THESIS

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Title:

A DSGE model for the interaction between monetary and fiscal policies: Case of Algeria

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Abstract:

Small open resource-rich economies such as Algeria, present certain characteristics that significantly increase their vulnerabilities to external shocks in general and resource related shocks in particular. This thesis embraced three chapters that deal mainly with monetary and fiscal policies and their interaction, both domestically and internationally. The aim of this study is to present an empirical framework for the interaction between monetary and fiscal policies in Algeria as an oil dependent economy using a New Keynesian Dynamic Stochastic General Equilibrium model (NK-DSGE) for small-scale open economy estimated using a Bayesian approach (1980-2018)

Our results revealed that a 1% negative resource-price shock contracts output, depreciates the real exchange rate and increases inflation. In response, the central bank embarks on contractionary monetary policy while primary deficit increases. We find evidence of active monetary policy and passive fiscal policy over the most sample.

Contrary to expectation, taxes have a non-significant and a weak reaction to debt. Thus, government expenditures play a more significant role than taxes in stabilising debt. In addition, the reduction in government spending in response to lower oil revenues and aggregate output signifies fiscal pro-cyclicality.

This thesis contributes in breaking new ground to address the gap in the DSGE-Algeria related literature and to give a share in the understanding of monetary-fiscal interactions in developing resource-rich economies.

Key words: Monetary policy, Fiscal policy, Interactions, Oil chocks, NK-DSGE model.

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Introduction:

Algeria's economy is highly dependent on hydrocarbons for growth, budget revenues, and exports. Despite the country's favourable demographics, its economy remains almost entirely dependent on oil and natural gas, which account for 95% of merchandise exports. In addition, the nonhydrocarbon sector, consisting largely of industry and services, is driven by public spending financed by hydrocarbons revenues, and therefore its performance is also highly correlated with oil prices. Where the collapse in oil prices has leaded to:

- Unsustainable fiscal position and swung once-comfortable current account surpluses into deep deficit. The budget deficit doubled from 8% of GDP in 2014 to 15.8% of GDP in 2015 and declined marginally to an estimated 14% in 2016

- As the international oil price collapse the authorities responded by devaluing the dinar to help mitigate the local-currency impact of hydrocarbons revenues. From levels around AD77=$1 in early 2014, the dinar surpassed AD100=$1 in July 2015 and AD130=$1 in July 2020.

Hence, this study has two main objectives, the first is to identify the relative potentials of monetary and fiscal policy in achieving output target and government budget recovery from the deficit. The second objective is to investigate the behavior of oil prices and exchange rate owing to the dynamics in both monetary and fiscal policy stance of the country. In addition, both of these objectives aim to identify the interaction and the combination of these macroeconomic policies in economic decision-making in Algeria while emphasizing the role of each policy separately than both policies to strike the balance between economic stability, output growth and deficit financing.

In light of the above, our problematic is: **"which policy (monetary policy of fiscal) is more effective under oil fluctuation and macroeconomic instability, and what is its perfect combination?".**

In order to answer the main problematic, we must derive and answer the following questions:

- **what are the macroeconomic effects of the oil prices shocks?**

- **what are the links between oil and the rest of the economy in term of demand, supply, monetary and fiscal policy?**

- **How can monetary policy be effectively employed to solve economic problems? (such as currency depreciation)**

- **What are the needed fiscal adjustments to reduce the government budget deficit?**

- **What role does the responsiveness of taxes to changes in government debt play for the transmission?**

To answer these questions, we have selected the following hypothesis:

- Fiscal policy affects aggregate demand through changes in **government spending** and taxation

- Expansionary monetary policy should work along with fiscal policy in time of crisis.

Added value of the thesis

Changes in oil prices have a direct and relevant impact on government budget for most oil-producer countries such as Algeria. Consequently, these changes can affect dramatically government expenditure and investment decisions. In addition, such shocks can generate large fluctuations on oil producer economies. However, most studies have focused on an analysis of an oil price shock from the point of view of an oil importer country while our project aims to contribute in filling this gap by proposing an explicit model with a price oil shocks from the point of view of an oil exporter country highlighting the role of macroeconomic policies and its interaction. Main results are:

- The first NK DSGE model applied on the Algerian economy for the interaction between taking the oil fluctuation in consideration regarding the nature of this economy.

- The resultant model can be used to simulate monetary and fiscal policies paths and help analyze the robustness of policy conclusions.

- The parameter estimates show that the monetary authority reacts to inflation but only weakly reacts to the output gap.

- The degree of interest rate smoothing is high. Fiscal policy has contributed to the debt stabilization but there is no evidence on active fiscal stabilization of output gap.

- Estimation results of the Phillips curve reveal that past and expected future inflations are key factors in determining current inflation and backward-looking behavior remains predominant.

Despite successful disinflationary attempts, the inflation in Algeria still has some degree of persistence

- Distinguish the difference impact of the oil crisis between an oil exporter and an oil importer country and the way to deal with.

- The results obtained from the DSGE model can reach a solution to the oil curse in Algeria

- This thesis may also suggest some macroeconomic regulation and implication in Algeria by finding the convenient atmosphere and diversifying the country's economics.

<u>Methodology: analysis tools and investigation techniques:</u>

First, we have adopted a descriptive and analytic method to build a theoretical framework that demonstrates an understanding of theories and concepts that are relevant to the economic policies and the interaction between monetary and fiscal austerity and how does it react to the economic crisis.

Therefore, and for a better representation of the Algerian and economy, we have built a macroeconomic model comprises equations representing the IS curve, a Philips curve, the monetary policy reaction function and uncovered interest policy.

We consider a multi-sector New Keynesian dynamic stochastic general equilibrium model proposed by **(Gali and Monacelli, 2005)** inhabited by several agents: Households, producing firms namely intermediate and final goods producers, Central bank and government and the rest of the world.

To this end, we extend Gali and Monacelli (2005) by incorporating: an oil sector as in Ferrero and Seneca (2019), oil in domestic consumption as in Medina and Soto (2005), oil in domestic production (Allegret and Benkhodja, 2015), a domestic fuel pricing rule that implies an implicit subsidy regime (Allegret and Benkhodja, 2015); and an inefficient financial sector as in Smets and Wouters (2007). In addition, we allow for fiscal rules that respond to oil-related flows (Algozhina, 2015). In addition, following (Çebi, 2012) we introduce monetary and fiscal policy rules to capture robust empirical relationships and to estimate parameters of policy interactions.

Henceforth, there are different methods to estimate and evaluate DSGE models in the literature. As stated in An and Schorfheide (2007), these techniques are summarized as calibration, generalized method of moments (GMM), full-information likelihood-based estimation, Bayesian estimation and minimum distance estimation based on the distance

between impulse response functions received from VAR and DSGE model. However, in our thesis we will adopt a Bayesian technic for calibration and estimation because of its advantages.

Chapter one:

Theoretical framework

Introduction:

Historically, the prominence of fiscal policy as a policy tool has waxed and waned. Before 1930, an approach of limited government, or laissez-faire, prevailed. With the stock market crash and the Great Depression, policymakers pushed for governments to play a more proactive role. More recently, countries scaled back the size and function of government, with markets taking on an enhanced role in the allocation of goods and services. Added to, in early days money provided by governments took the form of coins and therefore required a supply of gold, silver or other valued metals, however, in the mid of the 18th century some government starts to issue paper currency.

However, the birth of macroeconomic was through John Maynard Keynes's work presented in 1936 is considered as the pioneer work on monetary and fiscal policy, specially to describe the Great Depression. Up to 1970s, the general consensus was that discretionary fiscal policy mitigated the aftermath of the Great Depression and helped stabilization policy. Indeed, both fiscal and monetary policies were considered as two instruments to achieve macroeconomic goals. Yet, during the three past decades up to the 2008 financial crisis, theoretical and empirical work raised serious doubts about fiscal policy abilities to accomplish counter-cyclical stabilization **(Blinder, 2004).**

Thus, when policymakers intend to influence the economy, they use two main tools at their disposal—monetary policy and fiscal policy. Central banks indirectly target activity by influencing the money supply through adjustments to interest rates, bank reserve requirements, and the sale of government securities and foreign exchange; governments influence the economy by changing the level and types of taxes, the extent and composition of spending, and the degree and form of borrowing.

For many decades, monetary policy was seen as a twofold process: deciding about the money supply, and deciding to print paper money to create credit. While now thought of as part of monetary authority, interest rates were not coordinated with the other forms of monetary policy. Monetary policy was generally in the hands of the executive body, which benefited from seigniorage, or the power to print money. In addition, In the 1980s, many economists began to believe that making a nation's central bank independent was the best way to ensure a most favourable monetary policy. This would prevent the plain manipulation of the tools of monetary policies to effect political goals.

Moreover, fiscal policy with its instruments -public expenditures and public spending- objectives vary besides providing goods and services, In the short term, governments may focus on macroeconomic *stabilization*—for example, stimulating an ailing economy, combating rising inflation, or helping reduce external vulnerabilities. In the longer term, the aim may be to foster sustainable growth or reduce poverty with actions on the *supply side* to improve infrastructure or education. Although these objectives are broadly shared across countries, their relative importance differs depending on country circumstances. While in the short term, priorities may reflect the business cycle or response to a natural disaster—in the longer term, the drivers can be development levels, demographics, or resource endowments. Furthermore, the desire to reduce poverty might lead a low-income country to tilt spending toward primary health care, whereas in an advanced economy, pension reforms might target looming long-term costs related to an aging population. In an oil-producing country, fiscal policy might aim to moderate procyclical spending—moderating both bursts when oil prices rise and painful cuts when they drop.

This chapter is then organised as follows: **Section one** discusses a wide variety in the choice of instruments, operating procedures and strategies of monetary policy by central banks, in addition to the mechanism of monetary policy at the ZLB (Unconventional monetary policy). This raises the questions whether there is a relationship between these aspects of monetary policy and whether the specific choice of instruments and procedures affects the central bank's ability to attain its operational target. **Section two** deals with the theoretical framework of fiscal policy including the role of government in the frame of public finance, the instruments presented in public spending and public revenues, the development of fiscal policy stating different schools of thoughts in addition to the efficiency of fiscal policy in oil exporting countries and during crisis. Finally. **section three** deals with a theoretical review of the interaction between monetary and fiscal policies.

I.   Monetary policy:

1. Monetary policy – a historical analysis:

When presenting the monetary policy's history, Gheorghe Manolescu (1995) said *"it is hard, or almost impossible, to establish the exact moment the new way split from the road of the conventional economical thinking. The monetary policy has a log scientific history and it is hard to find an area for major or radical innovations or a breach in the richness of ideas, from the mercantilists to physiocrats, from the classic economists to Keynes and Friedman, and from Don Patinkin's study of the discrepancy between what is monetary and what is real, to the first real success with the value theory"*(**Mansolescu** & **Gheorghe**, **2009**).

1.1.   The gold standard:

Gold standard is the earlier form of monetary policy that was the main tool of Central Banks to maintain gold convertibility. Discount rate was also used by central Banks to adjust external shocks through the balance of payments.(**Assadi, 2015a**). This rule was successful for the countries of the classical gold standard (which are: France, the United States and the United Kingdom.) and for the smaller countries of Western Europe and the British Dominions. Hence, the gold standard rule was not effective for the peripheral nations of Southern and Eastern Europe and Latin America. Their experience was characterized by frequent suspensions of convertibility and devaluations.(**Micheal D, 2020**).

After the gold standard[1], the spot of monetary policy has shifted from gold convertibility to economic stability. The challenge to find a pure paper standard was another important development where Germany was the first country who switched from the gold standard to papers standard[2] after World War I that ended in hyperinflation (1923). Other countries pop off the gold standard were also trying to adjust to a paper standard regime.(**Otmar, 2010**)

Then, under the 1944 Bretton Woods Agreement[3], countries maintained a pegged exchange rate allowing Central Banks to intervene in the foreign exchange market with the predominant goal of domestic full employment.(**Assadi, 2015a**).

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[1] After World War I, the gold standard was restored, but emphasis was placed by Central Banks on the domestic objectives of stable prices, output, and employment. According to Mazieh (2015), the main reason for ending the gold standard period was that the commitment might have constrained monetary policy in a way that it did not allow highly expansionary policies that was needed.

[2] The reform of 1924 brought a new currency (Reichsmark) which was designed to be based on gold, an approach which ended a few years later.

[3] According to the business dictionary Bretton woods is *"a Set of multilateral agreements on international economic relations, negotiated at the UN Monetary and Financial Conference held in July 1944 (in the*

Table01: the development of monetary policy from gold standard to post Bretton woods:

Period	Regime		Stability	
	Financial	**Monetary**	**Financial**	**Monetary**
Classical Gold Standard	Liberalized	Gold credible	No	Yes
Intra-War period	Liberalized	Mixed	No	Mixed
Bretton woods	Repressed	Increasingly Fiat non-credible over time	Yes	Lost over time
Post Bretton woods	Liberalized	Fiat increasingly credible.	No	Regained over time

Source: Borio 2014

1.2. The Quantity theory:

The first notorious theory of monetary policy is the classical monetary theory, where the concept of money holdings started to take a form in the Quantity theory (QTM) by two alternative -but equivalent expressions: **the cash balance approach** by A.C Pigou[4], and earlier **the equation pf exchange** by Irving Fisher[5]. (Subramanian, 1999)

The QTM lays the foundation for the link between monetary policy (money) and economic variables. This theory shows that both velocity of money and output are presumed as constant, therefore any increase in the quantity of money eventually increase prices proportionally in accordance with the quantity theory.(Enock Nyorekwa & Nicholas, 2018).

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*aftermath of second world War) attended by the finance ministers **Tab**of the UK, US, and other Allied countries. The major objectives of this conference included (1) financing the reconstruction of the postwar Europe, and (2) avoiding unstable exchange rates and competitive-devaluations of pre-Second World War Western economies by instituting fixed exchange rates. World Bank (then called International Bank for Reconstruction & Development or IBRD) was established to serve the first objective, and International Monetary Fund (IMF) for the second* ".
Read more: http://www.businessdictionary.com/definition/Bretton-Woods-system.html
[4] Cambridge university, 1917
[5] Yale university, 1911

However, the quantity theory is best explained with the help of his famous equation of exchange:

1.2.1. Fisher's equation of exchange:

Irving Fisher's version of the QTM started from the formulization of the truth that over any period of time, the volume of money expenditures must equal the sum of cash payments received **(Fisher 1911).** The former is the Prices & Markets product of the quantity of money M, and how quickly it circulates to settle transactions V. The latter is determined by the gross number of transactions occurring T, at the average price of each transaction P.**(David, 2013)**

1.2.2. Velocity of circulation of money:

Alfred Marshall and Irving Fisher, both studied the demand for money and emphazied the"velocity of circulation of money V" which is defined as: "the ratio of total nominal GNP to the stock money", which means the rate at which the stock of money turns over relative to the total income or output of a nation.**(Samuelson & Norhauds, 1989)**.

$$v = \frac{GNP}{M} = \frac{p_1 q_1 + p_2 q_2 + \cdots}{M} = \frac{PQ}{M} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(1)$$

P: stands for the average price level.

Q: refers to the real GNP

V: is the velocity which stands to the amount of nominal GNP each year devided by money stock.

Fisher's income approach to the equation of exchange written as:

$$MV = PQ \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(2)$$

This comes from shifting M from the determinator on the right-hand side over the numerator by the left-hand side from equation (2).

If you boost the money supply M and the velocity V remains the same, the prices must increase (for the left and right sides remains equal) but the output remains the same.

1.2.3. Cambridge Approach/ cash balance approach:

As an alternative paradigme to the Fisher's quantity theory, the cambridge approach - by Figo (1917), Marshall and Keynes[6] (1923) - is also relates the the quantity of money to the nominal income and stresses the importance of money demand in determining the impact of money supply on the price level("Market business news,"). The only difference is that Fisher's approach amphasis the medium exhange functions of money, while the cambridge cash balance approach was based on the store of value function of money that provides satisfaction to its holder by adding conveniance and security. **(Subramanian, 1999)**

The two Cambridge economists explained the QTM by using demand and supply analysis. The change in money supply would definitely lead to the change of equilibrium in the money market. **(Thomas, 2004)**The demand for money under the Cambridge approach is a proportion of nominal income and written in the form of equation as follows:

but wealth is often omitted for simplicity. The Cambridge equation is thus:

$$M^d = k \cdot P \cdot Y \qquad (3)$$

Assuming that the economy is at equilibrium ($M^d = M$), *Y* is exogenous, and *k* is fixed in the short run, the Cambridge equation is equivalent to the equation of exchange with velocity equal to the inverse of *k*:

$$M \cdot \frac{1}{k} = P \cdot Y \qquad (4)$$

The Cambridge version of the quantity theory led to both Keynes's attack on the quantity theory and the Monetarist revival of the theory.

With k or V and Y being constant, the money supply determines the price level. If there is a change in money supply, then the price will be adjusted to restore equilibrium in the money market.**(Prapatchon, 2012)**

To have a clear picture of how the price level is determined in the classical concept, let us look at the diagram below, as introduced by Snowdon et al. (1994).

Figure 01 : the determination of the price level in the classical theory

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[6] John Maynard Keynes a British economist who was associated to Cambridge University and was one of the founders of Cambridge approach before he developed his own, eponymous school of thought whose ideas fundamentally changed the theory and practice of macroeconomics.
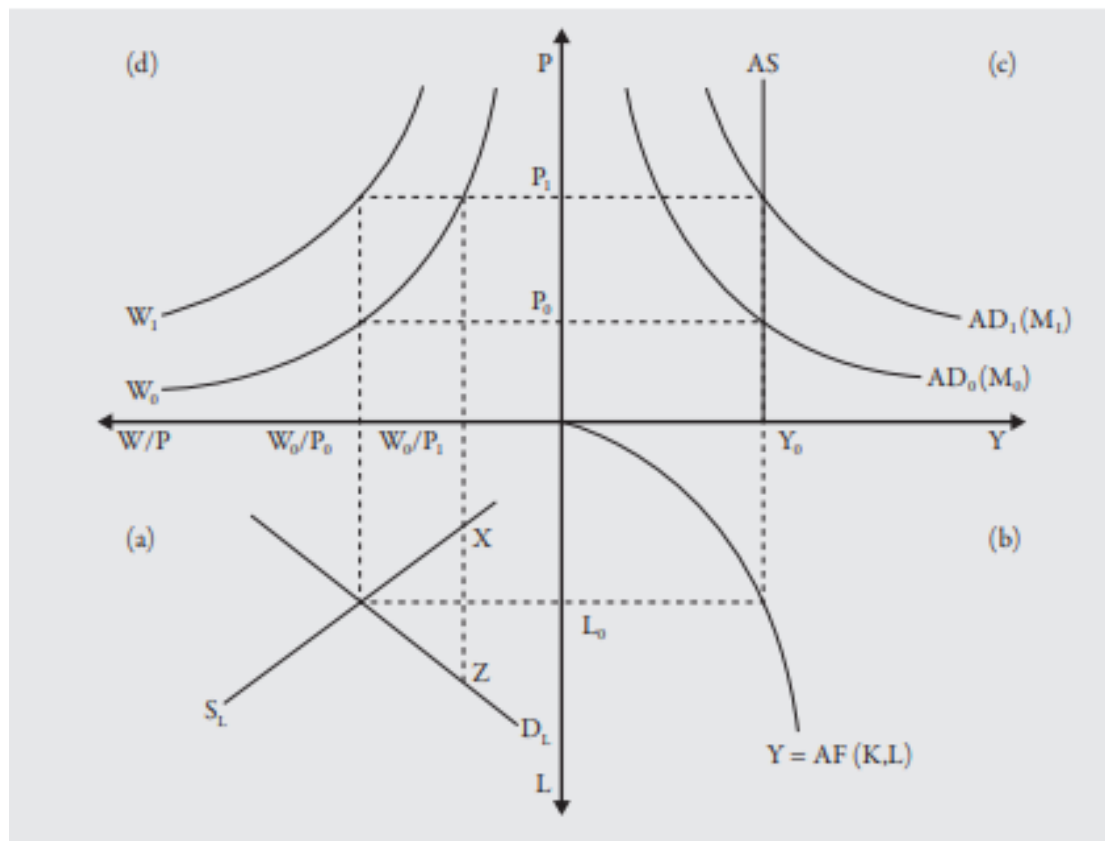
Source: (Thomas, 2004)

What we notice is that diagram has four quadrants; (a) and (b) show the labour market and goods market; while quadrant (c) illustrate the AD and AS; and finally (d) display the relationship between real income and price level.

As known, the labour and goods market are competitive (under the classical school thoughts). The equilibrium of real wage at $W_0 P_0$ and full employment at L_0 is yielded by the clearing of the labour market in quadrant (a). As a result, as shown in quadrant (b) production is employed at full output.

Under the classical school concepts, the aggregate demand curve (AD) is based on the QTM while the aggregate supply curve (AS) is inflexible. Thus, the equilibrium price level is at P_0 and output fully employed at Y_0

In addition, **(Thomas, 2004)**has also mentioned that If the supply of money rises from M0 to M1, this signifies that the national aggregate demand curve would shift to AD1. As a result, the producer price falls from P0 to P1, while the output remains at Y0. This has led to increased wage levels, and most importantly it also creates further demand for labor. In order to eliminate unemployment, nominal wages need to move from W0 to W1. From this, it can be confirmed that price level increases; however, there is no decline in real variables such as

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real output and real wage. This means being free from any kind of particularism which implies money neutrality.

1.3. Keynesian monetary theory:

Up until the 1930s when the great depression caused a wave of scepticism about the relevance and the validity of the QTM, Maynard Keynes whose ideas fundamentally changed the theory and practice of macroeconomics challenged the QTM theory, pointing out that the money supply appeared to lead to a decline in the velocity of circulation, and to rises in real income, thus contradicting the classical dichotomy. **(Thomas, 2004)**

However, since Keynes had been a major contributor to the quantity theory (1923), he did not reject the legitimacy of the quantity equation but he provided a more rigorous analysis from a completely different angle. Keynes analysed money in terms of "held" (as in the cash approach) nonetheless he concentrate on the motives[7] that lead people to hold money where the demand on money is ascended from these motives.**(Eatwell, Murray, & Newman, 1987)**.

the demand for money combines the demand for transaction and speculative balances which varies positively with interest rate:

$$Md = L(Y, r)\dots\dots\dots\dots\dots\dots\dots(5)$$

- **Transaction demand for money:**

$$L(t) = L(y) = KY\dots\dots\dots\dots\dots\dots\dots..(6)$$

L(t): demand for transaction balances

K: income balances.

Y: nominal income.

- **Speculative demand for money:**

$$L(s) = L(r) = R - dr\dots\dots\dots\dots\dots\dots.(7)$$

R: autonomous speculative component

d: Interest rate elasticity.

r: Representative interest rate.

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[7] Keynes assumed that the individuals hold money with three motivations: transactions, precautionary, and speculative. The transaction motive is similar the QTM concept placed on money as a medium of exchange, and he argued that the transaction demand for money depends on the income level. In addition, the precautionary motive also creates a demand for money through the provision of a contingency plan for unscheduled expenditures during unforeseen circumstances. Finally, the speculative demand for money is what Keynes called as "liquidity preference"

Keynes also argued that the demand for money, which he designated "the liquidity-preference function", had a special form such that under conditions of underemployment the V in the equation of money exchange and the k in the cash theory's equation (2) would be highly unbalanced and would passively familiarize to whatever changes independently occurred in money income or the stock of money**(Subramanian, 1999)**.

Monetary policy in this era took the 'quantity-oriented' view where its effects was inderectly transmitted to households; firmms and the global economy through the money markets It had also an impact on the accessibility of financial intermediary credit as central bank adjusts the level of money supply.(John, Murray, & Peter, 1989). Consequently, The main function of monetary policy is to sustain aggregate demand by regulating the quantity of liquidity or by adjusting the current interest rate to a new rate based on interest rate rule by monetary authorities. in addition, Monetary policy can simulate the economy efficiently when unemployment is raising or economic growth is strong. The effectiveness of monetary policy is frowned on by early Keynesians due to the unpredictability of financial markets.

Figure 02: Expansionary monetary policy in the Keynesian model
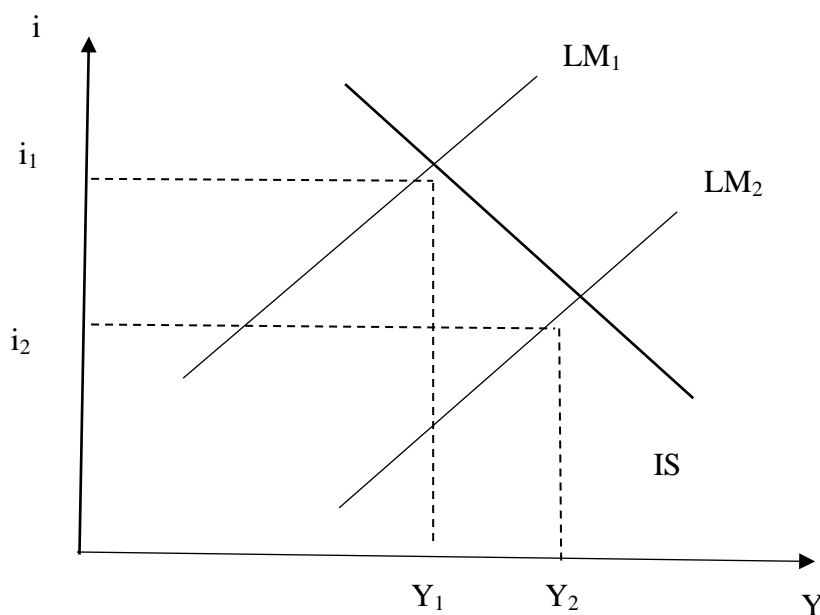
Source: by the auther.

From figure 02, we notice that when money supply increase, LM curve shifts out to the right increasing the bond's demand, what will lead to a boost in the bonds pricesresulting a drop in their yeild. Inversely, when interest rate reduces, bond prices raise, followed by an accretion in investment demand and concequently output increases.

Keynesian argued that "*if investment is relatively insensitive to change in interest rate and if the demand for the idle balances is highly elastic, monetary policy throught changing money supply becomes less effective in affecting output*"

1.4. Monetarism:

This theory was first created by the Chicago School of economics and Milton Friedman and was later joined by Anne Schwartz. As the name indicates, this theory sets the role of money as central to macroeconomic theory and policy. In one hand, It agrees with that QTM affects price levels and economic activity and in the other hand it is basically a theory of the determinants of aggregate demand.(see more**(Kamati, 2014)**). The main argument in the Monetarist theory is that instabilities in the economy are always related to the changes in the money supply or generally in the growth of credit money("University of pretoria,"). Which means that If the growth rate of real income was slower than the growth of money supply there will be definetly inflation. This is why Monetarists are always associated with the statement that "*Inflation is always and everywhere a monetary phenomenon in the sense that it is and can be produced only by a more rapid increase in the quantity of money than in output*"("University of pretoria,")

1.5. Monetary policy in the New-Keynisian Economics:

After the great depression, the field of macroeconomics was known by diferrent economic schools' debates. In this new concept, monetary policy is based on a class of policies known as "Taylor rule"[8] which lay down the interest rate set by central banks as an increasing fuction of inflation rate and forecast[9].**(Friedman, Goodhart, & Wood, 2003)**

Monetary theory in New Keynesian (NK) economics has many interesting aspects and it comes in various shapes of economic models that emphasise representative agents such as household, representative firm, government, and external sector.**(Rudriger, Stanley, & Richard, 2014)**. It also provides microfoundations for price and nominal wage rigidities rooted in optimizing behavior of firms and economic agents.**(Alvarez, Lucas, & Weber, 2001)**.

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[8] This rule is named on its discoverer Jhon B.Taylor of Stanford University. That rule tells the monetary authorities how to set interest rates in response to economic activity. It also illustrates a critical characteristic of any good policy rule.(Samuelson & Norhauds, 1989)

[9] These rules are analysed with the NK theory which is base on Dynamic General Equilibrium consistent stochastic models. See (Kamati, 2014)

The NK model is a hybrid that concerns a naturel rate of employment and endegenous growth theory. where monetary policy does not affect the long-run equilibrium levels of employment and output[10]. **(Kamati, 2014)** also claimed that monetary policy may be able to reduce volatility of output and employment around the equilibrium level, and policy may also be able to accelerate returns to equilibrium.

In order to understant the framework of the NK monetary theory, we must analyse the three log-linearized macroeconomics equation[11]. (More details in chapter three). **(Palley, 2007)**

1.6. Post Keynisian monetary policy:

There are two main structures that define the Post Keynesian theory: the principle of effective demand and dynamic historical time**(Palley, 2007)**. In this theory money is instigated in the economic system when households and firms start borrowing from the banks (or repay loans as well). Thus, in this process, deposits and bank money are created or destroyed**(J Galí & & Monacelli, 2008)**. Fontana and Venturino (2003) stated that The standard view in Post Keynesian economics is that money is the wheel of trade and growth in modern economies. Money plays a unique role in financing the production process or the upsurge of speculative purchases**(Palley, 2007)**. The PK model achieves some similar conclusions as the neo-keynisian model, but these conclusions rest on different reasoning of the way that the economy is influenced by monetary policy**(Lavoie, 2009).**

According to(Kamati, 2014), the equations of the PK model are:

Dynamic desiquilbrium philip curve:

$$\pi = h(u) + \lambda\pi^e$$ ………………………..(8)

$h_1 < 0$, $0 < \lambda < 1$, $\pi = \pi^e$

Where:

π: The inflation rate.

u: the unemployment rate

λ: the coefficient of the real wage[12]

---

[10] the long-run steady-state growth rate is exogenous and determined by the rate of technological progress. (Alvarez et al., 2001)

[11] The NK model is constituted of these 3 equations which are discussed in chapter3:
- Dynamic DIS-curve which represents aggregate demand in goods market.
- The New Philip curve NPKC which determines the aggregate supply.
- The reaction Function of the central Banks reacts to shocks in the Economy. See (Palley, 2007)

This equation (..) has a long term negative flair that gives rise to a permanent trade off between inflation and unemployment which is explained depending on the type of inflation.

- When inflation is in a demand-pull environment, it helps pushing the labour market adjustment according to the logic developped by Tobin, 1972.
- When λ=1 it cannot help grease the labour market adjustment.
- In the cost-push/ conflit inflation the microfoundations of the philips curve are changed, where the Phillips curve in this case is the product of wage and price setting by workers and firms, with the level of inflation depending positively on the degree of inconsistency between target wages and target markups. **(Fontanan & Venturinonn, 2003)**

Wage curve:

$$\frac{w}{p} = w(u, k) \ldots\ldots\ldots\ldots\ldots\ldots(9) \qquad w_1 < 0, \, w_2 > 0$$

Where:

w/p: real wage.

u: the unemployment rate.

k: the capital labour ratio.

Equation (..) is describing a conflict wage curve, where the real wage is a negative function of the unemployment rate bargaining power rather than the marginal product of labour.(Palley, 2007).

Profit rate:

$$\Pi = \Pi(\frac{w}{p}, u, k) \ldots\ldots\ldots\ldots(10) \quad \Pi_1 < 0, \, \Pi_2 < 0, \, \Pi_3 < 0 \ldots\ldots..(10)$$

Π: The profit rate

Equation (10) presents the profit rate function, where the real wage affects the profit rate negatively reflecting the cost effect of high wages. The profit rate is also affected negatively by unemployment. (higher unemployment decreases interest rate)**(Palley, 2007)**.

Growth rate:

---

[12] λ captures the degree of downwards real wage resistance in sectors with unemployment. When $\lambda = 1$ there is a full resistance and inflation is fully incorporated into nominal wage settlements in all sectors including those with unemployment

$g = g(\Pi, u)$................... (11) $g_1 > 0$, $g_2 > 0$

g: growth rate.

This equation characterizes the growth rate function, in which:

- The growth rate has a negative relation with unemployment , where higher unemployment rate effects negatively on consumer demand conditions which discourage capital accumulation.
- It depends positively on the profit rate, where a higher profit rate leads to a faster rate of capital accumulation and innovation.

All the above is illustrated in figure (04)

Figure 03: Post Keynesian model
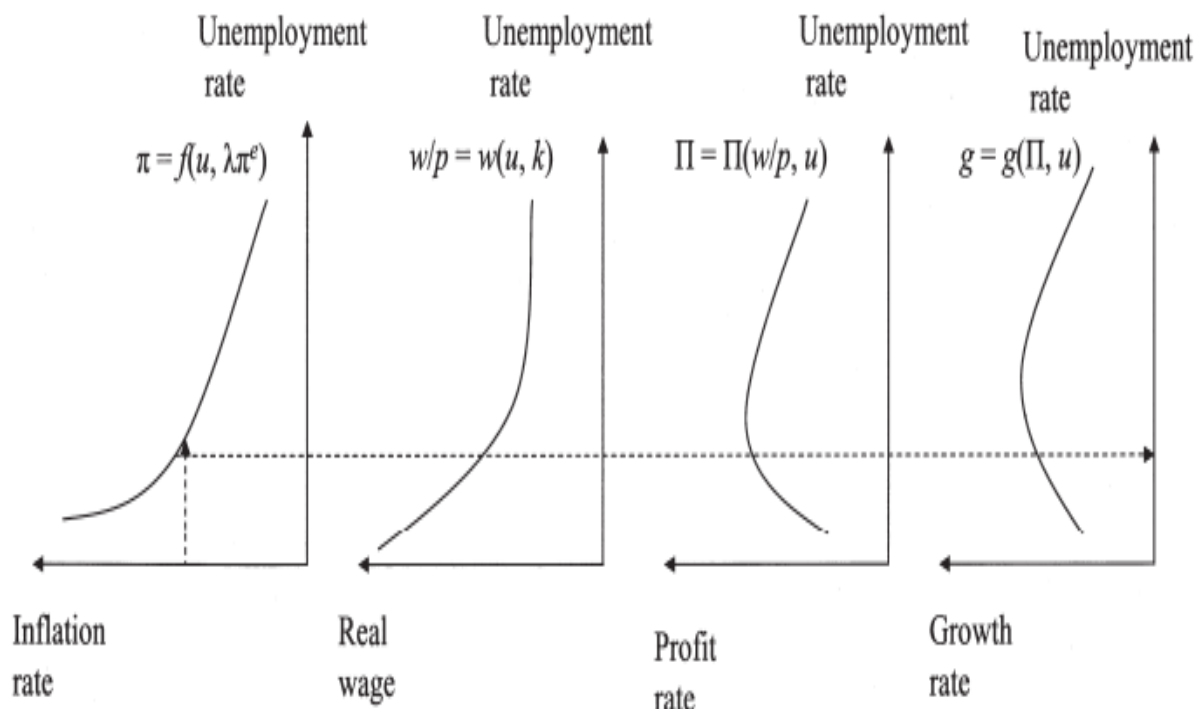
Source: (Palley, 1996)

2. Conventional monetary policy:

Monetary policy is mainly related with why and by what means monetary authority (Central Banks)[13] controls the supply of money and/ or the setting of short-term interest rate.(**Palley, 2007**). However, there is much misunderstanding of the implementation of monetary policy due to the failure of the distinguish between the monetary aggregate and their relation with that interest rate(**Palley, 2007**). Until recently, monetary policy in advanced economies targets interest rates with the goal of promoting economic growth with the official goal of stable prices. The price and output objectives must be balanced by monetary authorities, where even central banks targeting Inflation also pay attention to stabilizing output and keeping the economy near the full employment.(**Rochon & Rossi, 2007**).

Figure 04: monetary policy objectives:
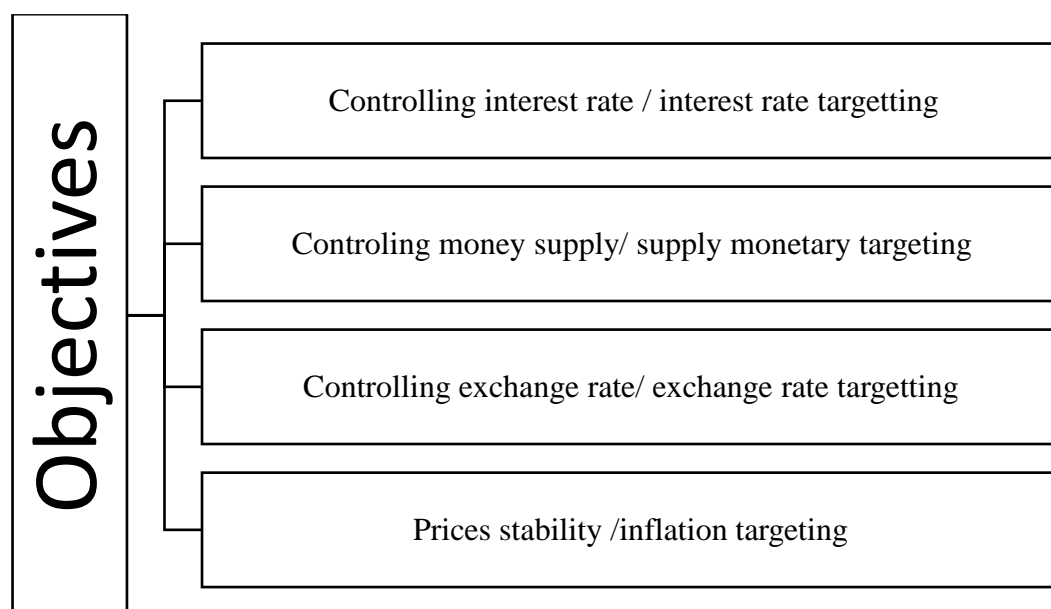
Source: Author's illustration.

A proper understanding of monetary policy implementation requires a full understanding of CMP instruments, its tools and its transmission channels.

2.1. Instruments and objectives:

Monetary policy implementation refers to the tools and practices that a central bank uses to achieve its policy objectives. The Federal Reserve uses a set of short-term interest rate management tools as the primary mechanism to achieve its dual mandate of maximum employment and price stability.(**2015a**).

---

[13] The Central Bank is the monetary authority that provides loans to the government, other financial institutions and manages the money supply in a country. It is also known as the Banker's Bank because it governs and supervises operations of the Commercial Banks, Merchant Banks, Investment Banks and other private savings and financial institutions (Palley, 2007).

In order to achieve monetary policy' goals, CB must be able to operate through variables which are directly under its control called instruments.(**Maehle, 2014)** We can find a wide variety of instruments, operating strategies and strategies of monetary policy.

Inflation and output are the main targets for monetary policy, but CB are not able to achieve its final objectives directly. It affects it through what is called monetary policy instruments mainly interest rate[14] (the price of liquidity) and reserve money (quantity of liquidity) and in order to influence these instruments(**Mathai, 2009**), CB use several monetary tools which are: The discount rate, The minimum reserve requirement imposed on banks and Open market operation.

Figure 05: The direction of influence of monetary policy changes

Instruments	operational goals	intermediate goals	objectives
•the discount rate •open market operation •the minimum reserve requirement	•monetary base •short term interest rate •treasure bill	•M1,M2,M3 •short and long run interest rate	•GDP growth •low unemployment •Stable prices and financial markets
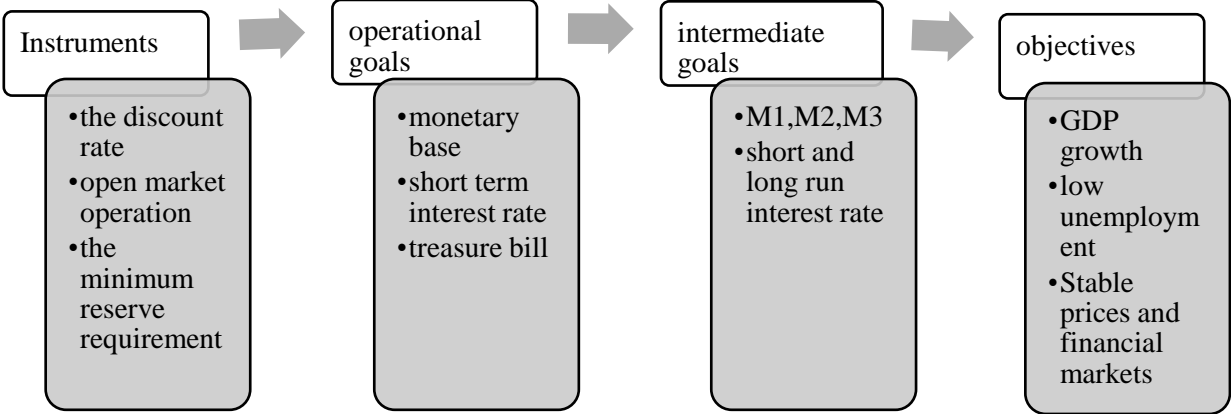
Source: by the author

2.1.1 The discount rate:

One of the functions of central banks is to be "lender of last resort". Each central bank will give short-run loans to commercial banks when they have unexpected and immediate needs for additional funds. (McConnell & Brue, 1999). The central banks charge commercial banks with an interest rate on commercial banks other depository institutions on loans they receive this is what is called **"Discount rate".("Open Market Operation during 2017," 2018**).

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[14] There are several interest rate used as a monetary instruments such as: Discount rate, Savings deposit rate, fixed deposit rate, Basic lending rate, Treasury bills rate.

Central banks reduce interest rate in order to increase money supply. When interest rate is decreased, that will encourage the commercial banks to borrow from CB. When the borrowing took a place the CB issues currency in making the loan consequently the money supply increase. An opposite process is applicable when the CB decide to decrease the money supply.

Figure 06: Commercial Bank Borrowing from the Central bank
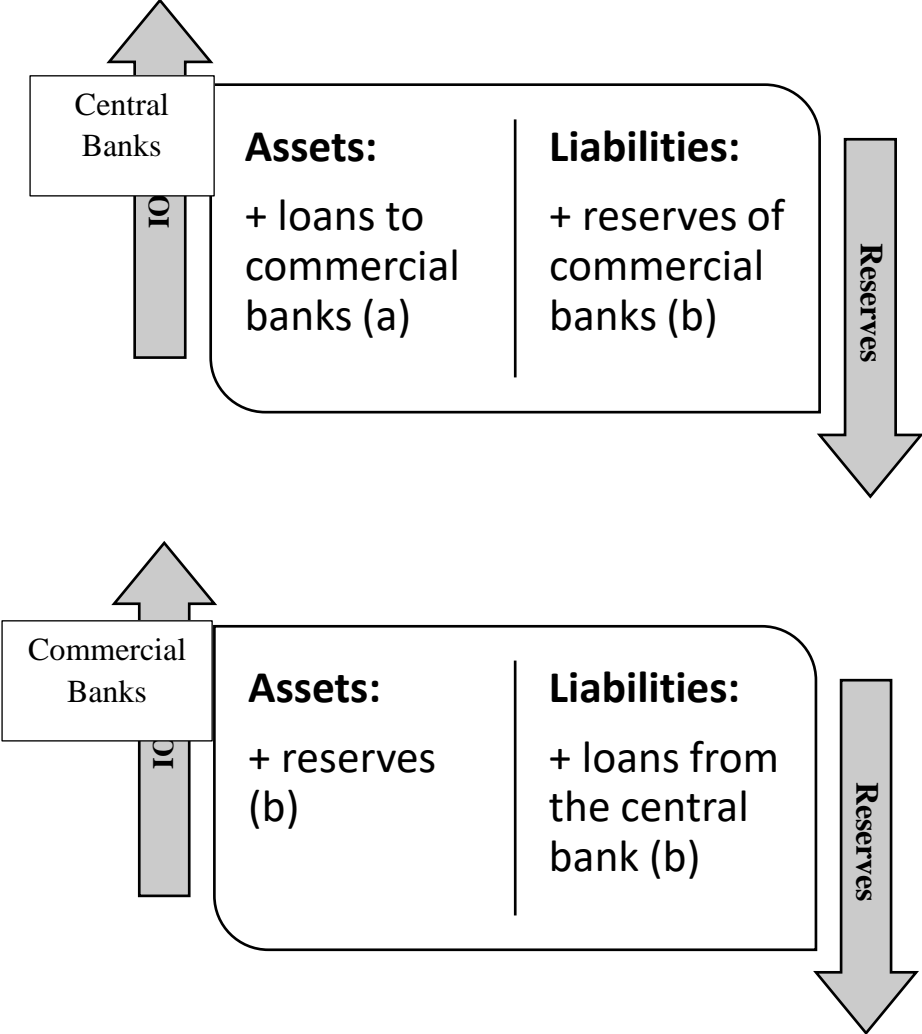
Source: (San Jose, 1990)

2.1.2 Open market operation:

The Federal Reserve moved from the discount rate to Open Market Operation in the early 1920s, and maintained Open Market Operation as its principal tool up to the 2008 financial crisis.**(Gichuki, Oduor, & Kosimbei, 2012)**

(Assadi, 2015a)defined Open market operation as one of the most important tools, through the sale and/or purchase of domestic financial assets (treasury bills and government bonds) by

the central bank in order to exert a specific influence on interest rates and the quantity of money.[15]

For example, when central banks decide to increase the money supply, it purchases government bonds on the open market from a broker or an institution (banks…). If the bonds are bought from a bank, the central bank will pay by increasing the cash reserves of the concerned banks. The bank will now have excess reserve which may create demand deposit causing the Money Supply to increase via the money multiplier[16]. The opposite process is followed when the CB's intention is to reduce the quantity of money.**(Assadi, 2015a)**

These operations have several advantages which are: Facilely reserved., Flexibility and rigorous., speedily implemented and Central banks have complete control over the quantity.

