DYNAMIC EFFECT OF STRUCTURAL SHOCKS ON PRIVATE INVESTMENT IN IRAN

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DEDICATION

This thesis is dedicated to my wife, who taught me that the best kind of knowledge to have is that which is learned for its own sake. It is also dedicated to my mother and father, who taught me that even the largest task could be accomplished if it is done one-step at a time.

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ABSTRACT

Constraint of government investment to handle the global financial crisis revealed the importance of private investment function in the economy. However, economic instability and uncertainty have caused postpone in private investment. Therefore, this study aimed to find out the factors with the most stimulant effect on private investment in Iran. Hence, applying the secondary quarterly data of Iran cover the period of July 1988 until March 2015 is used to determine the impact of six private and public structural shocks on private investment based on the Dynamic Stochastic General Equilibrium (DSGE) model. The present study considers a combination of different variables of private investment behavior, namely capital, investment, the price of capital (Tobin's Q), capital return, cost of capital utilization, and working hours as the endogenous variables. Second, investigating economy of a developing country, despite of most of the studies, which concentrate on developed economies. Third, evaluate the impact of liquidity as a monetary policy instrument in Iranian economy; and determine the distinction between public investment and current expenditures. The findings illustrated amongst private structural shocks, investment-specific technology shock convinces the private sector to invest at least in the short-run, as had persuaded them to deduct their consumption and increase their savings. Likewise, technology shocks affect positively the private investment behavior, unlike the two related technology shocks, the mark-up shock affects negatively the private investment indices. In addition, the micro-structural shocks, including government investment and current expenditures cause a crowding out effect on private investment in the short-run, but liquidity shock despite of positive impact on private investment can lead to speculation in the Iranian economy. Therefore, to persuade the private sector to invest, the policy makers should concentrate on micro structural shocks specially investment-specific technology and technology shocks.

ABSTRAKT

Batasan pelaburan pihak kerajaan untuk menangani krisis kewangan global menunjukkan betapa pentingnya peranan pelaburan swasta dalam ekonomi. Walau bagaimanapun, ketidakstabilan ekonomi dan ketidakpastian menyebabkan pelaburan swasta ditangguhkan. Oleh itu, kajian ini bertujuan untuk mengetahui faktor-faktor yang berperanan merangsang pelaburan swasta di Iran. Data sekunder sukuan Iran meliputi tempoh masa Julai 1988 sehingga Mac 2015 telah digunakan untuk mengesan enam kejutan struktur mikro dan makro terhadap tingkah laku pelaburan swasta berasaskan Model Dinamik Stotastik Keseimbangan Umum (DSGE). Kajian ini juga menerangkan kombinasi pelbagai pemboleh ubah tingkah laku pelaburan swasta, iaitu modal, pelaburan, harga modal (Tobin's Q), pulangan modal, kos penggunaan modal, dan jumlah jam bekerja sebagai pemboleh ubah endogen. Kedua, meneliti ekonomi negara sedang membangun, walaupun kebanyakan kajian memberi penumpuan pada ekonomi maju. Ketiga, menilai kesan kecairan sebagai instrumen dasar monetari yang nyata dalam ekonomi Iran; dan meninjau perbezaan antara pelaburan awam serta perbelanjaan semasa. Hasil penemuan kejutan mikro struktur menunjukkan bahawa kejutan khususnya teknologi meyakinkan pelaburan sektor swasta untuk melabur sekurang-kurangnya dalam jangka pendek, kerana ia telah mendorong pelabur untuk mengurangkan tahap penggunaan dan meningkatkan simpanan pelaburan. Malah, kejutan teknologi turut memberi kesan positif kepada tingkah laku pelaburan sektor swasta, tidak seperti kedua-dua kejutan teknologi yang berkenaan, kesan kejutan penyelarasan negatif memberi kesan kepada paras indeks pelaburan sektor swasta. Di samping itu, kejutan struktur makro, termasuk pelaburan kerajaan dan perbelanjaan semasa turut menyebabkan orang ramai keluar dari kesan pelaburan swasta dalam jangka pendek, tetapi kejutan kesan positif terhadap pelaburan sektor swasta membawa kepada spekulasi dalam ekonomi Iran. Oleh itu, untuk meyakinkan sektor swasta untuk melabur, para pembuat dasar harus memberi tumpuan kepada kejutan struktur mikro, terutamanya kejutan kejutan khususnya teknologi dan teknologi.

