749843143	105.8253114	7.147	4.115479346
1997	90.32232587	3.269360026	5.450695657	106.7683259	10.503	6.579570701
1998	95.62291587	3.832766897	4.804494136	102.1099159	12.899	4.999578718
1999	89.83332308	3.678377173	4.943154789	102.1493231	1.996	7.12447415
2000	88.80799032	4.261648239	5.232797916	103.8929903	-0.826	8.004430606
2001	84.74788271	4.276663576	5.295927897	102.6958827	-0.117	6.585925048
2002	83.89759542	5.0990449	7.605673252	101.8575954	-0.036	7.892902531
2003	83.57176615	4.562697101	7.28543528	102.0817662	1.027	8.284021188
2004	85.13121376	3.919861584	6.325781429	100.7872138	3.925	9.004188815
2005	84.29422271	3.564978584	5.800895384	100.7052227	6.349	10.07277368
2006	80.96309436	4.269595432	5.275770459	102.8340944	6.143	10.09625953
2007	78.14813853	4.393711606	5.730861647	97.48413853	7.668	9.959784663
2008	79.4440865	5.734209291	5.634525024	91.4400865	24.997	9.861353661
2009	76.16015858	7.082953215	6.162502003	87.60515858	-0.663	9.125415684
2010	81.29181899	8.201432295	6.344690529	89.37381899	3.997	5.589610023
2011	82.85979869	5.970051755	6.019412814	98.96679869	5.478	8.297193335
2012	80.17595484	6.270932318	5.788705826	95.49095484	2.925	9.34201613
2013	77.50925353	6.636570322	5.532220606	88.03225353	2.955	10.10755973
2014	77.20314613	6.105371626	5.469321114	90.58414613	3.852	10.94821171
2015	76.80514753	5.30656714	5.397979837	89.87414753	1.225	10.44111213

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Appendix 1.2: Commands and results in STATA 15.1

```
. tsset time, yearly
        time variable:  time, 1987 to 2015
                delta:  1 year
* Unit Root Test

. varsoc cc

   Selection-order criteria
   Sample:  1991 - 2015                         Number of obs      =        25
  +---------------------------------------------------------------------------+
  |lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
  |----+----------------------------------------------------------------------|
  |  0 |  -85.315                      58.4028    6.9052   6.91872   6.95395  |
  |  1 | -79.8625  10.905*   1  0.001  40.9136*    6.549*  6.57604*  6.64651* |
  |  2 | -79.8493  .02633    1  0.871  44.3108   6.62794   6.66851   6.77421  |
  |  3 | -79.4631  .77243    1  0.379   46.616   6.67705   6.73114   6.87207  |
  |  4 | -79.4541  .01796    1  0.893  50.5982   6.75633   6.82394    7.0001  |
  +---------------------------------------------------------------------------+
   Endogenous:  cc
    Exogenous:  _cons

. dfuller cc, drift lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        27

                               ----------- Z(t) has t-distribution -----------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -2.264            -2.492            -1.711            -1.318
------------------------------------------------------------------------------
p-value for Z(t) = 0.0164

. varsoc gi

   Selection-order criteria
   Sample:  1991 - 2015                         Number of obs      =        25
  +---------------------------------------------------------------------------+
  |lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
  |----+----------------------------------------------------------------------|
  |  0 | -45.1967                      2.35822   3.69574   3.70926   3.74449  |
  |  1 | -29.6405  31.113*   1  0.000  .736169*  2.53124*  2.55828*  2.62875* |
  |  2 | -29.5893  .10233    1  0.749  .794876   2.60715   2.64771   2.75341  |
  |  3 | -29.4855  .20762    1  0.649  .855334   2.67884   2.73293   2.87386  |
  |  4 | -29.3692  .23265    1  0.630  .920464   2.74953   2.81715   2.99331  |
  +---------------------------------------------------------------------------+
   Endogenous:  gi
    Exogenous:  _cons

. dfuller gi, drift lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        27

                               ----------- Z(t) has t-distribution -----------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -1.671            -2.492            -1.711            -1.318
------------------------------------------------------------------------------
p-value for Z(t) = 0.0538
```

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```
. varsoc gc

   Selection-order criteria
   Sample:  1991 - 2015                         Number of obs      =        25
  +---------------------------------------------------------------------------+
  |lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
  |----+----------------------------------------------------------------------|
  |  0 | -59.1753                      7.21521   4.81403   4.82755   4.86278* |
  |  1 |  -57.666  3.0187    1  0.082  6.92921*  4.77328*  4.80033*  4.87079  |
  |  2 | -57.6228  .08632    1  0.769  7.48658   4.84983   4.89039   4.99609  |
  |  3 | -57.0119  1.2219    1  0.269   7.7357   4.88095   4.93504   5.07597  |
  |  4 | -56.2814  1.4609    1  0.227  7.92562   4.90251   4.97013   5.14629  |
  +---------------------------------------------------------------------------+
   Endogenous:  gc
    Exogenous:  _cons

. dfuller gc, drift lags(0)

Dickey-Fuller test for unit root                   Number of obs   =        28

                               ----------- Z(t) has t-distribution -----------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)            -3.691           -2.479            -1.706            -1.315
------------------------------------------------------------------------------
p-value for Z(t) = 0.0005

. varsoc dis

   Selection-order criteria
   Sample:  1991 - 2015                         Number of obs      =        25
  +---------------------------------------------------------------------------+
  |lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
  |----+----------------------------------------------------------------------|
  |  0 | -85.1384                      57.5837   6.89107    6.9046   6.93983  |
  |  1 | -79.6873  10.902*   1  0.001  40.3444*  6.53499*  6.56203*   6.6325* |
  |  2 |  -79.436  .50275    1  0.478  42.8696   6.59488   6.63545   6.74114  |
  |  3 | -78.6611  1.5497    1  0.213  43.7191   6.61289   6.66698   6.80791  |
  |  4 | -78.5946  .13303    1  0.715  47.2359   6.68757   6.75518   6.93134  |
  +---------------------------------------------------------------------------+
   Endogenous:  dis
    Exogenous:  _cons

. dfuller dis, drift lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        27

                               ----------- Z(t) has t-distribution -----------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)            -2.358           -2.492            -1.711            -1.318
------------------------------------------------------------------------------
p-value for Z(t) = 0.0134

. varsoc inf

   Selection-order criteria
   Sample:  1991 - 2015                         Number of obs      =        25
  +---------------------------------------------------------------------------+
  |lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
  |----+----------------------------------------------------------------------|
  |  0 | -129.573                      2014.33   10.4459   10.4594   10.4946  |
  |  1 | -119.741  19.665*   1  0.000  994.026    9.7393   9.76634   9.83681* |
  |  2 | -119.186  1.1097    1  0.292  1030.91   9.77491   9.81548   9.92118  |
  |  3 | -117.465  3.4425    1  0.064  974.676   9.71721    9.7713   9.91223  |
  |  4 | -115.834  3.2621    1  0.071  929.188*  9.66672*  9.73434*   9.9105  |
  +---------------------------------------------------------------------------+
   Endogenous:  inf
    Exogenous:  _cons
```

```
. dfuller inf, drift lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        27

                               ----------- Z(t) has t-distribution -----------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -1.871            -2.492            -1.711            -1.318
------------------------------------------------------------------------------
p-value for Z(t) = 0.0368
. varsoc rate

   Selection-order criteria
   Sample:  1991 - 2015                          Number of obs      =        25
  +---------------------------------------------------------------------------+
  |lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
  |----+----------------------------------------------------------------------|
  |  0 | -57.1737                      6.14761    4.6539   4.66742   4.70265  |
  |  1 | -43.1987   27.95    1  0.000  2.17791    3.6159   3.64294   3.71341  |
  |  2 |   -40.56  5.2774*   1  0.022  1.91188*   3.4848*  3.52537*  3.63107* |
  |  3 | -40.5244  .07126    1  0.790  2.06855   3.56195   3.61604   3.75697  |
  |  4 | -40.5118  .02513    1  0.874  2.24461   3.64095   3.70856   3.88472  |
  +---------------------------------------------------------------------------+
   Endogenous:  rate
    Exogenous:  _cons

. dfuller rate, drift lags(2)

Augmented Dickey-Fuller test for unit root         Number of obs   =        26

                               ----------- Z(t) has t-distribution -----------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -1.208            -2.508            -1.717            -1.321
------------------------------------------------------------------------------
p-value for Z(t) = 0.1199

. gen d_rate=d.rate
(1 missing value generated)

. dfuller d_rate, drift lags(2)

Augmented Dickey-Fuller test for unit root         Number of obs   =        25

                               ----------- Z(t) has t-distribution -----------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -3.473            -2.518            -1.721            -1.323
------------------------------------------------------------------------------
p-value for Z(t) = 0.0011

* Markov Switching Model
. mswitch ar cc rate dis inf, switch(gi gc) ar(1) vce(robust)
Performing EM optimization:
Performing gradient-based optimization:

Iteration 0:   log pseudolikelihood = -74.946701  (not concave)
Iteration 1:   log pseudolikelihood = -72.445245  (not concave)
Iteration 2:   log pseudolikelihood = -62.712356  (not concave)
Iteration 3:   log pseudolikelihood = -61.844905  (not concave)
Iteration 4:   log pseudolikelihood = -61.454444  (not concave)
Iteration 5:   log pseudolikelihood = -61.166245  (not concave)
Iteration 6:   log pseudolikelihood = -60.895291  (not concave)
Iteration 7:   log pseudolikelihood = -60.658805  (not concave)
Iteration 8:   log pseudolikelihood = -60.429725  (not concave)
Iteration 9:   log pseudolikelihood = -60.166739  (not concave)
Iteration 10:  log pseudolikelihood = -59.910192  (not concave)
Iteration 11:  log pseudolikelihood = -59.633831  (not concave)
Iteration 12:  log pseudolikelihood = -59.290206  (not concave)
Iteration 13:  log pseudolikelihood = -58.097495  (not concave)
Iteration 14:  log pseudolikelihood = -57.451923
```

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```
Iteration 15:  log pseudolikelihood = -56.918746  (backed up)
Iteration 16:  log pseudolikelihood = -56.802379  (not concave)
Iteration 17:  log pseudolikelihood = -56.267907  (not concave)
Iteration 18:  log pseudolikelihood = -56.117273  (not concave)
Iteration 19:  log pseudolikelihood = -56.037014  (not concave)
Iteration 20:  log pseudolikelihood = -55.713274  (not concave)
Iteration 21:  log pseudolikelihood =  -55.69243  (not concave)
Iteration 22:  log pseudolikelihood = -55.605614  (not concave)
Iteration 23:  log pseudolikelihood = -55.567458  (not concave)
Iteration 24:  log pseudolikelihood = -55.535027  (not concave)
Iteration 25:  log pseudolikelihood =  -55.50793  (not concave)
Iteration 26:  log pseudolikelihood = -55.491692  (not concave)
Iteration 27:  log pseudolikelihood = -55.468753  (not concave)
Iteration 28:  log pseudolikelihood = -55.455468  (not concave)
Iteration 29:  log pseudolikelihood = -55.436718  (not concave)
Iteration 30:  log pseudolikelihood =  -55.42271  (not concave)
Iteration 31:  log pseudolikelihood = -55.408819  (not concave)
Iteration 32:  log pseudolikelihood = -55.355467  (not concave)
Iteration 33:  log pseudolikelihood = -55.320163  (not concave)
Iteration 34:  log pseudolikelihood = -55.307483  (not concave)
Iteration 35:  log pseudolikelihood = -55.294845  (not concave)
Iteration 36:  log pseudolikelihood = -55.247598
Iteration 37:  log pseudolikelihood =  -53.94056
Iteration 38:  log pseudolikelihood = -53.242898
Iteration 39:  log pseudolikelihood = -53.083223
Iteration 40:  log pseudolikelihood = -53.081623
Iteration 41:  log pseudolikelihood = -53.081622

Markov-switching autoregression

Sample: 1988 - 2015                             No. of obs        =         28
Number of states =    2                         AIC               =     4.7201
Unconditional probabilities: transition         HQIC              =     4.9092
                                                SBIC              =     5.3386
Log likelihood = -53.081622

------------------------------------------------------------------------------
             |               Robust
          cc |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
cc           |
        rate |  -1.944441   .0907453   -21.43   0.000    -2.122299   -1.766584
         dis |   .2430958   .0253493     9.59   0.000     .1934121    .2927795
         inf |   .0092361   .0069688     1.33   0.185    -.0044225    .0228946
             |
          ar |
         L1. |  -.8441357   .1118106    -7.55   0.000     -1.06328    -.624991
-------------+----------------------------------------------------------------
State1       |
          gi |   .3199453   .1445703     2.21   0.027     .0365928    .6032978
          gc |  -1.461035   .1230336   -11.88   0.000    -1.702177   -1.219894
       _cons |   81.90109   2.451689    33.41   0.000     77.09586    86.70631
-------------+----------------------------------------------------------------
State2       |
          gi |  -1.735656   .1304428   -13.31   0.000    -1.991319   -1.479993
          gc |  -2.020176   .1489515   -13.56   0.000    -2.312116   -1.728237
       _cons |   97.47783    3.48295    27.99   0.000     90.65138    104.3043
-------------+----------------------------------------------------------------
       sigma |   .9689257   .1331205                      .7401915    1.268343
-------------+----------------------------------------------------------------
         p11 |   .5819301   .2689389                      .1375352    .9239536
-------------+----------------------------------------------------------------
         p21 |   .3645643   .1851226                      .1069902    .7331462
------------------------------------------------------------------------------
. predict pr_state1 pr_state2, pr
```

```
. estat transition

Number of obs = 28
--------------------------------------------------------------------------------
    Transition Probabilities |   Estimate   Std. Err.     [95% Conf. Interval]
-----------------------------+--------------------------------------------------
                         p11 |   .5819301   .2689389      .1375352    .9239536
-----------------------------+--------------------------------------------------
                         p12 |   .4180699   .2689389      .0760464    .8624648
-----------------------------+--------------------------------------------------
                         p21 |   .3645643   .1851226      .1069902    .7331462
-----------------------------+--------------------------------------------------
                         p22 |   .6354357   .1851226      .2668538    .8930098
--------------------------------------------------------------------------------

. estat duration

Number of obs = 28
--------------------------------------------------------------------------------
           Expected Duration |   Estimate   Std. Err.     [95% Conf. Interval]
-----------------------------+--------------------------------------------------
                      State1 |   2.391944   1.538706      1.159468    13.14986
-----------------------------+--------------------------------------------------
                      State2 |      2.743   1.392871      1.363984    9.346647
--------------------------------------------------------------------------------

. twoway (tsline pr_state1)

. twoway (tsline pr_state2)
```

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Appendix 2: Relationship between government expenditure and economic growth

Appendix 2.1: Dataset

Time	GGDP	LAB	EXPO	GFCF	GFCE
1971	-4.9957	2.022358	-4.88959	2.309885	4.020208
1972	-5.4368	2.249771	-5.12411	2.309886	4.020627
1973	-18.9441	1.995437	-18.9251	2.309886	4.01978
1974	-5.23294	1.12346	-5.65152	2.309886	4.020217
1975	-1.34952	-0.11732	-2.40063	2.309886	4.021884
1976	0	-1.60427	1.731422	2.309886	4.01724
1977	-14.6764	-2.8582	-13.4663	2.309886	4.021528
1978	0	-3.37439	-1.4829	2.309886	4.026883
1979	-12.8286	-2.72296	-15.238	2.309886	4.00331
1980	-5.66841	-1.13838	-9.69574	2.309886	4.03439
1981	0.041092	0.834599	16.71897	2.309886	4.042948
1982	0	2.486654	0	2.309886	3.932592
1983	4.433406	3.551829	-11.0763	2.309886	4.127632
1984	4.932079	3.801993	-5.34643	2.309886	4.10398
1985	4.670184	3.522484	-9.24272	2.309886	3.63207
1986	3.800818	3.139598	-3.53711	2.309886	4.68341
1987	21.53152	2.93504	52.03686	3.368888	3.981506
1988	16.19306	2.859646	84.89263	2.267413	2.279209
1989	-0.25876	2.982815	54.9641	1.74681	7.669286
1990	1.160189	3.218283	12.2149	1.845187	7.231941
1991	7.586663	3.435481	139.6801	2.381479	17.8148
1992	7.029936	3.53876	14.63876	2.306098	10.16746
1993	4.091581	3.540696	36.85227	2.535311	4.675276
1994	7.675288	3.422805	65.88751	3.003433	7.2324
1995	5.921844	3.225832	49.0163	4.392383	5.096243
1996	4.600182	3.020638	-10.9533	4.809398	5.749843
1997	5.619793	2.833776	36.10493	3.26936	5.450696
1998	5.009033	2.637211	-2.96055	3.832767	4.804494
1999	11.90976	2.435216	49.57547	3.678377	4.943155
2000	8.767471	2.236057	30.2955	4.261648	5.232798
2001	8.14806	2.037299	16.70642	4.276664	5.295928
2002	6.579077	1.85534	13.02158	5.099045	7.605673
2003	8.505985	1.71376	11.08327	4.562697	7.285435
2004	10.34077	1.622577	28.08447	3.919862	6.325781
2005	13.24991	1.570833	16.39062	3.564979	5.800895
2006	10.771	1.52772	19.18504	4.269595	5.27577
2007	10.21259	1.489495	10.14665	4.393712	5.730862
2008	6.691602	1.479248	15.65529	5.734209	5.634525
2009	0.086858	1.499446	-9.86573	7.082953	6.162502
2010	5.962903	1.539045	20.56158	8.201432	6.344691

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2011	7.069627	1.588753	18.8842	5.970052	6.019413
2012	7.261456	1.630478	14.42489	6.270932	5.788706
2013	7.479845	1.649901	14.02212	6.63657	5.532221
2014	7.071482	1.638	11.27987	6.105372	5.469321
2015	7.036169	1.603527	7.212515	5.306567	5.39798