Table 02: balance sheet of central banks after the open market operations.

Assets	Liabilities
+ securities	+ Reserve of commercial banks
(a)(+) securities	(b)(-) reserves

Source: (Mohr & Louis, 2004)

Table 03: balance sheets of commercial banks after open market operations

Assets	Liabilities
(-) securities (a)	
(+) reserves (b)	

Source: (Assadi, 2015a)

2.1.3. Reserve requirement:

Reserve requirement is used as: "*a protection to depositors by ensuring liquidity or solvency and the capability of the banking system to meet the withdrawals of depositors.*"**(Mohr & Louis, 2004)**. The minimum reserve system renders two major objectives which are:

- create sufficient structural demand for Central Banks' credit, and contribute to the stabilisation of money market interest rates**(Cambelle McConnell, Brue, & Flynn, 2009)**.

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[15] The Federal Reserve moved from the discount rate to Open Market Operation in the early 1920s, and maintained Open Market Operation as its principal tool up to the 2008 financial crisis(Campbbell McConnell & Brue, 1999).

[16] The money multiplier is essentially a relationship between deposits and reserves. Money multiplier is defined as: **D= m(R)** where **D** is Deposits, **R** is for Reserves and **m** is Money multiplier.

According to (Cambelle McConnell et al., 2009) this tool played an important role in the financial system as:

- Safe guard to depositors.
- Prudential measures.
- A liquidity credit management tool.

However, and as a monetary policy tool, it has some limitations which are:

- Changes in instruments are less elastic then open market operations.
- It must be used carefully since even a slight change in it may have distributive effects on individual banks as it is likely that banks have varying levels of liquidity.(San Jose, 1990).

2.2. Relative importance.

However, according to the literature, the open market operations are one of main monetary policy tools. The aggregate effect of changes in the discount rate or in reserve requirement can easily be swamped by an adequate volume of open market operations. The discount rate is less important regarding two main reasons: first, the amount of commercial banks reserves acquired from borrowing from central banks is usually very small. Second, the discount rate depends on actions (borrowing) of the commercial bank to be effective contrary to the reserve ratio and open market operations which are initiated with the actions of central banks. In addition, reserves requirement is limited due to the fact that reserve earn no interest, where raising or lowering reserve requirements have substantial effects on bank profits.(**Assadi, 2015a**).

2.3. Conventional monetary transmission mechanisms:

Understanding the monetary transmission mechanisms has been the subject of long-standing interest among economists since it is an important element of the Central Bank's activity of the country.(**Gray, 2011**)

The transmission of monetary policy is defined as: "a process where monetary policy influences the real economy in general and the price level in particular". In other words, the transmission mechanisms are the way where the real aggregate demand and employment is affected through changes in short-term interest rate or the stock market which are the main policy-induced changes.(**San Jose, 1990**). Another definition states that "*The transmission mechanism of monetary policy works through various channels, affecting different variables*

and different markets, at a various speeds and intensities".(Campbbell McConnell & Brue, 1999)

2.3.1. Interest rate channel:

Interest rate channel is the main monetary transmission mechanism in the basic Keynesian model[17]. Keynes (1936) states in his famous work that interest rate is the oldest transmission mechanism which works through short term interest rate. Shocks in these rates are transmitted to medium and long-run interest rate.(Ireland, 2010).

Figure 07: interest rates channel

Stage 1   Stage 2   Stage 3
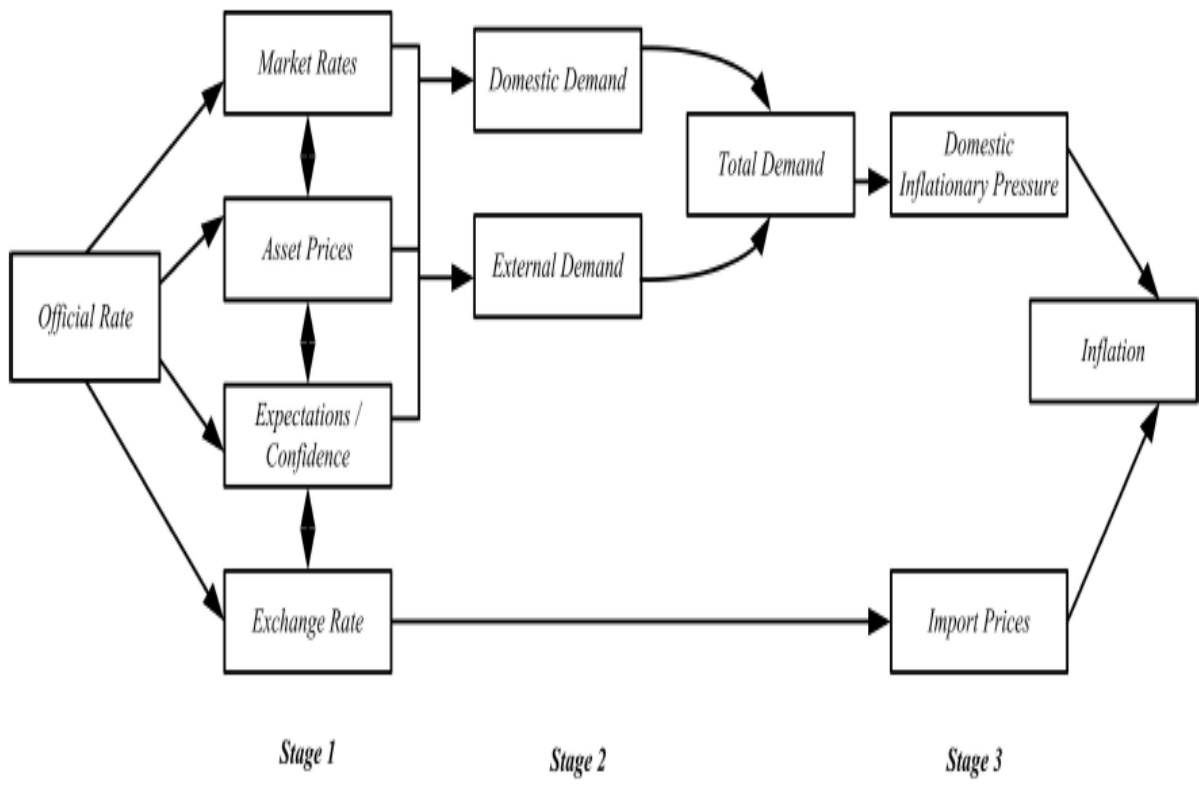
Source:(Muric, 2010)

Figure 05 shows that this channel has three stages:

- **Stage 01:** monetary policy authorities modify the official interest rate, which will affect other interest rates as stated above. Banks and other financial institution must change their

---

[17] This interest rate channel lies at the heart of the traditional Keynesian textbook IS-LM model, due originally to Hicks (1937),and it also appears in the more recent New Keynesian models.(Kozmenko & Plastun, 2016)

savings and loans as a reaction to any official rate change. The prices of many assets (shares, houses, gilt-edged security prices…) will be also affected. **(P. Ireland, 2006)**

- **Stage 02:** The aggregate demand of consumers and firms will be affected by the changes in markets[18]. The change in exchange rate will affect the level of imports and exports.
- **Stage 03:** this stage highlights the effect of different levels of aggregate demand and supply changes on GDP and inflation.

2.3.2. Exchange rate channel:

The real effects of a policy induced increase in the short-term interest rate in an open economy comes through when the domestic nominal interest rate rises above its foreign counterpart[19](**Muric, 2010**). When prices are slow to adjust, this makes foreign produced goods more attractive than domestically produced goods which is more expensive. As a consequence, net exports fall, as do domestic output and employment, while inflation decreases(**Muric, 2010**).

Figure 08: deflationary monetary policy through interest rate channel.
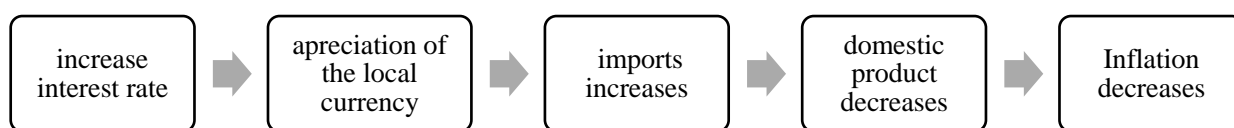
Source: author's illustration

2.3.3. Asset price and wealth channel:

Tobin (1969) explained the asset price channel through Tobin's "q" theory of investment and Ando and Modigliani (1963) in their theory "life-cycle theory of consumption".

Tobin's theory[20] explains the monetary policy mechanism that causes changes in the price of such assets (shares) and affects the real economy. Share prices will rise, which will increase the market values of companies' situation in relation to their acquisition costs. This will

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[18] Higher interest rates are likely to reduce the level of aggregate demand, as consumers are affected by the increase in the rates and may look to cut back spending. See (Odeoye & Shoband, 2017)

[19] the domestic currency will tend to appreciate towards foreign exchange rates, due to its increased attractiveness as an investment currency.(Muric, 2010)

[20] Tobin's *q* measures the ratio of the stock market value of a firm to the replacement cost of the physical capital that is owned by that firm.(P. Ireland, 2006)

encourage companies to issue new shares at higher prices and use the earned income to buy investment goods**(P. Ireland, 2006)**.

With a lower value of q, firms find it less desirable to issue new shares of stock to finance new investment projects; hence, investment, output, and employment fall.**(Andreas, 2017)**. While in a relaxing monetary policy, it will entail to higher equity prices which may cause investment more attractive. Higher equity prices will lead to increase wealth, rises spending and increases aggregate demand. **(Irland, 2005)**

We can explain this mechanism as follow:

$$\mathbf{M} \longrightarrow \mathbf{Pe}\uparrow \longrightarrow \mathbf{Q}\downarrow \longrightarrow \mathbf{I}\uparrow \longrightarrow \mathbf{Y}\uparrow \ \dots\dots\dots\dots (12)$$

Where **M** refers to the deflationary monetary policy, **Pe** is equity prices, **q** is Tobin's q ratio, I is investment, and **Y** is the production.

The asset and wealth channel is also advocated by F. Modigliani in his theory of life-cycle, where he determined the level of consumption through the consumer's life-cycle income, which is consisted of three essential components: human capital, real capital and financial wealth[21].(Irland, 2005). This theory, additionally, this theory also identifies a channel of monetary transmission: When stock prices increase, the value of financial wealth raises, thus increasing the consumers' lifetime[22] resources, and consumption ought to rise. In view of that, expansionary monetary policy can lead to a rise in stock prices(Dovciak, 1999).

This process is described as follow:

$$\mathrm{M}\uparrow \rightarrow \mathrm{Ps}\uparrow \rightarrow \text{wealth}\uparrow \rightarrow \text{consumption}\uparrow \rightarrow \mathrm{Y}\uparrow \ \dots\dots\dots\dots (13)$$

2.3.4 The monetary and credit channel:

Monetary policy also affects the volume of credit in the economy, which plays a significant role regarding its close relation to aggregate expenditures. Where banks play an important role in the financial system not only by issuing liabilities (bank deposits) that contribute to the broad monetary aggregates, but also by holding assets (bank loans) and solve asymmetric information problems in credit markets(Dovciak, 1999).

---

[21] The main component of financial wealth is bound up in shares, see(Dovciak, 1999)
[22] Lifetime resources is what determines consumption spending, and its main components are the financial wealth and the common stock, see (Mishkin, 2005)

This channel has a wider sense -**bank lending channel**- and a narrower mechanism -**balance sheet channel**-:

- **The bank lending channel:**

The bank lending channel approach (also called as credit channel in its the strict sense) highlights the effects of monetary policy on the level of economic activity through modifying short-term interest rates, and altering the availability and terms of bank loans(Mishkin, 2005).

When monetary policy is expansionary, bank reserves and bank deposits increase, and the quantity of bank loans available rises. Thus, borrowers are reliant on bank loans to finance their activities, causing an increase in loans that will leads investment spending to rise(Mishkin, 2005).

Schematically, this process is as follow:

$$M\uparrow \rightarrow \text{bank deposits} \uparrow \rightarrow \text{bank loans} \uparrow \rightarrow I\uparrow \rightarrow Y\uparrow \dots\dots\dots (14)$$

- **The balance sheet channel:**

Bernanke and Gertler (1995) describe a broader credit channel "the balance sheet channel" which is similar to the bank lending channel, regarding to its importance that arises from the presence of asymmetric information problems in credit markets. this channel is characterised through the effect of the net worth[23] on business firms.(**Hernando, 1998**).

Monetary policy can affect firms' balance sheets in different ways: When monetary policy is expansionary, it will lead to an increase in stock prices, raising the net worth of firms and so leads to higher investment spending and aggregate demand due to the fall in adverse selection and moral hazard problems(**Mishkin, 2005**).

This is explained in the following schematic:

$$M\uparrow \rightarrow Ps \uparrow \rightarrow \text{adverse selection} \downarrow, \text{moral hazard} \downarrow \text{ (the asymmetric information}$$
$$\text{problems}\downarrow) \rightarrow \text{lending} \uparrow \rightarrow I\uparrow \rightarrow Y\uparrow \dots\dots\dots (15)$$

The second mean of balance sheet' transmission is **"the cash flow balance"[24]** which operates through its effects on cash flow.

---

[23] Lower net worth means that lenders in effect have less collateral for their loans, and so potential losses from adverse selection are higher. See(Pétursson, 2001).
[24] The cash flow channel is referred by Lower interest rates influence the spending decisions of households and businesses by reducing the amount of interest they pay on debt and the interest they receive on deposits. This affects how much disposable income (or 'cash flow') they have available to spend. See (Mishkin, 2005)

In this channel, expansionary monetary policy increases cash flow which leads to an enhancement in the balance sheet because it increases the liquidity of the firm, making it easier for lenders to know whether the firm (or household) will be able to pay its bills(Stuart & Gumede, 2011).

The following schematic describes this additional balance sheet channel(Mishkin, 2005):

$$M\uparrow \to i\downarrow \to \text{cash flow} \uparrow \to \text{adverse selection} \downarrow, \text{moral hazard} \downarrow \to \text{lending} \uparrow$$
$$\to I\uparrow \to Y\uparrow \ldots\ldots\ldots\ldots (16)$$

(Atkin & La Cava, 2017)mentioned another way of balance sheet channel' transmission which is **"Household Liquidity"**, which characterises the liquidity effects on consumer durable and housing expenditures.

When monetary policy is expansionary, stock prices will rise, the value of financial assets will also increase, raising consumer durable expenditure since consumers have a more secure financial position and a lower estimate of the likelihood of suffering financial distress.

$$M\uparrow \to P_s \uparrow \to \text{financial assets} \uparrow \to \text{likelihood of financial distress} \downarrow \to$$
$$\text{consumer durable and housing expenditure} \uparrow \to Y\uparrow \ldots\ldots\ldots\ldots (17)$$

2.3.5. Expectations channel:

The importance of expectations in monetary policy has been understood starting from the 1950's, this channel is considered as the monetary transmission channel in which the effects of monetary policy appear fastest **(Mishkin, 2005)**. where, the medium and long-term interest rates are affected by the expectations of future official interest rate changes. More precisely, long-term interest rates depend on market expectations regarding the forthcoming course of short-term rates.**(Stuart & Gumede, 2011)**. Thus, monetary policy can impact the individuals and firms' behaviour through their expectations**(Mishkin, 2005)**.

Figure 09: conventional transmission channels

Policy measures' impacts	Interest rate	Exhange rate	Asset prices	Bank lendig	Balance sheet	Expectations
	• Money markets rate. • bank funding costs. • saving and borrowing costs.	• Prices of Imports. • competitiveness.	• investment. • consumtion. • wealth.	• Bank lending supply and demand.	• Private sector balance sheets. • Net worth. • Nollateral value.	• Private sector long-term expectations including by signalling the future policy course.

Source: by the author.

2.4. The effectiveness of conventional monetary policy and its limitation in times of crisis:

2.4.1. The effectiveness of monetary policy:

The transmission mechanism process works best when the conditions are met. First, the central bank policy rate should have flexibility and should not be restricted with its lower bound. Second, credit risk must be well contained by funding markets that move in synch with changes to the policy rate. Third, Inflation expectations needs to be well moored. Therefore, price stability is now achieved by a less sticky inflation target, thus, monetary policy's objectives can be easily maintained.**(Gular, 2016)**.

2.4.2 Limitation of monetary policy at the zero-lower bound:

3. Unconventional monetary policy:

The 2008 financial crisis which had its origin in the US subprime market, forced the central banks of different developing countries to loosen monetary policy by reducing interest rate to historically low levels (virtually zero)[25] where the Federal Reserve set its central bank interest rate to **0.25%** and UK's monetary policy committee decrease the short-term policy rate to **0.5%** in March 2009 followed by ECB in May 2009 with a rate of **1.0%**. In addition, and interbank market did not work properly due to uncertainty about credit worthiness of other banks. Thus, this big easing wasn't enough to strengthen aggregate demand and economic activity and inflation did not improve where CMP become ineffective. As a consequence, a proposed policy alternative was used namely "unconventional" monetary policy to distinguish it from the typical monetary policy.**(Andreas, 2017)**

3.1. What is unconventional monetary policy: measures and tools:

Unconventional monetary policy is an umbrella term for policy instruments, that a central bank would only use when its traditional tool-box is either exhausted or has lost its effectiveness in meeting the challenges it faces**(Pétursson, 2001)**. Smaghi (2009) in his speech defined this policy as follow:

*"Unconventional measures can be defined as those policies that directly target the cost and availability of external finance to banks, households and non-financial companies. These sources of finance can be in the form of central bank liquidity, loans, fixed-income securities or equity. Since the cost of external finance is generally at a premium over the short-term interbank rate on which monetary policy normally leverages, unconventional measures may be seen as an attempt to reduce the spreads between various forms of external finance, thereby affecting asset prices and the flow of funds in the economy".***(Potter & Smets, 2019)**

Unconventional monetary policy is characterized by three measures as stated in (**Mahmoud Fatouh, 2005**):

- To adopt forward guidance of ultra-low policy rates in order to shape public expectations about the future course of interest rates, namely **Signaling**.

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[25] Once interest rates are lowered close to zero, the economy also risks falling into a liquidity trap where people are no longer incentivized to invest and instead hoard money, preventing a recovery from taking place.

- Adjusting the composition of the Central Bank's balance sheet through large-scale asset purchases through financial market interventions, namely **Quantitative Easing (QE)**.
- Increase the size of the Central Bank's balance sheet (large-scale liquidity support, namely **Credit Easing (CE)** .

Figure 10: Illustration of Unconventional policy measures:
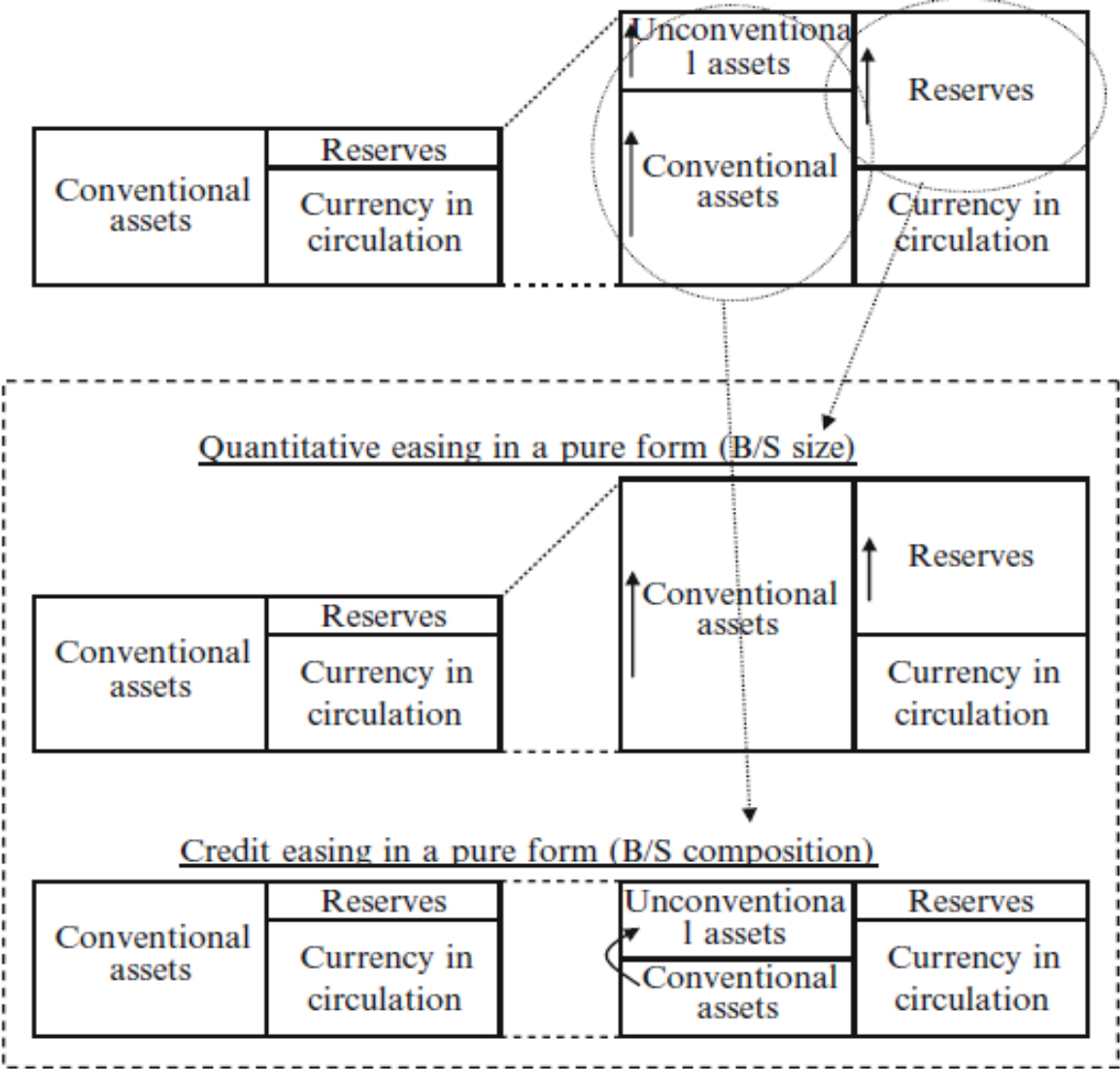
Source: (Markmann, 2018)

Therefore, the responses of CB policy to the financial crisis is an emergency operation to rescue financial system under the zero-lower bound of nominal interest rates and are not only a natural extension of the pure monetary policy.**(Smaghi, 2009)**

Table 04: Unconventional monetary policy measures:

Forward guidance	Quantitative easing	Credit easing
- It consists of providing information concerning future policy actions to influence policy expectations.[26] - The success of FG is critically depending on the capability of CB to communicate their willingness effectively. - FG tools use machine learning technics and Artificial Intelligence could also help mitigate uncertainties and expectations.	- Instead of changing its composition, the central bank can modify the size of its balance sheet to achieve desired results.[27]. - Quantitative easing may also work by altering expectations of the future path of policy rates. - Quantitative easing that is sufficiently aggressive and perceived to be long-lived may have expansionary fiscal effects.[28]	- A strategy used by CB to ease credit conditions in the economy via the purchase of private sector assets. [29] - Credit easing is aimed at boosting liquidity in a disturbed market to avert financial instability.

Source: by the author

3.2. The Transmission of Unconventional Monetary Policy:

Before the 2008' financial crisis, the approach in which monetary policy was implemented across different countries, was defined in terms of short-term interest rate and generally extend its impact on the economy by means of effecting financial assets' prices and returns. However, in the aftermath of the global financial crisis, short-term interest rate was virtually zero and conventional monetary policy' channels turn-out impotent. At the time, the authorities took other measures to motivate the economy which was the most significant shift

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[26] Most central banks share their intentions routinely regarding future settings of short-term policy rates. Thus, the purpose of FG is shaping private sector expectations about future policy in ways that departed from past communication styles. For more see(B. Bernanke, Reinhart, & Sack, 2004b).

[27] *When short-term policy rate is almost zero, CB buy longer-term assets. The CB credits the price of the purchased assets to the account of the seller's bank, which in turn credits amount into the seller's account. consequently, the central bank can increase the broad money in the economy.* See (Shiratsuka, 2013)

[28] The existence of government debt implies a current or future tax liability for the public when expecting positive short-term interest in the future or reserves.

[29] Ben S Bernanke advocated credit easing, he defined it as a combination of lending to financial institutions, providing liquidity directly to key credit markets, and buying of long-term securities. see more on(Shiratsuka, 2013)

in the practice of central banking in the recent years namely UCM channels shown in **figure (09)**. For more see **(B. S. Bernanke, 2009; Mahmoud Fatouh, 2005; Potter & Smets, 2019)**.

Figure (11): unconventional monetary transmission channels
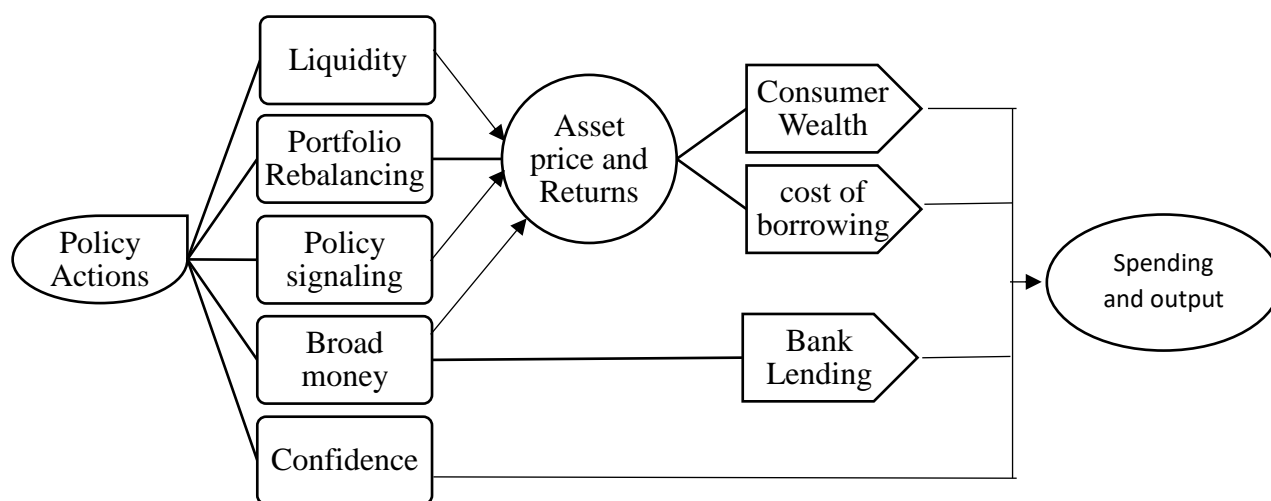
Source: by the author depending on (B. Bernanke et al., 2004b)

The influence of all channels in **figure (09)** is exerted on the economy through asset prices and returns except bank lending which appeals only under quantitative easing and consumer confidence that directly influence spending and output affecting long-term interest rates. These UCM can be distinguished from other conventional activities that are more closely to the lender of last resort. see **(Joyce, Tong, & Woods, 2011)**.

Figure : UCM channels working via asset prices.
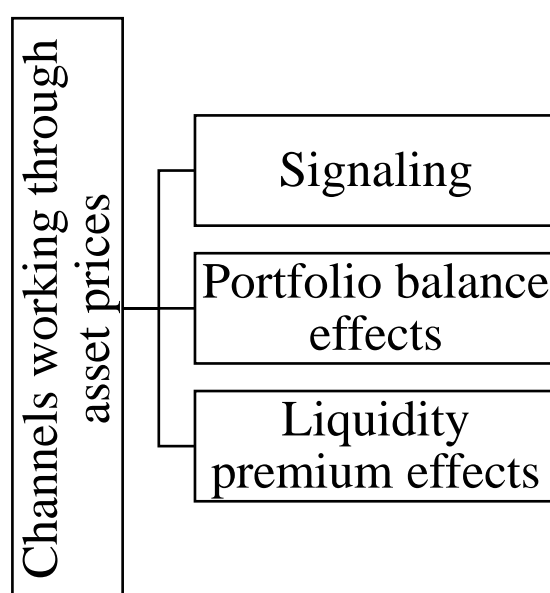
Source: by the author.

3.2.1. The signaling Channel:

We start the discussion of UCM transmission channels by the approach of "signaling channel" which is also called as "the inflation risk channel"[30]. This channel- as a balance sheet integral part of their transmission mechanisms- sequels central banks communication policies in order to signal the intended future policy rates and influence public expectations about key factors that underpin an assets market valuation which will influence future policy decisions. See **(Mahmoud Fatouh, 2015; Janus, 2016)**.

Wallace (1981) introduces the idea behind the functioning of this channel "neutrality proposition" which states that the OPM operations conducted by the central banks and the relative share of different assets in its balance have no effect on the dynamics of main macroeconomics indicator and on the general equilibrium of an economy. From this theorem, and from the prospective of UCM in general and balance sheet in particular, this hypothesis is substantial[31]. See **(Borio & Disyatat, 2010; Joyce et al., 2011)**.

According to **(Borio & Zabai, 2018)**, the signaling channel includes the following phenomena:

---

[30] These models put a strong emphasis on inflation expectations in effective realisation of unconventional monetary policy. For more see

[31] It is also assumed that the use of signaling channel in the situation of the ZLB comes from the work of Krugman (1998)

- Rise consumption, investments and the aggregate demand.
- Inflationary expectations' prompting.
- The decrease of real interest rate.
- Changes in the term structure of market interest rates particularly the fall of long-term interest rates.

3.2.2. Portfolio balance effects:

A second channel is portfolio rebalancing effect, adopted by the central bank's asset purchases which may boost economic activity through long-term interest rates and asset prices beyond changes in expected short-term interest rate (Eggertsson & Woodford, 2003).

This channel is built based on the assumption that money and other financial assets are imperfect substitutes[32]. It also affects risk premia inwards long-term interest rates structure. Portfolio balance channel can be operative only when the market' long-term debt is effectively segmented from the rest of the financial market which create arbitrage opportunities that the market will exploit.**(Bauer & Rudebusch, 2013).**

Table 05: the difference between Perfect and segmented (imperfect) financial markets.

Perfect financial markets	**Segmented financial markets**
- When the short-term interest rates achieve the ZLB, the changes in the composition and/or the size of the central banks balance sheet would have no effect on asset prices or the economy. - Investors will simply sell their holdings and rebalance their portfolio with money or securities sold by the central bank whilst asset prices and long-term rates remain constant.	- At the ZLB interest rate, central banks are able to influence term, risk and liquidity premium and thus the overall yield. - Investors will buy other assets to rebalance their portfolios[33]. - This process will raise the prices of assets and long-term rates to the point where the investors in total are willing to hold the overall supplies of asset and money.

Source: by the author depending on (Dale, 2010) and (Thornton, 2014)

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[32] The concept of imperfect substitutability goes back to **Tobin (1958)**, where various factor may affect the degree of substitutability between assets including duration, credit risk and liquidity. For more see (Cecioni, Ferrero, & Secchi, 2011)

[33] These assets are better substitute for the ones they have sold. For more see (Joyce et al., 2011)

As a conclusion, and in view of (Gambacorta, Hofmann, Peersman, & Banking, 2014), the efficiency of this channel is relied on the degree of substitutability between assets and the amplitude to which changes in the relative supply of specific assets influence absolute and relative returns.

3.2.3. Liquidity premiums:

According to (**Joyce et al., 2011**), this channel may function effectively at times of financial market stress. By increasing the volume of trading, and so the liquidity of financial markets through central bank asset purchases, liquidity premia[34] will decrease. Contrary, a higher liquidity premium makes taking leverage more costly, which leads to less risk taking, higher risk premia, lower asset prices, and less investment. Risk premia are also higher in the bond market (**Gambacorta et al., 2014**). However, the effects of this channel are likely to be persist only while monetary authority is conducting asset purchase, and their extent may be minor in highly liquid gilt markets.

3.2.4 Confidence effects:

Asset purchases may have broader confidence effects beyond any effects generated through the effect of higher asset prices. One specific aspect of QE is that asset purchases can be used to repair malfunctioning markets where demand is reduced by fears of impending crisis. When confidence has returned in the affected markets, QE stand to be less efficient (**Gambacorta et al., 2014**). In addition, this policy leads to better economic outlook, where it boost directly the consumer confidence and people's willingness to spend. This enhancement in confidence is reflected back in higher asset prices, especially by reducing risk premia (**Christensen & Gillan, 2018**).

3.2.5 Bank lending effects:

The bank lending effects result from the provision of new reserves to banks when central banks purchases assets from them. The high level of liquid assets encourages banks to increase lending and give new loans more than they would have done otherwise. Additionally, when assets are bought from non-banks -either directly or indirectly via intermediate

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[34] Changes in the liquidity premium have potentially substantial effects on the investment decisions of financial institutions and hence on asset prices and the cost of capital in the economy.

transactions- the banking sector gains both new reserves at the central bank and a corresponding in customer deposit. **(Hanson & Stein, 2015)**.

However, in times of financial stress, weakly-capitalized banks may be less able to expand credit supply in response to expansionary measures due, for example, to an intensified pressure from the markets or from regulators.**(Panizza, Wyplosz, & Finance, 2018)**

3.3. The effectiveness and limitations of the unconventional monetary policy:

The role of central banks during normal times does not provide direct lending (to the private sector or the government), and does not purchase government bonds, corporate debt, or other types of debt instruments. However, during downturns and upturns, central banks is involved in driving the level of interest rate, in order to provide sufficient monetary stimulus and contain inflationary pressures respectively. Thus, when interest rates are lowered to zero due to powerful economic shocks, a range of unconventional monetary policy is used at a point where cutting policy rates further is impossible **(Joyce et al., 2011).** The great financial crisis proclaims a new chapter in the history of central banking. Still, the slow recovery that followed the great financial crises has naturally raised questions about the effectiveness of these new tools which proclaims a new chapter in the history of central banking literature. Although the theoretical literature on unconventional monetary policy has blossomed extensively over the past 20 years, empirical analysis of the impacts has been much more limited. **(Mahmoud Fatouh, 2016).**

As pointed out by **(Albertazzi, Nobili, & Signoretti, 2016; Korniyenko, 2015) (Filardo & Nakajima, 2018)** among others, the distinguishing feature of these alternative measures is that the central bank actively uses its balance sheet in face of a liquidity trap to affect market prices and conditions beyond a short-term interest rate. **(Pattipeilohy, Van Den End, Tabbae, Frost, & De Haan, 2013)** argued that unconventional monetary policy is not only able to effect expectations of the future interest rate but also the expectations of future price levels. They also discussed the effects of changing both the price level and related exchange rates that appear stronger than that of changing long-term nominal interest rates or expectations of future short-term interest rates that are already close to zero.

From another side**, (Borio & Disyatat, 2010)** discussed the possible factors which could limit the implementation of UMP measures in developing economies as follows:

- An insufficiently developed government bond market that limits the central bank's ability to buy such bonds.
- An insufficiently developed corporate bond market, which limits its capacity to be a source of corporate funding even if it is functioning normally.
- Legal restrictions on central bank purchases of government assets and other securities.
- A high degree of "dollarization" of domestic liabilities that limits the lender-of-last resort function of the central bank.
- an exchange rate peg that limits monetary policy flexibility.
- insufficient credibility on inflation fighting that might cause adoption of unconventional policy measures to be perceived by the market as a loss of inflation discipline.
- Related to (vi) above, vulnerability of the currency to capital outflows.

In addition, from the monetarist view, for UMP shocks to be effective central banks must change broad money instead of base money[35]. While Ricardian equivalence stated that Central Banks cannot eliminate the credit risk associated with the assets which is only shifted from the private sector's balance sheet to the Central Bank's balance sheet, as a consequence the government's net wealth becomes more uncertain when purchasing riskier assets that would lead to an additional tax burden for households in the future. see **(B. Bernanke, Reinhart, & Sack, 2004a).** Contrary, UMP was criticised upon the argument of neutrality[36] by **(Bowdler & Radia, 2012)**, where **(Woodford, 2012)** explained within a new Keynesian model that QE may be an effective tool to stimulate the economy if the government securities purchases are not equivalent to reserves, where not all households can invest in those assets and/or financial frictions impair investment. Thus, to the extent that market participants take full advantage of arbitrage opportunities, QE should have no effect on real economic outcomes **(Farmer, 2012)**.

II.   The theoretical framework of fiscal policy:

The last few years, government spending, taxation, and deficit financing became a lead of policy debates worldwide. Therefore, for a better understanding to fiscal policy we must first

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[35] According to the monetarist view, any increase in the deposit holdings of the nonbank private sector, can generate a shock to the supply of money. The non-bank private sector would consider holding this increased supply of money if the determinant factors for the demand of money change. For more see (Ben-Haim, Demertzis, & Van den End, 2017)

[36] According to Wallace neutrality argument, in a complete market environment, the government cannot remove risk. It can simply transfer that risk from the private balance sheet to the public balance sheet. Since the public balance sheet is ultimately backed by the tax liabilities of the private sector, the risk does not disappear, it is simply relabelled. As it can be recognized by the rational agents, the Central Bank balance sheet policy have no influence on realized security prices, for more see (Morgan, 2012).

discuss public finance which is the field of economics that studies government activities and the alternative means of financing government expenditures.

1. Public finance and the role of government:

The role of government has been and will always be argumentative. Some believe government does too much while others believe it needs to do more. Government, its programs and scope have grown significantly from a small share of the economy in the early 1900s to between 30 and 50 percent of the economy in modern industrial nations today. **(Wallace, 1981).**

1.1. What is public finance?

Public finance is a science composed from two words, "public" is normally referred to Government or State and "finance" which is related with income, expenditures, how to collect money and how to spend it. This is why it can be said that public finance studies how government provide the desired public goods and services and how they secure financial resources to pay for it. There are several experts who have defined public finance where some important definitions are as follow:

(Chen, Filardo, He, & Zhu, 2012) says while defining it that Public finance deals with the expenditure and income of public authorities of the state and their mutual relation as also with the financial administration and control,

(Assadi, 2015b) has defined public finance in his book "the economics of public finance" as a fiscal science, its policies are fiscal policies, its problems are fiscal problems where it studies the manner in which the state through its organ, the government, raises and spends the resources required. Public Finance is thus concerned with the operation and policies of the fiscal public treasury.

(Hyman, 2014) argued that public finance is concerned with the income and expenditure of public authorities, and with the adjustment of one to another**.**

After studying different definitions, we conclude that public finance with its basic meaning is concerned with government`s income and expenditures at all levels; National, State, and Local. However, in the modern context the meaning of public finance has been enlarged to include not only revenues and expenditures but also accounts auditing, financial administration and financial control to achieve their political, economic, social and cultural goals.

1.2. The scope and importance of public finance:

1.2.1. The role of the state:

Government's role in economy and society is constantly debated. Views range from that of anarchists, who believe in no government, to that of totalitarian socialists, who believe in complete state control of economy and society. **(Bastable, 1895)**

The classical economists from Adam smith onward, favoured a minimal role for the public sector According to **(Taylor, 1953)** in his book "Wealth of Nations", the functions of "a complete sovereign rich nation" can be divided into following three categories:

- Defending the society from external aggressions.
- Securing internal justice or law and order.
- Erecting and maintaining public institutions and work.

However, many economists, such as **Robert Owen** and **John Stuard mill** steward the attention of people towards laissez faire and supported Government intervention. While J.M Keynes through his general theory of employment, emphasized on government participation in socio-economic life of the country as a foundation for the development of the role of the state. the modern states became "welfare states".**(Dalton, 1971)**

It is interesting to mention that public opinion has switched again to minimize the economic interventions of the state in many countries. The results of the inflationary pressure of the 1970s[37] was seen as government failure. The 1980s testified a revulsion towards economic liberalism, suggesting a rolling back of the frontiers of state ownership and involvement in the economy.**(Lipford & Slice, 2007)**

We can summarize the role of a modern government in the following figure:

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[37] Some of these results are the slowdown in the growth of the world economy, the apparent inefficiency and loss-making of some state enterprises. For more see

Figure 12: the modern functions of the state.
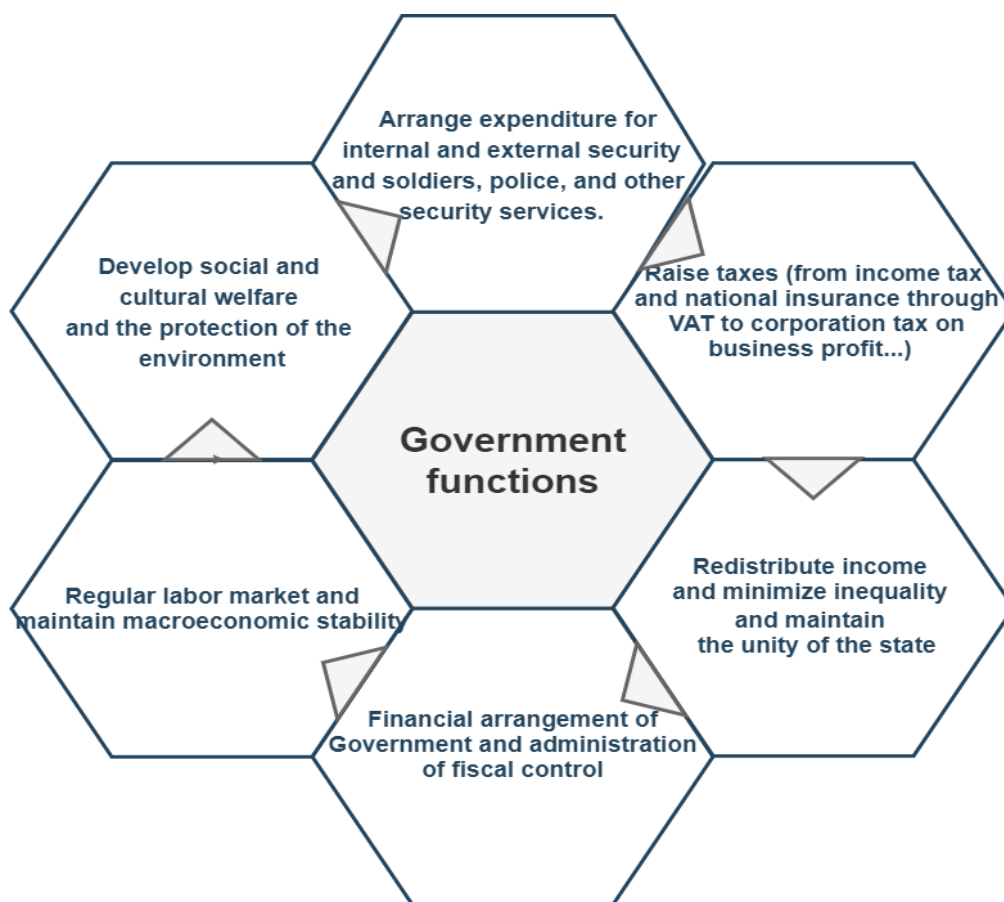
Source: author`s illustration.

1.2.2 Fiscal operations:

Fiscal operation refers to the operations of public finance. Those operations effects the levels of investment, consumption, aggregate demand and stabilizes the economy. **(Smith, 1776)**.

(Nugroho, 2018) says that "although particular tax and expenditure measures affect the economy in many ways and may be designed to serve a variety of purposes, several more or less distinct policy objectives may be set forth", **(Demirbas & Demirbas, 2011)** has also presented fiscal operations in his book "public finance in theory and practice" as follow:

- To secure adjustment in allocation of resources: Market mechanism alone cannot perform all functions of the economy thus the government should also perform some functions of the economy through its public sector. Therefore, there is need for production of social goods and services by public sector such as defense, justice, social and cultural welfare, public utilities, transports… so resources should be allocated between social goods and private goods through budgetary policy.

- <u>To redistribute income and wealth:</u> the taxation and public expenditure measures are used to redistribute income and wealth among the people of the country. It is being done through imposing taxes of high-income group households (rich people) and so collected revenue is being spent for betterment or uplift of the poor.

- <u>To secure economic stabilization:</u> the revenue and public expenditure process of the government helps to control economic fluctuations like inflation, deflation, depression… the overall employment level and price-situation are mainly depending on aggregate demand so the fiscal operation could be used to control unemployment and price instability. For instance, if the country is suffering from unemployment, opportunities by the establishment of public sector industries.

- <u>To accelerate economic development:</u> actually, fiscal operation is boon to poor or underdeveloped countries. The poor countries always suffer with capital deficient problem.

1.2.3 Distinction between public finance and private finance

The public sector involves all organizations, agencies and state offices owned by the government, while the private sector comprises all the privately owned businesses, companies, partnerships and the profit and non-profit corporations **(Idris, Bakar, & Ahmad, 2018)**.