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CHAPTER 1

INTRODUTION

1.1 General Overview

The recent global financial crisis and the European sovereign-debt crisis have put financial constraints on governments limiting their capacity to increase public investment and to promote economic growth. In addition, in periods of high uncertainty firms tend to postpone the implementation of their projects, which has a negative impact on the economic growth. Therefore, in a context of scarce governmental resources, it is necessary to find alternative and viable solutions to promote investment, and hence growth. Instead of the traditional direct public investment, governments can stimulate private investment (Barbosa *et al.*, 2016).

The significance of private investment is discussed in previous literature; such as Asker *et al.* (2012) who compare the investment behaviour of public and private firms and showed that private firms investment is more efficient than that of a matched sample of public firms. In another study, Jongwanich and Kohpaiboon (2008) asserted private investment plays a vital role in the growth generating process in developing Asian economies. Based on their believe, private investment plays an essential role in the expansion of the economy's production capacity and long-term economic growth. In addition, Ang (2009) introduce private investment as a main catalyst for generating long-run growth in developing countries.

In spite of aforementioned remarkability of private investment, previous research has neglected to investigate the response of investment behaviour to different variables. In present study, using Iranian economy quarterly aggregate data, the researcher examined the responsiveness of private investment indices to the six private and public sector structural shocks. The private sector structural shocks in this study is composed of investment-specific technology -the shock of households in business cycle, mark up -the shock of final goods producer in business cycle, and technology shocks -the shock of intermediate goods producer. In addition, this study includes three public sector structural shocks as well, including government current and investment expenditure -the government fiscal policy, and monetary base or liquidity that is the government monetary policy.

The intention of private investment variables in this study refer to the following indices: Capital Supply (K_t), Investment (I_t), Price of capital dynamics equation (Tobin's Q), Capital return (R_t^k), Cost of capital utilization (z_t), and Working hours (L_t), which the reaction of these variables is assessed due to the aforementioned shocks. A novel feature of the model is to incorporate various shocks from private sector to public sector of the business cycle.

1.2 Background of the Study

The literature review of this study is based on the different shocks, which are divided into two main parts. The first part investigates the studies related to the private sector structural shocks and the second part investigate the studies of the public sector structural shocks.

1.2.1 Background of Private Sector Shocks

There are three different private sector structural shocks in the model, including investment-specific technology shock (the shock of households in business cycle, which discerns equipment investment from final use categories (Guerrieri, 2011)), mark-up shock (the shock of final goods producer in business cycle), and technology shock (the shock of intermediate goods producer). In the following, the related literature to the different private sector structural shocks are reviewed respectively.

A number of studies, starting with the work of Greenwood *et al.* (2000) and being continued by Schmitt-Grohé and Uribe (2011), Schmitt-Grohé and Uribe (2004), Fisher (2006) and Justiniano *et al.* (2011) have emphasized the role of investment-specific productivity shocks as an engine and the main source of business cycles. Chen and Wemy (2015) has reached even a consensus that technological innovations may not come through increases in Total Factor Productivity (TFP) but rather through the introduction of new, more efficient capital goods triggered by a fall in the relative price of investment – the so- called Investment-Specific Technological (IST) changes. Additionally, In and Yoon (2007) presented that an IST shock increases the efficiency of investment, and then improves the expected marginal product of capital in the next period, also, Araújo (2012) and Chen and Wemy (2015) contend respectively, 30 percent of output fluctuations and 70 percent of price of investment variations could be explained by IST shocks. Nevertheless, in more recent studies the impact of IST shocks on stock market is investigated, for instance Prabheesh and Vidya (2018) found relatively weak effect of this shocks on the business cycle and stock returns, while Tsai *et al.* (2018) concluded presence of IST cause decline in capital price, which can have positive influence on business cycle. Therefore, to make the impact of Investment Specific Technology shock on private investment more comprehensible, more investigation is required.