Appendix 2.2: Commands and results in STATA 15.1

```
. tsset time, yearly
        time variable:  time, 1971 to 2015
                delta:  1 year

. * Unit Root Test
. varsoc ggdp

   Selection-order criteria
   Sample:  1975 - 2015                         Number of obs      =        41
  +---------------------------------------------------------------------------+
  |lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
  |----+----------------------------------------------------------------------|
  |  0 | -134.743                        43.98    6.6216   6.63682    6.6634  |
  |  1 | -127.192  15.102*   1  0.000  31.9523   6.30204   6.33248*  6.38563* |
  |  2 | -126.601  1.1828    1  0.277  32.6016   6.32198   6.36763   6.44736  |
  |  3 | -125.725  1.7518    1  0.186  32.8114   6.32803   6.38891   6.49521  |
  |  4 | -124.028  3.3923    1  0.065  31.7348*  6.29407*  6.37017   6.50304  |
  +---------------------------------------------------------------------------+
   Endogenous:  ggdp
    Exogenous:  _cons

. dfuller ggdp, drift lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        43

                               ----------- Z(t) has t-distribution -----------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -2.521            -2.423            -1.684            -1.303
------------------------------------------------------------------------------
p-value for Z(t) = 0.0079

. varsoc lab

   Selection-order criteria
   Sample:  1975 - 2015                         Number of obs      =        41
  +---------------------------------------------------------------------------+
  |lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
  |----+----------------------------------------------------------------------|
  |  0 | -81.8057                      3.32488    4.0393   4.05452    4.0811  |
  |  1 | -39.5369  84.538    1  0.000  .444142    2.02619   2.05663   2.10978  |
  |  2 |  1.85852  82.791    1  0.000  .061919    .055682    .10134   .181065  |
  |  3 |  33.5174  63.318    1  0.000  .013882  -1.43987    -1.379  -1.27269  |
  |  4 |  39.9355  12.836*   1  0.000  .010665* -1.70417* -1.62807*  -1.4952* |
  +---------------------------------------------------------------------------+
   Endogenous:  lab
    Exogenous:  _cons

. dfuller lab, drift lags(4)

Augmented Dickey-Fuller test for unit root         Number of obs   =        40

                               ----------- Z(t) has t-distribution -----------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -2.880            -2.441            -1.691            -1.307
------------------------------------------------------------------------------
p-value for Z(t) = 0.0034
```

```
. varsoc expo

   Selection-order criteria
   Sample:  1975 - 2015                         Number of obs      =        41
  +---------------------------------------------------------------------------+
  |lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
  |----+----------------------------------------------------------------------|
  |  0 | -197.268                      928.637   9.67159    9.6868   9.71338* |
  |  1 | -195.989  2.5571    1  0.110  916.166     9.658   9.68844   9.74159  |
  |  2 | -194.375  3.2288    1  0.072   889.28   9.62803   9.67368   9.75341  |
  |  3 | -192.297  4.1547*   1  0.042  844.056*  9.57547*  9.63635*  9.74265  |
  |  4 | -191.999  .59707    1  0.440   873.96   9.60969   9.68579   9.81866  |
  +---------------------------------------------------------------------------+
   Endogenous:  expo
    Exogenous:  _cons

. dfuller expo, drift lags(0)

Dickey-Fuller test for unit root                   Number of obs   =        44

                               ----------- Z(t) has t-distribution -----------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -4.856            -2.418            -1.682            -1.302
------------------------------------------------------------------------------
p-value for Z(t) = 0.0000

. varsoc gfcf

   Selection-order criteria
   Sample:  1975 - 2015                         Number of obs      =        41
  +---------------------------------------------------------------------------+
  |lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
  |----+----------------------------------------------------------------------|
  |  0 | -78.1895                      2.78719    3.8629   3.87812    3.9047  |
  |  1 | -43.6237  69.132*   1  0.000  .542127*  2.22555*  2.25598*  2.30913* |
  |  2 | -43.6077  .03197    1  0.858   .56889   2.27355    2.3192   2.39893  |
  |  3 | -43.2821  .65114    1  0.420  .588129   2.30645   2.36732   2.47362  |
  |  4 | -42.8943  .77572    1  0.378  .606317   2.33631    2.4124   2.54528  |
  +---------------------------------------------------------------------------+
   Endogenous:  gfcf
    Exogenous:  _cons

. dfuller gfcf, drift lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        43

                               ----------- Z(t) has t-distribution -----------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -1.331            -2.423            -1.684            -1.303
------------------------------------------------------------------------------
p-value for Z(t) = 0.0953

. gen gfcf2=gfcf^2

. varsoc gfcf2

   Selection-order criteria
   Sample:  1975 - 2015                         Number of obs      =        41
  +---------------------------------------------------------------------------+
  |lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
  |----+----------------------------------------------------------------------|
  |  0 |  -168.32                      226.254   8.25952   8.27474   8.30132  |
  |  1 | -140.872  54.896*   1  0.000  62.2768*  6.96939*  6.99983*  7.05298* |
  |  2 | -140.865  .01409    1  0.906  65.3796   7.01783   7.06348   7.14321  |
  |  3 | -140.459  .81314    1  0.367  67.3242   7.04677   7.10765   7.21395  |
  |  4 | -140.378  .16092    1  0.688  70.4549   7.09163   7.16773    7.3006  |
  +---------------------------------------------------------------------------+
   Endogenous:  gfcf2
    Exogenous:  _cons
```

DOI: 10.14750/ME.2020.019

```
. dfuller gfcf2, drift lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        43

                               ----------- Z(t) has t-distribution -----------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -1.642            -2.423            -1.684            -1.303
------------------------------------------------------------------------------
p-value for Z(t) = 0.0542

. varsoc gfce

   Selection-order criteria
   Sample:  1975 - 2015                        Number of obs      =        41
  +---------------------------------------------------------------------------+
  |lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
  |----+----------------------------------------------------------------------|
  |  0 | -93.8581                         5.9856   4.62722   4.64244   4.66902  |
  |  1 | -89.0179  9.6803*   1  0.002  4.96345*   4.4399*  4.47034*  4.52349* |
  |  2 | -88.9867  .06252    1  0.803  5.20459   4.48716   4.53281   4.61254  |
  |  3 | -88.8727  .22804    1  0.633  5.43641   4.53037   4.59125   4.69755  |
  |  4 | -88.6897  .36591    1  0.545  5.66084   4.57023   4.64633    4.7792  |
  +---------------------------------------------------------------------------+
   Endogenous:  gfce
    Exogenous:  _cons

. dfuller gfce, drift lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        43

                               ----------- Z(t) has t-distribution -----------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -3.155            -2.423            -1.684            -1.303
------------------------------------------------------------------------------
p-value for Z(t) = 0.0015

. gen gfce2=gfce^2

. varsoc gfce2

   Selection-order criteria
   Sample:  1975 - 2015                        Number of obs      =        41
  +---------------------------------------------------------------------------+
  |lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
  |----+----------------------------------------------------------------------|
  |  0 | -216.458                        2368.04   10.6077   10.6229   10.6495  |
  |  1 |  -214.46  3.9943*   1  0.046  2255.76*   10.559*  10.5895*  10.6426* |
  |  2 | -214.459  .00266    1  0.959  2368.81   10.6078   10.6534   10.7331  |
  |  3 | -214.448  .02235    1  0.881  2486.77    10.656   10.7169   10.8232  |
  |  4 |  -214.32  .25554    1  0.613  2596.41   10.6985   10.7746   10.9075  |
  +---------------------------------------------------------------------------+
   Endogenous:  gfce2
    Exogenous:  _cons

. dfuller gfce2, drift lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        43

                               ----------- Z(t) has t-distribution -----------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -3.683            -2.423            -1.684            -1.303
------------------------------------------------------------------------------
p-value for Z(t) = 0.0003
```

```
. * Model 1

. reg ggdp lab expo gfcf gfcf2

      Source |       SS           df       MS      Number of obs   =        45
-------------+----------------------------------   F(4, 40)        =     15.28
       Model |  1536.30406         4  384.076016   Prob > F        =    0.0000
    Residual |  1005.64829        40  25.1412073   R-squared       =    0.6044
-------------+----------------------------------   Adj R-squared   =    0.5648
       Total |  2541.95236        44  57.7716445   Root MSE        =    5.0141

------------------------------------------------------------------------------
        ggdp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         lab |   1.233867   .4784476     2.58   0.014     .2668882    2.200845
        expo |   .1034614   .0275841     3.75   0.001     .0477119    .1592108
        gfcf |   9.155437    2.51713     3.64   0.001     4.068128    14.24275
       gfcf2 |  -.8485044    .281386    -3.02   0.004    -1.417207   -.2798021
       _cons |  -19.81935   4.850381    -4.09   0.000    -29.62234   -10.01637
------------------------------------------------------------------------------

. varsoc ggdp lab expo gfcf gfcf2

   Selection-order criteria
   Sample:  1975 - 2015                         Number of obs      =        41
  +---------------------------------------------------------------------------+
  |lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
  |----+----------------------------------------------------------------------|
  |  0 | -567.189                        911002   27.9116   27.9877   28.1206  |
  |  1 | -474.019  186.34   25  0.000    33107   24.5863   25.0429   25.8401  |
  |  2 | -414.676  118.69   25  0.000   6561.4    22.911   23.7481   25.2097  |
  |  3 | -351.918  125.52   25  0.000  1209.84   21.0692   22.2867   24.4127* |
  |  4 | -316.496  70.845*  25  0.000  998.703*  20.5608*  22.1588*  24.9492  |
  +---------------------------------------------------------------------------+
   Endogenous:  ggdp lab expo gfcf gfcf2
    Exogenous:  _cons

. estat bgodfrey, lag(4)

Breusch-Godfrey LM test for autocorrelation
---------------------------------------------------------------------------
    lags(p)  |          chi2               df                 Prob > chi2
-------------+-------------------------------------------------------------
       4     |          4.805               4                   0.3079
---------------------------------------------------------------------------
                        H0: no serial correlation

. estat imtest, white

White's test for Ho: homoskedasticity
         against Ha: unrestricted heteroskedasticity

         chi2(13)     =      8.84
         Prob > chi2  =    0.7849

Cameron & Trivedi's decomposition of IM-test

---------------------------------------------------
              Source |       chi2     df      p
---------------------+-----------------------------
  Heteroskedasticity |       8.84     13    0.7849
            Skewness |       4.61      4    0.3301
            Kurtosis |       1.20      1    0.2743
---------------------+-----------------------------
               Total |      14.64     18    0.6864
---------------------------------------------------

. predict e1, resid
```

```
. sktest e1

                    Skewness/Kurtosis tests for Normality
                                                       ------ joint ------
    Variable |        Obs  Pr(Skewness)  Pr(Kurtosis) adj chi2(2)   Prob>chi2
-------------+---------------------------------------------------------------
          e1 |         45     0.0985        0.0258        6.93         0.0312

. estat sbcusum

Cumulative sum test for parameter stability

Sample: 1971 - 2015                                Number of obs =         45
Ho: No structural break

                              1% Critical       5% Critical      10% Critical
 Statistic    Test Statistic      Value             Value             Value
------------------------------------------------------------------------------
 recursive      0.3433           1.1430            0.9479             0.850
------------------------------------------------------------------------------

. * Model 2

. reg ggdp lab expo gfce gfce2

      Source |       SS           df       MS      Number of obs   =        45
-------------+----------------------------------   F(4, 40)        =      9.94
       Model |  1267.24764         4  316.811911   Prob > F        =    0.0000
    Residual |  1274.70471        40  31.8676178   R-squared       =    0.4985
-------------+----------------------------------   Adj R-squared   =    0.4484
       Total |  2541.95236        44  57.7716445   Root MSE        =    5.6451

------------------------------------------------------------------------------
        ggdp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         lab |   1.134745   .5540884     2.05   0.047     .0148903    2.254599
        expo |   .1757728   .0401916     4.37   0.000     .0945426     .257003
        gfce |   2.820671    1.35825     2.08   0.044     .0755463    5.565796
       gfce2 |  -.1952448   .0724735    -2.69   0.010    -.3417192   -.0487703
       _cons |  -9.583976    5.07478    -1.89   0.066    -19.84049    .6725364
------------------------------------------------------------------------------
. varsoc ggdp lab expo gfce gfce2

   Selection-order criteria
   Sample:  1975 - 2015                            Number of obs      =        41
  +---------------------------------------------------------------------------+
  |lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
  |----+----------------------------------------------------------------------|
  |  0 | -638.507                      3.0e+07   31.3906   31.4667   31.5996  |
  |  1 | -575.498  126.02   25  0.000  4.7e+06   29.5365   29.9931   30.7903  |
  |  2 | -493.014  164.97   25  0.000   299636   26.7324   27.5695   29.0311  |
  |  3 | -409.165   167.7   25  0.000  19746.9   23.8617   25.0792   27.2053  |
  |  4 | -357.456  103.42*  25  0.000  7365.22*  22.5588*  24.1569*  26.9473* |
  +---------------------------------------------------------------------------+
   Endogenous:  ggdp lab expo gfce gfce2
    Exogenous:  _cons

. estat bgodfrey, lag(4)

Breusch-Godfrey LM test for autocorrelation
---------------------------------------------------------------------------
    lags(p)  |          chi2               df                 Prob > chi2
-------------+-------------------------------------------------------------
       4     |          8.198               4                   0.0846
---------------------------------------------------------------------------
                        H0: no serial correlation

. estat imtest, white

White's test for Ho: homoskedasticity
         against Ha: unrestricted heteroskedasticity

         chi2(13)     =     15.46
         Prob > chi2  =    0.2798
```

```
Cameron & Trivedi's decomposition of IM-test

---------------------------------------------------
              Source |       chi2     df      p
---------------------+-----------------------------
  Heteroskedasticity |      15.46     13    0.2798
            Skewness |       4.37      4    0.3588
            Kurtosis |       1.42      1    0.2338
---------------------+-----------------------------
               Total |      21.24     18    0.2675
---------------------------------------------------

. predict e2, resid

. sktest e2

                    Skewness/Kurtosis tests for Normality
                                                          ------ joint ------
    Variable |        Obs  Pr(Skewness)  Pr(Kurtosis) adj chi2(2)   Prob>chi2
-------------+---------------------------------------------------------------
          e2 |         45     0.0088        0.0854        8.45         0.0146

. estat sbcusum

Cumulative sum test for parameter stability

Sample: 1971 - 2015                              Number of obs =         45
Ho: No structural break

                              1% Critical       5% Critical      10% Critical
 Statistic   Test Statistic       Value             Value             Value
------------------------------------------------------------------------------
 recursive      0.7370           1.1430           0.9479            0.850
------------------------------------------------------------------------------

* Robustness test (Test second degree polynomial regression)

** Zivot-Andrews test

. zandrews ggdp

Zivot-Andrews unit root test for  ggdp

Allowing for break in intercept

Lag selection via TTest: lags of D.ggdp included = 0

Minimum t-statistic -6.008 at 1981  (obs 11)

Critical values: 1%: -5.34 5%: -4.80 10%: -4.58

. zandrews ggdp, break (trend)

Zivot-Andrews unit root test for  ggdp

Allowing for break in trend

Lag selection via TTest: lags of D.ggdp included = 0

Minimum t-statistic -6.175 at 1988  (obs 18)

Critical values: 1%: -4.93 5%: -4.42 10%: -4.11

. zandrews ggdp, break (both)

Zivot-Andrews unit root test for  ggdp

Allowing for break in both intercept and trend

Lag selection via TTest: lags of D.ggdp included = 0

Minimum t-statistic -6.546 at 1989  (obs 19)
```

```
Critical values: 1%: -5.57 5%: -5.08 10%: -4.82

** generate orthogonal polynomial terms

. orthpoly gfcf, generate (pgfcf*) deg(2)
. orthpoly gfce, generate (pgfce*) deg(2)

. reg ggdp lab expo pgfcf1 pgfcf2 pgfce1 pgfce2 du1 du2 du3 du4

      Source |       SS           df       MS      Number of obs   =        45
-------------+----------------------------------   F(10, 34)       =     16.96
       Model |   2117.3807        10   211.73807   Prob > F        =    0.0000
    Residual |  424.569809        34  12.4873473   R-squared       =    0.8330
-------------+----------------------------------   Adj R-squared   =    0.7838
       Total |  2541.95051        44  57.7716024   Root MSE        =    3.5337

------------------------------------------------------------------------------
        ggdp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         lab |   1.390972   .3530353     3.94   0.000     .6735184    2.108427
        expo |   .1957883   .0318157     6.15   0.000      .131131    .2604456
      pgfcf1 |   1.427857   .6823517     2.09   0.044     .0411519    2.814563
      pgfcf2 |  -1.657147   .5817172    -2.85   0.007    -2.839338    -.474955
      pgfce1 |  -2.486317   .7030935    -3.54   0.001    -3.915175   -1.057459
      pgfce2 |  -2.264892   .8374725    -2.70   0.011    -3.966841    -.562943
         du1 |  -15.65349    3.74593    -4.18   0.000    -23.26614   -8.040846
         du2 |  -11.45674   4.565079    -2.51   0.017    -20.73409    -2.17938
         du3 |  -10.87162   3.010238    -3.61   0.001    -16.98916   -4.754076
         du4 |   -6.66261   3.714469    -1.79   0.082    -14.21132     .886099
       _cons |  -.5881995   .8196158    -0.72   0.478    -2.253859     1.07746
------------------------------------------------------------------------------

. reg ggdp lab expo gfcf gfcf2 gfce gfce2 du1 du2 du3 du4

      Source |       SS           df       MS      Number of obs   =        45
-------------+----------------------------------   F(10, 34)       =     16.96
       Model |  2117.38071        10  211.738071   Prob > F        =    0.0000
    Residual |  424.569795        34  12.4873469   R-squared       =    0.8330
-------------+----------------------------------   Adj R-squared   =    0.7838
       Total |  2541.95051        44  57.7716024   Root MSE        =    3.5337

------------------------------------------------------------------------------
        ggdp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         lab |   1.390972   .3530353     3.94   0.000     .6735183    2.108427
        expo |   .1957883   .0318157     6.15   0.000      .131131    .2604456
        gfcf |   6.317769   2.032822     3.11   0.004     2.186579    10.44896
       gfcf2 |  -.6178275   .2168793    -2.85   0.007    -1.058579   -.1770757
        gfce |   2.304241   1.207549     1.91   0.065    -.1497932    4.758274
       gfce2 |  -.1785005   .0660028    -2.70   0.011    -.3126344   -.0443666
         du1 |  -15.65349    3.74593    -4.18   0.000    -23.26614   -8.040845
         du2 |  -11.45673   4.565079    -2.51   0.017    -20.73409   -2.179378
         du3 |  -10.87161   3.010238    -3.61   0.001    -16.98915   -4.754075
         du4 |   -6.66261   3.714469    -1.79   0.082    -14.21132     .886099
       _cons |  -20.03595   4.484032    -4.47   0.000     -29.1486    -10.9233
------------------------------------------------------------------------------
```