According to **(Richard A Musgrave, 1996),** both government and individuals need resources but those resources are limited. This is why both public and private sectors are required to match their income and expenditures in such to make the optimum use of their resources

However, some important differences between private and public finance must be highlighted

Table 06: the dissimilarities between public and private finance:

Basis of comparison	Public finance	Private finance
Income and expenditure	Public income adjusted according to expenditures	Individual`s expenditures adjusted according to income.
Borrowing	Borrow internally and externally	Borrow externally only
Present vs future income	Public investment done for long term benefits	Private investment can be for short term benefits
Areas	Army, police, health, mining, education, transport, telecommunication, agriculture, banking, insurance…	Finance, technology, mining, manufacturing, private banking, private transport, construction, private pharmaceuticals…
Transactions	Public finance transactions are open to the society	Private finance transactions are maintained secretly
Profits of working	Job security, retirement benefits, allowances, perquisites…	Good salary package, competitive environment, incentives…
Job stability	Yes	No
Objectives	Public sector seeks to provide the welfare of the society and serve the citizens to create social benefit	Private individuals aim to maximize their profits
Capital structure	Public sector financing is consisted of a combination of pay-as-you go funding and tax-exempt debt (no equity)	Private sector funding is a combination of debt and equity, with equity accounting for 20% to 30% of total investment.

Source: author`s illustration depending on (**Richard Abel Musgrave, 1989**)

1.2.4 Importance of public finance :

Public finance is assuming increasingly greater importance, and the scope of public activities has been increasing day by day. The importance of public finance has increased greatly in recent years. The importance of public finance can be justified on the following grounds **(Ewton Cain, 2014; Ghosh & Ghosh, 2014)**

- **Taxation**: The consumption of cigarette, alcohol, opium and other commodities that fall within that need to be discouraged. The governments often levy taxes to discourage the consumption of these harmful commodities. For more see **(Gielen & van der Krabben, 2019)**

- **Protection to Infant Industries**: The Government of an underdeveloped country protects its infant Industries against foreign competition through various public finance activities like imposition of heavy tariff duties on imports, putting restrictions on imports, giving subsidies to keep the cost low etc. If the infant and newly started firm or industries in developing nations are allowed to struggle with foreign firms especially from those technologically advanced countries, it may not succeed due to many reasons and factors. For further details see **(Shoup, 2017)**

- **Provision Public Goods:** according to **(Zhyber, 2019)** governments provide public good, the government-financed items and services such as roads, military forces, lighthouses, and streetlights. Private citizens even the wealthy ones would not voluntarily pay for these services, and therefore businesses have no incentive to produce them.

- **Planned economic development:** public finance plays an important role to achieve the planned economic development in the country. It effects aggregate resource use, financing patterns, influence the balance of payments, and the rates of inflation, interest and exchange. Additionally, according to **(Laković, Mugoša, Čizmović, & Radojević, 2019)** public finance expands productive capacity by raising the level of real capital including skills as well as plants and equipment and to check the demand generating effect of expanding investment

- **Correct market failure:** governments can correct the undesirable side effects -also called spillovers or externalities- of a market economy through public finance. Where **(Melitz,**

2005) argued that various types of market failures exists, which needs different means of government intervention[38].

- **Reducing inequalities (equity):** as stated in **(Petrick, 2006)** public finance plays a vital role in reducing social inequalities that exists in many dimensions: income, wealth, education, political voice, and others. Government provides equity through its fiscal policies.

- **Maintaining Balance or Trade:** The Government always restricts the imports only to the essential items: hence imports of non- essential items are taxed heavily. On the other hand, the Government encourages the exports of its surplus production. It reduces the burden on export items and also supports them with subsidies and grants. These operations restricting imports and encouraging exports of the Government maintain the balance of trade.

- **Income redistribution:** government redistribute income by collecting taxes from their wealthier citizens to provide resources for their needy ones. For more see **(Chulu, 2015)**

- **Industrial development:** public finance helps industrial development as follow:

  o Subsidies and grants: In modern times, subsidies and grants are inevitable for producing essential goods and services meant for the masses. It has a prominent place in the government in the government expenditure of developing countries.

  o Public finance induces the investment during the time of depression through it taxation policy by allowing tax-debates for investments in desired direction.

  o The role of public finance in under-developed countries is to bring economic stability to keep the level of consumption and investment quite up to the level of production.

  o To strengthen the economic development, it is essential to give highest priority to capital formation because industrial and development cannot be imagined without capital.

  o Industrial development of a country will bring in more employment opportunities to people especially in under-developed countries

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[38] If we take the problem of public goods as an example as in **Blanca & Wodon, 2008**,, and when the government fails in defining the charge that should be paid by consumers, the government tries overcome that failure by revealing the citizens' preferences for public goods.

Thus, it is evident that the government of a country can push up the industrial and economic development of the country, provide more employment opportunities, encourage investments and savings in the desired direction and increase social benefits through public expenditure.

1.3. Public revenues:

The government budget is not only about the collection of revenues and expenditures but much more than that and for a better understanding to the budgetary activities of a government, it is substantial to explain the sources of the collection of public revenues and its structure, including the process by which it raises those revenues and spends them on public goods and services. **(Blanca & Wodon, 2008).**

1.3.1. the definition of public revenues

Government Revenue is all amounts of money received by a government from external sources, it is also known as public revenue or public income. According to Dalton public revenue has two definitions. The narrow definition includes income from the public authority sources only such as taxes, prices of public goods and services, and revenues from administrative activities, while the wider sense comprises all incomes or receipts that a government may secure during any period of time including amounts received by all agencies, boards, commissions, or other organizations categorized as dependent on the government concerned. **(Cuesta & Negre, 2016)**

1.3.2 Sources of public revenues:

Historically there are different classification criteria for the sources of public revenue explained in the following table:

Table 07: the different classifications of public revenue sources.

Economic school	Classification
The cameralism[39]	Identifies four large groups of public income; revenues obtained from the state companies, the royalties, the public credits, and taxes which were a last resort option

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[39] The cameralists were partly economists, partly political scientists, partly public administrators, and partly lawyers, they jutted in the 15ᵗʰ and disappeared in the middle of the 19ᵗʰ century, they were mainly situated in the German-speaking lands. During this period the cameralists had heaped a collective bibliography of more than 14,000 items which lay mainly in their ability to operate more effectively in a substantive manner, and not on the development of theoretical argument. Cameralist1s public finance treated state lands and enterprises as principal sources of revenue, and most certainly not as objects of subsidy where their vision to the state was like a business firm. For more see **(Bandyopadhyay & Esteban, 2007)**.

	for public finance.
Adam smith classifications **-the classicals-**	Adam Smith identified two categories of public revenue: "the original" revenues obtained from the state property and "the derivatives" gained from the use of the power of constraint that holds the State over individuals (such as taxes).
Seligman Classification	Based on different criteria, Seligman elaborates three classifications of public income: - Gratis revenue includes gifts, donations and grants received by the public authorities free of cost. - Contractual revenue which arise from the contractual relations between the government and the individuals such as prices and fees. - Compulsory revenue derivates from the sovereignty of the State and includes taxes, fines and income from the state administration.
Neumark Classification	Neumark classified the public income depending on their economic source, under two groups: the income that comes from the public economy (from the own public economy or from a public foreign economy) and the income that comes from the private economy (fees, special contributions, taxes, fines, monetary penalties....)
Dalton classification	Prof Dalton classified public revenues into two main categories namely prices and taxes

Source: author`s illustration depending on **(Chaudhry & Munir, 2010; Khan, 2019)**.

However, these classifications are too narrow, unsatisfactory and incomplete in view of the modern needs of public finance. public revenue of the modern state can be broadly classified under two main heads taxation and non-taxation revenue. Tax income is composed of compulsory unrequited public income while all other government revenue is non-tax income which embrace a wide and diverse variety of income sources**. (Wagner, 2012)**

1.3.2.1   Non-taxation public income:

According to **(Wagner, 2012)**

- **Revenue from private income:** A government derives revenue from citizens from non-tax sources such as fees, prices, special assessments, rates, etc.

- **Irregular revenue:** Under this heading, we can include all items such as gifts[40], penalties[41], war indemnities, etc.

- **Revenue from state ownership:** A government also obtains income from the different assets which it owns.

- **Grants:** are noncompulsory transfers received by government units from other government units or international organizations.

- **Natural resources revenues:** such as oil and gas revenues, mining, forestry, Etc.

- **Borrowing:** from the central bank or international borrowing.

- **Commercial revenues (price):**

- **Intergovernmental Revenue:** the transfers from a higher-level government to one or more lower-level governments. For example, transfers to local government from the federal government. Most of these transfers are grants and subsidies, commonly known as grants-in-aid. See **(Morrison, 2007).**

- **Fees:** The other important sources of public revenue are the fees charged by government for rendering certain services. Some time the government provides certain special services to the public of the country and in payment for these services, it charges fees. Fee is that revenue which is paid to the government for the special services rendered by it. [42]

- **Escheats:** The persons who die without any legal heirs behind or without any special will, their properties are taken possession of by the government. Such right of government to

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[40] Public revenue is also derived from the gifts made by individuals, private organizations and foreign governments. This is, however, not a certain and fixed source of revenue for the government and is also out of the control of the government. Its significance as a source of public revenue has been gradually declining over the years. For more details see (Morales Contreras, Ramos Riera, & Triguero Cano, 2018).

[41] Fines and penalties are the payments made for the contravention of law. The distinction between taxes and penalties lies in the motive. A public authority imposes taxes mainly to obtain revenue and imposes penalties mainly to deter people from doing certain acts. See (Morales Contreras et al., 2018) for further explanation.

[42] Smriti Chand, previous reference.

acquire property is called the right of escheat and the properties so acquired are called escheat.

- **Special Assessment:** Special assessment is an American invention which has been defined by Professor Seligman as a compulsory contribution levied in proportion to the special benefits derived, to defray the cost of a specific improvement to property undertaken in the public interest. It is a device for securing for the public treasury part of the unearned increment in the value of fixed property. In simple words, we can say that sometimes the government performs certain services as a result of which the property or wealth of a particular group of persons in the community is increased. [43]

- **Borrowings:** Another source of public revenue-in a sense of provisional or temporary source-is the borrowing of money. Just as individuals or firms may borrow in anticipation of other revenues, so also governments borrow funds.

- **Money printing:** Finally, the governments may resort to the printing of paper money as a means of paying their bills. Governments, unlike individuals, have the power to create money and assign it legal tender qualities.

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1.3.2.2.   Taxes revenue:

Tax revenue is considered as a predominant share of government revenue in several countries, it is composed of compulsory and non-refundable transfers to the general government sector, however, Certain compulsory transfers, such as fines, penalties, and most social security contributions, are excluded from tax revenue**.   (Slemrod, 2002).** Additionally, Taxes influence the decisions of households to invest in different social aspects (education and housing…), save and provide employment. Taxes also affect the decisions of firms to produce, offer labour, invest and innovate, as well as the choice of savings channels and assets by investors. For further explanations see **(Kennedy, 2012).**

i. Definitions, canons and classification of Taxes:

(Khan, 2019) defined Taxes as *"a compulsory payments to the governments without expectation of direct return to or benefit to the tax payer"*.

In the words of **Bastable** in his third edition of his book "public finance" in 1932 tax is *"a compulsory contribution of the wealth of a person or body of persons for the service of the public powers"*.

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[43] Amber Gosh, Ghandana Gosh, previous reference, p113.

(OECD, 2018) has also defined taxes as *"from the standpoint of view of the state, a tax is a source of derivative revenue, from the angle of the citizen a tax is a coerced payment, from the administrative point of view it is a demand for money by state in conformity to established rules from the point of view of theory a tax is a contribution from individuals for common expenditure.*

From definitions above we notice that taxes have some features which characterize it from other sources of revenue. Those characteristics are:

- o Tax is compulsory where all citizens must pay and no one has the right to refuse and object the payment of a tax

- o It is paid by taxpayer for the common benefit.

- o It is not imposed in return for any special services[44]

- o Tax is levied on income, property or merchandise, but it is paid by persons and not by things.

ii. Canons/ principles of taxes:

There is four widely known principles set by **(Smith, 1776)** in his book "wealth of nations" which is one of the most important sources of a sound taxation canons. equality, certainty, convenience, and the economy of taxation.

- **Canon of Equality:**

In the words of **(Kennedy, 2012)** *"The subjects of every state ought to contribute towards the support of the government, as nearly as possible, in proportion to their respective abilities; that is, in proportion to the revenue which they respectively enjoy under the protection of the state."*

From the above, the concept of the equity in taxation refers to the principle of justice in in the amount of the tax paid in accordance to the respective abilities to the tax payers. According to **(Taussig, 1967)**, Equity can be either, vertical or horizontal where the term *Horizontal Equality* which is largely accepted, enquire on whether "*a tax system makes arbitrary*

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[44] As stated by **(Johansson, 2016)**, there is no direct logrolling between the tax payer and the government. In the words of **(Taylor, 1953)**, *"The essence of a tax, as distinguished from other charges by government, is the absence of a direct quid pro quo between the tax payer and public authority"*

distinctions among taxpayers, or distinctions based on irrelevant criteria"[45]. While the concept of *Vertical Equality Vertical Equity* takes into consideration when taxing the different levels of income and their abilities to pay. (Smith, 1776) has also divided the taxes under this principle into three heads: a regressive tax *"requires a lower-income people to pay a greater percentage of their incomes in taxes than do people with higher incomes"*. Contrary to the progressive tax where higher-income people pay a larger percentage of their income in taxes. Finally, the proportional tax is "*where all income groups pay the same percentage of income in taxes"*.

Despite the wide acceptance of the canon of equity that stresses the importance of the connection between ability to pay and level of taxation, Smith has not made it explicit if he prefers proportional or progressive taxation. Where we find several points of views on the "fair tax", some trust that higher-income must pay the same percentage of their income in tax as the lower-income, while others believe that what is fair is that who have more disposal income must pay a higher percentage of their income to tax. **(Kiprotich, 2016).**

- **Canon of Certainty:**

(Wise & Berger, 2010) has pointed to the principle of certainty saying that:

"The tax which each individual is bound to pay ought to be certain, and not arbitrary. The time of payment, the manner of payment, the quantity to be paid, ought all to be clear and plain to the contributor, and to every other person."

This principle means that the time and the manner of taxes payment must be certain. The certainty plays an important role to avoid insolence and corruption, and would help governments to plan expenditures. According to **(Kiprotich, 2016)**, a predictable tax can also be effective for business entities who prefer to plan costs well ahead in advance.

- **Canon of Convenience:**

 According to **(Wise & Berger, 2010)**,every tax *"Every tax ought to be levied at the time, or in the manner in which it is most likely to be convenient for the contributor to pay it."*

Thus, the canon of convenience states that the time the manner of payment should be convenient. For example, the income tax should be paid when the income is earned, while the tax on sales are earned at the time of the transaction…

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[45] As an example to the horizontal equality principle, **(Smith, 1776)** affirms that if a consumer pays sales tax on an item bought from a local store, while other purchased the same item over the Internet, but does not pay sales tax, this violates the principle of horizontal equity

- **Canon of Economy:**

Another canon set by (Smith, 1776) where he argued that *"Every tax ought to be so contrived as both to take out and to keep out of the pockets of the people as little as possible, over and above what it brings into the public treasure of the state."*

This principle proposes that when the cost of collecting tax is minimum, the tax will be economical. Contrarily, the tax is uneconomical if the administration of the tax collection spends a big portion of tax revenue.(**Kiprotich, 2016**). However, if there is corruption or oppression involved in the frequent visits to the income tax office and the odious examination by the taxing officer the canon of economy is not satisfied.

The principles mentioned above is still relevant today, however, David Ricardo (1998) among other economists criticized Smith's taxation principles. After 50 years of Smith's book the wealth of nation, Ricardo said that Smith *"overlooked many important truths"* and determined the relationship between different human communities. He also asserted that any society goes through the different allocation of resources "whole produces of earth" to the three classes of community: owner of land, owner of stock and capital and laborer via rent, profit and wage and that therefore 'laws' are needed 'which regulate this distribution' via taxation. **(Smith, 1776)**.

In addition, other taxation canons were formulated by **A. Wagner** and **L. von Stein** in the 19th century in a quite different way. These principles strengthened the taxation bases, where Wagner modified and divided the existing principles into four groups: fiscal, economic, technical and equity. That what leads taxation to earn extra fiscal roles meeting the new demands of taxes theory. **(Smith, 1776)**

Table 08: A. Wagner`s classification of taxes 'canon

Category	Principles
Fiscal	Stability Efficiency Flexibility
Economic	The inviolability of the taxpayer`s property The creation of motivation The rule of one-off taxation
Social justice	Universality

	Equality
Technical	Low costs of taxation
	Convenience
	Certainty
	Accuracy and transparency of tax law

Source: (Soyode & Oyedokun, 2019)

Thus, canons of taxation refer to the characteristics or qualities which a good tax system must have, in view of the continuous development of the economy worldwide, modern writers keep adding other taxation canons summarized as follow:

Figure 13: modern canons of taxation.

Canon of elasticity • taxation must have built-in flexibility

Canon of productivety • The tax system should be able to provide anough revenue for the treasury to avoid budget deficit.

Canon of diversity • A good tax system should incorporate a broad taxpayer base and sources of income.

Canon of simplicity • A tax system should be easy for tax payers to comply.

Canon of buoyancy • taxes revenue should have an inherent tendency along with an increase along with an increase in national incomes.

Source : author's iluustration depending on **(Jarczok-Guzy, 2017; Kiprotich, 2016)**

iii. Classification of taxes:

(Jarczok-Guzy, 2017; Kennedy, 2012) wrote about the sources of taxation where they mentioned that taxes may be levied in a several means. Contrarily to the past when taxes was often levied in kind; today most of taxes are excised in monetary terms. Moreover, different taxation bases exist; such as persons, property, oncome, commodities and transactions.

According to **(Kiprotich, 2016)**, several points must be considered when designing and classifying taxes as follow:

- The basis on which the tax is levied.
- The government level to which the tax revenue is paid (national government taxes, county taxes)
- The extent to which different sections of the population are affected (whether they are progressive or regressive taxes, for example).

Taxes can be divided broadly under one of the common classifications "direct and indirect" taxes, where according to (Daunton, 2007) *"a direct tax is one which is really paid by a person on whom it is imposed, whereas an indirect tax, though imposed on a person, is partly or wholly paid by another"*.

another distinction was presented by J.S Mill saying *that "a direct tax is demanded from the person who is intended or desired should pay it. Indirect taxes are those which are demanded from the person with the expectation and intention that he shall indemnify hiself at the expense of another"*. **(Vosslamber, 2010)** explained the words of JS Mills arguing that the direct tax effects the same person (taxpayer) while the indirect taxe the taxpayer is not the tax bearer.

Taxpayer and as indirect taxes those that are levied on transactions irrespective of the circumstances of buyer or seller. We can summerize the differences between direct and indirect taxes in the following table.

Table 09: the difference between direct and indirect taxes:

Basis	Direct taxes	Indirect taxes
Meaning	Tax levied on incomes/ wages/ earnings and paid by the taxpayer directly to the government.	Tax paid indirectly to the government and levied on goods and services.
Types	Income tax, capiyal gains tax, transaction tax, wealth tax, prequisites tax, estate duties, corporation tax…	Excise duty, custom duties, Consumption taxes (Value added (VAT), sales tax, goods and services tax (GST))
Burden	Tax burden is progressive. Use a marginal tax rate that	Tax burden is regressive. the same for each sale amount,

	increases as the amount of taxable income increases.	regardless of the purchaser's income (also due to cascading effect).
Tax evasion	Easy	Difficult
Advantages	-Taxes are simple, certain, flexible and easy to understand. -Reduce inequalities	-Tax is convenient, productive and diverse. -Powerful tool for economic policies.
Disatvantages	-Difficult to enforce in countries with weaker laws/ rights -It is nconvenient to pay. -Discourage savings and investment.	- Complex and inefficient leading to higheradministrative costs. - Encourage dishonesty. - the burden is heavier on the poors than on the rich

Source: author's illustration based on (Mutua, 2012) and IMF document accessible on:

https://www.imf.org/~/media/Files/Publications/REO/MCDCCA/2018/November/En/MENAP/key-characteristics-of-different-taxes.ashx

1.3.2.3. The taxation of natural resources:

The increase of revenues from the economic activity related with the exploitation of natural resources is virtually a worldwide phenomenon among the nations of the world. This can take several different forms. It may consist of taxes specific to the resources in question **(Boadway & flatters, 1993)**. In addition, natural resources are frequently owned and/or controlled by governments, as well as being subject to a variety of conventional taxes. This section describes different resource taxation's effect from different aspects: the timing and scale of resource development, the pace of resource use and other macroeconomic issues such as employment. These effeciency effects are summerized according to **(Auerbach et al,2013)** as follows:

i. Effects related to natural resource development:

- **The cut-off grade problem:**

The cut-off grade problem is resulted when a natural resource is subject to a tax of per-unit-of-output, it will not allow for the higher costs of marginal deposits, which will stop some of these resources from developing even if their value exceeds the costs of their recovery

(excluding taxes). and hence the overall efficiency effects, depend to an important extent on how easy it is to select the deposits in order of increasing costs and to eliminate only the most costly deposits from production.

- **Tilting of output:**

The resource taxation effect on the timing of output has been an active topic for theoretical consideration when considered from an individual deposit of an extractive resource of constant quality. Generally, taxes on the volume or value of output incline to tilt the output path by reducing initial output, although much depends on the role of the productive factors in resource production.

- **Exploration effects**

The problem ascends mainly in the case of underground or undersea deposits of extractive resources. Any taxation of discovered deposits reduces the private value of such deposits, and hence reduces the profitability and scale of exploration activity aimed at finding new deposits. There may also be external effects that influence the pace of exploration activity and are in turn influenced by the tax system. (**Strnad,2002**)

- **Factor mix**

Resource taxation with its several types, have direct or indirect effects on the ratio of resource to non-resource inputs used in the production of a natural resource and on the relative use of other production factors such as: labour, capital, energy, and other materials in the mix of non-resource inputs.

ii. Other effects related to macroeconomic issues

In addition to the effects of resource taxation on the effectiveness of resource development, it exists other macroeconomic impact as follows:

- **Local employment**

In setting tax rates and subsidies for resource developments, governments are often affected by the number of jobs directly or indirectly created by the project. Where this this effect is generated when there is a supply of under-employed labour sufficiently great to produce a large gap between the market wage and the wage rate reflecting the next best alternative use of labour. **(Auerbach et al,1985)**

- **Boom-town problems**

The boom-town problem is created during the construction phase of a resource project construction since employees and equipment are used for the construction phase and then when the project comes on stream or comes to an end. These workers are idled or relocated. These costs are mitigated by tax policy through encouraging a co-ordinated sequence of projects in the region.

- **Macroeconomic issues:**

Since the costs of the macroeconomic adjustments in resource rich countries[46] are usually less

if there is a moderately paced exploitation of resources, these considerations usually incline tax authorities to use their tax and regulatory powers to achieve that result.

- **Distribution of benefits**

The distribution of the benefits from natural resources is one of the most important natural resource policies. The main margins of this distribution are between:

- Producers – Consumers.
- Government revenues – Producer profit
- Producing firms – Workers.
- Domestic shareholders – Foreign shareholders (of producing firms).
- Between generations.

- **Competition and industrial structure**

The majority of theoretically efficient resource taxation systems depend on energetic competition among resource development firms and factor suppliers to resource projects for their performance. In countries or jurisdictions where technical knowledge is limited, the trust in industry and/regulatory agencies for operating and protecting resources is even greater.

1.4.   Public expenditures :

Public spending is the amount spend by the public authorities (central, states and local governments) in order to satisfy public needs which people cannot satisfy in their own capacity. Those expenditures are funded through taxation, public borrowing and sometimes from current account balance **(Dalton, 1971)**.

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[46] Regarding countries which specialize in natural resource exploitation, sharp changes in the pace of resource development or export may create macroeconomic issues ranging from regional or national inflationary pressures during the construction phase to structural adjustment problems (often referred to as the Dutch disease) for more see **(Auerbach et al,1985)**

Public expenditures are thus a financial mechanism that helps the government to achieve its economic and social goals where Keynesian school stressed on the importance of public expenditures to realise the maximum social welfare. The public needs are presented in social functions which include education, public health, social security, irrigation, canal, drainage, roads, buildings, etc. **(Kennedy, 2012)**. Public expenditure also plays a crucial role in Investments and savings through fiscal and human capital formation over time. For these expenditures to be effective they need to be targeted to productive sectors of the economy. **(Ghosh & Ghosh, 2014)**.

According to **(Kennedy, 2012)** public expenditure has four main roles:

- it contributes to current effective demand;

- it expresses a coordinated impulse on the economy, which can be used for stabilization, business cycle inversion, and growth purposes;

- it increases the public endowment of goods for everybody;

- it gives rise to positive externalities to economy and society as a whole (or in specific sectors and geographical areas), the more so through its capital component.

1.4.1. Theories of public expenditures:

Taxation had and still have a high attention from economic theorists, while public expenditures have been relatively neglected and has received less economic attention, however, the literature of the theories and principles of government spending was a dilemma during ages where no consensus between the economist and expert on public finance exists. Harries, Samuelson, Musgrave were amongst number of other economists who discussed public expenditures has received far less economic attention **(Hall, 2010)**.

- **The classical approach:**

While reviewing the principles of classical school on government spending, we noticed that they advocated it to be at the lowest possible extent. Public expenditure was a subject founded on the hypothesis on non-interference where Government was only a "police state" and derived from the theory of state function where it has to defend people and spend their money directly and sparingly to provide public goods and services. **(Bretteville-Jensen et al., 2017)**. **J.B Say** characterized public expenditure through his famous dictum *"the very best of all plans of finance is to spend little and the best of all taxes is that which is least in amount"*,

additionally, another pillar of this school**, David Ricardo** argued that public spending is so wasteful that he never-felt it necessary to analyse them **(Ghosh & Ghosh, 2014; Păun & Brezeanu, 2013)**. Moreover, similar opinions shared by the eminent economist **J.S Mill** where he discussed public expenditure based on the perception of inherent in the system of natural liberty that public expenditure should be at the narrowest compass possible **(Păun & Brezeanu, 2013).** The French economist **Paul Leroy Beaulieu,** is also another advocate of the classical concepts, where he stressed the importance of matching public expenditures with the government revenue and resources to fund them, stating that *"public finance studies are in fact studies of public incomes and their usage for covering public expenditures"* **(Anghelache, et al., 2007).**

- **The Keynesian approach:**

Based on Keynesian paradigm, the economy should have a significant effect on state spending and social spending. A key element of the Keynesian model is the linkage between effective demand and economic growth that results in the recovery of the economy following a recession (Romer, 2001). Keynesian Economics, which is based on Keynes' theory of economic fluctuations. Keynesian economics focuses on short-term economic changes.

- **Wagner's law of public expenditures:**

Wagner's literature was very famous among German economists; however, it becomes widely known in the fifties after the book "Classics in the Theory of Public Finance" written by **Musgrave** and **Peacock** (1958) who compiled the works of Wagner in English. Wagner's writings opposed the classical "laissez-faire" doctrine offering an active economic role to the state and conducting a different analysis to the dialectical of public expenditures . **(Ahiakpor, 2013; Vasudevan, 2020).**

(Păun & Brezeanu, 2013) stated that Wagner`s law is mainly based on the roles of the state, and it explains that additional dimensions appear when the population density increase in urban areas. These dimensions can be improved by adjusting social differences, determining governments to spend more per capita in urban environments. in addition, Wagner stated that industrialization process leads to an economic boom, that causes an increase in income per capita of a nation and providing more diverse public goods and services. Thus, the share of public expenditures increases **(Jaén-García, 2018).** The process mentioned and explained

above is translated through figure (13) that analyses the relationship between public expenditure and the growth of an economy. (**Mose, Kibet, & Kiprop, 2019**)

Figure 14 : Wagner's curve of public spending growth
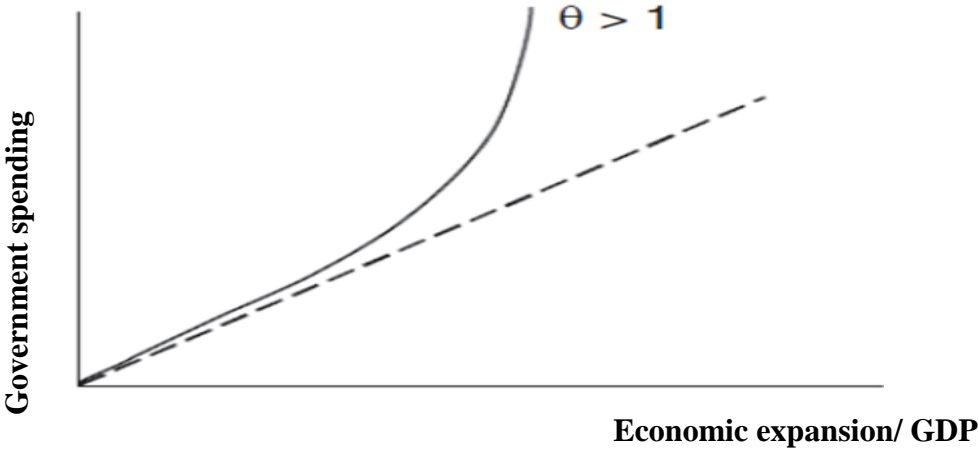
Source: (Păun & Brezeanu, 2013)

- **Peacock and Wiseman hypothesis**

Alongside Wagner's law, another known theory on government expenditures is the Peacock and Wiseman's "displacement effect." Alan Peacock and Jack Wiseman questioned the generality of Wagner's growth of Public Expenditure theory through their hypothesis based on the British economy for the period 1890-1955 wherein they explained their hypothesis according to the government expenditure structure that tends to evolve in a steplike pattern, coinciding with social upheavals, notably wars. (**Sideris, 2007**).

However, this approach is not a law and it is less effective comparing to Wagner's theory. Despite its governmental activity in Europe which has been strongly related to major social disturbances such as war and depression, Peacock and Wiseman hypothesis does not apply to the different pattern of public sector growth such as the Unites States (**Jaén-García, 2018**).

The main essence of this hypothesis as stated in (**Balatsky, 2012**) is that government spending does not rise in a smooth and continuous manner as shown in figure (14).

Figure 15: irregular expenditure growth in Peacock and Wiseman hypothesis.
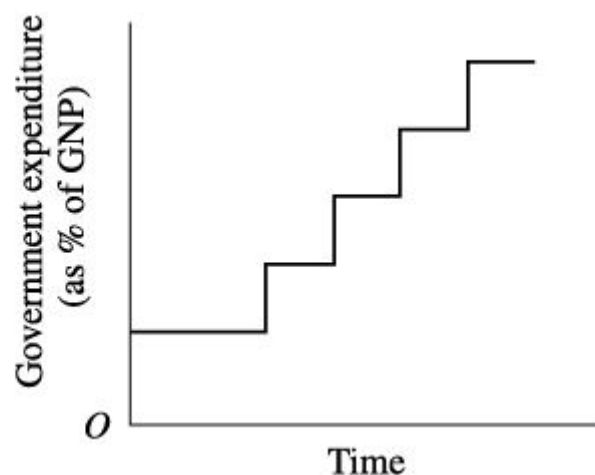
1.4.2. The effects of public expenditures:

The aim of government spending in modern era is not only providing a mere financial mechanism but it also seeks to achieve direct and indirect social and economic goals. based on **(Aggarwal, 2017)** we can summarise those effects as follow:

Effects on Production*:*

The effects of government expenditure are shown through these three elements:

- Ability to work, save and invest.

- desire and willingness to work, save and invest.

- The allocation of resources between different employments and localities.

Thus, public expenditure is a strong and effective instrument to encourage investment and through different mechanisms for example Government expenditures on health, education… may increase the productivity of employees at work as a result income will raise and that would certainly increase investment and capital formation.

Effects on Distribution:

One of the main goals of the government is to maximize social benefit through the public expenditure by reducing inequalities of income and wealth distribution in the country. (by

raising taxes for wealthy ones so their income will decrease in the other way the state provides medical cares, free education and free or cheap housing facilities for the poor).

Effects on consumption:

as an example: the aid of government to the poor in education, housing and medical cares would certainly improve their capacity of consuming and saving.

Effects on economic growth:

Government expenditure is a very useful and helpful tool to keep the economic growth balanced.

Effects on Level of Income and Employment:

According to Keynes, the government can remove widespread unemployment during periods of depression through liberal public expenditure on public works. It can thus raise the level of income and employment in the country. Keynes observed that when government increases its investment expenditure on public works, then the increase in level of income and employment will not be merely equal to the increase in those activities, but it will be many times more than this what he has called the 'Income Multiplier'. The value of multiplier depends on the marginal propensity to consume. Suppose the MPC is 5/6 the multiplier will be 6.

Figure 16: effect of public expenditure on income and employment level
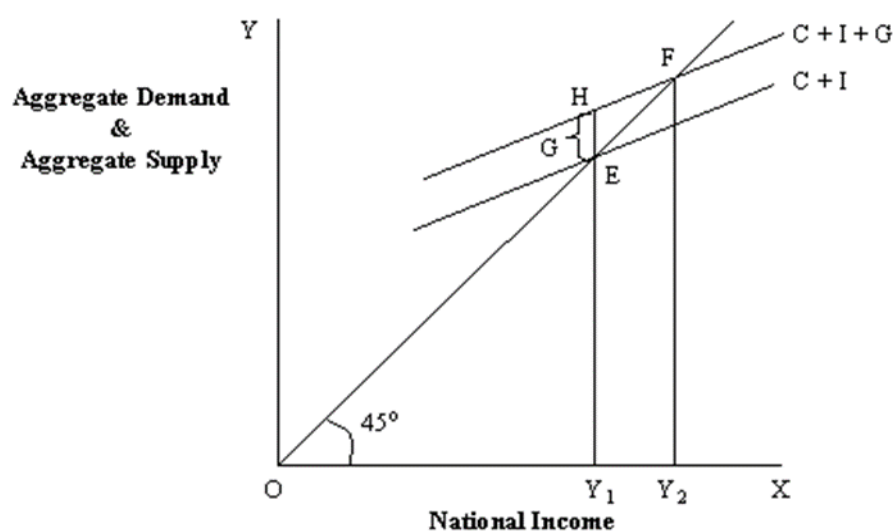
In the figure above, the aggregate demand curve C + I cut the aggregate supply curve OZ at E according to which OY1 national income is determined. Now if consumption and investment

remain constant and government does not increase its expenditure, then OY will remain the national income and correspondingly the level of employment. Rather, it is possible, and it happens during depression, that this level may go down owing to decrease in aggregate demand and there may be widespread unemployment in the country.

According to Keynes, the government should increase its expenditure in such a situation so that the level of national income and employment in the country may increase. In the above diagram, if the government increases investment expenditure by EH, the aggregate demand curve moves upwards as shown by the curve C + I + G. Now this new aggregate demand curve C + I + G cuts the aggregate supply curve at F and accordingly the national income increases to OY2. It will be seen that even though the government has increased its investment expenditure by EH, the national income has increased by Y1Y2 which is many times more than the increase in investment. **(Kennedy, 2012)**

$$multiplier = 1/(1 - mpc)\text{....................................(19)}$$

1.4.3. The classification of public expenditures:

Different classifications of government spending exists from different economic theorists views and based on different government functions. Table 09 summarise different types of public spending.

Table 10: the classification of public expenditure

Adam Smith's classification	Pigou's classification	Dalton's classification	Nicholson's classification	J.K Mehta classification
• Protective functions such as defence expenditures. • Commercial functions such as industrian	• Transferable expenditures 47 • Such as pension, sikness benefits… • Nontransferable expenditures48 such as	• Purchase prices which is what government gets services or comoditiee in return of	• Expenditures with direct return • Expenditures with indirect returns • Expenditure	• Constant expenditures. • Variable expenditure.

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[47] The transferable expenditures are those incurred to purchase current national resource service.

[48] The non-transferable expenditures are those that take the form of payment made to citizens either freely or to buy an existing property rights.

For more see (Kennedy, 2012)

exhibition. •Development functions such as expenditures on education	expenditures on army, civil services, educational services…	occuring expenditures. •Grants which is opposite to the price purchase.	producing partial return. •Expenditure producing full return.	

Source: author's illustration based on (Kennedy, 2012)

1.5. Public debt:

Public expenditures should be met by different ordinary public revenue, however, in this modern era, the public and social needs are increasing which have led to public sector deficits due to several factors such as population rapid growth, large infrastructure investments, development financing, budget deficits amongst others… as a solution to this situation, the government refers to borrowing**.** As mentioned in **(Kennedy, 2012)** Public borrowing was first scientifically examined by Charles Davemont in 1710. Thereafter,economists such as David Hume, Adam Smith, D. Ricardo, Malthus, J.S. Mill, J.B. Say, A.P. Lerner, and A.G. Hart have worked on borrowing while Smith and Ricardo opposed public borrowing.

1.6. Government Budgeting:

The practice of public budgeting and fiscal policy was first initiated by Sir Robert Walpole in his position as Chancellor of the Exchequer, in an attempt to restore the confidence of the public after the chaos unleashed by the collapse of the South Sea Bubble in 1720. Thirteen years later, Walpole announced his fiscal plans to bring in an excise tax on the consumption of a variety of goods and services such as wine and tobacco, and to lessen the taxation burden on the landed gentry **(Pigou, 1949)**

1.6.1. what is government budget?

According to **(Liou,2011),** government budget is the medium for the making and carrying out of decisions regarding the acquisition, allocation, and use of resources, particularly money. In addition, a government budget has to ensure discipline, control, and fiscal sustainability **(Mikesell& Mullins, 2011),** this budget confirms that financial resources are directed toward the programs of higher public revenues as well as encouraging plans to make the most effective use of resources.

Thus, public budget is a detailed estimated document of the government expenditures and its revenue and/or other political entity presenting its anticipated tax revenues and proposed spending/expenditure for the coming financial year during the upcoming financial year, prepared and presented by the finance minister to the nation, and approved by the legislative authorities.

Therefore, government budgeting has much similarities in common with private budgeting such as:

- The way to generate income.
- How to allocate that income to different needs
- How to keep track of spending.

However, there are several distinguish characteristics for public budgeting stating:

- Government budget are exposed to external influences such as rules, regulations and procedural guidelines. **(Dumitrescu & Degaru, 2014)**
- Government budget are essentially and suitably political. **(Epp, Lovett, & Baumgartner,2014; Rubin, 2015).**
- Public budget necessitate recognition that there are constraints in the various steps of government decision making.
- The objective of government budget is to enable efficient decision making on the use of public funds via the determination of the government policies and resources mandatory to accomplish them **(Al-Ali, 2012).**
- The process of public budgeting contains the allocation of resources to achieve the wanted objectives and ensure that the planned programs are considered efficiently and economically **(Schick, 2013).**

Hence, revenue and expenditure forecasting are an integral part of government budget process and play an important role in public budgeting and financial management. This may result two types of government budget: balanced and unbalanced budget as illustrated in figure 16.

Figure 17: types of government budget

Types of government budget → Unbalanced budget → Surplus budget

Deficit budget
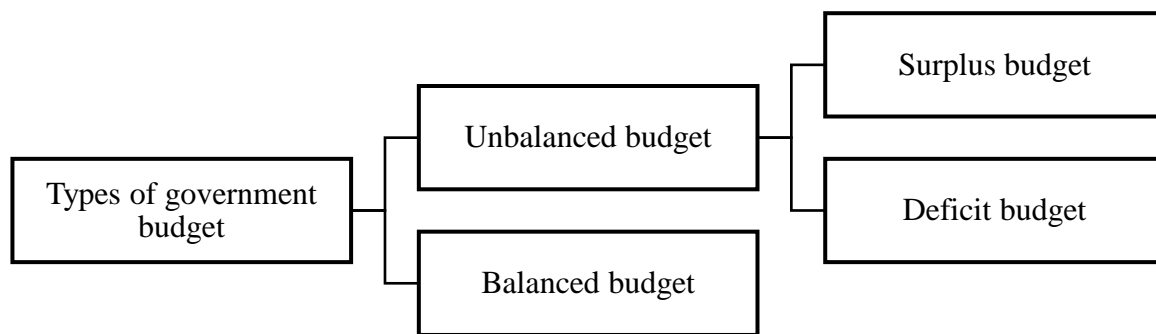
Balanced budget

Source: by the author.

The advantage of the automatic changes in the budget balance with the level of economic activity is that they help stabilize the economy. They do so by directly adding to the demand for goods and services when unemployment rates increase. Tax revenues decline more than proportionately with increases in unemployment, thereby maintaining disposable income. Similarly, unemployment insurance payments enable workers who are laid off to maintain their spending until they go back to work. (hayman,2011)

- **Balanced Budget**

The budget where the government's proposed expenditures is equal to the estimated revenue during the financial year. Adam smith as most of classical economists advocated the balanced budget and according to them revenues shouldn't fall of expenditures however modern economists believe that balance budget is not always suitable for economy. **(Holtfrerich, 2013)**

- **Unbalanced Budget**

It is the budget where revenues and expenditure are not equal and there are two types of unbalanced budget as follow:

Surplus Budget

In this budget estimated receipts (revenues) are higher than the anticipated expenditures. This surplus is generally used to cover the deficit, to decrease public debt or to increase the government reserves.

Deficit Budget

It's the budget where the estimated government revenues are less than its expenditure. The government cover this deficit is by borrowing from public through government bonds. This is why public debt rises.

Figure 18: government budget types curve
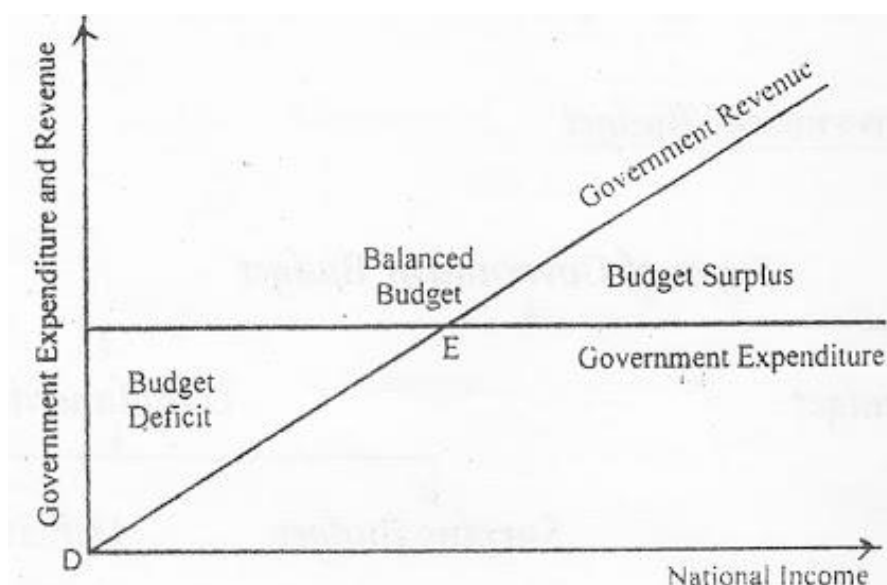
Source: **(Ali and Bill,2012)**

The budget is balanced at the Point E, but on the left of this point E the government budget is in deficit and on the right the budget is in surplus.

The goal of any country is to reach a surplus budget to avoid the deficit but this is very difficult to be achieved and for this reason, states always work to have a balanced budget to avoid unemployment, inflation, loss, debts or any other consequences.

Still, governments can spend more than they collect from taxes and other sources of revenue by borrowing. By running up the public debt, governments can put off the burden of taxation to the future. When government spending exceeds revenues, the result is a budget deficit. Budget deficits have been common for the federal government in the United States since 1960. State and local governments by and large are required by state law to keep their budgets in balance and borrow only to finance capital expenditures. Since 1960, it has been common for state and local governments to run modest budget surpluses. However, unanticipated declines in revenue can result in deficits for state and local government that require rebalancing of their budgets. The recession that began in late 2007 resulted in sharp declines in revenues for most state governments in 2008 and 2009. Several states had budget deficits amounting to more that 20 percent of their planned expenditures. The deficits forced these state governments to cut expenditures, layoff or furlough state employees, and increase tax rates to bring their budgets back into balance. **(Hyman, 2011)**

In addition, there are three types of government budget accounts represented as follow:

- An actual account for the preceding year.

- The revised budget for the current year.