The second shock in this category refer to mark-up shock that previously was called “cost-push” (Clarida *et al.*, 1999). To clarify significance of this shock in business cycle, Beetsma and Jensen (2004) understood that mark-up shocks call for procyclical fiscal policy rules meaning the government spending gap is positively correlated with the output gap, since productivity shocks call for countercyclical fiscal policies. Beetsma and Jensen (2005) illustrated that a positive mark-up shock, both monetary and fiscal policy are contracted in order to weaken inflationary pressures. The monetary contraction reduces the consumption gap, so that both policy reactions contribute to a fall in the output gap. Hence, the optimal fiscal rule must be procyclical. Notwithstanding its remarkable function in business cycle, recently scholars have paid less attention to mark-up shocks.

The third private sector structural shock of this study's model is the technology shock. Following Kydland and Prescott (1982) and Long Jr and Plosser (1983), business cycle fluctuations are initiated by shocks to Total Factor Productivity (TFP) which proportionately influence the efficiency of productive inputs. Based on the standard RBC models immediately after an aggregate technology shock, a sharp rise in aggregate labour and investment, as well as the real interest rate happens. However, Gali (1999) found that aggregate technology shocks in the U.S. economy are contractionary to labour, investment, and the real interest rate in the short run. In contrast, Wang and Wen (2011) based on the findings of Michelacci and Lopez-Salido (2007), propound that a positive shock to the aggregate technology leads to a short-run increase in job creation and job destruction and a contraction in aggregate employment, output and equipment investment. According to Dave and Dressler (2010), the firm suppress the exogenous increase in output (technology shock) by decreasing the utilization rate of the existing capital stock. Dave and Dressler (2010) showed that endogenous capital utilization provides an intensive margin allowing firms to alter the productivity of the pre-existing capital stock. Therefore, a decrease in capital utilization together with a decrease in labour can offset and even decrease the reaction of output in response to a positive innovation to neutral TFP.

1.2.2 Background of Public Sector Structural Shocks

Three different public sector structural shocks in the model are government investment and current expenditure or government fiscal policy, and monetary base (liquidity) or the central bank monetary policy, which in the following are mentioned in literature respectively.

Public investment has some remarkable functions in economy, for instance an increase in public investment leads to improvement of income distribution Pradhan *et al.* (1990) and generates higher growth in long run through raising private sector productivity for instance (Azzimonti *et al.*, 2009; Cashin, 1995; Futagami *et al.*, 1993; Ghosh and Roy, 2004; Glomm and Ravikumar, 1997; Hassler *et al.*, 2007; Paul Klein *et al.*, 2008). Aschauer (1989) and Barro (1990) investigated the significance of government expenditure and illustrated the long run rate of growth depends on the structure of government expenditure. In addition, empirical studies confirm the positive impact of public investment on productivity and output e.g. (Aschauer, 1989; Mittnik and Neumann, 2001; Morrison and Schwartz, 1992; Pereira, 2000).

One of the considerable debates in the field of government expenditure is the substitutability of government investment and private investment. While some studies like Aschauer (1989), Barro (1990), Gavin (1992) and Glass (2009), believed on crowding in nature of government investment, on the other hand, the others such as of Pradhan *et al.* (1990), Voss (2002), and Fujii *et al.* (2013) believe on the crowd out nature of the government investment. Therefore, obviously there is still no consensus of whether government expenditure has a crowding in or out effect relation with private investment, hence need to be addressed by more studies.

The other significant issue that is omitted in former studies is lack of differentiation between components of public expenditure namely, public consumption such as public sector wages and current public spending on goods and public investment such as infrastructure, health and education. To the best of the researcher's knowledge the only study that have separated public consumption is Fiorito and Kollintzas (2004). In their study the government investment is divided into the public goods (current expenditure) and merit goods (investment expenditure), the estimation showing that public goods are substitutes while merit goods are always complemented by private consumption. This distinction between public consumption and public investment authorise this study to introduce the effects of public investment on the aggregate supply (Dai and Sidiropoulos, 2011). These effects could correct the decision-making by the government and the interaction between central bank and government will be more transparent.