Appendix 3: Government spending and competitiveness

Appendix 3.1: Dataset

Time	R	E	GFCF	GFCE
1970	0.409221	98.27903388	2.309885837	4.020205161
1971	0.525782	98.27911932	2.309885496	4.02020816
1972	0.335312	98.27898719	2.309885625	4.020627015
1973	0.525838	98.27899432	2.309885555	4.019780302
1974	0.467498	98.27937699	2.30988572	4.020217172
1975	0.44393	98.27859085	2.309885874	4.021883561
1976	0.42521	98.27901631	2.309885874	4.017240188
1977	0.466149	98.28052334	2.309885582	4.021527758
1978	0.443043	98.27623203	2.309885582	4.026882738
1979	0.464191	98.28029233	2.309885769	4.003310052
1980	0.47278	98.28504597	2.309885927	4.034390492
1981	0.41368	98.26335819	2.309885979	4.042947677
1982	0.364857	98.29247298	2.309885979	3.932591982
1983	0.369817	98.29930653	2.309885871	4.127631815
1984	0.514741	99.01901503	2.309886104	4.103979608
1985	0.462926	99.15729602	2.309885905	3.632070265
1986	0.980886	97.63202435	2.309885889	4.68340964
1987	1.577449	101.5383459	3.368888447	3.981505657
1988	2.390444	101.4078164	2.267412747	2.279208851
1989	2.791509	91.0858548	1.74680995	7.669285913
1990	6.308796	93.0412919	1.845187481	7.231940612
1991	8.449937	77.62890449	2.38147881	17.81479796
1992	13.80859	85.66061718	2.306097709	10.16746411
1993	25.96407	108.17653	2.535310686	4.675276257
1994	24.9761	99.93248434	3.003432562	7.232400166
1995	22.2201	96.60685463	4.392383193	5.096243472
1996	23.78885	102.1247907	4.809398076	5.749843143
1997	27.9316	96.90189657	3.269360026	5.450695657
1998	37.73004	100.6224946	3.832766897	4.804494136
1999	38.13712	96.95779723	3.678377173	4.943154789
2000	39.39643	96.81242092	4.261648239	5.232797916
2001	39.71772	91.33380776	4.276663576	5.295927897
2002	39.57167	91.79049795	5.0990449	7.605673252
2003	40.67213	91.85578734	4.562697101	7.28543528
2004	40.63251	94.13540258	3.919861584	6.325781429
2005	40.74993	94.36699639	3.564978584	5.800895384
2006	40.30915	91.05935389	4.269595432	5.275770459
2007	38.96504	88.10792319	4.393711606	5.730861647

2008	36.61085	89.30544016	5.734209291	5.634525024
2009	36.68564	85.28557427	7.082953215	6.162502003
2010	36.98523	86.88142902	8.201432295	6.344690529
2011	35.56665	91.15699202	5.970051755	6.019412814
2012	35.42011	89.51797097	6.270932318	5.788705826
2013	35.06691	87.61681326	6.636570322	5.532220606
2014	35.14565	88.15135784	6.105371626	5.469321114
2015	34.75865	87.24625966	5.30656714	5.397979837