- Budget estimates for the economic year

the structure of the government budget is presented in figure 18 and table

figure 19: The structure of government budget
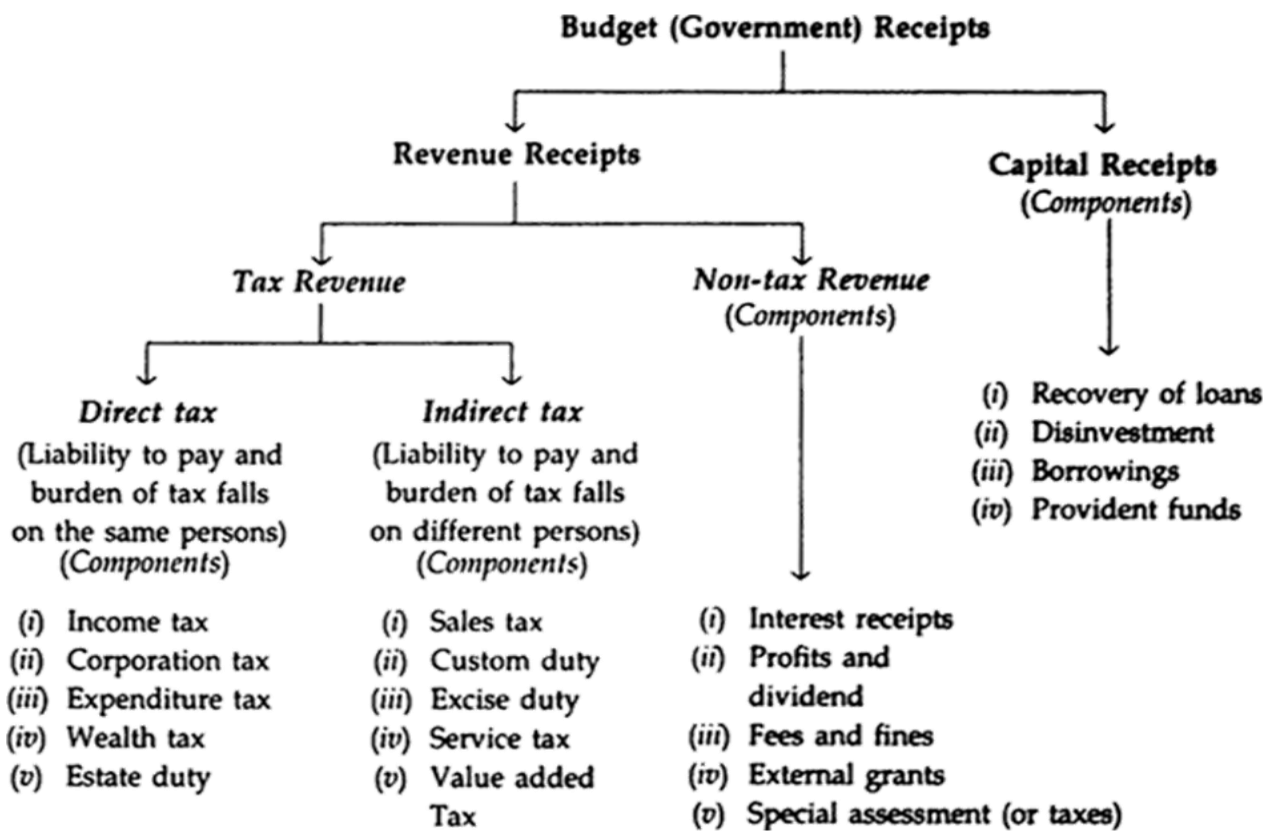
Source: **(Kudrin, 2015)**

Table 11: structure of government budget:

Local budget	
Current budget	
Revenues	**Expenditures**
Tax revenues	Public order (police, fire protection…)
Non-tax revenues	Public services
Subsidies (received)	Subsidies (paid)
Profit of communal companies (such as oil producing countries)	Loss of communal companies.
Other	Other
From sales of assets • movable • immovable • capital	
Received instalments of debts and loans	Instalments of debts and loans
Current budget surplus	Current budget deficit

Source: author's own based on **(Hamerníková, 2010)**

- **Process in the preparation of the budget:**

- Budget estimates are prepared by the ministry of finance from different ministers and departments by estimating their income and expenditures.

- Prepares budget.

- Presented by the finance minister to the cabinet for approval.

- Budget is ready for presentation to the parliament.

1.6.2. The economic effect of the government budget balance:

The literature has discussed different effect of the government unbalanced budget when it is in surplus or in the case of a deficit. We can summarize these effects based on **(hayman,2011)** as follows:

- **Effect of a Deficit on Credit Markets**

The economic effects of a government budget deficit on the economy depend on how it affects interest rates, national savings, and investment. The influence of a deficit on these economic variables is contingent on how the federal deficit influences the demand and supply

of loanable funds in credit markets. A government budget deficit adds to the national debt and, by doing so, increases the future interest costs to the federal government. Therefore, each year more and more tax revenues must be devoted to paying interest on the national debt instead of providing goods and services to citizens.

The traditional view: of the economic effects of government budget deficits assumes that, other things being equal, the deficit contributes to higher interest rates. By doing so, the deficit can choke off private investment, thereby slowing the real rate of economic growth for the nation. **Figure 19** shows that an increase in demand for loanable funds by the government to finance a deficit can increase market interest rates. The market demand for loanable funds is composed of the demand for credit by households, business firms, state and local governments, and the federal government.

Figure 20: Government demand for loanable funds and the market rate of interest**.**
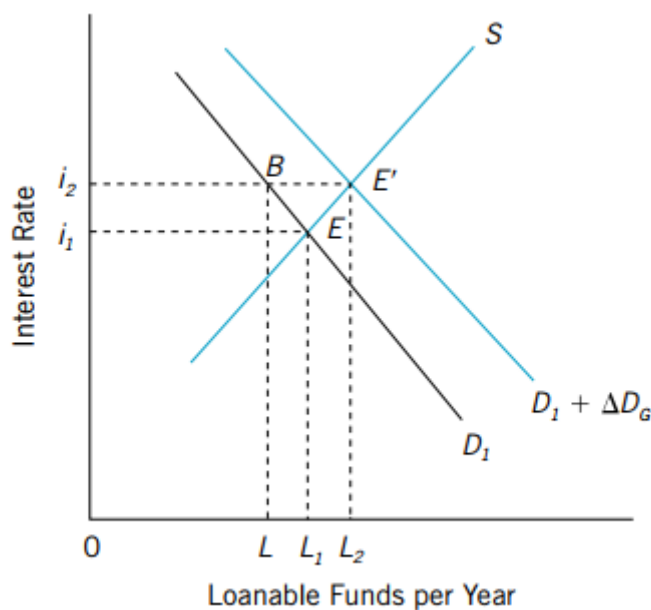
Source: (hayman,2011)

Figure 20 shows that an increase in government demand for loanable funds to cover budget deficits shifts the demand curve from D_1 to $D_1+ \Delta D_G$. This increases the equilibrium market rate of interest from i_1 to i_2. The higher interest rate increases the quantity of loanable funds supplied to the market but also "crowds out" some private borrowing that would have otherwise occurred. As the quantity of funds demanded for private investment falls, these funds are reallocated to finance the deficit

Thus, the budget deficit can be represented by the distance *BE* in Figure 20, which is the difference between private borrowing, *L*, and total borrowing L_2 after the government

finances its deficit. Part of the budget deficit is financed by an increase in the quantity of loanable funds supplied to the markets represented by the distance L_1L_2. The remainder of the budget deficit is financed by a reduction in borrowing for private investment represented by the distance L_1L_2. This is a reduction in the quantity of loanable funds demanded to finance private investment that results from the increase in the market equilibrium interest rate from i_1 to i_2. These funds are then reallocated to buy government securities that finance the deficit.

Ricardian view: The idea of Ricardian equivalence has been advanced in recent years by the American economist Robert Barro of Harvard University. If an increase in government borrowing to finance a deficit causes a sufficient increase in private saving to keep the level of interest rates in the economy fixed, **Ricardian equivalence** prevails. According to this idea of, both tax finance and deficit finance have the same impact on current aggregate spending and future economic growth. this view concludes that government borrowing to cover deficits does not increase the market rate of interest. It causes no crowding out of private investment or of consumer borrowing for durable goods.

Figure 21: Ricardian Equivalence: Deficits Do Not Affect Interest Rates.
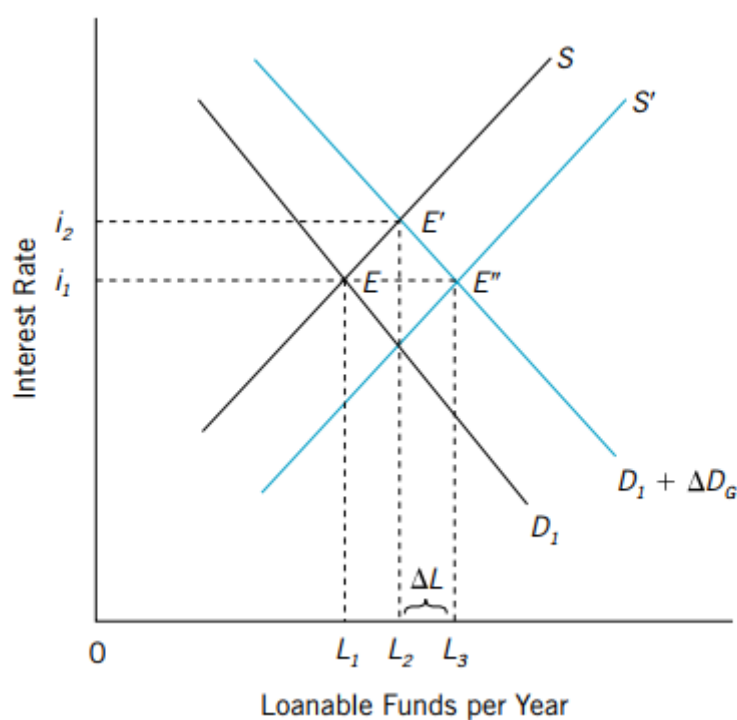
Source: (hayman,2011)

Figure 21 :shows that the increase in government borrowing to cover the deficit increases the demand for loanable funds. However, as a direct result of this borrowing, the supply of

savings increases from *S* to *S'* to provide funds for higher taxes anticipated in the future. The increase in the supply of loanable funds results in a new equilibrium at point *E*. At that point, an additional *L* dollar of loanable funds are made available per year for financing future taxes resulting from the deficit. The equilibrium amount of loanable funds is now L_3 dollars per year. If these extra funds exactly equal the amount of funds required to finance the deficit, the interest rate under the equilibrium is i_1, the initial level. Consequently, Under Ricardian equivalence, the increase in government borrowing to finance the deficit is exactly offset by an increase in annual private savings to pay the taxes necessary in the future to retire the debt.

- **Effect of a budget surplus on Credit Markets**

There is no need for the government to enter the credit markets as a borrower when the government's budget is in balance or in surplus. Naturally, a balanced budget or a budget in surplus implies that the market demand for credit is equal to the private demand for credit. However, when the government runs a surplus, it can affect the supply of loanable funds available for private investment in the credit markets.

Figure 21: illustrates the possible effect of a surplus used to retire outstanding government debt on the credit market and the equilibrium market interest rate.

Figure 22: Impact of a Budget Surplus on Credit Markets
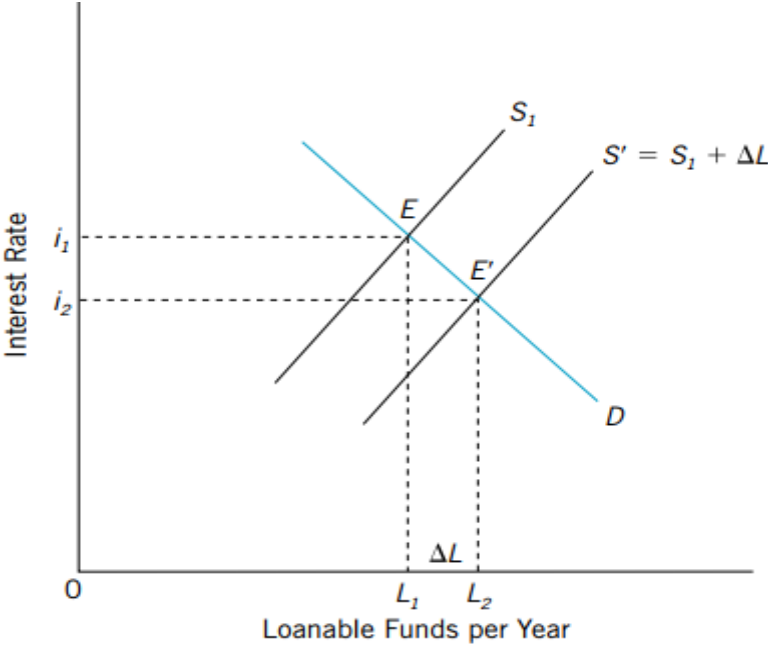
Source: **(Hayman,2011)**

Figure 22: shows that when the budget is balanced there is neither a surplus nor a deficit, the demand for credit will be *D* and that demand will be equal to private demand for credit. The market equilibrium interest will be i_1. If the government runs a surplus and uses that surplus to retire existing debt, then the supply of credit will increase from S_1 to *S'* where *S'* is equal to S_1 *ΔL* and ΔL is the amount of government debt that is retired. By retiring the debt, the government exchanges bonds for cash, thereby increasing the supply of loanable funds. This increased supply of loanable funds causes the market equilibrium interest rate to decline from i_1 to i_2. The lower interest rate increases the quantity of loanable funds demanded for investment and other private borrowing from L_1 to L_2. The increased investment contributes to increases in future worker productivity and can increase future income and living standards.

1.7. Public debt:

In the perspective of a modern state, the needs constantly increase; therefore, the state has to spend more to meet these needs. Public expenditures are generally met by ordinary public revenues such as taxes, duties, fees, parafiscal revenues, property and enterprise revenues, taxes, and penalties. However, the state is faced with the public sector deficit due to reasons such as large infrastructure investments, war, development financing, natural disasters, economic crises, budget deficits, as well as the ever-increasing ordinary public expenditures. To overcome this situation, they refer to borrowing. **(Salsman, 2017)**

1.7.1. Definition:

According to **Prof. J.K. Mehta,** "Public debt is comparatively modern incident and it would come in practical form with the development of democratic governments". **'Adam Smith'** also defined public debt as "Public debts create the conditions of war and extra expenditure". **Dalton**, from his side considered "Public debt is a way of collecting income from public officers".

Public debt is a source of collecting income by state. Public or local debt is the debt the state collects from the citizens of other countries. When government borrow, then it gives birth to public debt. Government can take debt from banks, business or organizations, business houses and the person. **(Cassimon et al, 2008)**

Government can take debt from:

- Inside the country.
- Outside the country.

- From both the sides.

In addition, there is a main source of borrowing for government where public debt is normally in the form of bonds (or if debt is for short time, then in the form of fiscal letter). In these bonds, government process that he will not only pay back the money on fix time, but also give instalments on a regular-gaps on complete fix rate or in last in the form of a fix amount he will pay interest also. Debt is the last way of income for government.

Figure 23: the classification of public debt.
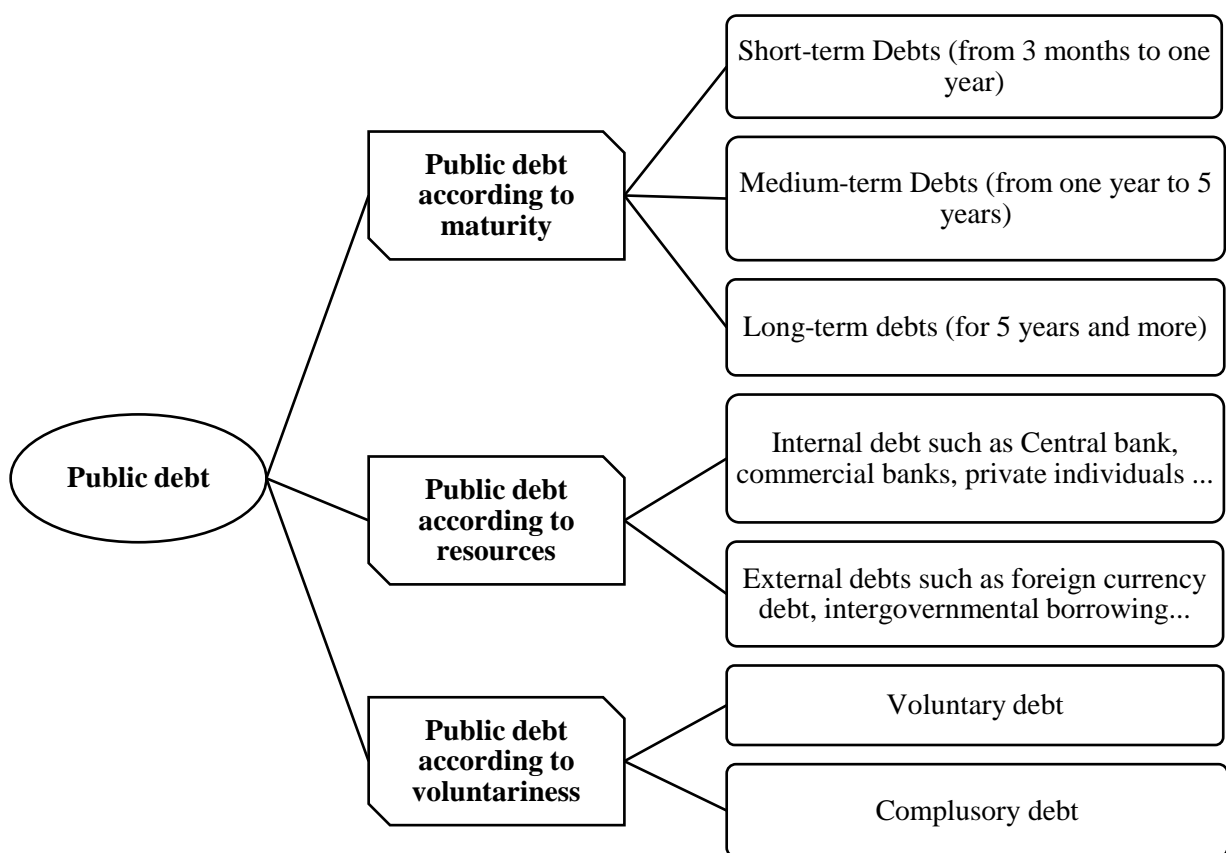
Source: author's own based on **(Corina, 2013)**

1.7.2. Effects and objectives of public debt:

The existing literature agreed that there are two main effects for public debt in any country which are 'revenue effect and 'expenditure effect.

- **Revenue effect:**

People must apply changes in their budget when money is taken from public by the medium of national debt. It is possible that Public debt doesn't affect consumption- expenditure

directly as the taxation does, because people use the saving of present and future to buy government securities. However, in some matter, it can be possible that the people try to increase their saving by reducing their waste expenditure to buy securities. It is clear that public debt affects the consumption expenditure, this can be said first effect of public debt. **(Cecchetti, 2010)**

- **Expenditure effect:**

Money coming in from borrowing will be spent on dividends and debt payments. This is not unlike the expenditure of tax revenue – the money collected from the debt is used in the same way that tax revenue is used. However, the fact remains that the money collected from the debt is always used differently to ensure that tax revenue is used. But it's not always a fast difference. Tax revenues, for example, may be used to pay teachers' salaries and then the debt amount may be used to build school buildings. But tax and debt expenditure are mostly similar, whatever the consequences. In some things, however, we can clearly see a difference. The consumption of debt amounts is used to arrange capital financing, such as the establishment for nuclear power production. However, tax revenues are used to manage current or recital expenditures financially. The first type of effect is obviously different from the second type. **(Lora & Olivera,2007).**

In addition, other effects exist, and according to **(Auerbach, 2009; Cecchetti et al,2010; LPU,2014)** we can summarize the objectives of public debt as follows:

- **Income and revenue:**

The target of public debt normally is to cover the gap developed in any year between proposed expenditure and expected revenue because of increased administrative expenditure or flood, natural disasters and communicable diseases like unexpected problem. In this case, governments must spend more to cover these problems which will lead to an increase in the public revenues. This will be covered by borrowing and debts.

- **Intergenerational equity**

Giving this point of view, the higher the national debt, the more future generations will have to pay. Based on a view of social welfare that takes account of the relative well-being of current and future generations, one presumably determines the level of national debt at which the burdens being passed to future generations produce the most equitable distribution of resources among generations. Unlike the other underlying objectives to be discussed,

intergenerational equity cannot be evaluated by economic analysis alone, because it requires judgments about how to weigh the welfare of different individuals. **(Auerbach, 2009)**

- **Economic performance**

National public debt is viewed as an obstruct to through various channels economic performance.

- National debt may decrease the accumulation of real assets when producing a perception of increased private wealth among those who hold it through the "crowding out" process. This reduction in saving can lead either to reduced domestic capital accumulation and higher interest rates, or to reduced foreign capital accumulation.
- A future raise in revenues as a share of GDP associated with an increase in marginal tac rates on economic activity is necessary for debt accumulation. see (Barro, 1979).

- **Fiscal sustainability:**

When the level of government debt and the expected path of the main surpluses indicate that current fiscal policy is not sustainable, then a variety of things might occur to alter this path. There may be voluntary changes in monetary and fiscal policy, such as tax increases or money creation, which bring with them the undesired economic consequences just discussed. But changes in fiscal policy may also be precipitated by a fiscal crisis that brings with its considerable economic disruptions. There might even be increases in the price level prior to any monetary response, according to the "fiscal theory of the price level," which posits that the price level, rather than fiscal policy changes, serves to balance the government's intertemporal budget constraint. **(Woodford, 1995)**

- **Effect on employment**

Cost, consumption and production decrease during the time of depression. This situation, in which government allocate money from the financial securities and in order to increased employment and takes care of most government needs.

- **Effect on investment:**

Normally, public debt has a negative impact on investment. If banks borrow money from the government, the amount of investment remains the same. The reduction in the money for debts will happen if the investment pays off all or nearly all of the outstanding debt. if the

interest rate is steady, there is no reason for a decrease in private. **(Sánchez-Juárez & García-Almada, 2016)**

- **Investment effect on consumption**

When people buy government securities, it is not always necessary for them to do so on the basis of previous savings. Sometimes people buy these securities with their current income, which they then use for different purposes in other situations. Because they have an offer to buy government bonds for a lower price, they buy bonds by foregoing some consumption. In India, the saving plan is of the same nature as the financial arrangements of five-year plans. As a result of the money invested in national plan certificates, the people's current expenditure is reduced to such a level. However, when people buy government securities with their savings, the effects are different. It has no effect on current expenditure, which remains the same as before. In this situation, private non-government investment becomes ineffective; however, if this amount is credited from the amount saved in banks, it reduces the amount of available money in the banks. In this situation, banks have less money to lend to private businesses, which has an impact on private investment. **(LPU, 2014)**

2. **Fiscal policy:**

In the last decade, fiscal policy has gained traction in macroeconomic discourse. A number of studies have been devoted to the analysis of fiscal policy and its macroeconomic impacts in an extensive and controversial academic literature. See such as Bernheim (1987), Elmendorf and Mankiw (1999), Blanchard and Perotti (2002), Canzoneri et al. (2011), and Afonso et al. (2012) among others.

2.1. **What is fiscal policy:**

G.K Shaw says that fiscal policy is: "any decision to change level composition or timing of government expenditure or to vary the burden, the structure or frequency of the tax payment is fiscal policy".

Fiscal policy is the use of government spending and taxation to influence the economy. Governments typically use fiscal policy to promote strong and sustainable growth and reduce poverty. The role and objectives of fiscal policy have gained prominence in the current crisis as governments have stepped in to support financial systems, jump-start growth, and mitigate the impact of the crisis on vulnerable groups. **(Horton & El-Ganainy, 2009)**

2.2. **Measures of fiscal policy:**

Fiscal policy refers to the government measures to control the inflation and achieve economic growth depending on the purpose of the stimulation, by increasing public expenditures and/or decreasing the tax rate during recession. Thereafter, fiscal policy deals entirely with government spending and taxation which is totally controlled by government **(Blanchard et al,2009)**. In the short run it softens a business cycle while in the long run, a decrease in taxes may lead to a stimulation of GDP. This means that governments influence the usage of resources in the economy directly and/or indirectly where we can illustrate this concept in the basic equation of national income.

GDP = C + I + G + NX………………………..(20)

Where:

GDP is Gross Domestic Product, presenting the value of all final goods and services produced in the economy.

C is the aggregate demand of private consumption.

I refers to the private investment.

G is the government spending on goods and services.

NX is the net exports minus imports.

This equation highlights that government (G) affects economic activity (GDP) directly, and influence (C, I and NK) indirectly through changes in taxes, spending and transfers.

Therefore, fiscal policy that increases spending and decreases taxes is typically called **expansionary fiscal policy** (loose fiscal policy) which is used to lower the budget surplus and to control inflation. While contractionary (or tight) fiscal policy is usually applied to reduce government spending in the case of a budget deficit. For more see **(Blanchard et al, 2009)**.

Figure 24: types of fiscal policy

| Expansionary fiscal policy | • Helps speed-up the economy |
| Contractionary fiscal policy | • Helps slow-down the economy |
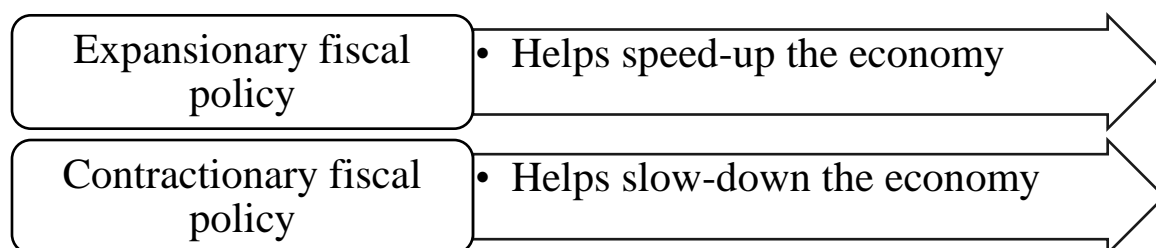
Source: author's own

2.3. Role of fiscal policy:

Fiscal policy plays an important role in influencing the economic direction of the United States. When speaking of fiscal policy, the federal government generally is referring to two major governmental economic activities, taxation and spending. The national budget is the major fiscal instrument by which the federal government determines how much of its energy and resources to devote to these two major activities. The development of a fiscal policy generally has four primary purposes or functions (**Allsopp & Vines, 2005; Sims, 2011; Arestis, 2012**)

- ## **Allocation:**

The first major function of fiscal policy is to determine exactly how funds will be allocated. This is closely related to the issues of taxation and spending, because the allocation of funds depends upon the collection of taxes and the government using that revenue for specific purposes. The national budget determines how funds are allocated. This means that a specific amount of funds is set aside for purposes specifically laid out by the government. This has a direct economic impact on the country.

- ## **Distribution:**

Whereas allocation determines how much will be set aside and for what purpose, the distribution function of fiscal policy is to determine more specifically how those funds will be distributed throughout each segment of the economy. For instance, the government might allocate $1 billion toward social welfare programs, but $100 million could be distributed to food stamp programs, while another $250 million is distributed among low-cost housing authority agencies. Distribution provides the specific explanation of what allocation was intended for in the first place.

- ### **Stabilization:**

Stabilization is another important function of fiscal policy in that the purpose of budgeting is to provide stable economic growth. Without some restraints on spending, the economic growth of the nation could become unstable, resulting in periods of unrestrained growth and contraction. While many might frown upon governmental restraint of growth, the stock market crash of 1929 made it clear that unfettered growth could have serious consequences. The cyclical nature of the market means that unrestrained growth cannot continue for an

indefinite period. When growth periods end, they are followed by contraction in the form of recessions or prolonged recessions known as depressions. Fiscal policy is designed to anticipate and mitigate the effects of such economic lulls.

- **Development:**

The fourth major function of fiscal policy is that of development. Development seems to indicate economic growth, and that is, in fact, its overall purpose. However, fiscal policy is far more complicated than determining how much the government will tax citizens one year and then determining how that money will be spent. True economic growth occurs when various projects are financed and carried out using borrowed funds. This stems from the belief that the private sector cannot grow the economy by itself. Instead, some government input and government bring about development. This economic model developed by John Maynard Keynes has been adopted in various forms since the World War II era.

2.4. The transmission mechanisms of fiscal policy:

Fiscal policy intervention, as mentioned, is via two instruments: Public spending and taxes and its shocks is generally transmitted through different channel where the literature in this area depends on the degree in which the price levels adjust in response to policy shocks and on the framework of a two-country Mundell-Fleming [49] model with flexible prices to distinguish at least three channels for the cross-country transmission of fiscal shocks: *The trade channel*, *the exchange rate channel* and *the exchange rate channel*. See **(Beetsma et al., 2006; Badarinza, 2008; Wikens,2008).**

- **The trade channel:**

A fiscal expansion in a foreign economy increases aggregate demand and thus also the demand for domestic goods and services through the trade channel, which, in turn, has a positive effect on domestic output.

- **The exchange rate channel:**

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[49] The Mundel-Fleming model is constructed upon the following equations.

IS : $yt = \alpha (st + pt - pt - \beta Rt + \gamma gt + \delta yt$

LM $mt = pt + yt - \lambda Rt$

UIP $Rt = Rt + Et st+ - st$

$yt\ yt*$ are domestic fand foreign output, pt and $pt*$ are domestic and foreign price levels, Rt and $Rt*$ are domestic and the global nominal interest rates, st is the nominal exchange rate, and gt is government expenditure.

The exchange rate regimes affect the outcome of fiscal policy may be a channel for fiscal policy in two ways, where the implementation of fiscal policy is strongly influenced by exchange rates. For example, under a flexible exchange rate regime, an expansionary fiscal policy is expected to raise the demand for money that appreciates the currency. This in turn is expected to cause a decrease in aggregate demand due to an appreciation in the exchange rate that crowd out the net export. The outcome, therefore, would be a lower output counteracting the effect of initial policy. However, under a fixed exchange rate regime a fiscal expansion tends to magnify the effect of policy on output suggesting a relatively larger fiscal multiplier, see (Corsetti et al, 2011).

In addition, domestic output is affected by a foreign fiscal expansion by the terms-of-trade changes through the *real exchange rate channel*. In the foreign economy, prices increase after a fiscal expansion due to higher aggregate demand; and they are expected to increase more strongly than world market prices since the latter are typically not affected one-to-one by the fiscal action of a single country. As a consequence, the terms of trade of the foreign country improve as the real effective exchange rate appreciates and imports increase (while exports decrease). The domestic economy benefits from this situation in terms of higher output as long as it is a net exporter to the foreign economy **(Cuaresma et al, 2011)**

- **Interest rate channel:**

The *interest rate channel* captures the impact of a rising interest rate in a foreign economy after a fiscal expansion; this interest rise could either be due to a non-accommodative monetary tightening to keep inflation in check or due to the pressure on investments induced by higher aggregate demand. The higher foreign interest rate could then translate into higher domestic interest rates (with a negative impact on domestic output), simply due to the fact that a higher foreign interest rate attracts more capital imports from the domestic economy, reducing domestic exchange reserves and thus also domestic money supply. The specific sign and size of the cross-border fiscal multiplier depend on the interaction between these different channels. **(Cuaresma et al, 2011).**

2.5.   Fiscal policy theories:

The modern theory of fiscal policy is first and foremost a product of Keynesian economics, and its changing status is intimately linked with the intellectual upheaval which accompanied the Keynesian revolution and the latter-day reappraisals of the economics of Keynes. Added to, the significant progress of the theory of fiscal policy came in the 1930s. The Great

Depression in 1929 underlined the importance of interventionist fiscal policy when the invisible hand had failed to create or retrieve the required equilibrium to the economy (**Al-Fazari, 2006**).

Consequently, the following decades after the Great Depression were marked and influenced by the Keynesian view of economic policy. Later Hicks' reformulation of Keynes' ideas into the IS-LM model and Samuelson's synthesis of Keynesian macroeconomic theory with neoclassical microeconomic theory were key milestones in the Keynes revolution, which culminated in the establishment of a sub-discipline in economics, so-called Neo-Keynesian economics in the 1960s (**Klamer, 1984; De Vroey, 2010**). The period between the end of the 1960s and the early 1970s was characterised by the collapse of the neo-Keynesian consensus.

2.5.1. The Keynesian approach: activist fiscal policy:

The book published by J. M. Keynes in 1936 "The General Theory of Employment, Interest and Money" is not considered as the start of modern macroeconomics only, but it is also a turning point in the fiscal revolution (**Blanchard, 2010**). Hence, in the next three decades fiscal policy played a central role in stabilising the economy as a whole (**Blinder, 2004**). This theory contradicts the classical economic approach [50] that argued that fiscal policy transmission mechanism is not effective in stabilizing the economy. Consequently, under the influence of the ongoing Great Depression, Keynes formally in his work rejected the classical assumption that the economy naturally tends towards a state of full employment and defended the postulate that the government should actively intervene to ensure that the economy realises its potential output. In addition, according to Keynesian view, when the economy faced with a recession one potential short-run solution is to run an expansionary fiscal policy and to increase the level of government debt. However, it is generally believed that in the long-run fiscal policy shall increase prices but not output that is referred in the literature as the Neoclassical view (**Wickense, 2008; Romer, 2011**), This could be due to the potential crowding out of private sector activity caused by the higher interest rates associated with expansionary fiscal policy.

- **Fiscal policy in the IS-LM framework:**

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[50] According to classical economic theory, the main objective of the government is to ensure a balanced budget. This assertion of fiscal policy is known as the "Treasury view", claiming that an increase in government spending has no effect on economic activity. This is based on the assumption that an increase in government spending is fully offset by a reduction in private consumption of the same amount. Such a perception is associated with a fundamental assumption of the classical economic theory which states that the invisible hand repeatedly or continuously adjusts the economy to the state of full employment. (De Long, 1998)

The IS-LM model comprises analysis in the market of goods along with analysis in the market of money, while the supply side (e.g., the labor market) of the economy is not incorporated in the analysis. In particular, the model assumes that nominal wages are rigid downwards as well as upwards, which implicitly causes that supply side to be unresponsive regarding changes in aggregate demand. The model is graphically constructed with two curves, where the: IS curve determines the balance in the market of goods; and LM curve characterizes the balance in the market of money. The IS curve[51] is derived from the Keynesian cross model which formulates that the equilibrium local point in the goods market is specified by the equality between aggregate demand for goods or aggregate expenditure and aggregate production or the total amount of national output. Component-wise, aggregate demand consists of household consumption *(C),* investment *(I)* and government consumption *(G).* Household consumption *(C = C0 +c * Y)* is composed by autonomous consumption (C0) and the variable component of the consumption function, which depends on the marginal propensity to consume (c) or induced consumption and disposable income *(Y D = Y — T).* This form of consumption function is based on Keynesian consumer theory which assumes that the consumption of households (in the short run) is proportional to current disposable income. On the other hand, collected taxes depend on the level of production *(T = T0 +* r * Y *),* whereas aggregate investment *(I = 70 -d * i)* is inversely related to interest rates, i.e. the higher the interest rate, the less companies will invest and vice versa (**Blanchard, 2010).**

The IS curve indicating a balance in the market of goods is defined by the equation (21):

$$Y = C + G + I \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{ (21)}$$
$$Y = C_0 + c * (Y - T) + I_0 - d * i + G \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{ (22)}$$
$$Y = C_0 + c * (Y - T_0 - \tau * Y) + I_0 - d * i + G \dots\dots\dots\dots\dots\dots\dots\dots\dots \text{ (23)}$$
$$Y = \frac{1}{1-c(1-\tau)} [C_0 + c * T_0 + I_0 - d * i + G] \dots\dots\dots\dots\dots\dots\dots\dots\dots \text{ (24)}$$

With the help of the last line in the above definition it is possible to elaborate how output in equilibrium reacts with respect to a change in government consumption (25):

$$dY = \frac{1}{1-c(1-\tau)} \left[dG - d * \frac{\partial i}{\partial G} dG\right] \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{ (25)}$$

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[51] Due to simplification, the IS-LM model is derived from a closed economy, although the introduction of the international dimension does not alter the conclusion of the analysis

The constant factor $\left(\frac{1}{1-c(1-\tau)}\right)$ in the above equation is called the Keynesian multiplier. This formula measures by how much output in equilibrium changes if government spending increases by one unit, thereby not taking into consideration the probable impact of the change in government spending on interest rates. As we will see later in this chapter, a rise in the autonomous consumption component in the IS-LM model influences an increase in interest rates, which subsequently results in a decrease in investment efforts by various economic agents. This effect is generally known as the crowding-out effect of investment and depends on the degree of elasticity in interest rates influenced by the change in autonomous consumption. In general, it is assumed that the magnitude of the fiscal multiplier effect is smaller when the economy is at or near full employment, and bigger when the potential output in the economy is higher than the actual output, i.e. indicating a negative output gap.

If we neglect the effect a change in government spending has on the interest rate, under the assumption that the value of the parameters are $c = 0.75$ and r = 0.4, respectively, we may evaluate that a change in government spending by one unit raises output by 1.8 units in the IS-LM theoretical framework. This simple calculation approximately reflects the theoretical result obtained in the large Keynesian macroeconomic models. For example, by assessing the models developed by **Wharton, Klein-Goldberger and Brookings, Evans (1969)** concludes that the size of the fiscal multiplier with respect to a change in government spending is approximately 2, in both the short and long run **(Ramey, 2011a)**. Thus, the increase in GDP is bigger than the initial increase in government spending due to the multiplying transmission mechanism fiscal process, implying that fiscal policy in such a

theoretical framework is very effective in stabilizing the output or the economy as a whole. The LM curve, which forms the other part of the IS-LM model, represents the local equilibrium point in the market of money. This conjecture is satisfied when the supply of real money *(M / P)* is equal to the demand for money in real terms *(Y * L(i))* (depicted in equation 26)[52].

$$\frac{M}{P} = Y * L(i)\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(26)$$

According to the above equation, an increase in disposable income (Y) causes an increase in demand for money. Thus, the rise in interest rates ($L(i)$) subsequently leads to a reduction of

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[52] Note that the variable *M* represents nominal money stock and *P* price levels on the left side of the equality, whereby *Y* as real income and *L(i)* as the functional form of the nominal interest rate are depicted on the right side of the equality.

the amount of money demanded for transactions, ceteris paribus[53]. Assuming that the supply of money is fixed, a higher income, in turn, causes an increase in interest rates that eventually means the LM curve is an increasing function of income. This equilibrium in the IS-LM model is shown in Figure (24). It reflects how the economy reacts to the adoption of an expansionary fiscal measure. According to the transmission mechanism of fiscal policy in this theoretical framework, both output and the interest rate increase. In this theoretical framework, a crucial and relevant question is the size and magnitude of the effects of the fiscal transmission mechanism conditional on the increase in output and interest rate initiated by the expansionary fiscal action. Namely, according to the above description, the increase in the interest rate has a negative effect on private investment and hence on overall output. This implies that the transmission mechanism of fiscal policy is more effective when the response of those measures on the interest rate is smaller since the size of the fiscal multiplier is then substantially higher.

Figure 25: Fiscal policy in the IS-LM model framework
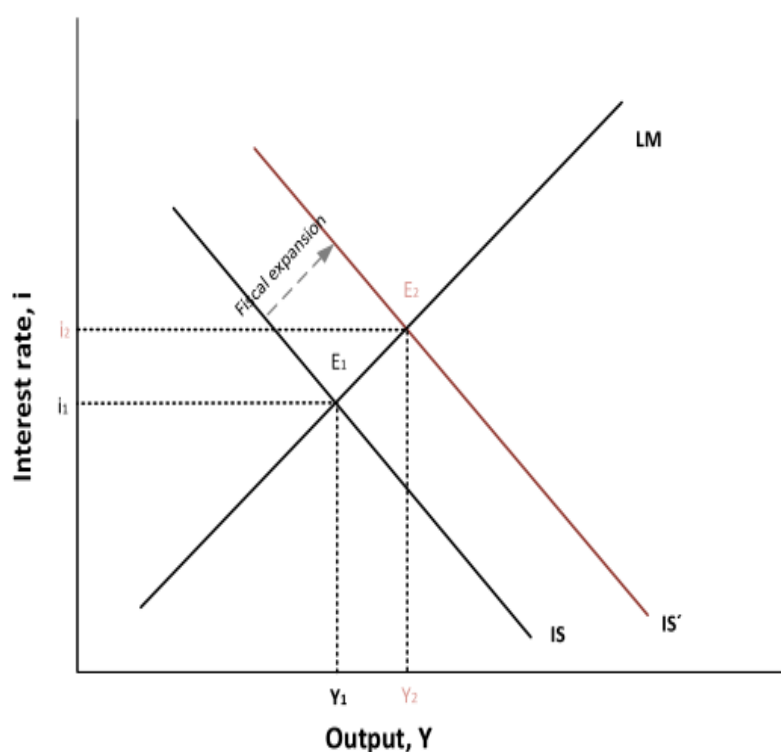
Source: modified according to **Blanchard (2010)**

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[53] With the *ceteris paribus* assumption it is assumed that all other exogenous variables remain unchanged or fixed in comparison with their initial level.

In normal circumstances, the transmission mechanism of monetary policy is a more effective macroeconomic tool for maintaining stable and less volatile GDP due to a possible prompt response and the easier implementation of monetary policy instruments. However, as I mentioned, a situation in the economic environment exists where the transmission mechanism of monetary policy loses much of its effectiveness as a counter-cyclical policy instrument (**Jannsen et ah, 2015; Blanchard, 2010**). In particular, when the economy is in a liquidity trap, monetary policy can no longer stimulate output since the interest rate is already too low or even near to zero. Accordingly, the transmission mechanism of monetary policy is impaired in further lowering the interest rate through monetary expansion by the authorities. Namely, nominal interest rates cannot drop below the zero lower bound because at the zero nominal interest rate debt securities and cash (i.e. bank deposits) became substitutes. The reason for the occurrence of the liquidity trap problem usually relates to the situation where the economy is hit by a sudden, large-scale negative demand shock, which has a negative impact on expectations of economic agents that subsequently triggers a big increase in savings and a reduction in investment. The excess of savings in the balance induces a decline in the equilibrium interest rate, showing the equivalency between savings and investment, into the negative area. When this occurs it is possible that the equilibrium real interest rate $(r = i - \pi^e)$[54] is significantly lower than zero, making it impossible for the

central bank to reach even if it reduces the reference interest rate to zero. Namely, the lowest real interest rate reachable by the central bank is equal to the negative value of inflation. Further, economic conditions could deteriorate even further when the liquidity trap problem is accompanied by the emergence of deflation or at least disinflation in the economy, which often (in the medium term) is a side-effect of negative demand shocks. As a consequence, this would additionally amplify the upward movement of the real interest rate that in turn has a magnified negative effect on economic activity.

In addition to the limited impact of the invoked/enacted heterodox monetary policy instruments (e.g. quantitative easing) during an economic and financial crisis, the transmission mechanism of fiscal policy is therefore the only macroeconomic tool available through an increase in government spending or reduction of overall tax burdens that may foster/promote economic growth and stabilise economic activity. Among others, this theoretical framework implies that the maximum magnitude of fiscal multipliers can be

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[54] The equation for the real interest rate (r) is derived as the nominal interest rate (i) minus the expected rate of inflation (π^e)

obtained when the economy is facing a liquidity trap. In such economic circumstances, a temporary fiscal expansionary policy will have a less exaggerated effect on the rise in the interest rate, which would subsequently diminish the impact of the fiscal transmission mechanism. In comparison with the transmission mechanism of monetary policy, it is only through the fiscal transmission mechanism with the adoption of expansionary policy instruments that it is possible to attain the full employment output level in the economy, whereas with a monetary expansion policy only a sub-optimal level of output is achievable. Figure 25 schematically presents this situation:

Figure 26: Fiscal policy in the IS-LM with a liquidity trap
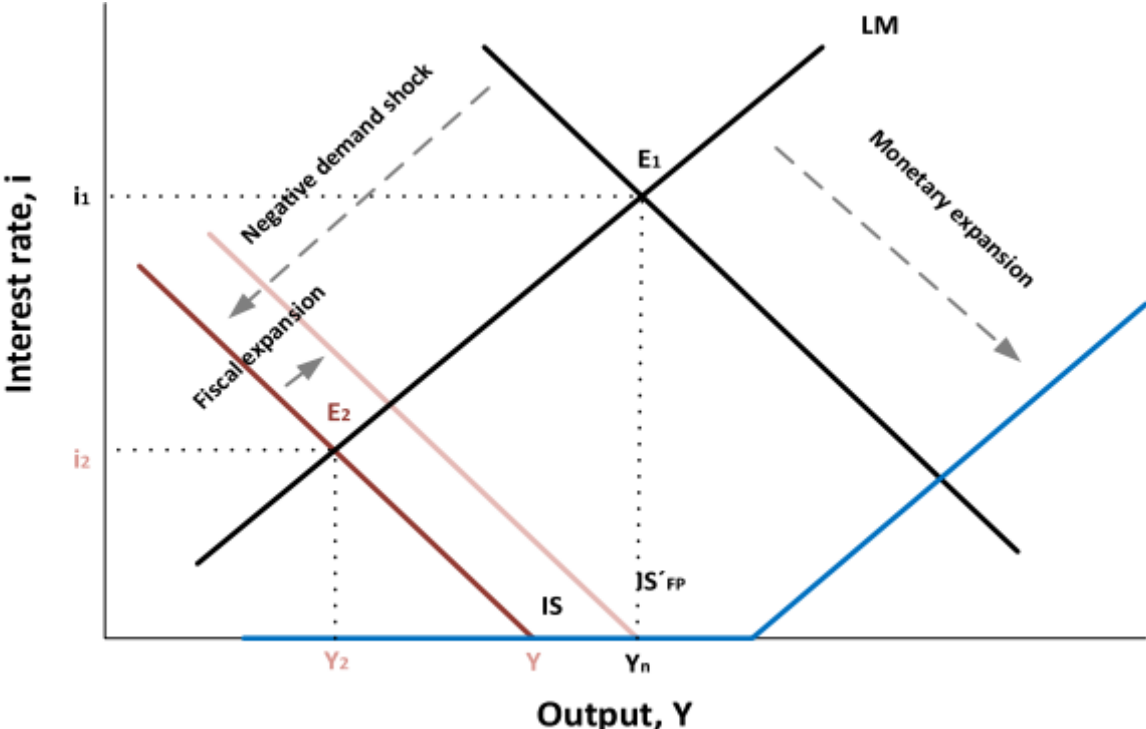
Source: Reconstructed/modified according to Blanchard (2010)

The liquidity trap is a relatively rare economic phenomenon. Prior to the recent economic and financial crisis, the zero bound problem was underestimated and overlooked in economic literature **(Chung et al., 2012).** The main economic events related to the liquidity trap problem are the Great Depression in the 1930s and Japan's deflationary experience in the 1990s **(Krugman, 1988b).** Indeed, there are many similar data patterns that indicate the presence of the liquidity trap problem the advanced economies found themselves in during the current (and elsewhere persistent) recession that started in 2008 **(Pollin, 2012)**. As highlighted in the model described above, the Keynesian fiscal fine-tuning policy of the

economy was strongly influenced by the role of the fiscal transmission mechanism in the first two decades after World War II.