The other public sector structural shock of the study refers to monetary policy shock. Among a few studies about the impact of monetary policy on private investment, Gavin (1992) concluded, exchange rate depreciation associated with expansionary monetary policy may very well generate a decline in domestic investment. In other study by Mojon *et al.* (2002), the effects of a change in monetary policy on firms’ investment in Germany, France, Italy and Spain is analysed. The result illustrates changes in the level of interest rates have an impact on firms’ investment through the user cost of capital. Notwithstanding its remarkable function in business cycle, recently scholars have paid less attention to monetary policy shocks on investment indices; therefore, to contribute to the science in this subject, more investigation is required.

1.3 Problem Statement and Conceptual Framework

Limited public investment capability to promote economic growth would entail to seek an alternative, which can be private investment as an alternative with even more efficiency than public investment. In spite of such a remarkability of private investment, previous researches have neglected to investigate the impact of different structural shocks on investment indices to find out the stimulant factors of private investment, therefore, it would be required to be addressed deeply.

According to Greenwood *et al.* (2000), Fisher (2006) and Justiniano *et al.* (2011) an Schmitt-Grohé and Uribe (2011), investment-specific productivity shock operates as an engine and the main source of business cycles. Furthermore, recent studies have reached to a consensus that technological innovations may not come through increases in TFP but rather through IST changes (Chen and Wemy, 2015). Notwithstanding most of the studies failure to apply the function of investment-specific technology (IST) in business cycle, therefore, it would be vital to address this void and investigate the impact of this shock on private investment variables.

The other found issue in most previous studies is to fail to distinguish between different components of public expenditure namely public current expenditure and public investment expenditure. This distinction makes transparent the effects of public investment on aggregate supply in the literature of central bank (Dai and Sidiropoulos, 2011), which could rectify the decision-making by governments and the interaction between central bank and government. Hence, the scholar considered this distinction to make the conclusions more reliable.

Instability in Iranian economy always has been one of the reasons of speculation demand, such as foreign currency, gold and house, the kind of investments that are not in relation with economical productivity. Attractiveness of these markets and the immense benefits that the investors earn overnight, always divest the economical productive part from private investment and lead to businesses shot down. Therefore, finding out the effective factors on private investment variables need to be addressed by scholars to direct these capitals to the proper part of economy to deduct the speculation demands and cause economic growth.

Additionally, Iranian macroeconomic policy system encompasses some specific aspects such as fiscal policy domination on monetary policy, and it just so happened that interest rate policy is neutral and the only available instrument that central bank could exert to handle its aims somewhat, is monetary base (liquidity). The literature have failed to address monetary base and its interaction with private investment behaviour, therefore to provide a better understanding it would be essential to evidence monetary base (liquidity) function in private investment, especially in such economy with fiscal authority.

In addition, according to the sufficient searched done by the scholar, the academic failed to provide empirical evidences to evaluate the interaction between private- and public sector structural shocks and private investment factors in Iranian economy by dynamic models such as Dynamics Stochastic General Equilibrium (DSGE), hereupon this study has provided an opportunity for a comprehensive dynamic model survey.

Based on the above scenario, the present study has investigated the following issues:

(a) Studying the impact of private and public sector structural shocks on private investment variables.

(b) Adding the investment-specific productivity shocks to the private sector shocks, instead to find the influence of technology shocks merely.

(c) Distinguishing between public investment and current expenditure in the present study.

(d) Investigating the impact of monetary base (as an accurate monetary policy) on private investment variables in Iranian economy.

(e) Applying for the first time a Dynamic Model to investigate the influence of private- and public-structural shocks on private investment variables in Iranian economy.

Figure 1.1 is the conceptual framework of the study, which illustrates the relationships between different parts. As it is evident, there are five different sections in the model including; households, with investment-specific specific shocks, intermediate good producers, with technology shocks, final good producer, with mark-up shocks, government, with government investment and current expenditure shocks, and finally central bank, with monetary base shock.