Appendix 3.2: Commands and results in STATA 15.1

```
. tsset time, yearly
        time variable:  time, 1970 to 2015
                delta:  1 year

. * Unit Root Test

. varsoc r

   Selection-order criteria
   Sample:  1974 - 2015                         Number of obs      =        42
  +---------------------------------------------------------------------------+
  |lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
  |----+----------------------------------------------------------------------|
  |  0 | -178.769                      305.683   8.56042   8.57558   8.60179  |
  |  1 | -100.894  155.75    1  0.000  7.86101   4.89972   4.93005   4.98247  |
  |  2 | -98.3523  5.0836*   1  0.024  7.30578*   4.8263*  4.87179*  4.95042* |
  |  3 | -98.1093  .48595    1  0.486  7.57649   4.86235   4.92301   5.02784  |
  |  4 | -97.9854  .24784    1  0.619  7.90365   4.90407   4.97989   5.11093  |
  +---------------------------------------------------------------------------+
   Endogenous:  r
    Exogenous:  _cons

. dfuller r, drift lags(2)

Augmented Dickey-Fuller test for unit root         Number of obs   =        43

                               ----------- Z(t) has t-distribution -----------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -0.794            -2.426            -1.685            -1.304
------------------------------------------------------------------------------
p-value for Z(t) = 0.2160

. pperron r

Phillips-Perron test for unit root                 Number of obs   =        45
                                                   Newey-West lags =         3

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(rho)           -0.883           -18.560           -13.140           -10.600
 Z(t)             -0.699            -3.614            -2.944            -2.606
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.8469

. gen d_r=d.r
(1 missing value generated)
```

```
. dfuller d_r, drift lags(2)

Augmented Dickey-Fuller test for unit root         Number of obs   =        42

                              ----------- Z(t) has t-distribution -----------
               Test         1% Critical       5% Critical      10% Critical
            Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -3.161            -2.429            -1.686            -1.304
------------------------------------------------------------------------------
p-value for Z(t) = 0.0015

. pperron d_r

Phillips-Perron test for unit root                 Number of obs   =        44
                                                   Newey-West lags =         3

                              ---------- Interpolated Dickey-Fuller ---------
               Test         1% Critical       5% Critical      10% Critical
            Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(rho)          -27.895           -18.492           -13.108           -10.580
 Z(t)             -4.520            -3.621            -2.947            -2.607
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0002

. varsoc e

   Selection-order criteria
   Sample:  1974 - 2015                         Number of obs      =        42
  +---------------------------------------------------------------------------+
  |lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
  |----+----------------------------------------------------------------------|
  |  0 | -133.606                       35.586   6.40982   6.42499   6.45119  |
  |  1 | -125.266  16.681*   1  0.000  25.0897*  6.06026*  6.09059*  6.14301* |
  |  2 | -125.261  .00948    1  0.922  26.3119   6.10766   6.15315   6.23178  |
  |  3 | -124.414   1.693    1  0.193  26.5138   6.11496   6.17562   6.28046  |
  |  4 | -123.951  .92573    1  0.336  27.2159   6.14054   6.21637   6.34741  |
  +---------------------------------------------------------------------------+
   Endogenous:  e
    Exogenous:  _cons

. dfuller e, drift lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        44

                              ----------- Z(t) has t-distribution -----------
               Test         1% Critical       5% Critical      10% Critical
            Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -2.820            -2.421            -1.683            -1.303
------------------------------------------------------------------------------
p-value for Z(t) = 0.0037

. pperron e

Phillips-Perron test for unit root                 Number of obs   =        45
                                                   Newey-West lags =         3

                              ---------- Interpolated Dickey-Fuller ---------
               Test         1% Critical       5% Critical      10% Critical
            Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(rho)          -17.960           -18.560           -13.140           -10.600
 Z(t)             -3.202            -3.614            -2.944            -2.606
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0199
```

```
. varsoc gfcf

   Selection-order criteria
   Sample:  1974 - 2015                         Number of obs      =        42
  +---------------------------------------------------------------------------+
  |lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
  |----+----------------------------------------------------------------------|
  |  0 | -79.9655                      2.76663   3.8555   3.87066   3.89687  |
  |  1 | -44.2216  71.488*   1  0.000  .528995*  2.20103*  2.23136*  2.28378* |
  |  2 |  -44.206  .03126    1  0.860  .554477   2.2479    2.2934   2.37202  |
  |  3 | -43.8697  .67261    1  0.412  .572473   2.27951   2.34017     2.445  |
  |  4 | -43.4708  .79773    1  0.372  .589424   2.30813   2.38396     2.515  |
  +---------------------------------------------------------------------------+
   Endogenous:  gfcf
    Exogenous:  _cons

. dfuller gfcf, drift lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        44

                               ----------- Z(t) has t-distribution -----------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -1.325            -2.421            -1.683            -1.303
------------------------------------------------------------------------------
p-value for Z(t) = 0.0962

. pperron gfcf

Phillips-Perron test for unit root                 Number of obs   =        45
                                                   Newey-West lags =         3

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(rho)           -3.319           -18.560           -13.140           -10.600
 Z(t)             -1.233            -3.614            -2.944            -2.606
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.6592

. gen d_gfcf=d.gfcf
(1 missing value generated)

. dfuller d_gfcf,drift lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        43

                               ----------- Z(t) has t-distribution -----------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -5.297            -2.423            -1.684            -1.303
------------------------------------------------------------------------------
p-value for Z(t) = 0.0000

. pperron d_gfcf

Phillips-Perron test for unit root                 Number of obs   =        44
                                                   Newey-West lags =         3

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(rho)          -39.288           -18.492           -13.108           -10.580
 Z(t)             -6.604            -3.621            -2.947            -2.607
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000
```

```
. varsoc gfce

   Selection-order criteria
   Sample:  1974 - 2015                         Number of obs      =        42
  +---------------------------------------------------------------------------+
  |lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
  |----+----------------------------------------------------------------------|
  |  0 | -95.8661                      5.89912   4.61267   4.62784   4.65404  |
  |  1 | -90.7696  10.193*   1  0.001  4.85396*   4.4176*  4.44793*  4.50035* |
  |  2 | -90.7315  .07622    1  0.782  5.08234    4.4634    4.5089   4.58752  |
  |  3 | -90.6255  .21203    1  0.645  5.30515   4.50598   4.56663   4.67147  |
  |  4 | -90.4535  .34405    1  0.557  5.52156    4.5454   4.62123   4.75227  |
  +---------------------------------------------------------------------------+
   Endogenous:  gfce
    Exogenous:  _cons

. dfuller gfce, drift lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        44

                               ----------- Z(t) has t-distribution -----------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -3.168            -2.421            -1.683            -1.303
------------------------------------------------------------------------------
p-value for Z(t) = 0.0014

. pperron gfce

Phillips-Perron test for unit root                 Number of obs   =        45
                                                   Newey-West lags =         3

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(rho)          -23.884           -18.560           -13.140           -10.600
 Z(t)             -3.944            -3.614            -2.944            -2.606
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0017

. * Co-integration Test with ARDL test (Basing on AIC to select Lags of regression)

. varsoc r e gfcf gfce, maxlag(6)

   Selection-order criteria
   Sample:  1976 - 2015                         Number of obs      =        40
  +---------------------------------------------------------------------------+
  |lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
  |----+----------------------------------------------------------------------|
  |  0 | -423.951                      23065.8   21.3976   21.4586   21.5665  |
  |  1 | -305.608  236.69   16  0.000  138.957   16.2804   16.5857   17.1249  |
  |  2 |  -279.94  51.337   16  0.000  87.9552    15.797   16.3466    17.317  |
  |  3 | -256.124  47.631   16  0.000  63.5949   15.4062   16.2001   17.6018  |
  |  4 | -228.186  55.877   16  0.000  39.9656   14.8093   15.8474   17.6804  |
  |  5 | -165.012  126.35   16  0.000  4.78198   12.4506    13.733   15.9973  |
  |  6 | -102.225  125.57*  16  0.000  .687359*  10.1113*  11.6379*  14.3335* |
  +---------------------------------------------------------------------------+
   Endogenous:  r e gfcf gfce
    Exogenous:  _cons
```

DOI: 10.14750/ME.2020.019

```
. ardl r e gfcf gfce, maxlags(6) aic

ARDL(6,5,4,6) regression

Sample: 1976 - 2015                             Number of obs     =         40
                                                F(  24,      15)  =    2401.34
                                                Prob > F          =     0.0000
                                                R-squared         =     0.9997
                                                Adj R-squared     =     0.9993
Log likelihood = -4.7658219                     Root MSE          =     0.4451

------------------------------------------------------------------------------
           r |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
           r |
         L1. |  -.0617123   .1546773    -0.40   0.696    -.3913991    .2679744
         L2. |   .3155009   .1204814     2.62   0.019     .0587009    .5723008
         L3. |   .2284516   .1167958     1.96   0.069    -.0204928    .4773959
         L4. |  -.1032824   .1194371    -0.86   0.401    -.3578566    .1512917
         L5. |   .0186689   .1266545     0.15   0.885    -.2512887    .2886265
         L6. |   .2674437   .0955642     2.80   0.013     .0637534     .471134
             |
           e |
         --. |   .0215869   .0675287     0.32   0.754     -.122347    .1655209
         L1. |  -.2455011   .0594849    -4.13   0.001    -.3722902    -.118712
         L2. |    .204646   .0862464     2.37   0.031     .0208161    .3884758
         L3. |   .9161612   .1115276     8.21   0.000     .6784458    1.153877
         L4. |   1.072455   .1174097     9.13   0.000     .8222024    1.322708
         L5. |   .5583501   .1268321     4.40   0.001     .2880138    .8286864
             |
        gfcf |
         --. |   .7755424   .2032433     3.82   0.002     .3423395    1.208745
         L1. |   1.259174   .2563221     4.91   0.000     .7128362    1.805512
         L2. |   1.213775   .2664417     4.56   0.000     .6458678    1.781682
         L3. |   1.638917   .2265204     7.24   0.000       1.1561    2.121733
         L4. |   .8763706   .3017308     2.90   0.011     .2332467    1.519495
             |
        gfce |
         --. |   .1003863   .1252456     0.80   0.435    -.1665684    .3673411
         L1. |    .016828   .1144694     0.15   0.885    -.2271578    .2608137
         L2. |   1.395502   .1755473     7.95   0.000     1.021332    1.769673
         L3. |   2.601442   .2859664     9.10   0.000      1.99192    3.210965
         L4. |    2.08743   .2968004     7.03   0.000     1.454815    2.720045
         L5. |   .1944087    .198512     0.98   0.343    -.2287096    .6175269
         L6. |  -.5403665   .1386219    -3.90   0.001    -.8358322   -.2449009
             |
       _cons |  -285.1563   30.61522    -9.31   0.000    -350.4111   -219.9015
------------------------------------------------------------------------------

. matrix list e(lags)

e(lags)[1,4]
       r     e  gfcf  gfce
r1     6     5     4     6

. ardl r e gfcf gfce, ec lags(6 5 4 6)

ARDL(6,5,4,6) regression

Sample: 1976 - 2015                             Number of obs     =         40
                                                R-squared         =     0.9902
                                                Adj R-squared     =     0.9745
Log likelihood = -4.7658268                     Root MSE          =     0.4451

------------------------------------------------------------------------------
         D.r |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
ADJ          |
           r |
         L1. |  -.3349297   .0311365   -10.76   0.000    -.4012957   -.2685638
-------------+----------------------------------------------------------------
LR           |
           e |   7.546951   .4503683    16.76   0.000     6.587013    8.506888
        gfcf |   17.20892   .6826804    25.21   0.000     15.75382    18.66402
```