At that time, through an expansionary fiscal policy countries vigorously pursued the upholding of full employment, which was combined with accommodative monetary policy measures to ensure the stability of interest rates in order to diminish the negative effects of fiscal policy, i.e. the crowding-out effect in the economy. Such a policy mix of both economic policies proved to be successful in promoting a broader set of policy goals and economic development, which in the late 1960s and early 1970s subsequently evaporated or came to an end. Namely, the inflation shocks due to the war in Vietnam, the collapse of the Bretton Woods monetary system, and the oil crisis undermined the hitherto stable relationship between inflation and unemployment, depicted by the Phillips curve, and clearly demonstrated some of the limitations/deficiencies and restrictions of Keynesian policy, emphasising the aggregate demand side of the economy. Due to the growing constraints related to the supply side, the adopted expansionary fiscal policy measures only led to accelerated inflationary pressure on prices, while the unemployment rate stagnated or even went up during that period. Consequently, within just one decade (1967-1977) the Keynesian consensus dramatically collapsed **(Blinder, 2004).**

2.5.2. New classical theory:

Challenging the relevance of fiscal policy for more than two decades after World War II, the IS-LM model was perceived as the dominant macroeconomic analytical framework. At the end of the 1960s, this dominance was questioned by many economists who emphasized the requirements for introducing microeconomic fundamental principles into the macroeconomic Keynesian model (also known as the Lucas critique). Besides that, they argued that the underlying existing models and theories neglect the impact of expectations and their implications for economic behavior. At first, this triggered the successful development of disequilibrium models based on the micro-foundations incorporated into the Keynesian macroeconomic theoretical framework, albeit at the beginning of the 1970s the emerging theoretical development in macroeconomics had lost its momentum. Instead, the period of confrontation of different theoretical perceptions and the reappraisal of Keynesian theory at the beginning of the 1970swas characterized by the rise of the new classical economic theory which entirely rejected the implications and interpretations of Keynes' theoretical claims and looked back to the classical economic theory **(Vroey & Malgrange, 2011)**. The new classical

economic theory is basically derived from the monetarist tradition associated with Friedman's notion, albeit different with respect to a more sophisticated methodological approach and theoretical notions as well as regarding the perspective about the effectiveness of macroeconomic stabilisation policies (**Screpanti & Zamagni, 2005**). In contrast to the Keynesian view emphasising the inherent imperfection in the market and the use of interventionist policies to stabilise the economy, the new classical theory reflects a shift in paradigm toward neoclassical economic theory, which is derived from the theoretical background of the Walrasian general equilibrium theory with flexible prices and an instantaneous market-clearing mechanism subject to the adjustment process of prices and wages. The absence of rigidity in the markets in this theoretical framework (new classical models) implies that the economy attains a unique equilibrium settled at the level of full employment, which in turn neglects the possibility of the persistence or even permanence of cyclical (involuntary) unemployment. Moreover, these models are micro-founded using representative agents who according to the rational expectations' hypothesis/theory maximise their utility (or profits) by taking future economic conditions into account.

Friedman's critique of Keynesian theory, marking the start of the new classical theoretical revolution, is based on two theoretical fundamental aspects: on one side, Friedman disapproved of the Keynesian consumer function and, on the other, rejected the existence of a stable inverse relationship between inflation and unemployment, as depicted by the Phillips curve. In particular, the formulation of the Keynesian consumer function, indicating that current consumption only depends on current income, appears according to Friedman (1957) to be inappropriate in adequately determining the level of consumption since besides the current income consumers as rational agents also take their future income prospects into account. Alternatively, Friedman formulated the concept of permanent income, defined as the expected average income over a longer time span, which is determined by an individual's real wealth, both physical and human. This implies that individuals have the possibility to generate their earnings throughout their entire life span. According to the permanent income hypothesis, the consumption of individuals is instead driven by a change in their permanent or lifetime level of income or wealth than by a change in their current or temporary income. Namely, consumers prefer to have a stable consumption pattern over their life span, i.e. intertemporal consumption smoothing, which in turn means that a temporary change in current income has a relatively small effect on the individual's current consumption since the change in the level of permanent income is relatively small or even negligible.

2.5.3. Ricardian and non-Ricardian approaches

Contrary to the Keynesian analysis which clarify that a fiscal expansion, say a tax reduction without any cut in expenditure, can stimulate the economy by increasing private expenditure through the wealth effect channel, the Ricardian view states that this policy is ineffective as the situation with tax cut is equivalent to the non-policy situation**. (Wickense, 2008)**

The idea of Ricardian Equivalence on fiscal policy and budget deficit is popularized starting from 1970 by Barro (1974, 1979, 1983, 1989), where he mentioned that according to the Ricardian analysis, each time the government cuts current taxes, it has to increase future taxes, but in the future those taxes have the same value as the tax cut. It follows that because the government's budget constraint equates expenditures to taxation or other revenues as well as the issuance of interest-bearing debt, this will be the outcome. **(Baro, 1989)**. In another word, the Ricardian view refers to a situation in which either taxes and/or seigniorage adjust to ensure that the government's budget constraint is satisfied. In contrast, when the fiscal authority set its budget independently without considering the government's intertemporal budget equation, fiscal policy is described as the non-Ricardian, see **(Sims, 1994; Woodford, 1995; Cochrane, 1999; Christiano & Fitzgerald, 2000)**.

In this situation, as the Ricardian policy only postpones this the tax burden and does not reduce it, the forward-looking households would expect that future taxes will increase, and consequently, they will rise saving rather than consumption. Then, the fall in public saving would be matched with an equal increase in private saving implying national saving is unchanged **(Wickense, 2008)**. This is also the case with additional interest-bearing government bonds to finance debt. The Ricardian view holds that further tax is required in the future to ensure the debt repayment **(Assadi, 2015)**. Given that, the Ricardian argument asserts that a debt-financed tax cut will change the path of the tax burden but not its present value, therefore, it will not change permanent income and consumption (the aggregate demand of goods) either. In this sense, the term *__"Ricardian Equivalence theorem"__* refers that budget deficits and taxation have equivalent effects on the economy. In another words, a decrease in the government savings (the current budget deficit) leads to an offsetting rise in desired private savings, as a consequence, the desired national saving remains the same **(Baro,1989).**

Another Ricardian point of view holds that only monetary policy can shift the aggregate demand and influences prices and output, while the non-Ricardian view holds the opposite. It

states that a tax reduction policy can generate a positive wealth effect[55]. Contrary, regarding fiscal policy, the Ricardian approach stressed a ***monetary dominance***, where changes in the money stock or its growth rate will require either taxes, expenditures, or borrowing in the budget constraint to adjust. Thus, the Ricardian view presumes that the price levels primarily determined by the money supply in the long-run. In contrast, under the non-Ricardian view, that is ***fiscal dominance***, changes in government debt require changes in inflation even if monetary policy is exogenous. Therefore, a complete analysis of price level determinacy requires taking monetary and fiscal policy interactions into account. **(Canzoneri et al, 2011)**

2.5.4. The fiscal theory of the price level:

Price stability is an important goal of public policy. To reach this goal, two key questions must be addressed: How can price stability be achieved? and how much price stability is desirable? The first question was answered by the standard monetarist doctrine, stating that central banks are committed to maintain price stability and keep inflation down. However, this point of view has been challenged by some economists who rethink the foundations of this doctrine, giving rise to an alternative view in which a tough, independent central bank is not sufficient to guarantee price stability. In this view, price stability requires not only an appropriate monetary policy, but also an appropriate fiscal policy[56]. This concept has gained much attention in the new view of price-level determination, *Michael Woodford* has called it the Fiscal Theory of the Price Level[57] (FTPL). **(Cristiano & Fitzgerald, 2000).**

A key defining characteristic of the FTPL is the non-Ricardian assumption on fiscal policy[58]. As **(Woodford, 1998)** explains, the FTPL is in particular useful to examine the outcome of macroeconomic policy interactions. In addition, having said that fiscal policy might matter for the price level, it can impact prices in two ways **(Walsh, 2010)**.:

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[55] When agents (households and firms) expect that government will issue new bonds to finance the deficit, this would affect the price levels when the monetary authority follows an interest rate rule, say Taylor Rule, if fiscal policy requires the issuance of new debt.

[56] For example **(Cochrane ,2000)** goes so far as to say that monetary policy may be *irrelevant to* price determination. In his view, government-provided transactions assets are a vanishing component of all financial assets traded

[57] Benhabib, Schmitt-Grohe, and Uribe (2000), Cochrane (1998a, 2000), Dupor (2000), Leeper (1991), Sims (1994, 1999), and Woodford (1994, 1995, 1996, 1998a,b,c, 1999) all advocate the FTPL, while Buiter (1999), Carlstrom and Fuerst (2000), Kocherlakota and Phelan (1999), and McCallum (1998) provide critical reviews.

[58] As is noted in **(Christiano and Fitzgerald, 2000)**, Michel Woodford argues that under a non-Ricardian fiscal policy, fiscal shocks should produce the same results as shocks to prices, regardless of monetary policy. They call this event as "Woodford's really unpleasant arithmetic"

- First, equilibrium requires that the real quantity of money to be equal with the real demand for money. Given that fiscal variables influence the real demand for money, the equilibrium price level will also depend on fiscal policy.

- Second, the FTPL emphasises that the government's budget represents an equilibrium condition rather than a constraint.

As explained in Walsh (2010), the standard monetary models, which are built upon forward-looking expectations of the price's levels, show that there may be multiple price levels consistent with a given nominal quantity of money, and equality between the supply and demand of money. Thus, an additional equilibrium condition may be required to obtain the unique price level[59]. Moreover, it is also possible that the fiscal authority forces the monetary authority to finance the government debt with seigniorage. This can cause a higher inflation under the FTPL.

In addition, as mentioned, monetary policy must interact with fiscal policy in order to enable the monetary authorities to control inflation. To explain this view we must discuss two scenarios:

- **In the case of an active monetary policy:** in this case monetary authority set monetary policy independently (independent of fiscal policy) by announce the growth rate of the base money in order to control inflation. Thus, the fiscal authority would face the constraints imposed by the demand for bonds. Then, the government must set its budget to ensure that any deficit is financed through a combination of the seigniorage determined by the monetary authority, and bond sales to the public. For more see **(Leeper, 1991).**

- **In the case of an active fiscal policy:** in this case, the fiscal authority plans independently[60] its budget and proclaims all current and future deficits and surpluses in terms of the revenue that have to be planed through bond sales and seigniorage. Thus, the monetary authority under these circumstances is constrained by the demand for government bonds. If the fiscal deficits cannot be solely financed by the new bonds sales, the monetary authority is forced to create money and endure additional inflation.

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[59] Woodford (1995) argues that the government's intertemporal budget constraint can provide this additional condition for determining the equilibrium price level in which the fiscal stance replaces the money supply as the key determination of the price level, see Cochrane (1999), Leeper (1991), Sims (1994), Woodford (1995), and Christiano and Fitzgerald (2000).

[60] An active fiscal policy is one in which the tax and government expenditures are determined independent of intertemporal budget constraint, see Leeper (1991).

Consequently, monetary authority has less power to control inflation when the fiscal policy is the dominant., see **(Sargent & Wallace ,1981).**

The difference between the FTPL and the conventional view on inflation is captured through the government's intertemporal budget equation. This equation can be expressed in a simple form as follows.

$$\frac{B}{P} = \text{Present Value of Future Surpluses} \text{ ....(27)}$$

Where:

B represents the outstanding nominal government debt.

P is the price level.

This equation is a constraint on the government's budget policy regardless of the value of P.

If the Equation (21) is disturbed, the government must adjust either its expenditure or taxes to restore the equality. In contrast, the FTPL argues that the intertemporal budget equation is an equilibrium condition in a way that under any situation that disturbs Equation (21), the value of P, the price level, would adjust to restore equality. Thus, if the real value of government debt were to increase, no adjustment to fiscal and monetary policy would be made to satisfy Equation (21). This indicates a non-Ricardian fiscal policy, see **(Christiano and Fitzgerald, 2000).**

2.6.   Fiscal policy in oil exporting countries:

Over and above the challenges that face fiscal policymakers in developing countries, policymakers in oil producing and exporting countries may encounter exceptional and daunting challenges. **(Barnett & Ossowski, 2002**) state that these challenges arise from three existing facts as follows:

- Oil income is exhaustible, and its exhaustibility raises such critical and complex issues as sustainability and intergenerational resource allocation.
- Oil income is volatile and uncertain which will shape a kind of complicity in macroeconomic management and the process of fiscal planning. This arises from the difficulty that the policymakers face when trying to control or avoid transmitting oil volatility into their macroeconomic policies.

- Oil revenue in these countries comes from abroad. This means that the overall fiscal balance can be driven by any changes in the oil revenues without a direct effect on domestic demand. So, the fiscal use of these resources has its own significant consequences for the domestic economy.

It is apparent from the discussion above that the economies of oil-producing countries are usually subjected to a variety of problems such as *fiscal imbalances*, *deteriorations in the positions of national savings* and *reserves* and even *frequent economic instability*. However, the major problem for these countries in fact originates from their huge reliance on oil income. And the more the economy relies on oil income, the greater the negative effect of oil fluctuation will be on that economy. It is worth mentioning that in order to reduce the level of reliance on oil sector, some of these countries have adopted various policies and strategies, the most important of which is diversification policy. Nevertheless, the ratio of oil income either to GDP or to the budgetary total revenue is still too high. This indicates that these countries have failed to develop a sufficient level of non-oil revenues to reduce their heavy dependence on the oil sector **(Liuksila, et al. 1994)**.

- **Long term fiscal policy issues:**

In the long term the challenge stems from the exhaustibility of oil reserves and concerns the issues of fiscal sustainability and intergenerational resource allocation [61]. The principal policy options to address these challenges are to save oil revenues in order to accumulate financial assets or to invest in physical assets (use them for capital expenditure). To avoid a sharp adjustment of fiscal policy once oil reserves are exhausted, and to secure national wealth for future generations, one option for oil-exporting countries is to accumulate financial assets during the periods in which they produce oil. After the end of oil production, the revenues from these assets can be used to replace oil income and to maintain levels of expenditure. Oil wealth is thus gradually transformed into financial wealth, leaving the country's overall wealth unchanged and preserving it for future generations. This discussion is illustrated in figure (23).

Figure 27: fiscal revenue sustainability through financial asset accumulation

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[61] Fiscal sustainability is achieved if in the "post-oil age" the same amount of public goods (level of expenditure) can be provided as in the "oil age" without resorting to deficit financing of public expenditure. Intergenerational equity requires citizens in the "post-oil age" to enjoy the same amount of public goods as the generation in the "oil age" without bearing a higher fiscal burden (e.g. in the form of taxation). This implies that achieving intergenerational equity is more demanding than ensuring fiscal sustainability. If oil revenues are replaced by tax revenues, this would ensure fiscal sustainability but not necessarily intergenerational equity (Michael, François; Alegre, Juan Gonzalez
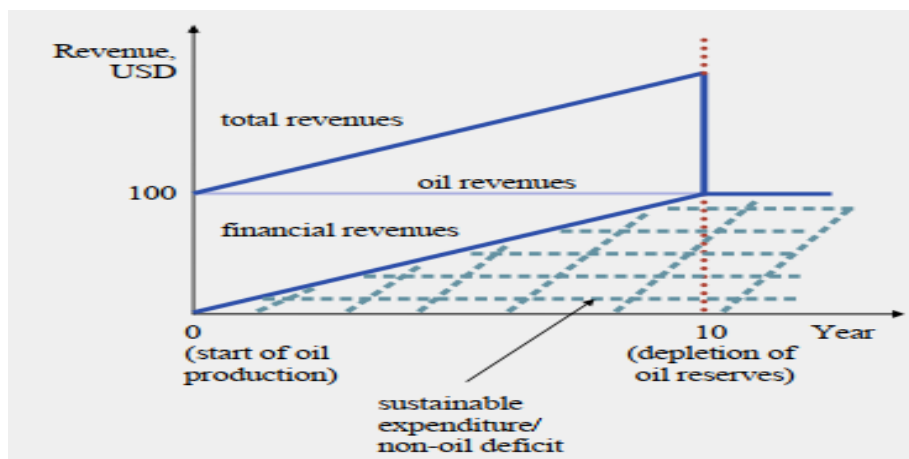
Source: (Christiano and Fitzgerald, 2000)

2.7. Fiscal policy in time of Crisis:

2.7.1. What is crisis?

Financial crisis is an economic depression due to low liquidity in the financial institutions. A recession or depression that results from a lack necessary liquidity needed by large financial institutions, it can be a result of national disasters, poor economic stability, or other events that result in a massive shock.

- **Why did oil prices fall?**

Numerous factors contributed to the 2014 drop in oil prices. Economies such as China, whose rapid growth and expansion created an unquenchable thirst for oil in the first decade of the new millennium, began to slow after 2010. China is the world's largest country by population, so its lower oil demand had significant price ramifications. Other large, emerging economies such as Russia, India and Brazil experienced similar economic trajectories in the early 21st century – rapid growth during the first decade, followed by much slower growth after 2010. The same countries that pushed up the price of oil in 2008 with their ravenous demand helped bring oil prices down in 2014 by demanding much less of it.

Spurred by the negative effect of high oil prices on their economies, countries such as the U.S. and Canada increased their efforts to produce oil. In the U.S., v private companies began extracting oil from shale formations in North Dakota using a process known as fracking. Meanwhile, Canada went to work extracting from Alberta's oil sands, the world's third-largest crude oil reserve. As a result of this local production, the two North American countries were able to cut their oil imports sharply, which put further downward pressure on world prices.

Saudi Arabia's actions also contributed to falling 2014 oil prices. Faced with a decision between letting prices continue to drop or ceding market share by cutting production in an effort to send prices upward again, the Middle Eastern country kept its production stable, deciding that low oil prices offered more of a long-term benefit than giving up market share. Because Saudi Arabia produces oil so cheaply and holds the largest oil reserves in the world, it can withstand low oil prices for a long time without any threat to its economy. In contrast, extraction methods such as fracking are more expensive and therefore not profitable if oil prices fall too low. By supporting low oil prices, Saudi Arabia hopes that countries such as the U.S. and Canada will be forced to abandon their more costly production methods due to lack of profitability. **(DePersio, 2014)**

2.7.2. Fiscal austerity/ Fiscal consolidation:

Austerity also called with other terms: **fiscal consolidation**, **fiscal reform**, **deficit reduction**, **fiscal contraction**.

According to **(Blyth, 2013)** austerity is "a set of economic policies implemented with the aim of reducing government budget deficits. Policies grouped under the term 'austerity measures' may include spending cuts, tax increases, or a mixture of both, and may be undertaken to demonstrate the government's fiscal discipline to creditors and credit rating agencies by bringing revenues closer to expenditures".

2.7.2.1. The debate about austerity

For the Classical economists of the 18th and 19th centuries, fiscal policy was about balancing the budget; anything else was considered economically destabilizing.

Frugality was a cardinal virtue; and it was reflected in the widely accepted principle that government budgets should be in balance, if not in surplus, and that deficits could be tolerated only in extraordinary circumstances, such as war. Substantial and continuing deficits – particularly during peace-time – were interpreted as the mark of fiscal folly.

The Classical debate about austerity thus mainly revolved around the question of whether to finance public spending through taxation or borrowing. The fundamental difference was the timing of the payments: taxation placed the burden of payment on taxpayers during the period of expenditure, whilst debt postponed payment until the interest and amortization payments come due. Debt financing thus enabled the shifting of the burden of payment onto others, who

(given the timing of payment) may or may not be the same people. The question was therefore about who should shoulder the burden of the debt – and when. **(Demopoulos & Yannacopoulos, 2012)**

One of the earliest contributors to the debate about the potentially beneficial effects of government spending was **Isaac de Pinto (1761)**. His "Traite de la Circulation et du Credit" argued that national debt and stock market speculation in securities played a positive role in fostering credit, increasing the circulation of money and promoting economic well-being. This contrasted sharply with the view of the 18th century British economists.

 David Hume (1752) and **Adam Smith (1776)** were concerned about England's sovereign debt crisis (brought about by imperial expansion) and the 'degeneracy' associated with public borrowing. For them, debt financing by government was evidence of profligacy; and it imposed fiscal burdens on future generations of taxpayers. David Ricardo, writing at the end of the Napoleonic Wars, referred to debt as '… one of the most terrible scourges ever invented to afflict a nation.' However, by this time, industrialization was much further advanced than in the late 18th century, when Hume and Smith were writing. Rulers, in league with the mercantilists, were no longer able to threaten economic progress and the national debt was considered less pernicious.

Ricardo's interest was mainly about whether there was an economic difference between the various means available to finance public debt. In his 'Essay on the Funding System,**'** **Ricardo (1820)** examined the relative 'equivalence' of financing a war by means of current taxes or by the issuance of government bonds. Although he concluded that there was no real difference, he doubted the practical consequences of this logical conclusion: if people had 'rational expectations', they would be indifferent between the two systems but since they do not, their decisions are distorted by a 'fiscal illusion' He therefore concluded that 'during peace, our unceasing efforts should be directed towards paying off that part of the debt which has been contracted during war.'

Thomas Malthus took a different point of view. Although he did not devote a chapter to the subject of the public debt and taxation in his Principles of Political Economy, Malthus (1836) argued that those living on the interest from the national debt – the 'idle rich' for Smith and Hume – 'contribute powerfully to distribution and demand … they ensure effective consumption, which is necessary to give the proper stimulus to production.'. Because employment and incomes for the many depend on the powers of production, Malthus maintained that 'it would be the height of rashness to determine, under all circumstances, that

the sudden diminution of the national debt and the removal of taxation must necessarily tend to increase the national wealth, and provide employment for the working classes.

John Stuart Mill, [62]whose father was a close friend of Ricardo, took a position between those of Malthus and Ricardo. Whilst a proponent of free markets, Mill argued that government intervention was justified in the interest of society as whole. In 'Of National Debt', in his Principles of Political Economy (1848), he defended public debt in situations of under-consumption, when 'some amount of national debt is desirable, and almost indispensable, as an investment for the savings of the poorer or more inexperienced part of the community.' However, Mill believed that public borrowing was harmful if it destroyed capital that would otherwise be used for production and employment. In answering the question of whether it is 'expedient to take steps for redeeming that debt,' Hume contended that 'in principle, it is impossible not to maintain the affirmative'. After Mill, the Classical economists devoted less attention to austerity economics and the national debt, which for Britain and the other developed economies remained relatively low and stable until 1914, with the outbreak of World War One. Although there was debate about the form of financing the national debt, there was general agreement that, except in extraordinary circumstances such as war – or, for those like Mill, social and economic exclusion – every effort should be made to maintain a balance (if not a surplus) in the government budget.

The Keynes vs. Hayek Debate

The debate between Keynes and Hayek was about how to address the boom that leads to budget deficit. Keynes argued that: government must keep the price of money low and cheap for a long duration that would increase reserves and savings, which will provide loans to investors. This will certainly lead to the creation of new jobs and helps jobless back to work, as a result GDP growth will increase and debt will decrease which will facilitate the financing of current projects. If the state needs money to achieve these policies, borrowing is the solution and it is easy to pay back as soon as everyone is back to work, they would pay taxes again. In other way Hayek argued about whether is the best to stimulate economy through employment as Keynesians said or rather leaving the market find its solution. He argued that government must free markets in a way, which it determines the right course of action by reducing spending and taxes. (**Kuepper, 2021**).

2.7.2.2. Fiscal austerity origin:

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[62] George D.Demopoulos & Nicholas A. Yannacopoulos, previous reference. P47

- **Fiscal Austerity in general:**

In simple terms, austerity means using policies to reduce government spending and/or higher taxes in order to try and reduce government budget deficit. Usually, austerity policies are associated with lower economic growth and higher unemployment. Austerity implies that decreased spending and tax increases are highly likely to have an adverse impact on aggregate demand and economic growth. In times of recession the budget deficit will automatically increase because of the lower tax revenues and because of the higher spending on unemployment benefits. Austerity generally refers to fiscal policy but it also includes monetary policy, because it uses policies, which reduce aggregate demand and increase unemployment. High interest rates and overvalued exchange rates can be seen as part of general austerity approach to the economy. Austerity measures are generally unpopular because they tend to lower the quality and quantity of services and benefits offered by the government **(Boljunčić, 2015)**.

2.7.2.3. Main impacts of Austerity

Some of the main impacts of austerity are lower demand, cut in government spending and bigger taxes will lead to lower aggregate demand and lower economic growth. If the output is declining, firms will employ fewer workers, which will lead to increase in unemployment. Also, present are fears over job losses and expectations of lower growth will make consumers to save more instead of to spend. This condition will further drag on consumer spending and economic growth. Second impact is lower inflation; spending cuts will lead to lower inflation. The fall in aggregate demand will lead to lower inflationary pressures in the economy. In case if government puts a limit on public sector wages, this will put downward pressure on wages, which will reduce the inflationary pressure. Furthermore, expected impact of austerity is that it will help to create greater pressure to reduce costs. The lower costs are useful in improving competitiveness. Measure to deflate the economy should make exports more competitive, but his way of improving competitiveness through lower inflation may take many years and costs are high. Also, higher taxes and lower spending will lead to improvement in the government budget deficit and this will help improve public finances in the long term, however, if austerity causes lower economic growth the government will also experience a fall in cyclical tax revenues, but if higher taxes cause a recession there will be less people working and income tax revenues can fall. If the austerity measures increase unemployment, it will take higher government spending on unemployment benefits. **(Boljunčić, 2015)**

2.7.2.4. The theoretical background of fiscal austerity

- **Ricardian equivalence proposition**

the most important Ricardian preposition about this point (especially in times of expansionary austerity) can be stated according to **(Boljunčić, 2015)** as follow:

- The current changes in public spending or current taxes will affect future taxes, so by giving the government a budget constraint, higher taxes today will be matched by lower taxes in the future, and individual recognizes that higher taxes today will generate a higher income in the next period.

- Government and rational agents increase consumption because they won't have to collect higher taxes in the future.

- **Ramsey optimal policy**

In the Ramsey optimal policy, only distortionary tax (excise tax) is available to the government. The government must be able to obtain a particular amount of "revenues in the least-distortionary manner". Ramsey considered a consumer economy consisting of several goods. A government needs one of each of the several goods in a fixed quantity, and these goods are purchased at given market prices. Revenue to buy these goods is collected through excise taxes and these taxes are charged at a flat rate on the consumption goods. This is based on the assumption that the quantities and prices for these goods are set up competitively for any given form of excise taxes. Ramsey sought after patterns of excise taxes that would give the maximum utility to the end user, and thus reduce both the "excess burden" as well as "welfare cost" of taxation. The "Ramsey optimal policy could help in finding the optimal path of government debt through finding the optimal path of tax revenues" **(Lucas & slokey, 2010).**

- **Neo classical theory for public debt (Tax smoothing approach)**

Barro (1979) first introduced this theory. It states that the government should not modify its taxes too often and drastically; otherwise, an economy would be "subject to shocks to preference and/or productivity". Drastic and quick revision of taxes is ineffective because of the convexity of the "deadweight cost of taxation in the tax rate". The optimal policy states that governments have deficits during the period of time when government spending is high, and that governments have surpluses when government spending is low. In the determination of public debt issue, the main hypothesis of this theory is that, for instance, when there is a

temporary increase in government spending due to war, there is a consequent positive effect on debt issue **(Battaglini & Coate, 2008)**. There is then a negative effect due to the temporary increase in income, and this results in a "countercyclical" reaction to the debt issue. In addition, this also creates a "one to one effect created on the growth rate of nominal debt due to expected inflation rate". This theory also pointed out that debt–income ratio would not affect the growth rate of debt. However, the level of government expenditure would affect growth rate of debt slightly **(Barro, 1979)**

- **Dynamic political economy theory**

(Battaglini and Coate, 2008) suggested this dynamic economic theory of public spending, taxation and debt. This theory has been derived from the famous tax smoothing approach to fiscal policy first established by Barro (1979) and takes into consideration the analogous economic environment as mentioned by Barro (1979). Here, the government body, instead of a generous planner, makes the decisions regarding policies. Furthermore, this theory assumes that the revenue collected could be disseminated back from the government bodies to their districts, where they have been collected through "pork-barrel spending". (Pork barrel is a type of government spending for local ventures protected exclusively or mainly used to gain revenue in a representative's region). Moreover, this theory assumes that a government body, whose members are chosen through ballot by "single member, geographically defined constituencies", undertakes the policydecisions. These representatives (legislatures) try to collect their revenue in two different ways according to **(Jain, 2013):**

- They either charge a proportional tax on the income earned by a worker, or they borrow funds by issuing risk-free one period bond from the capital market.
- They can also choose to buy bonds, and use the earnings obtained from the interest, to finance the public spending for the upcoming years.

Public revenue is used for the welfare of all citizens by financing the provision of public goods and for "pork-barrel spending". It is however, not easy to determine the value of the public goods provided to citizens, especially during unexpected circumstances, for example, in the case of wars or natural catastrophes. The governing body therefore, enforces the policy decisions according to majority rule.

2.7.2.5. Austerity measures:

Austerity is a policy used in time of financial crisis (budget deficits, high percentage of debt, oil crisis) to avoid a crisis of sovereign debt when the debt to GDP ratio reach more than 90% (the debts are almost equal to what countries produce in the year). Consequently, interest rate will increase because creditors will work to cover and compensate the high risks, what will cost more to repaid these debts.

It's also used to restore the trust in the way of managing a government budget. So austerity measures are a group of official actions taken by the government, in the aim of reducing budget deficit through a combination of spending cuts and/or tax rises.

Since the global recession in 2008-2009, different austerity measures have been announced and used, and there are two famous targets of austerity following either spending programs or taxes programs.

- **Spending decreases (also called rationing):**

These measures have effects on short term but it could have effects on the middle and the long term by using these measures and following austerity programs for years and we can state them as follow:

- Reduce salaries of government employees, benefits, and hours.

- Stop spending on new public projects.

- Reduce expenses on job contracts.

- Canceling vacancies and reallocation of jobs and employees among different government agencies.

- Stop buying cars and equipment and reduce the item of operating expenses.

- Reducing or cancelling some types of internal and external subsidies and assistance.

- Cut programs for the poor.

- Extending the eligibility age of retirement and health care benefit

- **Tax increases:**

Through the following taxes:

- Raising taxes on income.

- Raising value added taxes.

- Targeting tax fraud and tax evasion.

- Raise property taxes.

Examples

Table 12: Fiscal austerity measures

Country	Austerity measures
Greece	- Government targeted tax reform. - Increase taxes for 1700 wealthy and self-employed individuals. - Reorganized revenue collection agencies to reduce numbers of taxes evades, also reduce number of offices. - Raise property taxes. - reduce government employment by 150000 and the wages by 17%. - Eliminating heating fuel subsidy.
Italy	- Increase health fees. - cut subsidies to regional government. - Cut pension for wealthy. - Raise eligibility ages for pensions and went after tax evaders.
Ireland	- Reduce employees' salaries by 5%. - Reduce welfare and child benefits and closed police stations.
Portugal	- Cut military and infrastructure spending. - Reduce wages for top government employees. - Raise VAT by 1% and taxes on the rich. - Increase privatization
Spain	- Raised taxes on wealthy. - Raised Tabaco taxes by 28% - freeze government employments, salaries and reduce budget by 16.9%
United kingdom	- Cut budget by 49%. - Increase the retirement age to 66. - Eliminate 490000 government jobs - Reduce child benefits. - Raise Tabaco taxes.

Source: author's illustration based on (Amadeo,2016)

2.7.2.6. Impacts of austerity measures:

Austerity measures have a number of different effects on a country, including both economic and social implications. In fact, the book The Body Economic: Why Austerity Kills details how these measures may have led to more than 10,000 suicides and up to a million extra cases of depression. Moreover, public health cuts may also have contributed to higher HIV rates in Greece and the country's first malaria outbreak since the 1970s.

Here are some of the most common effects arising from austerity measures discussed by **(Amadeo,2016):**

- **Economic Effects**

Many aggregate demand models in economics suggest a relatively simple relationship between a government's budget and economic activity. That is, austerity measures lead to depressed consumption and economic output. But some studies suggest that the relationship between austerity and economic activity is nonlinear and depend on many outside factors, which makes these effects uncertain.

- **Political Effects**

Aside from the fiscal effects, austerity measures can have a number of effects on a country's politics. Since most austerity measures target developmental and social spending, social unrest is one of the most common after effects of austerity implementation. For instance, Greece saw a number of violent protests to measures undertaken in 2011 and 2012.

- **Social Effects**

Austerity measures also have a big impact on everyday life, since governments tend to be both large employers and social nets.

- **Impact of austerity in the long-term**

Suppose fiscal austerity does cause economic activity to slow or contract in the short run. This actually might worsen the fiscal situation since a reduction in GDP increases the debt-to-GDP ratio, everything else equal. Moreover, the decline in activity can counteract the effects of fiscal consolidation by increasing mandated social spending and causing a decline in tax collections.

While these effects are certainly a concern, they miss the crucial long-run benefits of austerity through maintaining intertemporal budget balance, which could outweigh the short-run costs.

Few studies on the effects of fiscal policy consider the short-run effects and the long-run effects together. One exception is recent work by Harald Uhlig He finds that fiscal stimulus leads to an initial output boom. Eventually, however, the long-run effects on output are negative because governments must raise taxes to pay for the stimulus. Symmetrically, this implies that austerity would initially cause an economic contraction that would be followed by a rise in output as economic agents expect lower taxes in the future due to lower government debt **(Amadeo, 2016)**.

- **Net positive effect**

Fiscal consolidation is also more likely to have net **positive effects** if markets perceive a high default risk on sovereign debt, in which case consolidation may help calm market fears. For example, sovereign risk was high during the economic expansions that coincided with the fiscal contractions that Giavazzi and Pagano studied in Denmark and Ireland in the 1980s. Sustainable fiscal policy could have beneficial effects in the short run, too. In the IMF study, fiscal consolidations during states of high sovereign risk are less contractionary—though still negative for growth—than those implemented during states of low sovereign risk.

III. The interaction between monetary and fiscal policies

(Rothenberg, 2005) indicates that separation is one of the most remarkable features of the fiscal and monetary policymaking powers in the economy since it will undoubtedly help the economy avoid inflation. By not giving fiscal policymakers control over the money supply, governments can avoids paying off deficits by printing money. Some studies such as Barro (1974, 1978,1983), Evans (1985,1987), and Plosser (1987) provided evidence that fiscal policy is not as competent as monetary policy to stimulate the economy how the macroeconomic impact of monetary and fiscal policy can differ depending on the assumption that which policy is constrained while the other policy can actively respond to the shocks. Building up on this ground, some recent studies find evidence in favour of the effectiveness of fiscal policy when monetary policy is constrained in the form of a policy commitment, i.e. a Taylor Rule or inflation targeting.

Despite the existence of a vast literature on the impact of monetary policy on the economy, monetary studies often neglect to consider potential role for fiscal policy in their analysis[63]. However, as discussed in Sims (2011) the fluctuations in the price levels cannot be solely

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[63] For exceptions, see Sargent and Wallace (1981), Cochrane (1998, 2001, 2009), Leeper (1991, 2013), Sims (1994,1997, 2011), and Woodford (1996, 1998). Nordhaus (1994) provides a theoretical model in which monetary and fiscal policy can undermine one another.

explained by monetary policy since fiscal policy may play an important role[64]. The underlying mechanism can be explained as follows. Consider a standard NK model with government budget constraint. A contractionary monetary policy may require additional debt to be issued to pay higher interest rates on the public debt. This policy shock can generate inflation if rational forward-looking agents believe that the debt will not be fully backed by future taxes. Thus, a monetary contraction can lead to an increase in nominal government debt through higher interest rates. As (**Sims, 2011**) explains, this monetary policy-generated increase in the interest rate can increase inflation through a positive wealth effect. An increase in the interest rates can affect bondholders' disposable income. The impact would intensify when interest expenses are a major part of the government budget due to a fiscal-induced increase in the interest expenditure share of government debt. If agents perceive that the rise in government's debt would be financed by issuing further bonds or seigniorage rather than taxes, it would increase the aggregate demand by encouraging private expenditure. This can cause a higher inflation rate and output, see **Davig and Leeper (2007, 2011)**, (**Sims, 2011**), (**Leeper & Walker, 2012**), and (**Leeper, 2013**).

(**Sims, 2011**) argues that a debt-financed fiscal expansion, may account for volatility in US inflation over the 1960-1980. He discusses that an expansionary fiscal policy shock under an active fiscal policy and a passive monetary policy coordination may contribute to increasing the price level. Accordingly, he strongly suggests that the econometric models intended to analyze monetary policy outcome entirely should explicitly account for the fiscal stance given that fiscal policy can be a primary source for changes in the inflation rate.

However, this is in fact, a fatal trap which if left unrestrained, can result in severe hyperinflation **(AI-Fazari,2006).** Therefore, fiscal policy and monetary policy should be complementary. both types of policy should work towards achieving the required rate of aggregate income and spending in the economy through:

- Influencing the size, composition and timing of public revenue and expenditure (fiscal policy).
- Influencing the money supply and the cost of borrowing funds from banks (monetary policy).

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[64]This does not imply that monetary policy shocks as a substantial factor in determining the price level can be ruledout. It indicates that monetary shocks may not be the dominant factor, see Sims (2011).

The literature on the interaction between monetary and fiscal policies explains that alternative macroeconomic policy coordination may yield different policy outcomes. [65] [66] An active monetary policy and a passive fiscal policy can be described in the form of aggressive response of monetary policy to current inflation while fiscal policy adjusts taxes sufficiently in response to government debt. This combination produces the conventional outcome that inflation is always a monetary phenomenon while tax policy ensures sustainability of government debt. In the case of an active fiscal policy and a passive monetary policy, both prices and money growth will increase while the monetary authority is forced to accommodate this shock (**Leeper & Walker, 2012**). Under this policy management, the fiscal authority sets its expenditure without taking into account the balanced budget requirements, which is tax revenues are not sufficient to finance the expenditures, and seigniorage must adjust to ensure that the government's budget constraint is satisfied. It implies that monetary policy must adjust to deliver the level of seigniorage required to balance the government's budget. Thus, as (**Walsh, 2010)** explains fiscal policy can alter the money supply and influences price levels.

Note that monetary policy has been switched to passive mainly when the concern of monetary policy moves away from inflation stabilization toward other issues such as output stabilization or financial crisis mitigation. In these circumstances monetary policy weakly adjusts the nominal interest rates in response to inflation, see Leeper and Walker (2012). However, the motivation for implementing an active fiscal policy mainly has been to prevent the deflationary spiral (**Davig & Leeper, 2011**), and (**Eusepi and Preston, 2011**)[67], argue that active fiscal policy and passive monetary policy during 1960s and 1970s may explain US inflation dynamics better than monetary factors. As discussed in Chung et al. (2007), and the references therein there is evidence that over this period the Federal Reserve weakly

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[65] There are three possible combinations of macroeconomic policy: (i) conventional combination in the form of an active monetary policy and a passive fiscal policy, (ii) a combination of a passive monetary policy and an active fiscal policy which mostly is described as the FTPL, and (iii) an unified monetary and fiscal policy in the form of either passive or active that generate unstable equilibrium, see Leeper (1991), and Canzoneri et al. (2011).

[66] Monetary and fiscal policy interactions can be either complementary or substitutive. They interact as substitutes when a monetary expansion is matched with a fiscal contraction and vice versa. For example, if the fiscal authority raises tax rates or cuts spending, then the monetary authority reacts to it by lowering the policy rates and vice versa. If they act as complements, both monetary and fiscal policy are either expansionary or contractionay, see Muscatelli et al. (2004)

[67] The Federal Reserve's bond-price pegging policy after World War II, or the Quantitative Easing policy after the recent financial crisis that shift the focus from targeting inflation, stand out as examples for passive monetary policy, see Leeper and Walker (2012). Another example is the case with Japanese economy since the mid-1990s, as their economy experienced a prolonged period of low interest rates combined with massive fiscal packages. In both these two circumstances interest rate reaches the zero lower bound

responded to inflation and failed to satisfy the Taylor principle. Then, from the mid- 1980s, it appears that the Taylor principle has been satisfied again.[68] **(Chung et al, 2007)** argued that under a passive monetary policy and an active fiscal policy regime, the price puzzle can be explained as a normal response of prices rather than a puzzle. As explained earlier, if agents anticipate this macroeconomic policy coordination would have government debt implication, it would generate a positive wealth effect. The consequence would be an increase in private expenditure leading to a rise in prices and output. Thus, inflation can sharply increase in short-run in response to a monetary contraction.[69] However, an active monetary policy with a passive fiscal policy would yield a Ricardian equilibrium, implying that debt-management policy has no monetary consequence.

Chapter's conclusion:

For ages, the common theoretical understanding has been that monetary policy is sufficient to achieve low inflation and stable economic growth. However, the 2008 financial crisis and the zero lower bound event caused most of the major Central Banks to adopt unconventional monetary measures. Further to the ongoing discussion on the impact of UMP, fiscal policy also received attention as an effective way to stimulate the economy. As discussed in Davig and **(Leeper, 2011)**, the ultimate impacts on the economy depends on the way that monetary and fiscal policy interacts.

For this reason, this chapter represents the theoretical background for both monetary and fiscal policies where we have highlighted the significant role of monetary policy - conventional or unconventional, where in managing financial systems, the key policy tool is monetary policy. This suggests that the efficiency and stability of the financial system, together with capital accumulation, are outcomes of the monetary policy stance and its effects within an economy. For instance, on the issue of the volume of credit that can be accessed by the productive sector of the economy or supplied by the financial markets, a key determinant is the cost of the funds. The cost of funds is also usually a function of the monetary policy

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[68] Taylor Rule, as a monetary rule, shows that how much a Central Bank should change the nominal interest rates in response to changes in inflation and output gap. In particular, Taylor Rule recommends that for each one percent increase in inflation, the Central Bank should raise the nominal interest rate by more than one percent. This is called the Taylor principle, see Taylor (1993).

[69] Chung et al. (2007) present results, within a Markov-Switching VAR model using Choleski identification, suggesting that there is a positive correlation between interest rate and inflation under the non-Ricardian case

stance within the economy. **(Mishkin, 2007)** argues about the importance of monetary policy for the financial stability and health of any economy.

In addition, we have also stressed the important role government intervention, the meaning, mechanism, theories and the importance of fiscal policy, in addition to considering issues that may affect its efficiency. It has concluded that fiscal policy is a policy under which government uses its expenditure and revenue programmes mainly taxes, to produce desirable effects and avoid undesirable effects on the national income and employment. In other word, in order to affect the rate of employment, raise the national income and achieve stability in the economy, government uses public expenditure and revenue as a tool. However, as it concluded, fiscal instruments are those certain financial procedures adopted by government to achieve the objectives of fiscal policy such as planned deficit and borrowing programmes.

The chapter has also showed that the intensive role of government in the economy dictates a broad usage of fiscal policy instruments. Depending on a number of determinations, the efficiency and effectiveness of fiscal policy vary from one country to another. In developing countries, these determinants play either a weak or negative role, and hence, the efficiency and effectiveness of fiscal policy in those countries is less than that in developed ones. In addition to the above mentioned challenges that face fiscal policy in developing countries and which can be applied to oil producing countries, fiscal policy in the latter encounters a unique and magnitude challenge. Oil income is exhaustible, and its exhaustibility imposes the complex issues of sustainability, economic fluctuation and intergenerational resource allocation.