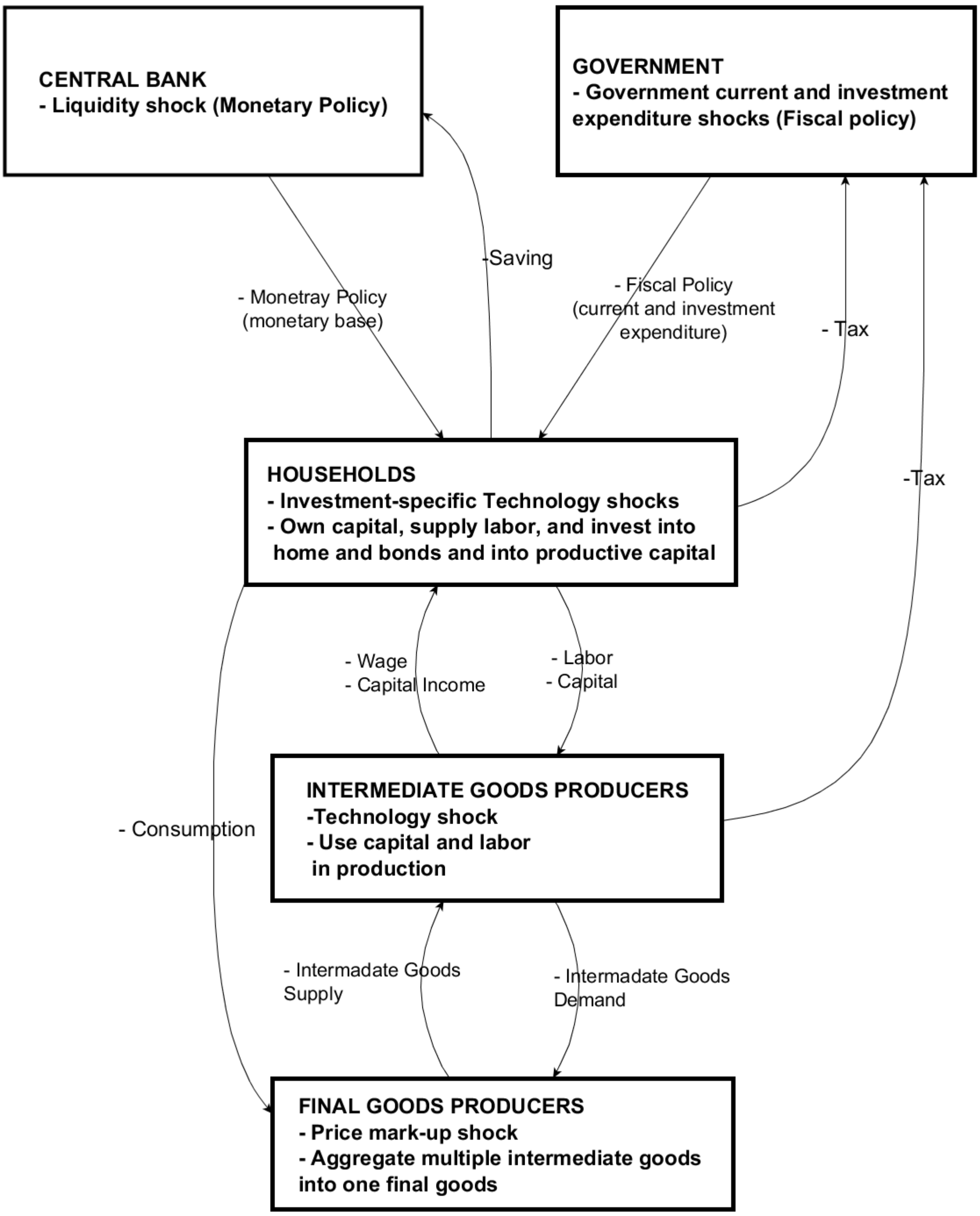

Figure 1.1 Conceptual framework of the study

1.4 Research Questions

To attain the objectives of the present study, the solution of following research questions have been investigated;

(a) How is the impact of investment-specific technology and technology shocks on private investment variables?