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```
        gfce |   17.48316   .8608254    20.31   0.000     15.64836    19.31797
-------------+----------------------------------------------------------------
SR           |
           r |
         LD. |  -.7267825    .128564    -5.65   0.000     -1.00081   -.4527549
        L2D. |  -.4112817   .0903105    -4.55   0.000     -.603774   -.2187893
        L3D. |  -.1828301   .0812073    -2.25   0.040    -.3559194   -.0097408
        L4D. |  -.2861126   .0654589    -4.37   0.001    -.4256349   -.1465902
        L5D. |  -.2674436   .0955642    -2.80   0.013    -.4711339   -.0637533
             |
           e |
         D1. |  -2.506111   .2751563    -9.11   0.000    -3.092593   -1.919629
         LD. |  -2.751612   .2603058   -10.57   0.000    -3.306441   -2.196784
        L2D. |  -2.546966   .2833407    -8.99   0.000    -3.150893    -1.94304
        L3D. |  -1.630805   .2092406    -7.79   0.000    -2.076791   -1.184819
        L4D. |  -.5583501   .1268322    -4.40   0.001    -.8286864   -.2880137
             |
        gfcf |
         D1. |  -4.988235   .5601088    -8.91   0.000    -6.182079   -3.794392
         LD. |  -3.729062   .4366081    -8.54   0.000     -4.65967   -2.798454
        L2D. |  -2.515287   .3143482    -8.00   0.000    -3.185304    -1.84527
        L3D. |  -.8763706   .3017308    -2.90   0.011    -1.519495   -.2332467
             |
        gfce |
         D1. |  -5.755244   .5656914   -10.17   0.000    -6.960987   -4.549502
         LD. |  -5.738416   .5408064   -10.61   0.000    -6.891118   -4.585715
        L2D. |  -4.342914   .5657166    -7.68   0.000    -5.548711   -3.137118
        L3D. |  -1.741472   .3678525    -4.73   0.000    -2.525531   -.9574132
        L4D. |   .3459577   .2169267     1.59   0.132    -.1164105    .8083259
        L5D. |   .5403664   .1386219     3.90   0.001     .2449008    .8358321
             |
       _cons |  -285.1563   30.61522    -9.31   0.000    -350.4111   -219.9015
------------------------------------------------------------------------------

. estat btest

note: estat btest has been superseded by estat ectest
      as the prime procedure to test for a levels relationship.
      (click to run)

Pesaran/Shin/Smith (2001) ARDL Bounds Test
H0: no levels relationship            F =  30.126
                                      t = -10.757

Critical Values (0.1-0.01), F-statistic, Case 3

      | [I_0]   [I_1]  | [I_0]   [I_1]  | [I_0]   [I_1]  | [I_0]   [I_1]
      |   L_1     L_1  |  L_05    L_05  |  L_025   L_025 |   L_01    L_01
------+----------------+----------------+----------------+---------------
  k_3 |   2.72    3.77 |   3.23    4.35 |   3.69    4.89 |   4.29    5.61
accept if F < critical value for I(0) regressors
reject if F > critical value for I(1) regressors

Critical Values (0.1-0.01), t-statistic, Case 3

      | [I_0]   [I_1]  | [I_0]   [I_1]  | [I_0]   [I_1]  | [I_0]   [I_1]
      |   L_1     L_1  |  L_05    L_05  |  L_025   L_025 |   L_01    L_01
------+----------------+----------------+----------------+---------------
  k_3 |  -2.57   -3.46 |  -2.86   -3.78 |  -3.13   -4.05 |  -3.43   -4.37
accept if t > critical value for I(0) regressors
reject if t < critical value for I(1) regressors

k: # of non-deterministic regressors in long-run relationship
Critical values from Pesaran/Shin/Smith (2001)

.  *check  dianostic  tests(No  serial-correlation,  homoscedasticity,  normality  and
stability)

. ardl r e gfcf gfce, ec lags (6 5 4 6) regstore (regress_res)

ARDL(6,5,4,6) regression

Sample: 1976 - 2015                             Number of obs     =         40
                                                R-squared         =     0.9902
```

```
                                                Adj R-squared     =     0.9745
Log likelihood = -4.7658268                     Root MSE          =     0.4451

------------------------------------------------------------------------------
         D.r |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
ADJ          |
           r |
         L1. |  -.3349297   .0311365   -10.76   0.000    -.4012957   -.2685638
-------------+----------------------------------------------------------------
LR           |
           e |   7.546951   .4503683    16.76   0.000     6.587013    8.506888
        gfcf |   17.20892   .6826804    25.21   0.000     15.75382    18.66402
        gfce |   17.48316   .8608254    20.31   0.000     15.64836    19.31797
-------------+----------------------------------------------------------------
SR           |
           r |
         LD. |  -.7267825    .128564    -5.65   0.000     -1.00081   -.4527549
        L2D. |  -.4112817   .0903105    -4.55   0.000     -.603774   -.2187893
        L3D. |  -.1828301   .0812073    -2.25   0.040    -.3559194   -.0097408
        L4D. |  -.2861126   .0654589    -4.37   0.001    -.4256349   -.1465902
        L5D. |  -.2674436   .0955642    -2.80   0.013    -.4711339   -.0637533
             |
           e |
         D1. |  -2.506111   .2751563    -9.11   0.000    -3.092593   -1.919629
         LD. |  -2.751612   .2603058   -10.57   0.000    -3.306441   -2.196784
        L2D. |  -2.546966   .2833407    -8.99   0.000    -3.150893    -1.94304
        L3D. |  -1.630805   .2092406    -7.79   0.000    -2.076791   -1.184819
        L4D. |  -.5583501   .1268322    -4.40   0.001    -.8286864   -.2880137
             |
        gfcf |
         D1. |  -4.988235   .5601088    -8.91   0.000    -6.182079   -3.794392
         LD. |  -3.729062   .4366081    -8.54   0.000     -4.65967   -2.798454
        L2D. |  -2.515287   .3143482    -8.00   0.000    -3.185304    -1.84527
        L3D. |  -.8763706   .3017308    -2.90   0.011    -1.519495   -.2332467
             |
        gfce |
         D1. |  -5.755244   .5656914   -10.17   0.000    -6.960987   -4.549502
         LD. |  -5.738416   .5408064   -10.61   0.000    -6.891118   -4.585715
        L2D. |  -4.342914   .5657166    -7.68   0.000    -5.548711   -3.137118
        L3D. |  -1.741472   .3678525    -4.73   0.000    -2.525531   -.9574132
        L4D. |   .3459577   .2169267     1.59   0.132    -.1164105    .8083259
        L5D. |   .5403664   .1386219     3.90   0.001     .2449008    .8358321
             |
       _cons |  -285.1563   30.61522    -9.31   0.000    -350.4111   -219.9015
------------------------------------------------------------------------------

. estimates store ardl_res

. estimates restore regress_res
(results regress_res are active now)

. estat dwatson

Durbin-Watson d-statistic( 25,    40) =  2.185318

. estat durbinalt

Durbin's alternative test for autocorrelation
---------------------------------------------------------------------------
    lags(p)  |          chi2               df                 Prob > chi2
-------------+-------------------------------------------------------------
       1     |          0.446               1                   0.5045
---------------------------------------------------------------------------
                        H0: no serial correlation

. estat hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of D.r

         chi2(1)      =     2.21
         Prob > chi2  =   0.1371
```

```
. predict resid, residuals
(6 missing values generated)

. sktest resid

                    Skewness/Kurtosis tests for Normality
                                                          ------ joint ------
    Variable |        Obs  Pr(Skewness)  Pr(Kurtosis) adj chi2(2)   Prob>chi2
-------------+---------------------------------------------------------------
       resid |         40     0.9012        0.0368        4.45         0.1079


. estat sbcusum

Cumulative sum test for parameter stability

Sample: 1976 - 2015                                Number of obs =        40
Ho: No structural break

                               1% Critical       5% Critical      10% Critical
 Statistic   Test Statistic       Value             Value             Value
------------------------------------------------------------------------------
 recursive      0.2307           1.1430            0.9479            0.850
------------------------------------------------------------------------------

. * Toda Yamamoto causality test

. gen trend=time-1969

. var r e gfcf gfce, lags(1/6) exog(L7.(r e gfcf gfce) trend)

Vector autoregression

Sample:  1977 - 2015                             Number of obs     =        39
Log likelihood =    77.4719                      AIC               =  2.180928
FPE            =    .000764                      HQIC              =  4.017456
Det(Sigma_ml)  =   2.21e-07                      SBIC              =   7.29958

Equation           Parms      RMSE     R-sq      chi2     P>chi2
----------------------------------------------------------------
r                    30     .100839   1.0000   4679189   0.0000
e                    30     2.52142   0.9586   903.2087  0.0000
gfcf                 30      .29816   0.9924   5060.134  0.0000
gfce                 30     1.23623   0.9398   608.3358  0.0000
----------------------------------------------------------------