We explain that regardless of the Ricardian or non-Ricardian view on fiscal policy, at the ZLB monetary policy tools turn to be less competent to stimulate the economy. This accounts for the use of fiscal policy. In addition, we discuss that within the FTPL, fiscal policy has an important role to determine the price levels. Having discussed the literature on monetary and fiscal policy interactions, we conclude that the outcome of monetary and fiscal policy intervention   depends on which policy dominates.

Finally, this chapter answers theoritically one of the main dissertation's question about the interaction between monetary and fiscal interaction/ combinations where the theoretical perspectives suggest that the coordination may take several stances and vary in its level of efficiency. For instance, a coordinated contractionary policy mix would work best if used to reduce a positive output gap. Policy divergence, however, can produce mixed results

depending on the relative strength of one policy's effects on another. By contrast, while a loose monetary/tight fiscal stance has been rarely observed empirically, a loose fiscal/tight monetary stance mostly raises the equilibrium point of real interest rates, potentially can result in crowding- out effects on investment demand and moderating any expansionary attempts of the government. **(Rothenberg, 2005)**

Chapter two:

monetary and fiscal policy interactions: a literature review

Introduction:

Monetary and fiscal policies are undertaken by various departments which have priorities and areas of responsibility which vary. Fiscal policy is mainly responsible for price stability while monetary policy deals mainly with price stability and output stabilisation. Fiscal and monetary authorities' goals sometimes depend on the state of the economy and their concerns. Macroeconomic effects of the policies are influenced by their interaction. Monetary policy and fiscal policy are important for understanding and managing macroeconomic policy..(Kennedy, 2012)

The literature on the interaction of monetary and fiscal policy shows that alternative coordinated macroeconomic policy can produce different policy outcomes. The aggressive monetary reaction to current inflation can be described as an active monetary policy and a passive fiscal policy while fiscal policy adjusts taxes sufficiently for public debt to take into account. This combination results in the conventional consequence that inflation is always a monetary phenomenon while tax policy ensures that government debt remains sustainable. The active fiscal and passive monetary policies will lead to price and money growth, while currency authorities are obligated to accommodate this shock, see Canzoneri et al. (2011), Davig and Leeper (2007 and 2011), and Leeper and Walker, respectively (2012). This policy management requires an expenditure from the fiscal authority, which does not take account of the budgetary balance requirement which does not allow tax revenue to finance the expenditures, and seigniorage must adjust to ensure the government's budgetary constraints are met. It implies that monetary policy needs to be adapted in order to achieve the necessary seigniorage to balance the government's budget. As explained by Walsh (2010), tax policies can change the supply of money and influence the price levels.. (Aybarç, 2019)

1. Investigating monetary-fiscal policies interactions using Game theory's approach and Vector autoregressive models:

Paper 01: Interaction of monetary and fiscal policies in Turkey:

This study was adopted by **(LeLoup, 2002)**, where they have inspected the interaction between monetary and fiscal policies and its macroeconomic effects in Turkey.

The objective of the study:

this paper focused on answering different questions regarding the effects of fiscal and monetary policy shocks on macro variables, the way that the shock on inflation and output (the non-policy variables) affect monetary and fiscal variables and the impact of monetary policy variables on fiscal policy and vis-versa.

Data and methodology:

In order to identify and analyse the interaction between monetary and fiscal policies, **(Büyükbaşaran, Cebi, & Yılmaz, 2020)** used a Bayesian structural vector autoregression model (SVAR) with zero and sign restrictions. This analysis was applied to a small set of variables including real tax revenue growth, real government spending growth, real GDP growth, inflation, nominal interest rate and nominal exchange rate, and a data set for the period from 2003Q2 to 2018Q4 representing the Turkish economy.

Results:

(Assadi, 2015b) found that in term of interactions between monetary and fiscal policies, the nature of shocks matters, with the finding that both policy shocks are complementary in response to demand and supply shocks while they are substitute in response to shocks caused by the each other. In addition, they confirm that using an appropriate definition for tax shocks is very important to achieve realistic results. Findings reveals that anticipated fiscal shocks yield more reasonable results than unanticipated shocks, especially when investigating tax shocks, where they found that an increase in tax revenues results a fall in output contrary to the results of the unanticipated shocks.

Paper 02: The Interaction Between Fiscal and Monetary Policies: Evidence from Sweden

The objective:

(Büyükbaşaran et al., 2020) aim to investigate the dynamics of monetary and fiscal policies interaction by stressing the role of fiscal policy in promoting monetary policy for the stabilisation of the Swedish economy without compromising public finances stabilization in the medium term.

Data and methodology:

This paper adopts a structural vector autoregressive SVAR model in order to estimate the relationship between monetary and fiscal policy using Quarterly data from 2000Q1 to 2015Q4 for six variables: domestic GDP gap, Foreign GDP gap, Real interest rate, Net lending gap, Inflation gap, Real exchange rate gap. Restrictions are derived from a New Keynesian approach.

Results:

(Büyükbaşaran et al., 2020) in this paper found that:

- A policy of fiscal stabilisation is also better when the effects of this policy on potential GDP are taken into consideration. That is, the structural and stabilizing policies are not clearly differentiated. Therefore, a fiscal stability policy that actively counteracts reduced potential GDP growth following temporary weak demand.
- Monetary and fiscal policy are complementary when estimating their response to demand and supply shocks while when fiscal and monetary policies shocks occur, the two policies act substitutionally.

Paper 03: Monetary and Fiscal Policy Interactions in the Czech Republic

(Büyükbaşaran et al., 2020) provide through this study an econometric investigation on the monetary and fiscal policies interaction in the Czech Republic.

The objective:

The aim of this paper is to capture the interaction between fiscal and monetary policies in addition to their evolution during economic fluctuations across time.

Data and methodology:

This study builds and estimates a Bayesian VAR with six variables: public spending, public revenues, GDP, exchange rate, discount rate and inflation rate for the Czech economy, and using quarterly data from 1999Q1 to 2015Q4. (Ankargren & Shahnazarian, 2019) referred to

fiscal policy with both public spending and revenues, while monetary policy was presented by two instruments; exchange rate and discount rate.

Results:

According to (Ankargren & Shahnazarian, 2019) the main results indicated that:

- Monetary and fiscal policies adopted by the Czech authorities have ambiguous impact and are lacking in relation one to another.
- The absence of systematic fiscal policy role in business cycles, as monetary policy measures have well responded to the actions of fiscal policy.
- The reaction of the central bank seems to be very mild or even negligible where estimated responses are subject to a huge uncertainty.

Paper 04: Monetary and fiscal policy interactions: Evidence from emerging European economies

(Rezabek & Doucek, 2018) through this paper, investigated the interactions between monetary and fiscal policy.

The objective:

The main goal of this paper is to contribute to the existing literature by examining the different interactions between monetary and fiscal policy and to determine the policy mix regimes for some emerging European economies.

Data and methodology:

In order to achieve the goal of the study, **(Rezabek & Doucek, 2018)** adopted a Markov regime switching model considering the monetary policy proposed by Taylor (1933) and the fiscal policy rule suggested by Leeper (2007) to analyse monetary and fiscal policies interactions for the following European countries: the Czech Republic, Estonia, Hungary, Poland, Slovenia and the Slovak Republic using quarterly data from 1995Q1 to 2010Q4 for the following variables:

- Fiscal variables: the ratio of tax revenue to GDP, the ratio of government expenditures to GDP and the ratio of debt to GDP.
- Monetary variables: interest rate, output gap and inflation.

Results:

According to **(Rezabek & Doucek, 2018)** The main results revealed the existence of switching properties for monetary and fiscal rules between active and passive monetary policies, while for fiscal policies, Czech Republic, Estonia, Hungary and Slovenia seems to have alternative between passive and active fiscal regimes, however, in Poland and the Slovak republic, fiscal policy can be characterized by a single fiscal policy.

Paper 05: Fiscal and monetary policy interactions: a game theory approach:

This study is developed by (Cevik, Dibooglu, & Kutan, 2014) in order to analyse the interaction between fiscal and monetary policies in Brazil.

The objective:

The aim of this paper is to investigate the optimal monetary and fiscal policies and examine their interaction in a framework of 3 scenarios:

- Authorities minimizes its welfare loss independently (Nash equilibrium).
- One of the authorities follows the other one (Stackelberg solution).
- Cooperation between both authorities to achieve the same goals.

Data and methodology:

(Cevik et al., 2014) adopted a game theory with two players (Central bank and government where each player has it own instrument; interest rate ang government spending respectively), based on the New Keynesian optimisation features in order to examine different coordination performance between monetary and fiscal policies in relations to social loss, and compare each alternative to another depending on IRFs according to the selected sensitivity parameters. In addition, the study indicates numerical simulation for the Stackelberg solution contrary to the other solutions where analytical solutions were obtained.

Results:

Findings revealed that:

- Impulse responses functions revealed that monetary policy respond strongly to inflation.
- The smallest social loss was recorded when monetary policy has the leadership (when adopting a Stackelberg model).

-   Under the optimal policy, there is evidence of a strong distaste for inflation by the Brazilian society.

Paper 06: Regime-switching monetary and fiscal policy rules and their interaction: an Indian case study.

The objective:

The aim of this study assessed by **(Cevik et al., 2014)**, is to investigate the effectiveness of monetary and fiscal policies and their interactions in India, in addition to their effect on different macroeconomic variables. Additionally, a comparison between different interactions was done under three different regimes, a regime based on debt growth rate, another based on the output gap and finally a regime based on inflation.

The data and methodology:

To answer the study's goals (Saulo, Rêgo, & Divino, 2013) used a Markov-Switching model for monetary and fiscal policies analysis using quarterly data from 1950Q1 to 2008Q4 for eight variables IIP (industrial production index) for output, Government debt, Interest rate for monetary policy, M3 (money supply), public spending, tax revenues, exchange rate (INR/USD), Inflation CPI.

Results:

According to (Saulo et al., 2013), empirical results are as follows:

-   The inflation increases when monetary and fiscal policies are active or passive at the same time (the unstable regime) as well for the fiscal debt.
-   Though the active and passive regimes for monetary and fiscal policies respectively (AM-PF) are found more efficient at decreasing debt levels, the active one is found to be more suited for debt management.
-   When monetary policy is passive and fiscal policy is active (AF-PM), inflation rate decreases, however, the growth rate of debt increases registering high volatility.
-   Active monetary policy-passive fiscal policy is the best combination for the Indian economy.

Paper 07: Assessing Monetary and Fiscal Policy Interaction in a Small Open Economy: The Case Republic of Macedonia

(Arora, 2018) in his paper presents an empirical evidence regarding the interaction between fiscal and monetary policies.

The objective:

The purpose of this study is to investigate the interaction and the best combination between monetary and fiscal policies for the economy of the Republic of Macedonia, in addition to their effects on the level of prices and GDP.

Methodology:

In order to examine the shocks resulted from different policy interaction, (Arora, 2018) adopted a structural vector autoregression model (SVAR) using monthly data from 1997 to 2009 for seven macroeconomic variables: GDP, M1 refers to money stock and an indicator for monetary policy, manufacturing price index MPI, Public revenues and public spending representing fiscal policy.

Results:

Main findings achieved by (Arora, 2018) are:

- Real GDP is better influenced by tax cuts rather than public spending which has a weak effect and only in short-lived period.
- Fiscal policy has no Keynesian effect on real GDP in the Republic of Macedonia.
- Money stock is not an effective transmission channel for monetary policy in Macedonia, as this last is not efficient in controlling inflation which is one of the main goals for the central bank

Paper 08: Interactions between monetary and fiscal policies:

The objective:

(Fetai, 2013) purpose is to examine the monetary and fiscal policies nature from the perspectives of both authorities (government and central bank) in a cross- country study, and to investigate the different interactions between both policies and their response to different macroeconomic shocks.

Data and methodology:

This study is built on the estimation on a 2SLS estimation for 28 European countries which are: Belgium, Croatia, Austria, Bulgaria, Czech Republic, Cyprus, Greece, Germany, Estonia,

Denmark, France, Ireland, Italy, Lithuania, Hungary, Malta, Luxembourg, Romania, Portugal, Netherlands, Poland, Sweden, Spain, United-kingdom, Finland, Latvia and Slovakia. Therefore, (Fetai, 2013) used annual data for two sub-periods from 1970 to 1999 and from 2000 to 2015 representing severable macroeconomic variables: Debt to GDP ratio, Nominal short-term interest rate, Inflation, current account balance, Real exchange rate, M3 (liquid liabilities), Output gap.

Results:

Main results found by (Fetai, 2013) are summarised as the following:

- Inflation shocks have a significant impact on monetary policy during both phases under study.
- Fiscal authorities increase their primary balances when government debt rises.
- A substitutional relationship between monetary policy and fiscal policy when higher debts level is registered.
- There is a structural effect for in 19 country which have Euro as a common currency on the response and the interaction between fiscal and monetary policies.

Paper 09: Monetary and fiscal policy interaction in the EMU: A Dynamic Game approach:

The objective:

(Afonso, Alves, & Balhote, 2019) aims to investigate the EMU which refers to a common monetary policy under fiscal policy restrictions at a national level, in addition this study also examines the interactions between both policies and the coordination resulted aside with spill-overs and external shocks (excluding shocks from Non-EMU countries).

Data and methodology:

In order to examine the effects of the coordination between fiscal and monetary policies, (Afonso et al., 2019) build a stylized dynamic model for the European Monetary Union based on three scenarios:

i.   Independent monetary and fiscal policies (non-cooperative).

ii.   Partial monetary-fiscal policies coordination.

iii. Monetary-fiscal policies full coordination.

This model includes a system of equations each equation presents a macroeconomic aspect that influence GDP as follows:

- Trade competitiveness between EMU countries.
- Real interest rate (calculated as difference between the output price and inflation)
- Foreign output.
- Domestic fiscal deficit.

In addition, for the numerical simulation to analyse several coalitions, (Afonso et al., 2019) used a differential game approach where the parameters of the model were chosen from similar papers, while the weights of the player's objective function was assumed.

Results:

The main findings revealed that:

- When countries are asymmetric, the non-cooperative scenario between monetary and fiscal policies is the most reliable (Nash Equilibrium).
- The macroeconomic adjustments are highly sensitive to the structural model's parameters.

3. <u>Monetary-fiscal policy interaction through dynamic stochastic general equilibrium model (DSGE):</u>

3.1. DSGE literature review in Non-oil countries:

Paper 01: Fiscal and Monetary Policy Interactions in a New Keynesian Model with Liquidity Constraints

The objective:

(Van Aarle, Engwerda, & Plasmans, 2002) construct a new -Keynesian framework in order to examine the interaction between monetary and fiscal policies in the united States and to capture their effects on the economy.

Data and methodology:

(Van Aarle et al., 2002) utilise a New Keynesian dynamic general equilibrium model based on sticky prices and liquidity constrains. This model includes different agents; households and

firms, where they derived the IS (forward-looking NK IS curve) and the New Keynesian Philips curve in addition to the monetary and fiscal authorities. in order to estimate the model, they used Quarterly data for the US economy from 1970Q1 to 2001Q2 for the following variables: Government consumption (total spending minus interest payments and transfers), payroll taxes, public transfers excluding personal taxes. Accordingly, the model was estimated using Generalised Model of Moments (GMM) approach.

Results:

According to (Van Aarle et al., 2002) results show that:

- Forward-looking monetary policy rules are more efficient when combining with taxes (both payroll and personal taxes) as a fiscal policy instrument.
- Payroll taxes are more effective than any other fiscal tool in stabilising the economy.
- Results confirms the significant role regarding the behaviour of the rule-of-thumb (non-Ricardian) consumers.
- Fiscal policy is a leader policy where monetary policy needs to readjust its behaviour in response to the changes in fiscal policy.

Paper 02: The interaction between monetary and fiscal policies in Turkey: An estimated New Keynesian DSGE model:

(A. Muscatelli, Tirelli, & Trecroci, 2006) through this paper assessed a framework for the Turkish economy where he highlighted the interaction between monetary and fiscal policies.

The objective:

The aim of this study is to investigate the relationships and interactions between monetary and fiscal policies in a New Keynesian small open economy in the post-crisis period in Turkey.

Data and methodology:

(A. Muscatelli et al., 2006) expanded a standard small-scale NK open economy of Lubik and Schorfheid (2007) where he included the government sector. DSGE Features characterised in this paper are: Calvo price rule for nominal rigidities, a complete international asset market, perfect exchange rate pass-through and discretionary taxation.

In order to calibrate the model, non-standard parameters were calculated using a GMM approach, while for the DSGE estimation, **(A. Muscatelli et al., 2006)** implement a Bayesian estimation technique using quarterly data for the Turkish economy over the period 2002Q1 to

2009Q3 for macroeconomic variables : real GDP, GDP deflator, government spending (ratio to GDP), taxes ratio to GDP, real interest rate (interbank money market interest rate) and inflation.

Results:

According to **(Çebi, 2012)** ,results indicate that:

- Monetary policy does not respond as strongly to the output gap as it does to inflation.
- The degree of interest rate sensitivity is high.
- No evidence exists for fiscal stabilisation of output gap, but it contributes to debt stabilisation with both government spending and taxes.

Paper 03: Monetary and Fiscal policy Interactions in an Emerging Open Economy: a Non-Ricardian DSGE approach:

(Çebi, 2012) This study focuses on the interaction between monetary and fiscal policy which has been a growing literature since the 2008 crisis given the global rise in government debt.

The objective:

This paper aims to develop a macroeconomic model for the interaction between monetary and fiscal policies in an emerging open economy that considers its structural particularities.

Data and methodology:

In order to achieve the study's object, **(Çebi, 2012)** developed a dynamic stochastic general equilibrium model DSGE constructed of two types of households, look forward and rule of thumb households, firms, fiscal policy through taxes rule, and monetary authority using interest rale and exchange rate instruments, while presenting the foreign sector with three equations. for the calibration, the study used a quarterly data from 1995Q1 to 2011Q3 for the Hungarian economy.

Results:

This paper introduces a novel theme of an evolving open economy that has gathered results of a debt based DSGE model.

- Public spending is inflationary, but expenditure is not.
- The exchange rate is not determined by the interest rate, but by the foreign debt level to finance investments.

- The impact of exchange rate to inflation is important, though interest raise can also increase inflation.
- The emerging countries may prefer public investment over public consumption. and be careful with interest rate policy as it rises inflation. **(Çebi, 2012).**

Paper 04: Fiscal and Monetary Policy Interactions in Pakistan Using a Dynamic Stochastic General Equilibrium Framework:

(Aliya Algozhina, 2012), in this study, investigated the interaction between monetary and fiscal policy in Pakistan during stressed economy.

The objective:

The study's goal was derived from the unsatisfactory economic and financial situation in Pakistan, where they examined the efficiency of monetary and fiscal policies and its interactions one to another and to the macroeconomic variables as well.

Data ana methodology:

This paper adopts a small-scale open economy DSGE model, where **(Aliya Algozhina, 2012)** presented the economy of Pakistan through several sectors: Ricardian households, firms behaviour and price setting according to the Calvo rule, monetary policy rule presented by interest rate Taylor rule based on inflation and output gap, and the government sector by considering the response of fiscal policy rule to the economic activity. To calibrate the model.

Results:

The findings demonstrate several points which are:

- Fiscal and monetary policies interact and respond to each other in response to several macroeconomic shocks.
- Fiscal policy rule is affected with monetary policy authority.
- Inflation responds to both monetary and fiscal policies shocks.

Paper 05: Monetary and fiscal policy interactions in Thailand

(Aliya Algozhina, 2012) through this paper examines the interaction between monetary and fiscal policies in Thailand.

The objective:

The aim of this study is to investigate monetary and fiscal policies mechanisms in addition to its combination and interactions in Thailand.

Data and methodology:

(Shahid, Qayyum, & Shahid Malik, 2016) used the information from a New Keynesian DSGE model for a small open economy as an input to build a Structural vector autoregressive error correction model based with its identifications and restrictions. This model is characterised with an imperfect international asset market and a dictionary tax. For the estimation, (Shahid et al., 2016) used quarterly data for the Thai economy from 1993Q1 to 2013Q for the following variable: Real foreign interest rate, Government spending, Tax revenues, GDP, Government debt ratio to GDP, real gross national spending, interest rate and CPI inflation.

Results:

Main findings are represented as follows:

- GDP in Thailand is positively affected in response to positive and negative shock in fiscal policy through both public consumption and taxes respectively.
- A strong evidence to the relation between monetary and fiscal policies where fiscal policies mitigate monetary policy shock on output.
- Monetary policy also counters the effect of fiscal policy shock when implementing both instruments.
- Fiscal policy is effective in promoting economic development.
- Monetary policy is effective in targeting inflation.
- Fiscal solvency allows policy makers to better control economic fluctuation.

Paper 06: Monetary-fiscal policies interactions and optimal rules in Egypt

This paper is developed by **(Chucherd, 2013)** where they presented a DSGE framework to analyse the interaction between monetary and fiscal policies Egypt.

The objective:

The aim of this study is to evaluate the interaction between monetary and fiscal policies in Egypt and to investigate their effect of economic stability.

Data and methodology:

In order to analyse the role of fiscal and monetary policies in stabilizing the Egyptian economy while also evaluating policies' interactions, (Chucherd, 2013) build this paper on Lubik and Schorfheide (2007)'s stylized small open economy DSGE model, by formally integrating fiscal policy actions into the modelling framework. The model is based on micro-foundations for four agents: households, firms, central banks (monetary authority) and government (fiscal policy). In addition, it is characterized with New Keynesian features such as; monopolistic competition, sticky prices according to the Calvo rule while monetary and fiscal policies reactions follow Taylor rule and optimum simple rules. Finally, the model is calibrated and estimated based on a Bayesian estimation using quarterly data 2005Q1 to 2016Q4 for the following variables: CPI inflation, GDP, the growth of nominal exchange rate, Government spending ratio to GDP, Taxes income ratio to GDP, Trade growth, interbank policy rate.

Results:

According to (**Chucherd, 2013**), findings revealed that:

- Monetary policy through interest rate instrument and fiscal policy instruments government expenditure, and taxes; contribute to economic stability by controlling inflation, production, and debt stock in Egypt.
- The monetary policy Taylor rule estimation indicate that the central bank in Egypt prioritizes anti-inflationary policy and (to a lesser extent) production targeting, but reacts only weakly to nominal exchange rate fluctuations.
- Interest rate smoothing has a huge impact on the central bank's decisions, rendering its strategy blatantly transparent and predictable.

Paper 07: The macroeconomic effects of monetary policy shocks under

fiscal constrained: An analysis using a DSGE model.

(**Al-shawarby & El Mossallamy, 2019b**) examines three specific contributions to the literature; the relationship between monetary and fiscal policies in Brazil; the possibility of adopting US fiscal rule by the Brazilian government and its effect on household's sector.

The objective:

The aim of this paper is to investigate the macroeconomic effects of a monetary policy shock under fiscal policy constraints, and to assess the effects of fiscal policy in the stabilization of debt.

Data and methodology:

In order to achieve the study's purposes, (Al-shawarby & El Mossallamy, 2019b) constructed a Neo Keynesian dynamic stochastic general equilibrium DSGE model for Brazilian economy. The model includes two types of households; Ricardian and non-Ricardian households, and monetary and fiscal authorities. in addition, fiscal policy is based on a restriction on public spending presenting fiscal austerity and its macroeconomic effects on the macroeconomic variables as proposed by EA 95/2016 -US legislation-. Some variables in the estimation process are standard and were kept fixed while others were estimated, accordingly, the DSGE model adopted is calibrated and estimated using Bayesian technics and depending on quarterly data 2003Q1 to 2018Q4 for three variables: the real gross domestic product (real GDP), household consumption and nominal interest rate.

Results:

Main results achieved by **(Al-shawarby & El Mossallamy, 2019b)** is summarised as follows:

- In order to achieve greater economic stability, Policy-makers must not implement any fiscal rules that restrict welfare when the welfare of the poor is being restrained.
- The results indicates that alternative rule, a more restrictive fiscal policy would be more stable in terms of public debt after interest rate shocks, and thus result in a decrease in the interaction between fiscal policy and monetary policy, making fiscal policy less vulnerable to rate increases.
- Policy makers face a trade-off between fiscal policy and household welfare.

Paper 08: Monetary-fiscal policy interaction and fiscal inflation: A Tale of three countries

The objective:

(de Jesus, da Nóbrega Besarria, & Maia, 2020) through this paper try to study the interaction between monetary and fiscal policies in three different countries and their effect on each economy under study.

Data and methodology:

This study presents a monetary-fiscal framework for three countries, united states, Germany and Italy. And in order to investigate the impact of fiscal-monetary combination based on the low-frequency relation between inflation and fiscal stance. To do so, (de Jesus et al., 2020) processed two-steps empirical evidence:

      i.   First a simple regression was run using a time varying VAR.

     ii.   A new Keynesian DSGE model that allows to include the low-frequency characteristics for the relation between monetary and fiscal policies.

The estimation was based on a quarterly data from 1876Q1 to 2011 for the United states and from 1961Q1 to 1998Q4 for both Italy and Germany for the following variables: Nominal interest rate, Inflation, GDP growth, primary deficits over debt, Money growth.

Results:

(de Jesus et al., 2020) found that:

- Findings from TV-VAR revealed that there is a weak low-frequency relationship between inflation and fiscal stance when fiscal policy is responsible and during the independence of monetary authority (central bank) while it is more prominent when there is a high budget deficit.
- Results from the NK DSGE model showed that the interaction between fiscal and monetary policy and the changes in propagation of shocks can account for the switch in the low-frequency relation between inflation and fiscal stance.

Paper 09: Monetary and fiscal policy interactions in a New Keynesian model with capital accumulation and non-Ricardian consumers:

(**Kliem, Kriwoluzky, & Sarferaz, 2016**) through this paper use NK DSGE model to capture the interaction between fiscal and monetary policy through a simple fiscal-monetary policy framework where fiscal policy is considered non-neutral.

The objective:

The aim of this study is to investigate the monetary-fiscal policies interactions and to examine the dynamics of the equilibrium when in a non-Ricardian framework.

Data and methodology:

(Kliem et al., 2016) build this study on a New Keynesian DSGE model developed based on the model of Blanchard (1985) and include capital accumulation and the dynamics of public fiscal debt. It includes: Ricardian and Non- Ricardian households, two types of firms intermediate and final goods producers, government and monetary authority.

Results:

Main results are summarized as follows:

- When fiscal policy is not neutral, fiscal and monetary characteristics of stabilization are dependent on the public debt target-level regime.
- The degree of fiscal discipline decreases (increases) in the low (high) debt regime when monetary policy is more active.
- Findings stressed the importance of the explicit reference to public debt in order to infer where the monetary and fiscal policy should be effective in assuring economy equilibrium.

3.2. Literature review for DSGE in oil countries:

Paper 01: Fiscal stress and monetary policy stance in oil-exporting countries

This paper was developed by **(Kliem et al., 2016)** in order to investigate the connection between oil prices fluctuations and exchange rate and fiscal stress.

Data and methodology:

This study adopts a New Keynesian small open economy model with oil as government revenue consisted of the production sector (oil and non-oil producers' sectors), exporters, capital producer, households, monetary authority and fiscal policy. To calibrate the model, (Leith & von Thadden, 2006) used quarterly data on Russia from 2003Q1 to 2016Q4. Including several variables which are: investment, oil price and output, domestic and foreign interest rates, inflation rate, wage rate, exchange rate, government deficit and GDP.

Results:

The main results in (Leith & von Thadden, 2006) revealed that:

- The combination between monetary and fiscal policies active and passive regimes is fluctuating during the study's period.

- The sudden drop in price of oil leads to fiscal crisis that hinders the fiscal policy from cushioning public debt.
- Monetary policy is able to adjust inflation and currency devaluation in order to support government debt.
- Active monetary policy is effective in targeting inflation and influencing exchange rate.
- Fiscal policy is effective in controlling debt accumulation.
- The connection between exchange rates and oil prices is negative during times of oil price decline.
- The transmission channels of oil price shocks are greatly different between import and non-import regimes.
- The shocks in the energy sector varies according to different policy regimes.

Paper 02: Optimal Monetary and Fiscal Policies for a Non-Inflationary Exit from Stagnation in Iran: A DSGE Approach:

This paper was assessed by (**Jin & Xiong, 2021**), where they have built a new Keynesian small open economy for Iran.

The objective:

The aim of this paper is to investigate the optimality of both monetary and fiscal policies and their role in overcoming the economic stagnation in Iran on a non-inflationary exit in order to deal with macroeconomic uncertainty and control the level of inflation.

Data and methodology:

To achieve the goal of the study (Jin & Xiong, 2021) adopted a New Keynesian DSGE model for a small open economy with oil as Iran is a major oil producer. The model includes households, final and intermediate firms with oil as a production factor in addition to monetary and fiscal policies. Parameters was derived from different previous studies related to small open economies and resource rich economies. Accordingly, this model was calibrated and estimated using Bayesian estimation technics and seasonal data for Iranian economy from 1989 to 2016 taking into account seven observable variables which are: public spending, taxes, CPI, monetary base M1, investment, consumption and capital.

Results:

According to (Jin & Xiong, 2021) the simulation findings revealed is summarised as follows:

- When the central bank adopts an expansionary monetary policy in order to support GDP, Inflation rises.
- An expansionary fiscal policy through tax cuts instruments influences aggregate demand (GDP) and boost households' income and prevent the rise in prices as it brings a decrease in MC of firms.
- Optimal fiscal policy through taxes cuts is effective in exiting the economic stagnation in Iran in a noninflationary way but only when it is combined by the monetary authority's optimal behaviour.

Paper 03: Optimal Monetary Policy Rule and Cyclicality of Fiscal Policy in a Developing Oil Economy:

(Rousta, Hadian, Samadi, & Rostamzadeh, 2020) through this paper models monetary policy and the countercyclical fiscal stimulus for an oil dependent economy to determine an optimal tool to deal with economic fluctuations using a New Keynesian DSGE model.

The objective:

The aim of this study is to investigate the fiscal-monetary policy mix from an oil exporting country view and to analyse the optimal monetary policy taking into account two instruments -interest rate and foreign exchange rate- in association with cyclical fiscal policy tools – public spending and public investment-.

Data and methodology:

This study adopts a New Keynesian dynamic stochastic general equilibrium (NK-DSGE) model consisted of five sectors: Ricardian and Non-Ricardian households, oil and non-oil production firms, monetary and fiscal authorities, and a foreign sector representing the rest of the world. The model's calibration used quarterly data from 1995Q1 to 2012Q2 for Kazakhstan including: private and public consumption, fixed capital, inflation rate CPI, real GDP, Real exchange rate (USD), oil production, international oil brent price, FDI, public capital, government spending, public debt, government budget's oil revenues. The model captures a number of structural specifics, including those related to monetary policy and budget spending.**(Rousta et al., 2020)**.

Results:

Based on this research, (Rousta et al., 2020) found three important findings that emerged:

- The combination of the fiscal policy is expansionary and the monetary policy is semi-discretionary spending rule.
- The ability of fiscal policy to lead economic activity out of a recession is not without fiscal multiplier consequences.
- Monetary policy has a direct impact on interest rate and economic output during under an oil shock.
- The aggregate output can be affected by a combination of an appropriate domestic policies by a small open economy.

Paper 04: The Macroeconomic Effects of Natural Resource Extraction: Applications to Papua New Guinea

This paper determines the effect of natural resource sector prices shock on monetary and fiscal policy and how will both policies react to.

The objective:

(Aliya Algozhina, 2015) aims to investigate the effects of monetary and fiscal policies in addition to the effects substantial liquified natural gas (LNG) revenues on the economy of Papua New Guinea.

Data and methodology:

This paper adopts a New Keynesian small open economy DSGE model for the Papua New Guinea with natural resource sector and run a suite of policy simulations., the model's framework contains several sectors: households (Ricardian and non-Ricardian), firms in the tradable sector, non-tradable sector and natural resources, monetary authority following a Taylor rule, and fiscal policy. For calibration, **(Aliya Algozhina, 2015)** used standard parameters and others from the paper of Berg et al. (2010) which were divided into three categories: technology, preference parameters and steady-state values.

Results:

We can summarize the findings according to (Aliya Algozhina, 2015) study as follows:

- The macroeconomic effects from a resource boom are mostly linked to the impacts of Dutch Disease presented by a fall in tradable sector which is caused largely from the public spending related to the non-tradable sector.
- Monetary policy cannot undo the effect of tax policy without penalty or costs.

- Savings by the public sector sector will crowd out private sector investment.
- Despite depreciation of the local currency, the central bank cannot correct such damages without causing damage to the private sector. It has the best means of dealing with macroeconomic volatility and maintaining a stable fiscal regime (Basu, Gottschalk, Schule, Vellodi, & Yang, 2013).

Paper 05: Fiscal and monetary policy interactions: a simulation-based analyses of two country: new Keynesian DSGE model with heterogeneous households

(Jorge & Carvallho, 2009) through this paper, investigated the interactions between monetary and fiscal policy.

The objective:

The aim of this paper is to model a fiscal policy that pursues primary balance targets to stabilize the debt to-GDP ratio in an open and heterogeneous economy where firms combine public and private capital to produce their goods. The domestic economy is also assumed to follow a forward looking Taylor rule consistent with inflation targeting regime

Data and methodology:

The authors calibrate a DSGE model for Brazil to analyse some implication of monetary and fiscal policy interaction.

In this model ,there are two economies of different sizes that interact in both goods and financial markets except for monetary and fiscal policy each economic ,each economy is composed of households firms and the government which comprises a monetary authority that stes:

- nominal intrest rates and issues money ,

- fiscal authority that levies taxes on most economic activate and adjust its consumption expenditures.

Results:

According to (**Jorge, M. V., & Carvallho, F. 2009)** The main results revealed the simulations show an important endogenous interaction of monetary policy conditions with fiscal policy responses.

Expansionist primary surplus shocks can boost economic activity with significant implications to inflation.

Fiscal transfer shocks aimed at redistributing income, negatively affect general economic conditions as consequence of the fiscal rule.

Paper 06: Monetary-Fiscal policy interaction and indeterminacy in past war US Data

The objective:

(**Bhattarai · 2012)** The of this study is to answer three questions:

What monetary and fiscal policy regimes characterized post-war US data?

Was equilibrium indeterminacy a feature of the economy before paul volcher's chairmanship at the federal reserve?

What were the effects of shifts in monetary and fiscal policy on the aggregate economy.

Data and methodology:

(**Bhattarai, 2012**) utilise a New Keynesian dynamic general equilibrium model based on sticky prices and liquidity constrains. This model includes different agents; households and firms, where they derived the IS (forward-looking NK IS curve) and the New Keynesian Philips curve in addition to the monetary and fiscal authorities. in order to estimate the model, they used Quarterly data for the US economy from 1970Q1 to 2001Q2 for the following variables: Government consumption (total spending minus interest payments and transfers), payroll taxes, public transfers excluding personal taxes. Accordingly, the model was estimated using Generalised Model of Moments (GMM) approach. The system of linearized equations is solved for its state space representation

Results:

According to (**Bhattarai, 2012)** results show that:

- A passive monetary and fiscal policy regime charectirized the economy,since both policies were passive pre-volcker
- The effects of monetary and fiscal policy Shifts on the aggregate economy were substantially different in the two time periods.
- The response of the economy was similar to that predicted by the fiscal theory of the price level .

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- Shifts in fiscal policy influence and output under fiscal theory of price level

Paper 07: strategic monetary and fiscal policy interactions :An empirical investigation:

(Frogetta, 2010) in his study focuses on the interaction between monetary and fiscal policy

The objective:

This paper aims of this study is to identify monetary fiscal policy interaction in three countries: UK US and Sweden using a small scale structural general equilibrium model of an open economy and estimate by using Bayesian methods.

Data and methodology:

In order to achieve the study's object, **(M.Frogetta 2010)** developed a dynamic stochastic general equilibrium model DSGE constructed of households, by a unit-continum of monopolistically competitive firms and by two policy markets : the government and the central banks, and monetary authority using interest rale and exchange rate instruments, while presenting the foreign sector with three equations. for the calibration, the study used a quarterly data from 1995Q1 to 2011Q3 for the Hungarian economy.

Results:

This paper introduces a novel theme of an evolving open economy that has gathered results of a debt based DSGE model.

- Monetary and fiscal authorities act in a non-cooprative manner under a regime of fiscal leadership.

- The Fed in US explicity does not take into account the fiscal stance when making decisions

- Monetary and fiscal authorities in US operate under a nash regime or they may act non-strategically

- the model of fiscal leadership gives the best fit for the UK and Sweden

Paper 08: Monetary and Fiscal Policy Interactions and fiscal stimulus:

(Algozhina, 2012), in this study, investigated the interaction between monetary and fiscal policy by using DSGE-Markov switching.

The objective:

The aim of this paper is to estimate MARKOV Switching rules for US monetary and fiscal policy into a conventional calibrated DSGE model with nominal rigidities to deliver some quantitative predictions of the impacts of government spending increases.

This study also stimulates the general equilibrium impacts of the government spending path implied by 2009 American Recovery and reinvestment act.

Data and methodology:

The fiscal policy variables used in this paper to estimate the stwtching fiscal rule are defined as follow:

- Federal receipts-Federal transfer.
- Market value of privethy held gross federal debt.
- Nominal GDP/nominal CBO potential GDP
- Nominal federal government consumption expenditures and gross investment.

Results:

Monetary and fiscal policies fluctuate between active and passive inductive behaviour.

Government spending generate positive spending multipliers in some policy regimes.

The paper reports the model's predictions of the macro economic impact of the American recovery and reinvestment act has implied path for government spending under alternative monetary-fiscal combination.

Paper 09: Fiscal and Monetary Policy Interactions :Empirical evidence and optimal policy using structural new Keynesian model:

(**Algozhina, 2012**), in this study, investigated the interaction of monetary and fiscal policies using an estimated New-Keynesian dynamic general equilibrium model for the US

The objective:

The main contribution of this paper has been to provide a structural econometric interpretation to the macroeconomic interactions between fiscal and monetary policies. they have estimated a New-Keynesian model of inflation and output jointly with monetary and fiscal rules using data from the US, to provide some understanding of

the way in which different macroeconomic policy instruments interact over the business cycle. **Data and methodology:**

This paper adopts a new Keynesian DSGE model, where **(Muscatelli, V. A 2004)** comprising a dynamic IS model for output and a new kynesian philips curve specification for inflation .Structure of the model is as follow:

- a new Keynesian structural model
- monetary and fiscal rules
- estimation using GMM

In order to achieve the study's object, **(Muscatelli, V. A 2004)** developed a dynamic stochastic general equilibrium model DSGE ,comprising a dynamic IS model for output and a new Keynesian Philips curve specification for inflation , the study used a data from 1970 to 2001 for the US economy.

Results:

The findings demonstrate several points which are:

- The strategic complementary or substitutability of fiscal and monetary policy depends crucially on the types of shocks hitting the economy and on the assumptions made about the underlying structural model.
- The countercyclical fiscal policy can be welfare-reducing if fiscal and monetary fiscal policy rules are inertial and not co-ordinated

Paper 10: The impact of Fiscal Monetary policy Interactions on government size and macroeconomic performance:

The objective:

(Cuciniello, 2009) The aim of study is to analyse the relationship between inflation ,output and government size by examining the time inconsistency of optimal monetary and fiscal policies in a general equilibrium model with staggered timing structure for the acquisition of nominal money,and public expenditure financed by means of a distortive tax.

Data and methodology:

In order to achieve the study's object, **(Çebi, 2012)** developed a dynamic stochastic general equilibrium model DSGE constructed of two types of households, look forward and rule of thumb households, firms, fiscal policy through taxes rule, and monetary authority using

interest rale and exchange rate instruments, while presenting the foreign sector with three equations. for the calibration, the study used a quarterly data from 1995Q1 to 2011Q3 for the Hungarian economy.

Results:

This paper introduces a novel theme of an evolving open economy that has gathered results of a debt based DSGE model.

- Public spending is inflationary, but expenditure is not.
- The exchange rate is not determined by the interest rate, but by the foreign debt level to finance investments.
- The impact of exchange rate to inflation is important, though interest raise can also increase inflation.
- The emerging countries may prefer public investment over public consumption. and be careful with interest rate policy as it rises inflation. **(Çebi, 2012).**

Concluding remarks:

The subject matter of this thesis is to explore the conduct of monetary policy, and the way that it can be influenced by the fiscal stance. The investigation concerns both monetary and fiscal policy interactions and its international spill-overs in Algeria as a resource rich country.

To do so, this conceptual Chapter attempts to provide an insight into relevant literature that treats that policy mix in different economies and using different tools, this is done to establish a theoretical background and basis for the empirical chapter.

The analysis of the literature on the interaction between monetary and fiscal policies reveals that alternative macroeconomic policy coordination may yield different policy outcomes with regard to the nature of the country's economy. An active monetary policy and a passive fiscal policy can be described in the form of aggressive response of monetary policy to current inflation while fiscal policy adjusts taxes sufficiently in response to government debt. This combination produces the conventional outcome that inflation is always a monetary phenomenon while tax policy ensures sustainability of government debt. In the case of an active fiscal policy and a passive monetary policy, both prices and money growth will increase while the monetary authority is forced to accommodate this shock.

Based on the above, and to the best of our knowledge, this thesis is the first attempt to provide a DSGE analysis for the interaction between monetary and fiscal policy in Algeria, which will a gap this paper intends to fill.

Chapter 03

Empirical analysis

Monetary-fiscal policy interactions in an oil- dependent country: Some Insights from an Estimated DSGE Model for the Algerian Economy

1. DSGE background:

DSGE refers to "Dynamic Stochastic General equilibrium"[70], three characteristics which allow the modelling of different macroeconomic behaviour stated in **(Basu et al., 2013)** such as:

i.   The micro-foundations of firms, consumers and intermediate financial cores.

ii.   An imperfectly competitive economy where nominal rigidity, monopolistic, information problems and many other distortions are added.

iii.   The model is a system of equations which and contrary to previous macroeconomic models DSGE is estimated as a whole system and not as equations.

In addition, The model for an economy without any distortions is called RBC; Real Business Cycle model, which was the earliest DSGE model developed by (Basu et al., 2013) where he mainly focused on the productivity shocks effects. However, after including larger set of distortions and shocks in an RBC-DSGE model on which a number of Keynesian features, another range of DSGE model is introduced for policy analysis called New Keynesian DSGE model. **(Basu et al., 2013)**.

1.1.   The evolution of the Real business cycle models:

Real Business Cycle models was born and developed by **Kydland and Prescott (1982)** and **Prescott (1986)** in order to describes the behaviour of two types of agent: households and firm and to show how can households solve two main choice's problems which are: intertemporal consumption-savings and intertemporal consumption-leisure and how an optimal choice occurs **(Blanchard, 2018)**. It was also built on the hypothesis that there are large fluctuations in the technology progress and does not include monetary, fiscal policies or market failure when describing the aggregate fluctuation in business cycle. Where the key implication of RBC model is the monetary policy neutrality.(Blanchard, 2018; Prescott, 1986)

Real business theory establishes the efficiency of business cycles by explaining that in an environment characterized by **perfect competition and frictionless markets (flexible wages and prices)** observed fluctuations could be interpreted as an equilibrium outcome resulting from the economy's response to exogenous variations in real forces. **(Junior,**

2016). Moreover, only under a constant interest that "Optimal" fluctuations may exist for RBC theory. This implies that there will not be any need for stabilization policies.

These views are conflicting with Keynes' where the stabilization policies are desirable during recessions periods because there is misallocation of resources, and they can be ended by means of economic policies aimed at expanding aggregate demand. One can get "realistic" fluctuations in output and prices by assuming that prices and wages are fully flexible **(Gazda, 2010)**.

1.2. The revolution of the New Keynesian DSGE models

New Keynesian DSGE models (which are based on the new Keynesian school) has proved to be promising for two reasons:

- Being a model that gives all details of an economy which can generate the kind of wedges which we see in primitive, interpretable shocks, in macro-bases.
- Being sufficient micro-bases for structural shocks as well as for its parameters because it can be reasonably argued that they remain incompatible with monetary shocks **(Jordi Galí, 2015).**

In addition the NK models are considered as an extension to the RBC model what leads to the existence of few similarities although the conflicting policy implications between both models. The NK DSGE models embraces the concept that economies are vulnerable to market failures **(Jordi Galí, 2015)**.

In addition **(Plosser, 1989)**, summarised in his book the New Keynesian features which represents different distortions that oppose the RBC model which are:

- **Monopolistic competition:** to maximize their utility and objectives, private economic agents (firms and households) are able to set prices and/or wages.
- **Nominal rigidities:** there is some constraints imposed on firms which allows ro adjust the prices of goods sold (sticky prices), same concept can be applied by workers where they can adjust their waged (sticky wages)
- **Non-neutrality of monetary policy in short-term**: as a result to the nominal rigidities, short-run interest rate will change (whether due to the changes in the money supply or assessed directly by the central bank).