(b) How is the impact of mark-up shock on private investment variables?

(c) How is the impact of government expenditure shocks on private investment variables?

(d) How is the impact of monetary base (liquidity) shock on private investment variables?

1.5 Objectives of the Study

The objectives of this study are:

(a) To evaluate the impact of private sector structural shocks on private investment variables.

(b) To assess the impact of public sector structural shocks on private investment variables.

1.6 Significance of the Study

As was mentioned above, with the restriction in government expenditures the significance of private investment and its remarkable role in economy and business cycle, which finally leads to the economy growth, will be more evident. However, the problem is to find the ways to stimulate the private investors to invest in appropriate section of economy. This study evaluated the impact of six structural shocks on private investment variables by introducing the variables, to find out which of these shocks have the most important influence on private investment variables. Therefore, the results of this study contributes to the economic growth, which can increase the quality of living in the society.

As investment specific shock is added to the model, therefore, the result of the study will be more accurate than the previous studies, which investigated the technology shocks only. Based on recent studies such as Chen and Wemy (2015), applying IST shocks will lead to a technological innovation. Additionally, In and Yoon (2007) concluded that an IST shock increases the efficiency of investment, and then improves the expected marginal product of capital in the next period.

The other significance of the study refers to the distinction between public investment and current expenditure, which makes the result more reliable. Furthermore, the application of real monetary policy in Iranian economy (monetary base) unlike the previous studies that investigated interest rate as the monetary policy of Iranian economy. Applying the monetary base provides a better insight of monetary policy effect on private investment for public, governors, and researchers.

Furthermore, another significance of this study refers to the application of a dynamic model for the first time to investigate the impact of different shocks on private investment indices in Iranian economy. Applying DSGE model provides some advantages in comparison to econometric models, such as; this kind of models are based on optimization and are a powerful assistant to identify sources of oscillation and answer questions about structural changes. In addition, DSGE is able to track and predict economical indices such as investment, prices, consumption, GDP, employment, wages, and short-run interest rates. Furthermore, the most important feature is the ability to evaluate the influence of six structural shocks simultaneously.

1.7 Scope of the Study

In this study, there are three different blocks; including private investment block, private sector structural shocks block and public sector structural shocks block, which are composed of diverse variables. The private investment block, which encompasses the endogenous (dependent) variables of the study including capital accumulation (K_t), investment (I_t), price of capital dynamics equation (Tobin's Q), capital return (R_t^k), cost of capital utilization (z_t), and finally working hours (L_t). The other blocks refer to private and public sectors structural shocks, which are the exogenous (independent) variables of the study. The private sector structural shocks are included of investment-specific technology, mark-up and technology. The public sector structural shocks investment and current government expenditures (fiscal policy), and monetary base (monetary policy) shocks. In this study, the objective is to investigate the impact of structural shocks on private investment.

The Target Population in this study is the quarter economic data of Iran, since July 1988 until March 2015 that are collected from official website of Central Bank of the Islamic Republic of Iran. The applied model in this study is Dynamics Stochastic General Equilibrium (DSGE), and for data analysing, "Dynare" software is applied. Dynare is a software platform to deal with a wide class of economic models, particularly in DSGE and overlapping generations (OLG) models. To estimate the parameters the Markov chain Monte Carlo (MCMC) techniques for Bayesian estimation is applied. As the time series observed at quarterly and monthly frequencies often exhibit cyclical movements that recur every month or quarter, therefore, the Seasonal Adjustment is applied. In addition, by Hodrick-Prescott Filter the cyclical component of the time series from raw data is removed to obtain a smooth estimation of long-term trend component of the series.

1.8 Operational Definition

In this section the key terms of the study are defined. The present study mainly contained different concept such as private and public sectors structural shocks, private investment variables, dynamic effect, dynamic stochastic general equilibrium (DSGE), and the MCMC techniques for Bayesian estimation.