------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
r            |
           r |
         L1. |   .5424158   .0638327     8.50   0.000      .417306    .6675257
         L2. |   .0061706   .0405506     0.15   0.879    -.0733071    .0856482
         L3. |  -.0445215   .0465229    -0.96   0.339    -.1357048    .0466618
         L4. |  -.2673147   .0304815    -8.77   0.000    -.3270573   -.207572
         L5. |   .2771507   .0279476     9.92   0.000     .2223744    .331927
         L6. |   .3184309   .0297248    10.71   0.000     .2601713    .3766904
             |
           e |
         L1. |  -.3287431   .0113277   -29.02   0.000     -.350945   -.3065412
         L2. |   .4253942   .0264292    16.10   0.000     .3735941    .4771944
         L3. |   .6439877   .0167522    38.44   0.000     .6111539    .6768215
         L4. |   .3147951   .0732858     4.30   0.000     .1711575    .4584327
         L5. |   .2486664   .0733369     3.39   0.001     .1049287    .3924041
         L6. |  -.2019538   .0692031    -2.92   0.004    -.3375893   -.0663182
             |
        gfcf |
         L1. |   1.413332   .0530901    26.62   0.000     1.309277    1.517386
         L2. |   .0822409   .1199743     0.69   0.493    -.1529044    .3173862
         L3. |   1.204297    .102681    11.73   0.000     1.003045    1.405548
         L4. |   1.454737   .0763771    19.05   0.000     1.305041    1.604434
         L5. |  -2.721848   .2295982   -11.85   0.000    -3.171853   -2.271844
         L6. |   3.720048   .2057166    18.08   0.000     3.316851    4.123245
```

```
             |
        gfce |
         L1. |   .0745941   .0234682     3.18   0.001     .0285974    .1205909
         L2. |   1.286163   .0208259    61.76   0.000     1.245345    1.326981
         L3. |   1.709861   .0695331    24.59   0.000     1.573578    1.846143
         L4. |   .5132989   .2211558     2.32   0.020     .0798414    .9467564
         L5. |   .2286359   .1569388     1.46   0.145    -.0789584    .5362302
         L6. |  -.0284385   .0523143    -0.54   0.587    -.1309726    .0740956
             |
           r |
         L7. |  -.1926133   .0360636    -5.34   0.000    -.2632966   -.1219299
             |
           e |
         L7. |   .6387021   .0232903    27.42   0.000      .593054    .6843502
             |
        gfcf |
         L7. |  -.0347616   .1001693    -0.35   0.729    -.2310898    .1615666
             |
        gfce |
         L7. |   1.160824   .0547271    21.21   0.000     1.053561    1.268087
             |
       trend |   .0193872   .0050476     3.84   0.000      .009494    .0292804
       _cons |  -202.8282    20.0877   -10.10   0.000    -242.1993    -163.457
-------------+----------------------------------------------------------------
e            |
           r |
         L1. |   1.892167   1.596104     1.19   0.236     -1.23614    5.020473
         L2. |   4.213489   1.013946     4.16   0.000     2.226191    6.200787
         L3. |  -5.924813   1.163282    -5.09   0.000    -8.204803   -3.644823
         L4. |  -1.854106   .7621742    -2.43   0.015     -3.34794   -.3602721
         L5. |    5.35622   .6988158     7.66   0.000     3.986566    6.725874
         L6. |   .5799201   .7432538     0.78   0.435    -.8768304    2.036671
             |
           e |
         L1. |  -1.814102   .2832432    -6.40   0.000    -2.369249   -1.258956
         L2. |   2.776707   .6608474     4.20   0.000      1.48147    4.071944
         L3. |   .3194369   .4188812     0.76   0.446    -.5015553    1.140429
         L4. |  -4.875835   1.832474    -2.66   0.008    -8.467418   -1.284251
         L5. |  -4.201075   1.833752    -2.29   0.022    -7.795162   -.6069873
         L6. |  -4.132324   1.730387    -2.39   0.017     -7.52382   -.7408269
             |
        gfcf |
         L1. |   10.28498    1.32749     7.75   0.000     7.683144    12.88681
         L2. |  -18.57227   2.999895    -6.19   0.000    -24.45196   -12.69259
         L3. |   4.227349   2.567486     1.65   0.100     -.804832     9.25953
         L4. |  -4.587937   1.909769    -2.40   0.016    -8.331015    -.844859
         L5. |  -23.16103   5.740984    -4.03   0.000    -34.41315   -11.90891
         L6. |   38.43418   5.143837     7.47   0.000     28.35245    48.51592
             |
        gfce |
         L1. |   -4.10231   .5868098    -6.99   0.000    -5.252436   -2.952184
         L2. |   2.715366   .5207397     5.21   0.000     1.694735    3.735997
         L3. |    .767748   1.738639     0.44   0.659    -2.639922    4.175418
         L4. |  -15.92576   5.529887    -2.88   0.004    -26.76414   -5.087384
         L5. |  -5.625022   3.924172    -1.43   0.152    -13.31626    2.066214
         L6. |  -2.169689   1.308091    -1.66   0.097      -4.7335    .3941225
             |
           r |
         L7. |  -3.932934   .9017511    -4.36   0.000    -5.700334   -2.165534
             |
           e |
         L7. |   4.210251   .5823609     7.23   0.000     3.068844    5.351657
             |
        gfcf |
         L7. |   -21.2109   2.504681    -8.47   0.000    -26.11999   -16.30182
             |
        gfce |
         L7. |   6.737603   1.368422     4.92   0.000     4.055544    9.419661
             |
       trend |  -.0907524   .1262136    -0.72   0.472    -.3381266    .1566217
       _cons |   962.2873   502.2826     1.92   0.055    -22.16854    1946.743
-------------+----------------------------------------------------------------
gfcf         |
           r |
```

L1.	1.044308	.1887407	5.53	0.000	.674383	1.414233
L2.	.5275177	.1199	4.40	0.000	.292518	.7625174
L3.	-.6225227	.137559	-4.53	0.000	-.8921335	-.352912
L4.	-.6965042	.0901277	-7.73	0.000	-.8731513	-.5198571
L5.	.3042094	.0826356	3.68	0.000	.1422467	.4661721
L6.	.3130172	.0878904	3.56	0.000	.1407552	.4852792
e						
L1.	-.1733183	.0334938	-5.17	0.000	-.2389648	-.1076717
L2.	.4058491	.0781458	5.19	0.000	.2526862	.5590119
L3.	-.1159881	.0495331	-2.34	0.019	-.2130711	-.018905
L4.	-1.272705	.2166916	-5.87	0.000	-1.697413	-.8479971
L5.	-1.113749	.2168427	-5.14	0.000	-1.538753	-.6887449
L6.	-1.069741	.2046198	-5.23	0.000	-1.470788	-.6686932
gfcf						
L1.	.4516387	.1569768	2.88	0.004	.1439699	.7593076
L2.	-2.354055	.3547401	-6.64	0.000	-3.049333	-1.658777
L3.	-1.321483	.3036074	-4.35	0.000	-1.916542	-.7264231
L4.	-.3212567	.2258318	-1.42	0.155	-.7638789	.1213654
L5.	-4.911135	.6788761	-7.23	0.000	-6.241708	-3.580562
L6.	3.995163	.6082631	6.57	0.000	2.80299	5.187337
gfce						
L1.	-.2333008	.0693908	-3.36	0.001	-.3693042	-.0972974
L2.	.0007087	.0615779	0.01	0.991	-.1199818	.1213991
L3.	-1.170594	.2055955	-5.69	0.000	-1.573554	-.7676339
L4.	-3.807018	.6539138	-5.82	0.000	-5.088666	-2.525371
L5.	-2.044805	.4640367	-4.41	0.000	-2.9543	-1.13531
L6.	-.3791073	.1546829	-2.45	0.014	-.6822801	-.0759345
r						
L7.	-.5578745	.1066328	-5.23	0.000	-.766871	-.348878
e						
L7.	.3369277	.0688647	4.89	0.000	.2019554	.4719
gfcf						
L7.	.0036611	.2961807	0.01	0.990	-.5768423	.5841646
gfce						
L7.	1.109892	.1618171	6.86	0.000	.7927366	1.427048
trend	-.0037476	.0149249	-0.25	0.802	-.0329998	.0255046
_cons	333.8742	59.39534	5.62	0.000	217.4614	450.2869
gfce						
r						
L1.	-.4807372	.7825564	-0.61	0.539	-2.01452	1.053045
L2.	-2.232559	.4971293	-4.49	0.000	-3.206915	-1.258204
L3.	2.407835	.5703472	4.22	0.000	1.289975	3.525695
L4.	1.30409	.3736876	3.49	0.000	.571676	2.036504
L5.	-2.187157	.3426235	-6.38	0.000	-2.858687	-1.515628
L6.	-.7809954	.3644111	-2.14	0.032	-1.495228	-.0667628
e						
L1.	.6418188	.1388718	4.62	0.000	.3696351	.9140025
L2.	-1.432653	.3240079	-4.42	0.000	-2.067697	-.7976097
L3.	-.5437466	.205374	-2.65	0.008	-.9462722	-.1412211
L4.	1.906888	.8984467	2.12	0.034	.1459652	3.667812
L5.	1.675327	.899073	1.86	0.062	-.0868239	3.437478
L6.	2.219127	.8483943	2.62	0.009	.5563049	3.88195
gfcf						
L1.	-6.023881	.6508571	-9.26	0.000	-7.299538	-4.748225
L2.	8.036207	1.470823	5.46	0.000	5.153447	10.91897
L3.	-1.691666	1.258817	-1.34	0.179	-4.158902	.7755702
L4.	1.400537	.9363436	1.50	0.135	-.4346628	3.235737
L5.	11.599	2.814756	4.12	0.000	6.082175	17.11582
L6.	-17.94627	2.52198	-7.12	0.000	-22.88926	-13.00328
gfce						
L1.	1.385274	.2877079	4.81	0.000	.8213766	1.949171
L2.	-1.289698	.2553143	-5.05	0.000	-1.790105	-.7892915