2. Review of Literature on Forecasting with DSGE Models:

Lately, the Dynamic Stochastic General Equilibrium DSGE models are being used by central banks for both, policy analysis and forecasting. As stated in **(Costa, 2018),** these models are commonly micro founded and structured where each equation has an economic interpretation, derived from the optimization of agents' (consumers and firms) behaviour, and institutions (fiscal and monetary) modelling in addition to some policy rules, such as the Taylor rule. The individual actions in DSGE models are summarized by decision rules which often come from dynamic stochastic optimizations problems.

At present, there are two schools of DSGE modelling:

- The neoclassical theory of growth -Real business cycle (RBC)- founded by **(Jordi Galí, 2015)** which is based on analysis of microeconomic agents that optimize their behaviour under flexible prices
- New Keynesian DSGE models (NK) build on integrating nominal rigidities (price/wage stickiness) in the RBC models. T
- his framework was introduced by **(Chari, Kehoe, & McGrattan, 2009).**
- New Keynesian Synthesis (NKS) models presented by **(Breuss, 2018)**and **(Kydland & Prescott, 1982)** introduced a framework mixing RBC features with nominal and real rigidities.

Thus, the application of DSGE models for estimation and forecasting was not exclusive for international institutions (European Commission, IMF, ECB) and central banks[71], but it is also widely applied in academic research. Therefore, we must highlight some famous works designed for policy analysis and forecasting such as : **(Goodfriend & King, 1997)** developed a DSGE model to describe the business cycle in Chile, **(Clarida, Gali, & Gertler, 1999)** set forth a DSGE model for Switzerland, **(Smets, Christoffel, Coenen, Motto, & Rostagno, 2010)** estimated a DSGE model of the Euro Area, and **(Medina & Soto, 2016)** presented a DSGE model for the Canadian economy. These studies are amongst others for different central banks of the Czech Republic, New Zealand, France, etc.

A second stand focuses on an extensive literature on the coordination between macroeconomic policies and examining the monetary and fiscal policy mix where DSGE models have been developed and evaluated in this field. **(Cuche-Curti, Dellas, & Natal,**

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[71] For more on the role and the importance of DSGE models read (Rotemberg & Woodford, 1997).

2009), (Smets & Wouters, 2003), (A Dib, 2001) and (V. A. Muscatelli, Tirelli, & Trecroci, 2004) adopted a New Keynesian small open economy DSGE model to assess monetary and fiscal policy interaction for US, Brazil, Turkey and Egypt respectively.

Even so, only a few studies have adopted a DSGE model for the Algerian economy. Such as (da Silva Ornellas, 2011) who developed a multi-sector New Keynesian DSGE model to evaluate the real dynamic effect of the euro and the increase in oil prices in Algeria. (Çebi, 2012) has also presented a multi-sector DSGE model to investigate the impact of both windfall and boom on Algeria as an oil exporting economy, in addition, (Al-shawarby & El Mossallamy, 2019a) have also examined the dynamic effects of external shocks for Algeria taking into account three alternative monetary policy rules; a fixed exchange rate rule, a headline and a core inflation targeting rules). However, none of these studies have integrated the analysis of the monetary-fiscal policies coordination that has recently become important for governments and central banks to control inflation and reduce fiscal budget issues… To overcome these limitations, and as an addition to the existing literature, the present study develops a framework in which we examine the interaction between monetary and fiscal policy in Algeria and their behaviours in response to the oil crisis and to the Dutch disease.

3. Monetary and fiscal policies reform in Algeria:

a. Monetary policy:

The monetary policy is a modern practice in the Algerian monetary system, which was the result of the Money and Credit Law in 1990 that is considered as a major monetary reform reemphasized the role of money and monetary policy- through indirect tools- in macro-financial regulation, thereby enabling a gradual shift from the "financial repression" paradigm (Ali Dib & Mazouz, 2005) . Hence, the banking reforms of 1990 had a significant impact on the Algerian banking system, where these reforms have allowed liberalizing the banking sector from the state intervention. Furthermore, the reforms have encouraged opening the banking sector to private investment to increase the competition level in the banking sector and improving the banks' performance (Benkhodja, 2014). On the other hand, the law has allowed deregulating the interest rates on deposits by removing the interest rates ceiling. Hence, ceilings on lending interest rates were substituted by limits on banking spreads, and in 1995, these limits were removed. Furthermore, the law had unified the interest rates for the public and private banks (Allegret & Benkhodja, 2015).

After the sharp decline in oil prices and after the economic downturns due to the oil crises (2014), The Algerian government has achieved many reforms. Starting 2017, Algerian authorities has adopted quantitative easing policies which involve expanding the central bank's balance sheet to purchase sovereign bonds, which should drive down long-term interest rates and increase liquidity in the banking sector.

According to the **IMF's 2018 Article IV Consultation for Algeria**, between November 2017 and June 2018 the Bank of Algeria purchased sovereign debt equivalent to 3% of GDP from 2017. A further 8.6% of GDP was made up of debt held by state-owned enterprises and the National Investment Fund, with the latter having used the loans to finance capital and infrastructure investment projects in the country. By the end of May 2018, the total amount of non-conventional financing reached AD3.6trn (€26.1bn). however, as Algeria is long dominated by the government and largely dependent on the hydrocarbons sector, it did not benefit yet from a policy framework conducive to balanced, dynamic, private- sector-driven growth, despite some progress in recent years.

b. **Fiscal policy reforms:**

After the sharp decline in oil prices in middle 2014, the Algerian authorities adopted policy of austerity, which has burden on citizens by imposing new taxes, raising fuel and electricity prices and the car voucher in order to create additional resources for the state budget and compensate for the decline in state revenues due to the collapse of fuel prices. In addition, the fiscal amendment has led to the raising of the car voucher and the value added of the dinar as well as the consumption of natural gas and electricity, which exceeds a certain limit. Algeria remains economically independent due to the accumulation of exchange reserves during the past years, but these reserves have known a continuous depletion to fall from 193 billion dollars a month May 2014 to $ 105 billion in July 2017(**Akacem, 2004; Hacini & dahou, 2018**).

At the domestic level, the situation of public finances became very concerning because the decline in oil revenues generated recurrent budget deficits resulting in the consumption of the total savings of the treasury in the FRR, which was consumed in February 2017. As a result of the rise in oil prices which exceeded $ 60 a barrel as of November 2017,

However, **(Jbili, 1997)** have stated that *"the 2018' budget included an important increase in spending, which will result in a deficit more than 6% of GDP higher than originally planned under the 2017–2019 MTBF. Capital expenditures would increase by 21.2% in nominal terms*

from 2017, including repaying arrears, and current expenditures by 6.9%, including a significant transfer to the National Social Insurance Fund. The wage bill is kept virtually flat in nominal terms. The government intends to resume consolidation in 2019, with sharp cuts in spending"

Therefore, in the preparation of the draft budget for 2016, reconcile the private financial demand for the implementation of PIP-2019 operations and the contraction of financial resources, under pressure from domestic demand, which must achieve acceptable levels of investment and consumption. The State has allocated about $ 262 billion As a public investment program which assumes an annual rate of US $ 52.4 billion, with priority given to improving the living conditions of the population in the housing, education, health, water, electricity, gas, etc. sectors. It aims to:

- Work to generate strong growth of the domestic product.

- Diversification of the economy and growth of exports outside hydrocarbons

- Creating job positions.

- Growth rate targeting with the continuation of the social policy of the government through rationalization.

- Social transfers and support for disadvantaged 0

- classes.

- Encouraging investment of the updated product of wealth.

- Promote and support knowledge-based economic activities, strong technology and institutional support.

- Modernizing economic management and combating bureaucracy and turning the decentralized nature of the resolution off in order to ensure a good public service

- Promoting public-private partnership

Public investment program in the construction sector (65 billion dollars) aimed at achieving 1.6 Million new housing units by the year 2019, and this program will be implemented in partnership between National and international companies with the integration of new technologies for construction and respect for environmental standards.

4. The model:

We consider a multi-sector New Keynesian dynamic stochastic general equilibrium model proposed by (Gali and Monacelli, 2005) inhabited by several agents: Households, producing firms namely intermediate and final goods producers, Central bank and government and the rest of the world.

To this end, we extend **Gali and Monacelli (2005**) by incorporating: an oil sector as in Ferrero and Seneca (2019), oil in domestic consumption as in Medina and Soto (2005), oil in domestic production **(Allegret and Benkhodja, 2015),** a domestic fuel pricing rule that implies an implicit subsidy regime (Allegret and Benkhodja, 2015); and an inefficient financial sector as in Smets and Wouters (2007). In addition, we allow for fiscal rules that respond to oil-related flows (**Algozhina, 2015).** In addition, following (Çebi, 2012) we introduce monetary and fiscal policy rules to capture robust empirical relationships and to estimate parameters of policy interactions.

Figure 30: a bird's eye view of the Algerian economy
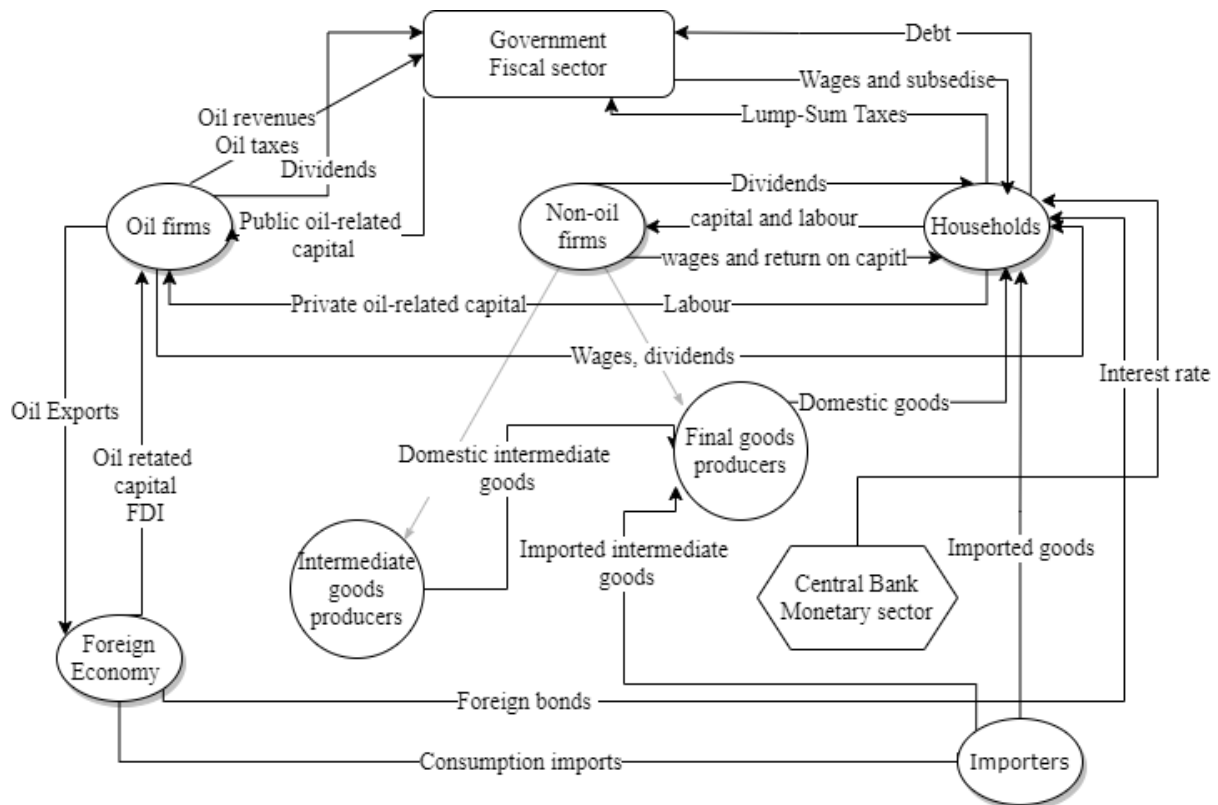
Source: constructed by the author based on the model set-up

4.1. Households:

In order to model the behaviour of the households within an oil exporting country we assume that the economy contains a continuum of two types of households normalized to $i \in [0,1]$. Each household provides labour to three major production sectors in Algeria: Government sector, oil and non-oil production sector. We will also include taxes that could affect the household's decision in order to enable government to control the demand of consumer goods and investment. For example, when government is interested in decreasing the demand for these goods, they increase the rate of this tax. In addition we have includes two more taxes that affect household's decision: tax on income from labour and tax from capital. These last are used by the government to affect decisions on the supply of production inputs (labour and capital).

4.1.1. Consumption and Consumer Price CPI:

We suppose that the utility function is strictly concave [72], where we assume that the consumption basket of a representative household is C_t a composite index determined by comprising non-oil consumption bundle, $C_{no,t}$, and oil consumption, $C_{o,t}$ defined by:

$$C_t = \left[(1 - \mu_o)^{\frac{1}{\psi_o}} (C_{no,t})^{\frac{\psi_o - 1}{\psi_o}} + \mu_o^{\frac{1}{\psi_o}} (C_{o,t})^{\frac{\psi_o - 1}{\psi_o}} \right]^{\frac{\psi_o}{\psi_o - 1}} \dots\dots\dots (1)$$

Expenditure minimization subject to equation (1), produces the demands for non-oil (core) consumption and fuel (oil) consumption as follows:

$$C_{no,t} = (1 - \mu_o) \left[\frac{P_{no,t}}{P_t} \right]^{-\psi_o} C_t \qquad\qquad C_{o,t} = \mu_o \left[\frac{P_{ro,t}}{P_t} \right]^{-\psi_o} C_t$$

Where:

ψ_o	The degree of substitution between core and fuel consumption
μ_o	The share of domestic consumption devoted to oil consumption
C_o	Oil consumption
C_{no}	Non-oil consumption bundle
P_{no}	The price of core goods
P_{ro}	The subsidized price of fuel [73]
P_t	The aggregate consumer price index

Furthermore, core consumption bundle, $C_{no,t}$ is defined as a composite index given by a constant elasticity of substitution (CES) aggregator that combines imported bundle, $C_{f,t}$, and domestically produced goods, $C_{h,t}$, as follows:

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[72] Strictly increasing in C_t and strictly increasing in L_t.

[73] The price of fuel is not simply the domestic currency price of fuel but rather a convex combination of the landing price of fuel and the domestic price of fuel in the previous period. Thus, following (Allegret and Benkhodja, 2015), $P_{ro,t}$ is determined based on a fuel pricing rule given as $P_{ro,t} = P_{ro,t-1}^{1-v} P_{lo,t}^{v}$ where the landing price of fuel, $P_{lo,t}$, is the current world price of fuel expressed in local currency.

$$C_{no,t} = \left[(1 - \mu_c)^{\frac{1}{\psi_c}} (C_{h,t})^{\frac{\psi_c - 1}{\psi_c}} + \mu_c^{\frac{1}{\psi_c}} (C_{f,t})^{\frac{\psi_c - 1}{\psi_c}} \right]^{\frac{\psi_c}{\psi_c - 1}} \quad \dots\dots\dots\dots\dots\dots\dots \text{ (2)}$$

Minimizing the household's expenditure subject to equation (2) yields the demands for $C_{h,t}$ and $C_{f,t}$ as follows:

$$C_{h,t} = (1 - \mu_c) \left[\frac{P_{h,t}}{P_{no,t}} \right]^{-\psi_c} C_{no,t},$$

$$C_{f,t} = \mu_c \left[\frac{P_{f,t}}{P_{no,t}} \right]^{-\psi_c} C_{no,t}$$

Where:

μ_c	parameter that measures the share of domestic consumption in the aggregate sourced from the rest of the world by way of non-oil imports
ψ_c	Represents the elasticity of substitution between home and foreign goods in the core consumption basket. ($\omega_c > 0$)
$P_{h,t}$	The price of domestically produced goods
$P_{f,t}$	The price of imported goods (expressed in domestic currency)
$P_{no,t}$	The core consumption price index.

The corresponding equations for the aggregate consumer price index, P_t, and core consumption price index, $P_{no,t}$, are standard as follows:

$$P_t = \left[(1 - \mu_o) P_{no,t}^{1-\psi_o} + \mu_o P_{ro,t}^{1-\psi_o} \right]^{\frac{1}{1-\psi_o}},$$

$$P_{no,t} = \left[(1 - \mu_c) P_{h,t}^{1-\psi_c} + \mu_c P_{f,t}^{1-\psi_c} \right]^{\frac{1}{1-\psi_c}}.$$

With $0 < \mu_o < 1$ and $\psi_o > 0$

4.1.2. The consumption and savings determination of Ricardian households:

The Ricardian consumers comprise a fraction, are optimisers who maximizes its expected lifetime utility over consumption and leisure, which has complete access to capital and

financial markets[74] in order to smooth consumption over time. A representative household in this category is able to smooth its consumption over time by buying and selling financial assets without any form of constraints (**Galí, 2018**).

$$E_{t=0} \, \beta_t \, U(C_t, L_t)$$

and optimizes the following welfare function:

$$\max E_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{(c_{R,t} - \phi_c c_{R,t-1})^{1-\sigma}}{1-\sigma} - \frac{L_{R,t}^{1+\varphi}}{1+\varphi} \right] \dots\dots\dots\dots\dots\dots \textbf{(3)}$$

Where δ, φ > 0 and**:**

$C_{R,t}$	Representative household's current level of consumption
$L_{R,t}$	The number of hours worked
β	Household discount factor (0 < β <1)
σ	The relative risk aversion coefficient of inter-temporal substitution of consumption
φ	The marginal disutility in respect of labour supply ($\varphi > 0$)
ϕ_c	A proportion of the previous period's consumption $\phi_c \in (0, 1)$
E_0	the mathematical expectation operator
R	superscript indicates that the household is Ricardian

While equation (3) is separable in both consumption goods and labor effort, we assume that consumption is subject to external habit formation, implying that the habit stock is proportional to aggregate past consumption. The parameter measures the degree of external habit formation in consumption[75].

The representative Ricardian household makes its inter-temporal decisions by maximizing equation (3) subject to a per period budget constraint:

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[74] Agents who wish to have a higher level of consumption today and this can only occur when they have free access to the financial market for carrying forward present income to the future income to the present

[75] It means that the consumption adjustment cost when a shock occurs that alert a household's income, these costs are measured in terms of utility. If habit formation is particularly significant in relation to a certain shock consumption will adjust very slowly overtime. (co

$$P_t(1 + \tau_t^c)(C_{R,t} + I_{no,t}^P) + \frac{B_{t+1}}{R_t^B \mu_t} + \frac{\epsilon_t B_{t+1}^*}{R_t^* \mu_t^*} = W_t L_{R,t}(1 - \tau_t^l) + R_{no} U_t K_h^P(1 - \tau_t^k)$$

$$-P_t K_h^P \left[\Psi_1(U_t - 1) + \frac{\Psi_2}{2}(U_t - 1)^2 \right] + B_t + \varepsilon_t B_t^* + \omega_R P_t TRANS_t \ldots \ldots \ldots (4)$$

With the law of motion of capital, the representative Ricardian household accumulates non-oil capital as follows:

$$K_{h,t+1}^P = (1 - \delta_h)K_{h,t}^P + I_{no}^P \left[1 - S\left(\frac{I_{no,t}^P}{I_{no,t-1}^P} \right) \right] \ldots \ldots \ldots \ldots \ldots (5)$$

Where parameter $0 < \delta_h < 1$ represents the capital depreciation rate.

On the right hand side of equation (4):

- The Ricardian consumer earns net labor income, $W_t L_{R,t}(1 - \tau_t^l)$ by supplying $L_{R,t}$ hours of work at a nominal wage rate, W_t and affected by the tax on income τ_t^l.

- The household also earns rental income $R_{no} U_t K_h^P$, by leasing an amount of non-oil capital K_h^P, to the domestic (non-oil) firms at a rental rate, R_{no} excluding the tax on capital τ_t^k.

- The household enters the period with the stock of nominal domestic bonds, B_t, and foreign bonds, B_t^*, which mature in period $t + 1$. B_{t+1} and B_{t+1}^* represent household's investments in domestic and foreign bonds at the end of period t, respectively; while the nominal exchange rate is denoted by ϵ_t.

On the left hand of the equation:

- Each domestic bond pays a gross nominal rate of return, R_t, in domestic currency while its foreign counterpart pays an exchange rate adjusted nominal rate of return, R_t^*. Where we allow for domestic risk premium, μ_t, over the monetary policy rate when households hold domestic assets as well as a stochastic disturbance term that represents the risk premium faced by households when borrowing abroad, μ_t^* **(Hollander et al., 2018; Smets and Wouters, 2007)**[76].

- On the expenditure side, the household purchases consumption goods, $C_{R,t}$,; and non-oil investment goods, $I_{no,t}$, at the cost of P_t per unit including tax on consumption (τ_t^c).

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[76] It is assumed that both μ_t and μ^* evolve as first order autoregressive processes with an exogenous shock.

The non-oil investment goods, $I_{no,t}$, comprise home-produced, $I_{h,t}$, and foreign-produced, $I_{f,t}$, which are combined as follows:

$$I_{no,t}^P = \left[(1-\gamma_i)^{\frac{1}{\psi_i}}(I_{h,t}^P)^{\frac{\psi_i-1}{\psi_i}} + \gamma_i^{\frac{1}{\psi_i}}(I_{f,t}^P)^{\frac{\psi_i-1}{\psi_i}}\right]^{\frac{\psi_i}{\psi_i-1}} \dots\dots\dots\dots\dots\dots \text{ (6)}$$

Where γ_i is the share of imports in aggregate non-investment goods and η_i is the elasticity of intra-temporal substitution between domestically produced and imported investment goods. Minimizing the representative Ricardian household's cost is subject to equation (6) yields the demand equations for home-produced and imported investment goods as follows:

$$I_{h,t}^P = \left(1-\gamma_i\right)\left[\frac{P_{h,t}}{P_{i,t}}\right]^{-\psi_i} I_{no,t}^P$$

$$I_{f,t}^P = \gamma_i \left[\frac{P_{f,t}}{P_{i,t}}\right]^{-\psi_i} I_{no,t}$$

While the aggregate investment price deflator, $P_{i,t}$, is presented as:

$$P_{i,t} = \left[(1-\gamma_i)P_{h,t}^{1-\psi_i} + \gamma_i P_{f,t}^{1-\psi_i}\right]^{\frac{1}{1-\psi_i}}$$

Finally, the investment adjustment cost function, $S\left(\frac{I_{no,t}^P}{I_{no,t-1}^P}\right)$, is defined as:

$$S\left(\frac{I_{no,t}}{I_{no,t-1}}\right) = \frac{\chi}{2}\left(\frac{I_{no,t}}{I_{no,t-1}} - 1\right)^2 \dots\dots\dots\dots\dots\dots\dots\dots \text{ (7)}$$

Where:

$\chi \geq 0$ is the sensitivity parameter governing the size of adjustment cost.

The details of the optimization problem yielding the equations for consumption Euler, demand for foreign bonds, supply of capital, and demand for investment are presented in **Appendix 1**.

4.1.3. Determination of Non-Ricardian household consumption:

In view of the fact that the non-Ricardian consumers are incapable of inter-temporal optimization, we assume that the representative consumer in that category chooses its consumption, $C_{NR,t}$, by maximizing:

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$$\max_{C_{N\pi,t}} E_t \sum_{t=0}^{\infty} \beta^t \left[\frac{(C_{NR,t} - \phi_c C_{NR,r-1})^{1-\sigma}}{1-\sigma} - \frac{L_{NR,t}^{1+\varphi}}{1+\varphi} \right] \dots\dots\dots\dots\dots \text{ (8)}$$

Subject to the budget constraint:

$$P_t(1 + \tau_t^c)C_{NR_t t} = W_t L_{NR,t}(1 - \tau_t^t) + (1 - \omega_R)P_t TRANS_t \ \dots \text{ (9)}$$

4.1.4. Labor and wage setting

Each household, *j,* supplies its differentiated labor, $L_{j,t}$, in a monopolistic market to a representative firm that aggregates the different labor types into a single labor input, L_t, using the following technology:

$$L_{j,t} = \left[\int_0^1 L_t(j)^{\frac{\psi_w - 1}{\psi_w}} dj \right]^{\frac{\psi_w}{\psi_w - 1}} \dots\dots\dots\dots\dots\dots\dots\dots \text{ (10)}$$

Where:

$L_{j,t}$ represents the amount of differentiated labor supplied by households j.

ψ_w refers to the elasticity of substitution between differentiated jobs.

To obtain the demand equation for differentiated labor L_t and the aggregate wage W_t level, the labor-aggregation firm's profit is maximized subject to equation (10), and given as:

$$L_t(j) = \left[\frac{W_t(j)}{W_t} \right]^{-\psi_w} L_t$$

$$W_t = \left[\int_0^1 W_t(j)^{1-\psi_w} dj \right]^{\frac{1}{1-\psi_w}} \dots\dots\dots\dots\dots\dots \text{ (11)}$$

The inclusion of taxes is a problem with the definition of wages; however, as there is no distinction between labor offered by Ricardian and non-Ricardian, the problem of definition of wages is singular $-x = (R, NR)$

We assume that household defining wages involves the assumption that they supply differentiated labor in a market structure of monopolistic competition. Where $(1 - \theta_w)$ is a

fraction of households chosen randomly and independently to optimally define their wages. The remaining household's fraction θ_w follow a waged stickiness[77] rule (the Calvo rule).

Each household who is able to optimally reset its wage contract evaluates the disutility of labor relative to the utility arising from its labor income. Thus, the optimal wage-setting problem involves maximizing equation (4.3) subject to the household budget constraint as well as the demand for the differentiated labor. This yields the optimal reset wage equation given by:

$$\max_{W_{j,t}^*} E_t \sum_{i=0}^{\infty} (\beta\theta_W)^i \left\{ -\frac{1}{1+\varphi}\left[L_{x,t+i}\left(\frac{W_{t+i}}{W_{j,t}^*}\right)^{\psi_w} \right]^{1+\varphi} \right.$$
$$\left. + \lambda_{x,t+i}\left[W_{j,t}^* L_{x,t+i}\left(\frac{W_{t+i}}{W_{j,t}^*}\right)^{\psi_w} (1-\tau_{t+i}^l) \right] \right\} \dots\dots\dots\dots\dots\dots\dots\dots (12)$$

Thus, the optimal wage-setting problem involves maximizing equation (3) and (8) subject to the household budget constraint as well as the demand for the differentiated labor. This yield the definition of optimal wages by the households chosen for this purpose given by:

$$W_{j,t}^* = \left(\frac{\psi_w}{\psi_w-1}\right) E_t \sum_{i=0}^{\infty} (\beta\theta_W)^i \left[\frac{L_{R,j,t+i}^{\varphi}}{\lambda_{R,t+i}(1-\tau_{t+i}^l)} \right] \dots\dots\dots\dots\dots\dots\dots\dots\dots (13)$$

Therefore,

$$W_{j,t}^* = \left(\frac{\psi_w}{\psi_w-1}\right) E_t \sum_{i=0}^{\infty} (\beta\theta_W)^i \left[\frac{L_{NR,j,t+i}^{\varphi}}{\lambda_{NR,t+i}(1-\tau_{t+i}^l)} \right] \dots\dots\dots\dots\dots\dots\dots\dots (14)$$

$$W_{j,t}^* = \left(\frac{\psi_w}{\psi_w-1}\right) E_t \sum_{i=0}^{\infty} (\beta\theta_W)^i \left[\frac{L_{x,j,t+i}^{\varphi}}{\lambda_{x,t+i}(1-\tau_{t+i}^l)} \right] \dots\dots\dots\dots\dots\dots\dots\dots (15)$$

Where

$W_{j,t}^{\bullet}$ is the optimal reset wage.

θ_W measures the degree of nominal wage rigidity.

ψ_w **is** the elasticity of substitution between differentiated labor.

Thus the aggregate nominal wage rule is therefore of the form:

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[77] wage stickiness refers to the general difficulty that a firm faces when trying to reduce wages, owing to either labour agreements or fear of a fall in the productivity of employees or another reason that conveys the same idea **(Costa, 2016)**

$$W_t = \left[\theta_w W_{t-1}^{1-\psi_w} + (1-\theta_w)\dot{W}_t^{1-\psi_w}\right]^{\frac{1}{1-\psi_w}} \dots\dots\dots\dots (16)$$

Finally, we aggregate consumption, C_t, and labour, L_t, for both the Ricardian and non-Ricardian households as follows:

$$\begin{aligned} C_t &= \omega_R C_{R,t} + (1-\omega_R)C_{NR,t} \\ L_t &= \omega_R L_{R,t} + (1-\omega_R)L_{NR,t} \end{aligned} \quad \textbf{(17)}$$

4.2. Firms:

Consumers do not face an infinite number of consuming possibilities literally, but they may purchase a large variety of goods that differ in size, colour and size, etc. in this kind of model "many" is treated as "infinite" for mathematical convenience. As a New Keynesian economy, the producing sector is divided into two parts: the wholesale firms which produce intermediate goods and retail firms for final goods production[78] in addition to the foreign goods importing firms and the oil-producing firm. The economic environments in which each of these firms operate are discussed next.

4.2.1. Non-oil firms that produce final goods:

Depending on the study of **(Omotosho, 2021)** we assume that the Algerian firms which produce final goods are perfectly competitive, $Y_{h,t}$, by bundling domestically produced differentiated goods, $Y_{h,t}(g_h)$, using a constant returns to scale aggregation technology given by:

$$Y_{h,t} = \left[\int_0^1 Y_{h,t}(g_h)^{\frac{\vartheta_h-1}{\vartheta_h}} dg_h\right]^{\frac{\vartheta_h}{\vartheta_h-1}} \dots\dots\dots\dots\dots\dots\dots (18)$$

Where: $\boldsymbol{\vartheta}_h$ represents a parameter of the elasticity of substitution among different intermediate goods. ($\boldsymbol{\vartheta}_h > 1$)

A standard down ward sloping demand function for intermediate inputs, $Y_{h,t}(g_h)$, as well as the corresponding domestic price aggregator, $P_{h,t}$, is obtained by optimizing the firm's problem, given as follows:

$$Y_{h,t}(z_h) = \left[\frac{P_{h,t}(g_h)}{P_{h,t}}\right]^{-\vartheta_h} Y_{h,t}, \; P_{h,t} = \left[\int_0^1 P_{h,t}(g_h)^{1-\vartheta_h} dg_h\right]^{\frac{1}{1-\vartheta_h}} \dots\dots\dots\dots (19)$$

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[78] A retailer buys a large variety of wholesale goods and transforms them to an aggregate good; a bundle of goods that will be sold to the final agents. For more details see (Lubik & Schorfheide, 2007).

where $P_{h,t}(g_h)$ is the price charged on each intermediate good, g_h, produced by an intermediate goods producing firm.

$Y^*_{h,t}(g_h)$ refers to the demand for export-bound intermediate goods,

$P^*_{h,t}$, the corresponding price aggregator.

4.2.2. Intermediate goods firms:

There is a continuum of intermediate goods firms, indexed by $h \in [0, 1]$ producing differentiated goods in a monopolistically competitive environment. Due to the differentiated nature of wholesale good, intermediate non-oil firms have some degree of market power and are thus price setters in a market structure of a monopolistic competition (**Omotosho, 2021**).

The intermediate non-oil firms solve its problem in two stages.

- First, the retail firm hires production factors which it considers their prices namely the return on capital and wages. Where, the production function for a typical intermediate goods firm is given by:

$$\mathbf{Y_{h,t} = A_{h,t}}(K^G_{h,t})^{\alpha_{h,1}}(K^P_{h,t})^{\alpha_{h,2}}(L^{No}_{j,t})^{\alpha_{h,3}} \dots\dots\dots\dots \textbf{(20)}$$

$\mathbf{A_{h,t}}$	Aggregate productivity shock
$K^G_{h,t}$	Public capital stock
$K^P_{h,t}$	Private capital stock
$L^{No}_{j,t}$	Labour
α_{h1}	Elasticity of the intermediate firm's output with respect to government capital. $1 > \alpha_{h1} > 0$
α_{h2}	Elasticity of the intermediate firm's output with respect to private capital. $1 > \alpha_{h2} > 0$
α_{h3}	Elasticity of the intermediate firm's output with respect to labor input. $1 > \alpha_{h3} > 0$

With the assumption of constant returns to scale, $\alpha_{h1} + \alpha_{h2} + \alpha_{h3} = 1$.

The law of motion of productivity:

$$\mathbf{\log A_t = (1 - \rho_A) \log A_{ss} + \rho_A \log A_{t-1} + \xi^{A_{no}}_t {}_t} \dots\dots\dots\dots\dots\dots \textbf{(21)}$$

Where Ass is the productivity value at the steady state.

each firm chooses its input factors to minimize total cost

$$\min_{N_t, K_{h,t},} W_t L_t + R_{h,t} K_{h,t}^p + R_{h,t} K_{h,t}^G \dots\dots\dots\dots\dots\dots\dots\dots \textbf{(22)}$$

Subject to equation (21). The first order conditions yield the optimal input combinations, which are then substituted into the production function to derive an expression for the real marginal cost as follows:

$$mc_{j,t} = \frac{1}{A_{h,t}(K_{h,t}^G)^{\alpha_h^1}} \cdot \left(\frac{R_t}{\alpha_h^2}\right)^{\alpha_h^2} \left(\frac{W_t}{\alpha_h^3}\right)^{\alpha_h^3} \dots\dots\dots\dots\dots\dots \textbf{(23)}$$

Where $mc_t = \frac{MC_t}{P_t}$ is the real marginal cost, $R_t = \frac{R_{h,t}}{P_t}$ is the real rental rate on capital, $W_t = \frac{W_t}{P_t}$ is the real wage.

- The second step is to define the price of the intermediate non-oil domestic goods. The firm decides how much to produce in each period to maximize their expected discounted real profit according to the Calvo rule [79] we allow a proportion of the intermediate goods producing firms, $(1 - \theta_h)$, to reset their prices optimally in any given period while the other fraction, θ_h, who are unable to re-optimise their prices maintain the price at last fixing.

Profit maximization subject to the demand for intermediate goods (shown in equation 19) yields the optimal reset price given by

$$\mathbf{P_{h,t}^{\cdot}} = \left(\frac{\epsilon_h}{\epsilon_h - 1}\right) \frac{E_t \sum_{s=0}^{\infty} (\beta\theta_h)^s P_{h,t+s} Y_{h,t+s} mc_{t+s}}{E_t \sum_{s=0}^{\infty} (\beta\theta_h)^s Y_{h,t+s}}, \dots\dots\dots\dots\dots\dots\dots \text{(24)}$$

Where $\theta_h \in [0, 1]$ is an index of price stickiness (Calvo, 1983) and $P^{\cdot}_{h,t}$ represents the optimal reset price. Next, the evolution of domestic price level is given by a law of motion as follows:

$$P_{h,t} = \left[\theta_h P_{h,t-1}^{1-\vartheta_h} + (1 - \theta_h)\left(P_{h,t}^{\cdot}\right)^{1-\vartheta_h}\right]^{\frac{1}{1-\vartheta_h}} \dots\dots\dots\dots\dots\dots\dots \textbf{(25)}$$

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[79] According to (Çebi, 2012), Intermediate firms are assumed to set nominal Calvo pricing according to the stochastic time dependent rule proposed by (Allegret & Benkhodja, 2015) Each firm resets its price with probability $1-\theta$ each period, independently of the time elapsed since the last adjustment. Thus, each period a measure $1 - \theta$ of producers reset their prices, while a fraction θ keep their prices unchanged.

4.2.3. The import goods retailers:

The importing firms purchase foreign goods and sell it to fulfil the domestic household demands. As in **(Medina and Soto, 2007)**, we enhance the expenditure switching effect of exchange rate movements by allowing for incomplete exchange rate pass-through into import prices in the short-run through local currency price stickiness.

Thus, a group of perfectly competitive assemblers produce a final foreign good, $Y_{f,t}$, by combining a continuum of differentiated imported varieties, $Y_{f,t}(g_f)$, using a Dixit-Stiglitz aggregation technology given by

$$Y_{f,t} = \left[\int_0^1 Y_{f,t}(g_f)^{\frac{\vartheta_f-1}{\vartheta_f}} dg_f\right]^{\frac{\vartheta_f}{\vartheta_f-1}} \quad\text{.......................................} \textbf{(26)}$$

With:

ϑ_f is the parameter represents the elasticity of substitution among different foreign goods $\vartheta_f > 1$.

We get the first-order condition for the firm's optimization problem by maximizing the import goods retailers' profit function subject to the aggregation technology in equation **(26).**

The price index for imported goods, $P_{f,t}$, given as:

$$Y_{f,t}(g_f) = \left[\frac{P_{f,t}(g_f)}{P_{f,t}}\right]^{-\vartheta_f} Y_{f,t}, \ P_{f,t} = \left[\int_0^1 P_{f,t}(g_f)^{1-\vartheta_f} dg_f\right]^{\frac{1}{1-\vartheta_f}} \text{...........................} \textbf{(27)}$$

Where:

$P_{f,t}(g_f)$ is the price charged on an imported intermediate product, z_f.

Added to, each retailer of imports goods has monopoly power to determine the domestic price of their varieties according to Calvo (1983) as follow:

$$P_{f,t} = \left[\theta_f P_{f,t-1}^{1-\vartheta_f} + (1-\theta_f)(P_{f,t}^{.})^{1-\vartheta_f}\right]^{\frac{1}{1-\vartheta_f}} \text{...................................} \textbf{(28)}$$

Where:

θ_f is the price stickiness parameter. (the probability of keeping fixed prices of foreign goods in the next period).

$(1-\theta_f)$ probability of optimally resetting foreign goods price.

In the other hand, we assume law of one price gap stating that importing firms have some power in the determination of the prices of their goods. The law of one price gap is defined as in (**Monacelli, 2005; Algozhina, 2015**) as follow:

$$\Omega_f = \frac{\epsilon_t P_t^*}{P_{f,t}} \dots\dots\dots\dots\dots\dots\dots\dots\dots \ (29)$$

Where:

P_t^* refers to the aggregate consumer price index of the foreign economy.

$P_{f,t}$ is the average price of imported goods in terms of domestic currency.

ϵ_t is the nominal exchange rate.

In addition, the real exchange rate, *RER*, is defined as the ratio of foreign price index expressed in domestic currency to the aggregate domestic price index as follows:

$$RER_t = \frac{\epsilon_t P_t^*}{P_t} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \ (30)$$

By using the definition of the real exchange rate (equation 30) we can re-write the equation for the law of one price gap (equation 29) as follows:

$$\Omega_f = \frac{RER_t}{P_{f,t}} \dots\dots\dots\dots\dots\dots\dots\dots\dots \ (31)$$

With:

$p_{f,t} = \frac{P_{f,t}}{P_t}$ is the real price of imported rules.

The log-linearization (presented in appendix 2) of equation (30), produces an equation for the development of the real exchange rate, *RER*.

Finally, we set the terms of trade, S_t, of the domestic economy as the domestic currency price of imports, $P_{f,t}$, relative to the export

$$S_t = \frac{P_{f,t}}{P_{h,t}} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \ (32)$$

4.2.4. The oil firms:

Algeria ranks third after Nigeria and Angola in respect to oil production in Africa where it represents 95% of exports.

The oil firms seeks to maximize its profit:

$$\pi_t^o = (1 - q_o)\, P_t^{o*}\, Y_t^o - W_t^o L_t^o \dots\dots\dots\dots\dots\dots\dots\ (33)$$

We assume that oil firm operating in perfect competition uses technology A_t^o, capital input $K_{o,t}^G$, labour L_t^o to produce crude oil Y_t^O which is exported at a price determined at the world crude oil market $p^*_{o,t}$ in foreign currency US\$. The oil production function is given by Cobb-Douglas extraction technology:

$$Y_t^o = A_t^o (K_{ot}^G)^{\alpha_{o1}} (L_t^o)^{\alpha_{o2}} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\ (34)$$

Where:

$A_{o,t}$ represents the oil technology and

α_{o1} and $\alpha_{o2} \in (0, 1)$ represent the elasticity of oil output with respect to oil-related capital and labor inputs, respectively.

We extend the oil sector in **(Costa, 2018)** by including oil-related private capital accumulated by foreign direct investment FDI which follows an exogenous AR (1) process as in **(Jordi Galí, López-Salido, & Vallés, 2007)**:

$$K_{o,t} = (1 - \delta_o)K_{o,t-1} + FDI_t^* \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\ (35)$$

Where:

δ_o represents the rate at which oil-related capital depreciates. Foreign direct invest ment inflows to the oil sector responds to the real international price of oil as follows:

$$FDI_t^* = (FDI_{t-1}^*)^{\rho_{fdi}} \big(p_{o,t}^*\big)^{1-\rho_{fdi}} \dots\dots\dots\dots\dots\dots\dots\dots\ (36)$$

Where ρ_{fdi} measures the degree of smoothing in the accumulation.

We assume that the real international price of oil and the oil technology evolve according to the following *AR* (1) processes with exogenous shocks:

$$p_{o,t}^* = \left(p_{o,t-1}^*\right)^{\rho_o} \exp\left(\xi_t^{p_o^*}\right),$$

$$A_{o,t} = \left(A_{o,t-1}\right)^{\rho_{a_o}} \exp\left(\xi_t^{A_o}\right) \quad (37)$$

$$\widehat{P_t^{O*}} = \rho_o P_{t-1}^{0*} + \epsilon_t^o$$

The oil firm receives its profit π_t^{o*} net of royalties levied on production quantity at a rate q_o As in (**Algozhina, 2015**): $\pi_t^{o*} = (1 - q_o) P_t^{O*} Y_t^o$

4.2.5. Open economy features

This chapter deals with a small open economy, where the activities in the foreign economy are assumed to be not effected by the fluctuations and developments in the domestic economy. Thus, besides the description of real exchange rate (imports sector), the relation between the domestic and foreign world in a small open economy is also described by the international risk sharing as in (**Monacelli, 2005**), given as:

- **International risk sharing:**

The domestic consumption is linked with foreign consumption by assuming that agents in the rest of the world have access to the same set of bonds and share the same preferences with their domestic counterparts.

Thus, the equation of the representative household in the rest of the world as follows:

$$\boldsymbol{1 = \beta E_t \left[\left(\frac{C_{t+1}^R - \phi_c C_t}{C_t^R - \phi_c C_{t-1}}\right)^{-\sigma} \frac{P_t}{P_{t+1}}\right] = \beta E_t \left[\left(\frac{C_{t+1}^* - \phi_c C_t^*}{C_t^* - \phi_c C_{t-1}^*}\right)^{-\sigma} \frac{\varepsilon_t}{\varepsilon_{t+1}} \frac{P_t^*}{P_{t+1}^*}\right]} \ldots\ldots\ldots\ldots \textbf{(38)}$$

Simplifying equation (38) and making use of the definition of the real exchange rate, *RER* in equation (30) yields the international risk sharing equation as follows:

$$\boldsymbol{C_t^R - \phi_c C_{t-1} = \varrho q_t^{\frac{1}{\sigma}} (C_t^* - \phi_c C_{t-1}^*)} \ldots\ldots\ldots\ldots\ldots \textbf{(39)}$$

Where ϱ represents a constant that depends on the relative initial conditions in asset holdings

$$\boldsymbol{\varrho \equiv E_t \left[\frac{C_{t+1}^R - \phi_c C_t}{(C_{t+1}^{R*} - \phi_c C_t^*) q_{t+1}^{\frac{1}{\sigma}}}\right]} \ldots\ldots\ldots\ldots\ldots\ldots \textbf{(40)}$$

4.2.6. Policy rules
4.2.6.1. Fiscal policy

Each period, the fiscal authority receives revenues from lump-sum tax, TX_t, issues one period bonds these results in a net debt position, B_t, and receives oil revenues in form of royalties from the oil firm, OR_t. The revenues are used to finance government expenditure on public goods, $G_{c,t}$, and service debt, $\frac{B_{t+1}}{R_t}$. Finally, when the need arises, the government makes subsidy payments, OS_t, within a framework that allows for the stabilization of domestic fuel price.

Accordingly, the government's budget constraint is given by:

$$TX_t + OR_t + B_t = P_{G,t}G_{c,t} + P_{G,t}I_t^G + OS_t + P_{Gt}TRANS_t + \frac{B_{t+1}}{R_t}\text{.......} \textbf{(41)}$$

With the total tax revenue:

$$TX_t = \tau_t^c P_t(C_t + I_t^p) + \tau_t^l W_t L_t + \tau_t^k(R_t - \delta)K_t^p \text{.......................} \textbf{(42)}$$

And the amount of oil revenue, OR_t, accruing to government is given by:

$$OR_t = \tau \in_t p_{o,t}^* Y_{o,t}\text{....................................} \textbf{(43)}$$

Where:

τ is the royalty rate on oil production quantity

$Y_{o,t}$ is the oil output.

$\in_t$ is the nominal exchange rate.