1.8.1 Private Sector Structural Shocks

The aim of private sector structural shocks – the first part of the exogenous variables- in this study refer to the shocks those are originated from the behaviour of individuals and firms in making decisions such as households, intermediate goods producers and final goods producers. The shocks are composed of investment-specific technology (the shock of households investment in the business cycle), mark up (the shock of final good producer in business cycle), and technology shocks (the shock of intermediate goods producer).

1.8.2 Public Sector Structural Shocks

The public sector structural shocks – the second part of the exogenous variables- in this study refer to the shocks those are originated from the government's fiscal and monetary policies through central banks and government expenditures will come up. The public sector structural shocks in this study are composed of government current and investment expenditure which known as the government fiscal policy, and monetary base or liquidity which are known as the government monetary policy in Iranian economy.

1.8.3 Private Investment Variables

Private Investment variables are the endogenous variables in this study, which are composed of six different items:

(a) Capital Supply (K_t)

(b) Investment (I_t)

(c) Price of capital dynamics equation (Tobin's Q)

(d) Capital return (R_t^k)

(e) Cost of capital utilization (z_t)

(f) Working hours (L_t)

1.8.4 Dynamic Stochastic General Equilibrium (DSGE)

"Dynamic Stochastic General Equilibrium (DSGE) model" often refers to a specific class of econometric and quantitative models of business cycle called real business cycle (RBC) models (Christiano et al., 2018). In DSGE models "dynamic" refers to the studying of the economical evolution over time, "stochastic" mentions the fact that the economy is affected by random shocks, "general" points to the entire economy, and of "equilibrium" subscribing to the Leon Walras's general equilibrium theory (Kocherlakota, 2009).

The estimated Dynamic Stochastic General Equilibrium (DSGE) model in different countries can make available the foundation for empirical models. These models are built on the new Keynesian theory and have been employing or developing by many central banks such as European Central Bank (ECB), The United States Federal Reserve Bank, Bank of Canada, Bank of England, Bank of Finland, Bank of Spain, Bank of Thailand, IMF and etc. for policy analysis, and as well as many central banks are in the process of applied so (Chen, 2010; Walsh, 2010). Investigating by a dynamic model like DSGE models has some superiority in comparison with static models. DSGE are effective tool that facilitate policy discussion and analysis through a coherent framework. In chapter four, some privileges and reasons of choosing this model is defined.

1.9 Structure of the Thesis

The present study comprises six chapters. The first chapter introduces the thesis and explain Background of the Study, Problem statement and Conceptual Framework, Research Questions, Objectives of Study, Significance of Study, Scope of Study, aim of the study, and Operational Definition.

Chapter 2 provides a broad overview of the literature of the study. This chapter starts with a comprehensive story of Iranian economy, including the monetary and fiscal policies in different periods, the private investment status, and the importance of Iran as a target population.

Chapter 3 is composed of different section, it starts with a definition of the Macroeconomics School of Thought including of Keynesian, Monetarism, Classical, Neoclassical, Ricardian, Equivalence, New Classical (RBC) and New Keynesian are mentioned. Then, the theoretical framework of the study comes in the next section. This section is divided to two different subsections, including exogenous variables related theories and endogenous variables related theories. In the last section, the extension literature review in the form of the empirical framework is discussed.

Chapter 4 describes the research methodology of the study. This chapter begins with an explanation of research strategy, philosophy, paradigm and design. In the next section, the process of selection of variables and sample size is mentioned. In addition, in this chapter data analysis and the statistical and dynamical methods are described comprehensively. Finally, it concludes with a discussion of the model elaboration to the target population.

Chapter 5 explains the empirical findings of the employed model in this study. The chapter presents the data collection process and estimated parameters. Subsequently, the results of shock decomposition and variance decomposition are delineated, moreover, in the most significant section of this chapter, the findings of the study in the form of impulse response function analysis of public and private sectors structural shocks on private investment variables are discussed.

Finally, Chapter 6 discusses the result, whereby it outlines the contributions that this research makes to the study of structural shocks effect on private investment variables. Afterwards, it considers some limitation to the study and makes some suggestion for the future study.

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