```
         L3. |  -1.367652     .85244    -1.60   0.109    -3.038404    .3030996
         L4. |    6.85735   2.711257     2.53   0.011     1.543384    12.17132
         L5. |    2.85267   1.923989     1.48   0.138    -.9182788    6.623618
         L6. |   1.506989    .641346     2.35   0.019     .2499737    2.764004
             |
           r |
         L7. |    1.71945    .442121     3.89   0.000     .8529087    2.585991
             |
           e |
         L7. |  -1.571579   .2855267    -5.50   0.000      -2.1312   -1.011957
             |
        gfcf |
         L7. |   8.241622   1.228024     6.71   0.000     5.834739    10.64851
             |
        gfce |
         L7. |   -2.50345    .670926    -3.73   0.000    -3.818441    -1.18846
             |
       trend |   .1959996   .0618815     3.17   0.002     .0747141    .3172851
       _cons |  -320.9262   246.2649    -1.30   0.193    -803.5967    161.7442
------------------------------------------------------------------------------

. vargranger

   Granger causality Wald tests
  +------------------------------------------------------------------+
  |          Equation           Excluded |   chi2     df Prob > chi2 |
  |--------------------------------------+---------------------------|
  |                 r                  e |  6968.3     6    0.000     |
  |                 r               gfcf |  2430.9     6    0.000     |
  |                 r               gfce |   10078     6    0.000     |
  |                 r                ALL |   58410    18    0.000     |
  |--------------------------------------+---------------------------|
  |                 e                  r |  138.29     6    0.000     |
  |                 e               gfcf |  114.34     6    0.000     |
  |                 e               gfce |  167.63     6    0.000     |
  |                 e                ALL |  353.71    18    0.000     |
  |--------------------------------------+---------------------------|
  |              gfcf                  r |  71.275     6    0.000     |
  |              gfcf                  e |  72.177     6    0.000     |
  |              gfcf               gfce |  61.575     6    0.000     |
  |              gfcf                ALL |  531.46    18    0.000     |
  |--------------------------------------+---------------------------|
  |              gfce                  r |  139.46     6    0.000     |
  |              gfce                  e |  66.544     6    0.000     |
  |              gfce               gfcf |  135.79     6    0.000     |
  |              gfce                ALL |  359.26    18    0.000     |
  +------------------------------------------------------------------+

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Appendix 4: Econometric theory

These are some basic tests conducted in time-series analysis. Those tests include unit-root tests (i.e., ADF and Phillips-Perron test) and diagnostic tests for checking autocorrelation, heteroscedasticity, and normal distribution.

A. Unit Root Tests

Unit-root is used to check that time-series data include a deterministic or a stochastic trend while those series transform from non-stationarity into stationarity (Kirchgässner et al., 2013). The deterministic trends can be identified as time-series data, which are stationary (no change in covariance, mean, and variance over time) (Fatichi et al., 2009). Time-series data are non-stationary, which can be interpreted as a form of unit root containing random walk, due to stochastic drift (stochastic trend) (Stadnytska, 2010). If the feature (i.e., stability, stationarity, or a unit root of data) on each variable is unknown, it causes difficulty to estimate the effect of each variable and to forecast future value. In time-series analysis the non-stationary variables, therefore, are transformed into stationary through differencing methods (e.g., Augmented Dickey-Fuller test and Phillips-Perron test). Most time-series analysts try to explore the order of differentiation which these time-series data are stationary, thereby determining genuine estimators to estimate coefficients of each variable in the regression and producing optimal forecasts. The two well-known tests of a unit root in time series are used to check differencing order, which leads to stationary data.

a). Augmented Dickey-Fuller

Dickey-Fuller test developed by Dickey and Fuller (1979) use autoregressive model:

$$y_t = \rho y_{t-1} + \varepsilon_t, \quad t = 1, 2, ..., n \tag{1}$$

where n: the number of observations;

ρ: the coefficient of first lag;

ε_t: error term.

This type of model mentioned above has trouble with serial correlation. Therefore, the model modified to deal with the problem is called the Augmented Dickey-Fuller (ADF) test. The model of the ADF test contains lags of first difference:

$$\Delta y_t = \alpha + \rho y_{t-1} + \delta t + \gamma_1 \Delta y_{t-1} + \gamma_2 \Delta y_{t-2} + ... + \gamma_k \Delta y_{t-k} + \varepsilon_t , \qquad (2)$$

where y_t : variable for testing;

δt : time trend;

k : lag length;

Δ : the first difference.

The constant or/and a time trend can be excluded. The lag length plays a crucial role in ADF test, so a number of lags are based on the Bayesian information criterion (BIC) developed by Schwarz (1978). The hypothesis of this test is set below:

Null Hypothesis: unit root or non-stationary

Alternative Hypothesis: no unit root or stationary

b) Phillips-Perron Test

Philips and Perron (1988) introduce the Phillips-Perron test to check a unit root. Newey and West (1987)'s standard error is employed to take into account autocorrelation. The estimation of a unit root is based on the regression.

$$y_t = \alpha + \rho y_{t-1} + \varepsilon_t, \quad t = 1, 2, ..., n \qquad (3)$$

where n : the number of observations;

y_t : variable for testing.

ρ : the coefficient of first lag;

ε_t : residual.

We can include a time trend or take away the constant. Z_ρ and Z_τ statistic can be calculated:

$$Z_\rho = n\left(\hat{\rho}_n - 1\right) - \frac{1}{2}\frac{n^2\hat{\sigma}^2}{s_n^2}\left(\hat{\lambda}_n^2 - \hat{\gamma}_{0,n}\right), \tag{4}$$

$$Z_\tau = \sqrt{\frac{\hat{\gamma}_{0,n}}{\hat{\lambda}_n^2}\frac{\hat{\rho}_n - 1}{\hat{\sigma}}} - \frac{1}{2}\left(\hat{\lambda}_n^2 - \hat{\gamma}_{0,n}\right)\frac{1}{\hat{\lambda}_n}\frac{n\hat{\sigma}}{s_n}, \tag{5}$$

$$\hat{\gamma}_{j,n} = \frac{1}{n}\sum_{t=j+1}^{n}\hat{\varepsilon}_t\hat{\varepsilon}_{t-j}, \tag{6}$$

$$\hat{\lambda}_n^2 = \hat{\gamma}_{0,n} + 2\sum_{j=1}^{q}\left(1 - \frac{j}{q+1}\right)\hat{\gamma}_{j,n}, \tag{7}$$

$$s_n^2 = \frac{1}{n-k}\sum_{t=1}^{n}\hat{\varepsilon}_t^2, \tag{8}$$

Where ε_t : residual;

k : the number of covariates in the regression;

q : the number of Newey-West lags used the calculation of $\hat{\lambda}_n^2$;

$\hat{\lambda}_n^2$: the Newey-West long-run variance estimate of $\hat{\varepsilon}_t$.

s_n^2 : the variance of $\hat{\varepsilon}_t$ estimated by OLS.

$\hat{\gamma}_{j,n}$: the covariance between two residuals at j periods apart. If j equals to zero, equation (2.7) becomes a maximum-likelihood estimate of variance of $\hat{\varepsilon}_t$.

$\hat{\sigma}$: standard error of $\hat{\rho}$.

The hypothesis of the Phillips-Perron test is proposed as follows:

Null Hypothesis: unit root or non-stationary

Alternative Hypothesis: no unit root or stationary

B. Autocorrelation

Autocorrelation (serial correlation), which exists on the residuals in time-series analysis, means that the residual at a time correlates with the residual of subsequent times. It significantly influences the value of confidence interval, standard error, and t-statistic, thereby leading to the wrong value of those and inefficient or unreliable results of testing coefficients of the model. If the residual is independent (no autocorrelation), the Ordinary Least Square (OLS) generates minimum variance of the residuals. Breusch-Godfrey test developed by Breusch (1978) and Godfrey (1978) bases on Lagrange multiplier (LM) statistic and checks the serial correlation of the residuals. The Breusch-Godfrey test's hypothesis is set below:

Null Hypothesis: no serial correlation

Alternative Hypothesis: serial correlation

C. Heteroscedasticity

If the linear regression is used to estimate relationships or to make predictive analysis, the residual of the regression cannot be heteroscedastic. That is, the variance of the residuals does not rise along with the fitted value of the regressand. If heteroscedasticity exists on the residuals of the model, the built model does not have efficiency and stability to explain the regressand. White (1980) proposes a heteroscedasticity-consistent variance estimator of variance matrix, named as White's test to check heteroscedasticity of the variance of residual. White's test also deals with non-linear forms of heteroscedasticity. Lagrange multiplier (LM) statistic, used in White's test, is the multiplication between sample size and R^2 value. LM also follows a Chi-squared distribution. The hypothesis of this White's test is suggested as follows:

Null Hypothesis: no heteroscedasticity

Alternative Hypothesis: heteroscedasticity

D. Normal Distribution

The normally distributed residuals is a crucial assumption in linear regression. If the residuals are non-normal distribution, the model estimated by OLS cannot fully explain all trends of the dataset. The Jarque-Bera test developed by Jarque and Bera (1987) joins between Skewness and Kurtosis. This test relies on asymptotic standard error without correlation for sample size. The hypothesis of this test is proposed as follows:

Null Hypothesis: normal distribution

Alternative Hypothesis: non-normal distribution

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Appendix 5: List of Abbreviation

ADB	Asian Development Bank
AIC	Akaike Information Criterion
ARDL	Autoregressive Distributed Lags
ASEAN	Association of Southeast Asian Nationals
BIC	Bayesian Information Criterion
CPI	Consumer Price Index
GDP	Gross Domestic Products
GFCE	Government Final Consumption Expenditure
GFCF	Government Fixed Capital Formation
ICT	Information and Communication Technology
IMF	International Monetary Fund
MSAR	Markov-Switching Autoregressive
MWALD	Modified Wald Test
NBC	National Bank of Cambodia
NGOs	Non-Governmental Organizations
OLS	Ordinary Least Squares
RBC	Real Business Cycle
R&D	Research and Development
UNDP	United Nationals Development Program
WTO	World Trade Organization