In addition, as in (**Medina and Soto, 2007**), we assume that government consumption basket consists of imported goods, $G_{f,t}$, and domestically produced goods, $G_{h,t}$:

$$G_{c,t} = \left[(1 - \gamma_G)^{\frac{1}{\psi_G}}G_{h,t}^{\frac{\psi_G-1}{\psi_t}} + \gamma_G^{\frac{1}{\psi_G}}G_{f,t}^{\frac{\psi_G-1}{\psi_t}}\right]^{\frac{\psi_G}{\psi_G-1}} \text{................................} \textbf{(43)}$$

Where:

ψ_G is the elasticity of substitution between imported and domestically produced goods consumed by government.

γ_G presents the share of foreign goods in government's consumption basket.

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We derive the demand function for home and foreign goods by minimizing government's consumption cost subject to equation **(43)** which yields:

$$G_{h,t} = (1 - \gamma_G)\left(\frac{P_{h,t}}{P_{G,t}}\right)^{-\psi_G} G_{c,t}$$

$$G_{f,t} = \gamma_G \left(\frac{P_{f,t}}{P_{G,t}}\right)^{-\psi_G} G_{c,t}$$

With the government consumption price index:

$$\boldsymbol{P_{G,t}} = \left[(1 - \boldsymbol{\gamma_G})\boldsymbol{P_{h,t}^{1-\psi_G}} + \boldsymbol{\gamma_G P_{f,t}^{1-\psi_G}}\right]^{\frac{1}{1-\psi_g}} \dots\dots\dots\dots\dots\dots\dots\dots. \textbf{(44)}$$

where $\boldsymbol{P_{G,t}}$ is the deflator of government expenditure. In order to allow for fuel consumption subsidy in the small open economy, we follow **(Allegret & Benkhodja, 2015)**.

We assume that aggregate refined oil, $\boldsymbol{O_t}$, is produced abroad and imported by the government into the small open economy at a landing price[80], $\boldsymbol{P_{lo,t}}$. In turn, the government sells the imported fuel at a regulated (subsidized) price, $P_{ro,t}$ based on a fuel pricing regime given by:

$$\boldsymbol{P_{ro,t} = P_{ro,t-1}^{1-v}P_{lo,t}^{v}} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \textbf{(45)}$$

With the landing price of imported fuel (expressed in domestic currency), $\boldsymbol{P_{lo,t}}$[81]:

$$\boldsymbol{P_{lo,t} = \varepsilon_t \frac{P_{o,t}^*}{P_t^*}\Omega_t^o} \dots\dots\dots\dots\dots\dots\dots\dots\dots.\textbf{(46)}$$

Where:

$\boldsymbol{P^*_{o,t}}$ is the foreign currency price of oil abroad.

$\boldsymbol{\epsilon_t}$ is the nominal exchange rate.

$\boldsymbol{\Omega_t^o}$ is the law of one price gap associated with the import price of fuel.

$\boldsymbol{v}$ is the parameter that governs the extent to which government subsidizes fuel consumption and $0 < v < 1$[82].

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[80] The cost of importing a litre of fuel into the domestic economy, expressed in domestic currency
[81] This is similar to the specification in **(Poghosyan and Beidas-Strom, 2011)**.

[82] When $v = 1$ the implicit subsidy regime seizes to exist while $v = 0$ implies complete price regulation.

Thus, the implicit fuel subsidy payment by government is given by the difference between the value of fuel imports expressed in domestic currency and the amount realized from fuel sales in the domestic economy as follows:

$$OS_t = (P_{lo,t} - P_{ro,t})O_t \text{ .... (47)}$$

With $O_t = C_{o,t} + O_{h,t}$

$C_{o,t}$ is the fuel consumption by households and $O_{h,t}$ is the fuel consumption by domestic firms.

Finally, following **(Algozhina, 2015)**, we consider backward looking fiscal policy reaction functions that allow government consumption and tax level to respond to lagged debt and output. In addition, we allow taxes and government consumption to respond to oil revenue and oil subsidy payments. Thus, our linearized benchmark fiscal policy rules are specified as follows:

As in (Calvo, 1983) we consider a backward looking from the fiscal policy reaction function and assume smoothing and fiscal instruments given as:

$$\widetilde{G}_t = \rho_G \widetilde{G}_{t-1} + (1 - \rho_G)\left(\gamma_b b_{t-1} + \gamma_y^G \widetilde{y_{t-1}^n} + \gamma_{os} \widetilde{os}_t + \gamma_{O_R}^G \widetilde{or}_t\right) + \xi_t^G \text{... (48)}$$

$$\widetilde{tx}_t = \rho_{tx} \widetilde{tx}_{t-1} + (1 - \rho_{tx})\left(\omega_b b_{t-1} + \omega_y^{tx} \widetilde{y}_{t-1} + \omega_{os} \widetilde{os}_t + \omega_{or} \widetilde{or}_t\right) + \xi_t^{tx}$$

..... (49)

Where:

ρ_g, ρ_{tx}	The degree of fiscal smoothing[83] in government spending and tax rules, respectively.
$\gamma_b, \gamma_y^G,$ $\gamma_{os}, \gamma_{O_R}^G$	Feedback coefficients for government consumption with respect to lagged domestic debt, lagged output, oil subsidy payments and oil revenues, respectively.
$\omega_b, \omega_y^{tx},$	Feedback parameters for taxes respond to lagged debt, lagged

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[83] Depending on the degree of fiscal smoothing the magnitude of the responsiveness of spending and tax with respect to debt and output gap changes. For example, the increase in the degree of fiscal smoothing results in the decline in the sensitivity of the government spending and tax to output gap and debt.

ω_{os}, ω_{or}	output, oil subsidy payments and oil revenues, respectively.
ξ_t^G, ξ_t^T	Government spending and tax shocks.

According to government spending and tax rules described above, the fiscal authority has two objectives, namely output and debt stabilisation.

With:

- A negative value for ω_{orr} implies revenue substitution between tax and oil revenues.

- $\omega_b > 0, \gamma_b < 0$ where the concept of Ricardian equivalence requires that increasing debt levels are associated with higher taxes and lower government consumption[84].

- $\omega_b < 0, \gamma_b > 0$ is a combination notes an active fiscal policy; a situation where the fiscal authority fails to adjust taxes strongly enough in response to deficit shocks and government expenditure does not adjust in a manner that stabilizes debt.[85]

4.2.6.2. Monetary policy:

We assume that the nominal interest rate $\tilde{R}$ responds to its lagged value, aggregate inflation π_t, aggregate output $\widetilde{y}_{h,t}$, and real exchange rate $\widetilde{RER}_t$ according to the CPI targeting, a simple linearized Taylor rule is set by the central bank given as follow:

$$CPI: \widetilde{R}_t = \rho_r \widetilde{R}_{t-1} + (1 - \rho_r)\left[\phi_\pi \widetilde{\pi}_t + \phi_y \widetilde{y}_{h,t} + \phi_e \widetilde{RER}_t\right] + \xi_t^r \ldots\ldots (50)$$

The foreign exchange intervention, as a purchase of foreign currency by a central bank, has its separate rule responding to the exchange rate and its rate of depreciation (**Allegret & Benkhodja, 2015**):

$$\widehat{Int_t^*} = \alpha_1 \widehat{RER}_t + \alpha_2 \Delta \widehat{RER}_t + \epsilon_t^{int},$$

With:

$$\alpha_1 < 0, \alpha_2 < 0$$

---

[84] This parameter combination implies passive fiscal policy where deficit shocks are financed with future taxes (**Leeper, 1991**). A combination of active monetary policy and passive fiscal policy espouses the monetary dominance view under which monetary shocks drive prices and fiscal shocks are immaterial. According to (**Leeper, 2005**), such a policy equilibrium is appropriate for the implementation of an interest rate-based inflation targeting regime.

[85] A combination of passive monetary policy and active fiscal policy represents a unique equilibrium that consistent with the Fiscal Theory of Price Level (FTPL) proposed by Woodford (1995). Under such an equilibrium, inflation is seen as both a fiscal and monetary phenomenon (**Leeper, 2005**)

ρ_r	The interest rate smoothing parameter that captures monetary policy inertia to structural shocks.
ϕ_π, ϕ_y, ϕ_e	The feedback coefficients on inflation, output and real exchange rate. With $(\phi_\pi > 1)$[86] or $(\phi_\pi < 1)$[87]
π_t	Aggregate inflation $\pi_t = \frac{P_t}{P_{t-1}}$
$y_{h,t}$	Domestic output
RER_t	Real exchange rate
ξ_t^r	The monetary policy shocks. assumed independent and identically distributed
$\widetilde{Int_t^*}$	The real foreign exchange intervention denominated in foreign currency.

4.2.7. The rest of the world

In this section we will summarize the demand for home produced goods by the foreign economy, and it is given as follows:

$$C_{h,t}^* = \gamma^* \left(\frac{P_{h,t}^*}{P_t^*}\right)^{-\psi^*} C_t^* \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (52)$$

Where:

$P^*_{h,t}$ is the price of domestically produced goods in foreign currency.

P^*_t is the aggregate consumer price index in the foreign economy.

C^*_t is aggregate foreign consumption.

η^* is the foreign price elasticity of demand for domestic goods while the share of domestic goods in foreign consumption is captured by γ^*.

The IS curve for the foreign economy is identified as:

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[86] In line with the Taylor principle, the feedback coefficient on inflation is expected to be greater than unity. Under such circumstance, the monetary authority is unconstrained and can thus respond strongly to inflation in order to achieve price stability. This is consistent with the notion of active monetary policy in the categorization of equilibrium policies by Leeper (1991). See **(Gali,2003)**

[87] The fiscal authority in this case set its budget independently while the monetary authority is required to adjust monetary policy in order to satisfy the government budget constraint (passive monetary policy). This combination is used by the central bank in order to achieve other macroeconomic objectives than price stability, such as output growth. **(Leeper, 1991).**

$$\frac{1}{R_t^* \mu_t^*} = \beta E_t \left[\left(\frac{C_{t+1}^{R*} - \phi_c^* C_t^*}{C_t^{R*} - \phi_c^* C_{t-1}^*} \right)^{-\sigma^*} \frac{1}{\pi_{t+1}^*} \right] \dots\dots\dots\dots\dots\dots \textbf{(53)}$$

Where:

ϕ_c^* is the habit formation parameter in the foreign economy.

σ^* is the relative risk aversion coefficient.

C_t^*, refers to the foreign consumption.

R_t^* represents foreign interest rate.

π^* defines the foreign inflation

The foreign central bank sets interest rate according to a Taylor rule similarly as the domestic economy, where the linearized monetary policy rule for the foreign economy is specified as follows:

$$\tilde{R}_t^* = \rho_{r^*} \tilde{R}_{t-1}^* + (1 - \rho_{r^*}) \left[\phi_{\pi*} \tilde{\pi}_t^* + \phi_\pi \tilde{Y}_{h,t}^* \right] + \xi_t^{r^*} \dots\dots\dots\dots \textbf{(54)}$$

Where

ρ_{r^*} represents the interest rate smoothing parameter in the foreign economy.

ω_{π^*} and ω_{y^*} are the feedback coefficients for inflation and output, respectively.

ξ^{r^*} represents monetary policy shock in the foreign economy.

Finally, inflation rate in the foreign economy is assumed to follow an *AR* (1) process as follows

$$\pi_t^* = (\pi_{t-1}^*)^{\rho_{\pi^*}} \exp\left(\xi_t^{\pi^*} \right).$$

4.2.8. Market clearing and aggregation

The domestic output $Y_{h,t}$ is captivated by several variables which are:

- $C_{h,t}$, the household's consumption of local produced goods.
- Government consumption of domestically produced goods, $G_{h,t}$.
- $C_{h,t}^*$ non-oil exports.

- Domestic investment $I_{h,t}$.[88]

Accordingly, the domestic resource constraint is given by

$$P_{h,t}Y_{h,t} = P_{h,t}C_{h,t} + \epsilon_t P_{h,t}^* C_{h,t}^* + P_{h,t}I_{h,t} + P_{h,t}G_{h,t}$$

Moreover, Y_t the aggregate GDP combines both oil ($Y_{o,t}$) and non-oil output ($Y_{h,t}$) and presented as:

$$P_t Y_t = P_{h,t}Y_{h,t} + \epsilon_t P_{o,t}^* Y_{o,t}^* + IM_t = P_{h,t}C_{h,t} + P_{h,t}I_{h,t} + P_{h,t}G_{h,t} + NX_t$$

Where:

(NX_t) denotes the net exports given by $NX_t = EX_t{}^{[89]} - IM_t{}^{[90]}$

With:

$$Y_{f,t} = C_{f,t} + I_{f,t} + G_{f,t}$$

Setting the current account equal to the financial account, we obtain the following expression for the Balance of Payments (BOP):

$$\frac{q_t b_t^*}{R_t^* \mu_t^*} = q_t b_{t-1}^* + nx_t - (1 - \tau)q_t p_{o,t}^* y_{o,t} + q_t f di_t^*, \dots\dots\dots\dots\dots \textbf{(51)}$$

Finally, the labor and capital markets clear as follows:

$$L_t = \int_0^1 L_t^R(j)dj + \int_0^1 L_t^{NR}(j)dj$$

$$K_{h,t} = \int_0^1 K_{h,t}(j)dj.$$

We can now say that the Algerian small open economy is assumed to be driven by 15 stochastic shocks summarized as follow:

- Domestic monetary policy shock
- Foreign monetary policy shock.
- Income tax shock.
- Government consumption

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[88] Which is used to augment the stock of physical capital available for use in the production process in period $t+$

[89] EX_t is aggregate exports including oil exports $EX_{o,t}$ measured as $\epsilon_t P_{o,t}^* Y_{o,t}$ and non-oil exports $EX_{no,t}$ defined as $\epsilon_t P_{h,t}^* C_{h,t}^*$

[90] IM_t represents aggregate imports comprising oil (refined fuel) imports $IM_{o,t}$ measured as $\epsilon_t P_{lo,t} O_t$ and non-oil imports $IM_{no,t}$ defined as $P_{f,t}C_{f,t}$

- Government investment
- Tax on capital shock.
- Tax on consumption shock.
- Shock related to real international oil price.
- Shock related to oil sector productivity
- Law of one price gap in oil price.
- Domestic total factor productivity.
- Domestic risk premium.
- Foreign risk premium.
- Domestic supply.
- Foreign inflation.

4.3. Model estimation:

This section presents the estimation of the NK-DSGE model for Algeria as a small open resource rich economy. First, we will describe the methodology, data, and prior distribution. Then we will analyse the response of GDP, Inflation, real exchange rate to the stochastic shocks of monetary and fiscal policy instruments in addition to the shocks related to oil.

4.3.1. Calibration, data and priors:

In order to obtain numerical implementation of the model, it is compulsory to designate values to the parameters, where we can find different methods to estimate and evaluate DSGE models in the literature. As stated in **(An & Schorfheide, 2007)**, the calibration methods are: *generalised method of moments* (**GMM**), *full-information likelihood based estimation*, *Bayesian estimation* and *minimum distance estimation* based on the distance between impulse response functions received from VAR and DSGE model.

Accordingly, the model is calibrated on an annual basis, as are the most of data for Algeria in this frequency. We have three types of parameters and exogenous variables:

      i. Parameters obtained from the literature.

     ii. Parameters individually calibrated.

   iii. Parameters jointly calibrated to match some of the long-run relationships for the Algerian economy from 1980-2016.

We use a combination of estimation and less formal calibration approaches in parameterizing the model. Specifically, we distinguish between three basic groups of parameters:

i. steady-state values of the observed macroeconomic variables

ii. Autoregressive coefficients estimated using OLS.

iii. Behavioural parameters estimated using a Bayesian approach.

In this chapter, we will use the Bayesian estimation technique as in **(Cebi,2012)** and (**Blazquez, 2019**) to calibrate and estimated a linearised NK-DSGE model[91]. We have used the Bayesian method in view of its several advantages over the competing techniques summarized as follow:

- Bayesian estimation allows one to use a prior distribution that brings additional information in the estimation process. **(Mancini-Griffoli, 2007)**
- Bayesian approach helps identifying parameters of the model Including the priors in the estimation process.
- Bayesian approach is system based, which allows us to take benefit from the advantages of the general equilibrium approach, contrary to GMM estimation which is based on a single equation, [92] **(Rabanal and Rubio-Ramirez, 2005)**.
- Bayesian approach presents better performance than GMM and maximum likelihood in small samples, see (Rabanal and RubioRamirez , 2005).

The estimation procedure is clearly explained in Koop (2003), An and Schorfheide (2007) and Mancini-Griffoli (2007) and consists of several steps. Following **(Cebi, 2012)** we get a state space representation of the model from the reduced form solution, where unobserved state variables are mapped into the observed data. we apply the Kalman filter to the reduced form in order to calculate the likelihood function of the observed data. A numerical optimisation of the likelihood function multiplied by the prior is used to obtain posterior modes. we then use a Metropolis–Hastings algorithm to generate a sample and approximate posterior distributions. Accordingly, the model is calibrated on an annual basis (1980-2018), as are the most of data for Algeria in this frequency. We have three types of parameters and exogenous variables:

i. Parameters obtained from the literature.

ii. Parameters individually calibrated.

iii. Parameters jointly calibrated to match some of the long-run relationships for the Algerian economy from 1980-2016.

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[91] An introduction to Bayesian Analysis can be found in Hamilton (1994) and Koop (2003)

[92] The existence of government solvency constraint serves as an important identifying restriction in model, and the need to take it into consideration prevents the use of an equation based where the presence of debt accumulation equation, which is potentially explosive, may impose strong restrictions on the values of the coefficients of the fiscal policy rules. Therefore, it is only a system-based approach can ensure sufficient identifying restrictions. **(Cebi, 2012)**

The values of our parameters are presented in **table 13**

- **Data:**

I estimate the DSGE model over the period of 1980–2018 using We use data on 15 variables: *yt, ct, Ino,t, qt, π, rt, y∗, π∗, r∗, Po∗, Tx, Gc,t,, Yo*, while the remaining variables are assumed to be unobserved. The choice of the data frequency (annual data) observable variables are guided by data availability as well as the need to properly identify certain structural and policy parameters that are of specific interest to our empirical investigation.

All variables must be stationary and fluctuate around constant means, however, the series used in the estimation is not stationary. Consequently, to render these series stationary we applied an HP-Filter and used the trended series instead of the original ones.

- **Parameterizing and choice of priors:**

Table 13: Parameters calibration

Parameters	*Symbol*	Value	Source
Households			
Household's discount factor.	β	0.99	Bouakaz et al., 2008
Inverse of Frish wage elasticity of labour supply.	φ	0.5	Individual calibration
The elasticity of substitution between home and foreign goods consumption.	ψ_o	0.33	Individual calibration
The labour elasticity of substitution between differentiated goods.	ψ_w	8	Benkhodja and allegret 2015
Private capital depreciation rate.	δ_p	0.25	Algozhina, 2015
Wage stickiness parameter.	θ_w	0.65	Individual calibration
Participation of Ricardian households in consumption and labour.	ω_R	0.5	Author's assumption
Firms			
Domestic price stickiness parameters for oil and non-oil prices	θ_h	0.65	Individual calibration
Government capital oil-related depreciation rate.	δ_o	0.03	Individual calibration

Elasticity of domestic output with respect to private capital	α_{h2}	0.12	Benkhodja and Allegret 2015
Elasticity of domestic output with respect to government capital	α_{h1}	0.33	Benkhodja and Allegret 2015
Elasticity of domestic output with respect to labour	α_{h3}	0.55	Benkhodja and Allegret 2015
Elasticity of oil output with respect to government capital.	α_{o1}	0.7	Algozhina, 2015
Elasticity of oil output with respect to labour	α_{o2}	0.3	Algozhina, 2015
Elasticity of substitution among different imported intermediate goods	ϑ_f	0.43	Individual calibration
Persistence in oil sector FDI process	ρ_{fdi}	0.32	Individual calibration
Share of imports in household's consumption	γ_c	0.40	Author's calculation
Share of fuel in household's consumption	γ_o	0.60	Author's calculation
Share of imports in household's investment	γ_i	0.20	Author's calculation
Foreign goods price stickiness -Calvo-	θ_f	0.08	Benkhodja et al
Government			
Elasticity of substitution between imported and home-produced goods consumed by government	ψ_G	0.6	Hollander et al, 2018
Share of imports in government consumption.	γ_G	0.12	Algozhina, 2015
Rate of tax on consumption in steady state.	τ_c	0.19	Author's aestimation based on Algeria data
Rate of tax on income from labour in steady state.	τ_i	0.17	Author's estimation based on Algeria data
Rate of tax on income from capital in the steady state.	τ_k	0.27	Author's estimation based on Algeria data
Fiscal policy rule			

Government consumption coefficient on debt	γ_b	0.13	Calibration
Government consumption coefficient on oil revenues	γ_{or}	0.40	Calibration
Government consumption coefficient on oil subsidies	γ_{os}	0.26	Calibration
Government consumption coefficient on output gap	γ_y	0.21	Calibration
Government tax coefficient on debt	ω_b	0.30	Cebi, 2012
Government tax coefficient on output gap	ω_y	0.05	Calibration
Monetary policy - Taylor rule			
Taylor rule coefficient on inflation	ϕ_π	1.5	Hollander et al, 2018
Taylor rule coefficient on output	ϕ_y	0.2	Hollander et al, 2018
Taylor rule coefficient on exchange rate	ϕ_e	0.50	Author's assumption

Source: author's own

In addition, we parameterize the steady ratios on the basis of observed fiscal ratios during the study's period as follow,

The ratio of government consumption to output $\bar{C}_h/\bar{Y}_h$ is assumed to be 0.60,

The ratio of labour to domestic output $\bar{L}/\bar{Y}_h$ is 0.12,

Share of oil in GDP $\bar{Y}_O/\bar{Y}$ is 0.51,

import to domestic product $I\bar{M}/\bar{Y}_h$ is around 0.15,

the share of fuel import to total Import $\bar{O}/I\bar{M}$ is 0.1,

oil sector FDI to net exports $q\bar{F}DI/\bar{N}X$,

the ration of government spending to oil revenues $p\bar{g}Gc/\bar{O}R$ is about 0.72,

fiscal debt to oil revenues is $\bar{B}/\bar{O}R$ is 0.68,

the ratio of fuel subsidy payment to oil revenue $\bar{O}S/\bar{O}R$ is 0.25.

Finally, we choose priors based on evidence from previous studies for oil exporting economies (like Medina and Soto,2005; Dib 2008a; Benkhodja and allegret, 2015; omotosho,2021). These priors are summarized in **Table 14**.

We assume Beta distribution for those parameters that must lie in the [0-1] interval as in **(Benkhodja and Allegret, 2015)**.

4.3.2. Results:

4.3.2.1. **Parameter estimates**

Added to the prior distribution, **table 14** also presents posterior distributions for the estimated structural and policy parameters.

The parameter for labour supply elasticity, φ, which controls the response of labour supply to structural shocks is estimated at 1.47. This is is slightly higher than the assumed prior of 1.45. At 1.34, the estimated relative risk aversion parameter (σ) implies that the response of savings/investment decision of households to structural shocks is not as high as 2.0 initially assumed.

Table 14: Parameters Estimation

Parameters	Prior distribution			Posterior distribution		
	Density	**Mean**	**Std Dev**	**Mean**	**90% HPD Int.**	
Structural parameters						
Ricardian consumers: ωR	Beta	0.50	0.0.5	0.438	0.310	0.574
Labour supply elasticity: φ	Inv. Gamma	1.45	0.10	1.473	1.312	1.631
Relative risk aversion: σ	Inv. Gamma	2.00	0.40	1.347	1.077	1.596
External habit: φc	Beta	0.65	0.05	0.413	0.285	0.538
Investment adj. cost: χ	Gamma	4.00	3.00	2.995	1.076	4.800
Fuel pricing parameter: ν	Beta	0.30	0.05	0.338	0.113	0.553
Oil - core cons. elast.: ψo	Gamma	0.33	0.10	0.258	0.038	0.272
For. - dom. cons. elast.: ψc	Gamma	0.60	0.20	0.631	0.295	0.945
For. - dom. inv. elast.: ψi	Gamma	0.60	0.20	0.613	0.297	0.919
Share of capital-oil	Beta	0.31	0.05	0.351	0.128	0.551

Share of labor-oil	Beta	0.24	0.05	0.229	0.098	0.193
Calvo - domestic prices: θh	Beta	0.67	0.05	0.632	0.463	0.732
Calvo - import prices: θf	Beta	0.67	0.05	0.634	0.432	0.758

Monetary policy parameters

Taylor, π: $\phi\pi$	Normal	1.500	0.20	2.866	2.588	3.141
Taylor, y: ϕy	Gamma	0. 250	0.10	0.086	0.033	0.137
Taylor, e: ϕe	Gamma	0.500	0.10	0.127	0.040	0.209
Taylor, smoothing: ρr	Beta	0.500	0.05	0.279	0.082	0.478

Fiscal policy rules parameters

Tax, b: ωb	Normal	0.30	1.00	-0.05	-1.158	1.114
Tax, or: ω_{or}	Normal	0.30	1.00	-0.03	-0.333	0.235
Tax, os: ω_{os}	Normal	0.10	1.00	0.836	0.343	1.283
Tax, y: ω_y	Normal	0.05	0.50	0.08	-0.650	0.885
Tax, smoothing: ρ_{tx}	Beta	0.50	0.25	0.539	0.370	0.718
Govt. Cons., b: γ_b	Normal	-0.30	0.20	-0.17	-0.453	0.130
Govt. Cons., or: γ_{or}	Normal	0.00	0.20	1.207	1.156	1.265
Govt. Cons., os: γ_{os}	Normal	0.80	1.00	-0.04	-0.215	0.093
Govt. Cons., y: γ_{gy}	Normal	0.00	0.50	1.188	0.673	1.704
Govt. cons., smoothing: ρ_{gc}	Beta	0.50	0.25	0.139	0.041	0.233

Source:

From **table 14**, we notice that:

- The elasticity of substitution between oil and non-oil goods, ψo, is estimated at 0.26, which is slightly lower than the assumed prior value of 0.3.
- The estimated value of the elasticity of intra-temporal substitution between domestically produced and imported investment goods consumed by the household, ψi, is 0.61, which is approximately the same value as the assumed prior of 0.60.
- The estimated Calvo price parameters for imported and domestically produced goods are estimated at about 0.63, compared to their respective priors of 0.67 which is slightly higher.
- The fuel pricing rule parameter, v, which governs the extent to which government subsidises the consumption of fuel in the domestic economy is estimated at about 0.34; implying a passthrough of about 34.0 per cent from international oil price changes to domestic petrol price. The estimated fuel pricing rule has implications for

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the evolution of domestic prices and the response of monetary policy to an oil price shock.

4.3.3. Impulse responses
### 4.3.3.1.   The effect of an oil price shock.

We discuss in this section the effect of a negative shock in the international oil price for selected macroeconomic variables particularly the behaviour monetary and fiscal policy under this shock.

As shown in **figure (31),** we notice that a 1% change when a negative oil price shock leads to a contraction of around 2 basis points in total output GDP. However, it tends to increase again in the aftermath of the oil shock. Such a response is consistent with the high sensitiveness and dependency of the Algerian economy on oil production.

In addition, as sticky prices exist under the existence of subsidized prices, and since Algerian firms use oil in the production of non-oil goods as well, this shock will decrease the real marginal cost which explains the immediate response of inflation. Thus, the pass-through effects of the depreciated real exchange rate to domestic prices causes imported inflation to rise with more than 0.5 basis following a 1% oil price shock to decrease again in the aftershock to fluctuate again in the rest of the period. Thus, a 1% negative real oil price shock, yields an increase of more than 0.6 basis points in domestic inflation.

Consequently, in response to higher inflation, the Algerian central bank embarks on a contractionary monetary policy with an initial interest rate hike of about 0.4 basis points. This is followed by an interest rate cut that helps to boost output and consumption. This highlights **(Ferrero and Seneca, 2019)**'s argument regarding the policy trade-off. More precisely, the Algerian central bank in this case faces the dilemma of stabilising either prices or output in the aftermath of a negative real international oil price shock.

Figure 31: impulse response – negative oil shock
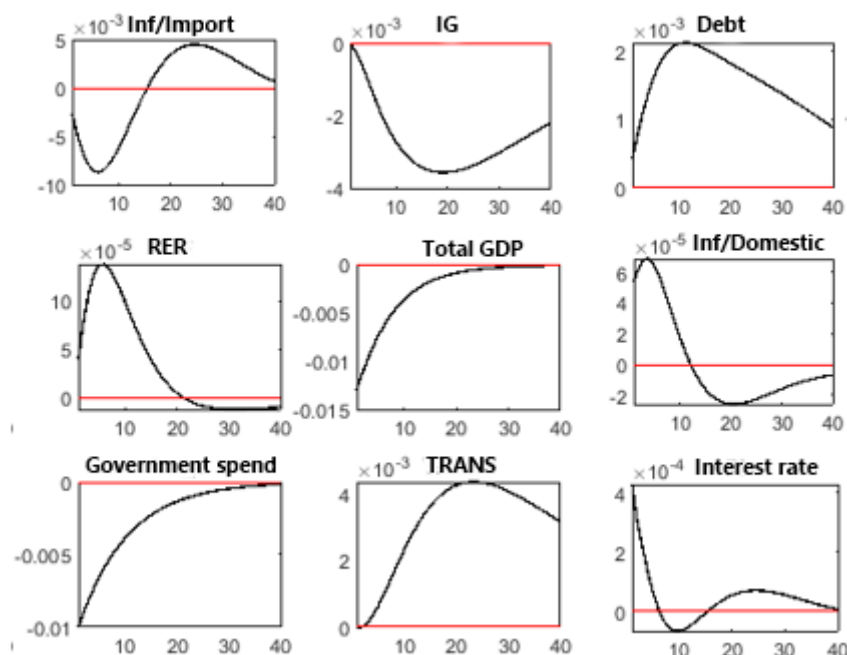
Source: authors illustration based on MATLAB outputs

In terms of the responses of the fiscal variables, government spending decline following a negative real oil price shock of 1%, then it increases again during the aftershock period. The reduction in government spending in response to lower oil revenues and aggregate output signifies fiscal pro-cyclicality, which is consistent with the findings of Romero (2008) in a similar study for the oil-exporting economy of Mexico.

However, we did not include the response of taxes (taxes on income, on capital and on consumption), because it is still fragile comparing with the oil taxes revenues (which presents more then 57% from total tax revenue in Algeria), and regarding the lack of data the oil-taxes was not included in the model. The poor domestic tax mobilisation systems prevalent in most resource rich emerging economies **(Salti, 2008).**

In addition, following a negative oil price shock, the interest rate rises initially but falls subsequently, remaining below its steady state level for more than 10 years to rise again and stabilize in the aftermath.

This has implications for the fiscal variables as a lower interest rate causes a reduction in debt to less than 1 following this shock. The lower debt as well as the reduction in fiscal revenues arising from the negative oil price shock provide an urge for the government to increase primary deficit. Thus, in rational expectations equilibrium, primary deficit acts in a manner

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that stabilises debt. Whereas the response of taxes is weak, government consumption falls strongly in response to the increased primary deficit to ameliorate the deficit shock and stabilise debt.

Table 15: Impulse response analysis

		GDP	Inflation	Interest rate	Debt	Employment	Government investment	Government capital
	Government spending							
	Tax on income from labour							
	Tax on income from capital							

2021–2022

Tax on consumption							
Taylor rule - monetary policy							
Productivity							
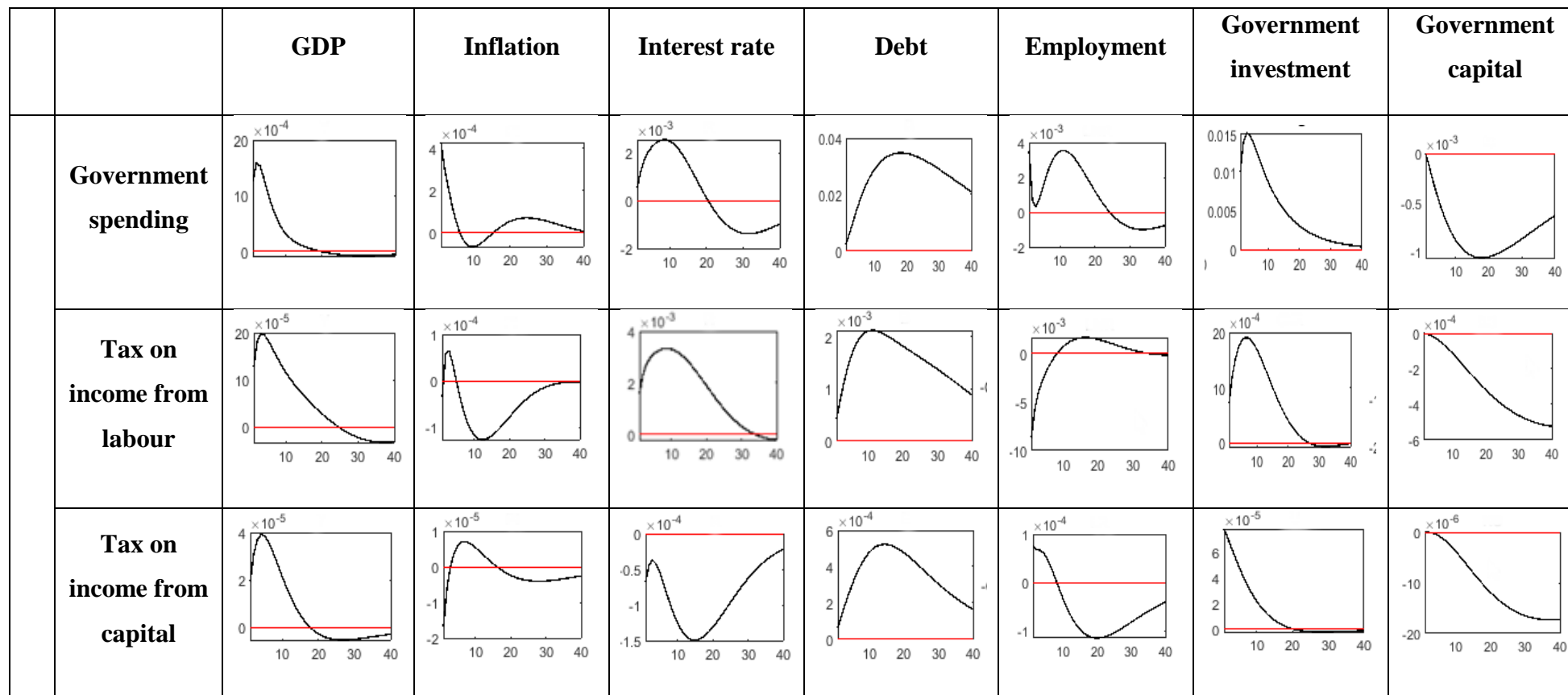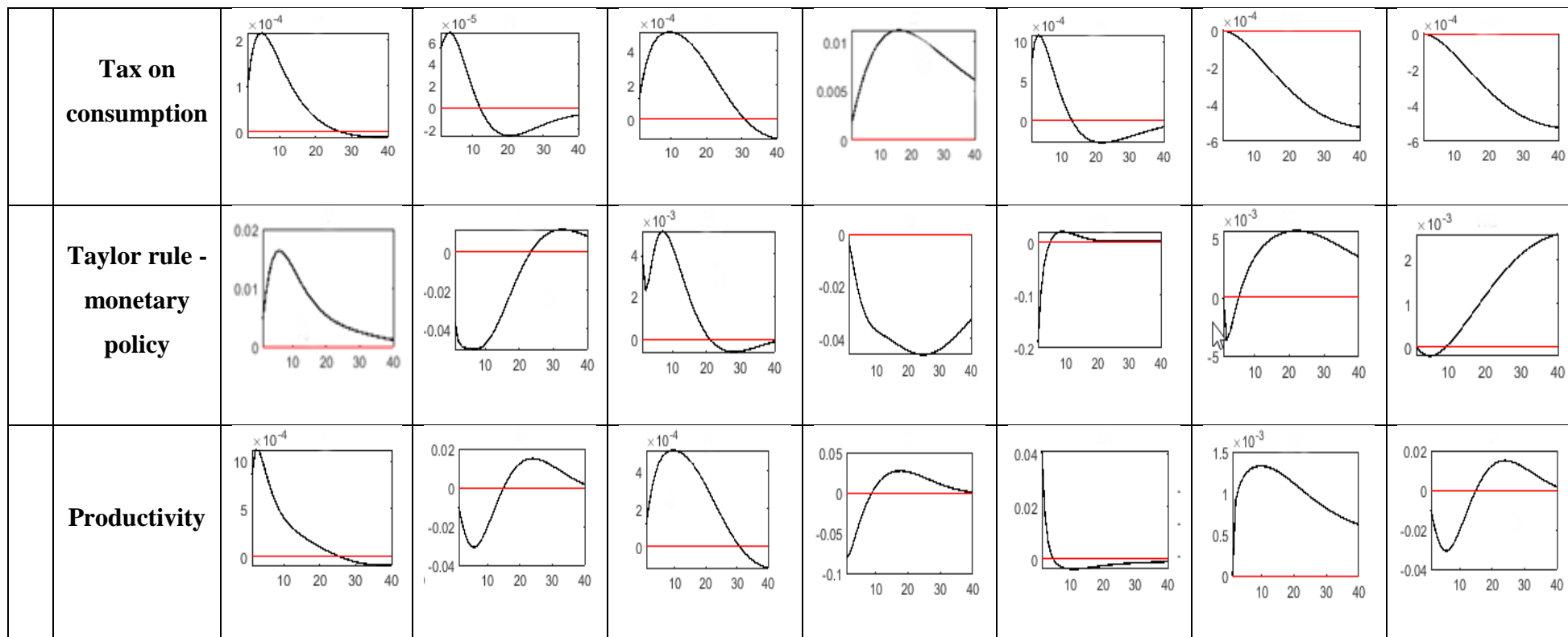
Source: author's illustration based on MATLAB outputs

Table 15 illustrates the results of impulse response analysis in terms of mean responses of observable variables as well as unobservable debt stock together with 90% confidence interval.

Following a positive productivity shock of 1% in the level of output GDP, the level of interest rate declines followed by debt decrease. The government responds to the fall in debt with an expansionary fiscal policy. This will affect the marginal cost of firms which leads to a drop in inflation which may slightly increase in a very short term. Because of the lower nominal interest rates debt falls and so the government increases spending and decreases taxes. An expansionary fiscal policy also affects marginal cost and hence inflation. As a result of this, inflation falls and monetary authority keeps interest rates low in order to reduce deflationary pressure.

A positive shock in monetary Taylor rule lowers both inflation and output. The higher level of interest rate also leads to the debt accumulation. In order to stabilise the debt stock the government cuts the government expenditures and increases taxes. Lower government expenditures and higher taxes also help to stabilise inflation by affecting marginal costs of the firms. This situation can be summarised as follows: a tight monetary policy is followed by a tight fiscal policy by means of spending and tax.

A positive spending shock leads to the increase of inflation and output. Although an increase in government spending decreases inflation via marginal cost, the effects of government spending on marginal cost and hence on inflation are offset by the effect of increase in output. This results in higher inflation and the monetary authorities raise the interest rate. The increase in government spending as well as the increase in nominal interest rates raises debt stock. In order to stabilise debt, the government raises tax. As a result of this, an expansionary fiscal policy via government spending is accompanied by a tight monetary policy and by a tight fiscal policy via taxes.

A positive tax shock (including the three types of taxes) reduces the output and increases the marginal cost and, thus, inflation (registered a slight increase in a very short period to increase accordingly). Following the increase in inflation, nominal interest rate is raised by the monetary authority.

The increase in taxes as well as in inflation leads to a reduction in the debt stock, this effect outweighs the effect of higher nominal interest rates on debt. As a result of this, a tight fiscal policy, introduced via the increase in taxes, is accompanied by a tight monetary policy.

Chapter's conclusion:

Monetary policy is nowadays more effective when combining with fiscal policy and vis-versa where the interaction between monetary and fiscal policies plays an important role for stabilising an economy. The implementation of a sound fiscal policy provides room for an active monetary policy. This chapter estimates a small-scale New Keynesian open economy DSGE model for the Algerian economy as a resource rich country using a Bayesian estimation technique for the period of 1980–2018. We investigate the effects of oil price shock on macroeconomic variables by stressing the effect of this shock on monetary and fiscal policy rules. In addition, this chapter mainly focuses on investigating the interactions between monetary and fiscal policies and assess their stabilisation role. While monetary and fiscal policies are implemented by two different authorities, these policies affect each other. We estimate some deep structural parameters serves as a data generating process to identify policy reactions.

We record a number of useful results. First, we show that a negative shock to the real price of oil contracts the aggregate GDP, depreciates the real exchange rate, and increases headline inflation in the resource-rich emerging economy. The central bank responds with an initial interest rate hike, while primary deficit increases. We report active monetary policy and passive fiscal policy over the full sample. This implies a Ricardian fiscal policy and a monetary policy reaction function that obeys the Taylor principle. To our knowledge, this represents the first attempt at estimating the fiscal reaction function for Algeria.

The main findings of this chapter are consistent with the suggestions of the related literature. Moreover, we find that the values of structural and policy parameters are generally consistent with those found for most resource-rich countries. The parameter estimates show that the monetary authority reacts to inflation in an active way and only weakly responds to the output gap. The difference between prior and posterior distributions demonstrates that data is informative for most policy parameters. We also find significant fiscal policy feedbacks on debt for both spending and tax rules. We show that fiscal policy has contributed to the debt stabilisation but we did not find any evidence on active stabilisation of output gap by fiscal means. Estimation results of the Phillips curve reveals that past and expected future inflations are key factors in determining current inflation and backward-looking behaviour remains predominant. Despite successful disinflationary attempts, the inflation in Algeria still has some degree of persistence.

General Conclusion:

John Maynard Keynes's work presented in 1936 which is considered as the pioneer work on monetary and fiscal policy. Despite the existence of a vast literature on the impact of monetary policy on the economy, monetary studies often neglect to consider potential role for fiscal policy in their analysis. However, as discussed in Sims (2011) the fluctuations in the price levels cannot be solely explained by monetary policy since fiscal policy may play an important role.

The importance given to the interaction between monetary and fiscal policies has made researchers analyse this case theoretically and empirically. Consequently, The theoretical literature on the coordination between monetary and fiscal policies has grown considerably where **(Benigno and Woodford 2003, Persson, Persson et al. 2006); and (Schmitt-Grohé and Uribe 2007)** are some examples of models with features New Keynesian which explain the role of an optimal coordination of fiscal and monetary authorities. If such arrangement is observed, both policies are under the same objective function and, therefore, they face the budget constraint of the public sector**.** many researches have adopted different econometric models and technics, starting with **(Muscatelli, Tirelli et al. 2004, p19)**who built a New-Keynesian model for the American case, showing that the strategic coordination between monetary and fiscal policies depends on the types of shocks observed by the economy. The authors show that a countercyclical fiscal policy may reduce welfare if it is not well coordinated with monetary policy. However, the macroeconomists regularly debate on the optimal mix and efficacity of monetary and fiscal policy, where different schools of thought criticize each other on various aspects of macro-economy, especially on the question of policy effectiveness.

In addition, Over the last three decades, oil has remained an important source of energy for households and firms, accounting for about 35 per cent of total energy supply globally **(IEA, 2019)**. Also, about 15-20 per cent of the global value added is accounted for by commodity exporting countries **(Bergholt and Larsen, 2016)**. Thus, oil price shocks have implications not only for the welfare of households, but also global macroeconomic stability.

Also, changes in oil price have been associated with external reserves volatility, exchange rate instability, inflation volatility, and severe macroeconomic imbalances in resource-rich emerging economies **(Adeniyi, Oyinlola and Omisakin, 2011; Akinleye and Ekpo, 2013; Richard and Olofin, 2013)**. Therefore, developments in the international oil market will

continue to attract significant interests from macroeconomists in both oil-importing and oil-exporting countries.

Thus, Algeria, like other countries, is striving to maintain economic, social and environmental stability by pursuing several economic policies. However, despite the great efforts and the big financial cover, Algeria has not yet achieved the ideal rate of development and couldn't escape the curse of oil. in the light of the recent monetary and fiscal policy actions and the recent downturns, it has become important to understand: how these policies respond to each other? And how different policy mixes affect macro-variables. Since the policies have different mandates and objectives, they are bound to take actions as per their own objectives which may be in contention with the objectives of the other policy.

Several theoretical and empirical studies have extensively examined the macroeconomic effects of monetary-fiscal policies interactions in an resource rich country, yet to the best of our knowledge this thesis is considered as a first attempt to treat this matter using a DGSE model.

This thesis sheds light on topical issues (theoretically and empirically) relating to the conduct of monetary and fiscal policy. Two features of the macroeconomic policies received less attention despite being central to the impact of the policy actions. First, monetary and fiscal policy interacts and influences the real activity measures jointly. A number of studies emphasize that separating monetary and fiscal policies undermines policy interactions that are important for the determination of prices, see Davig and Leeper (2007,2011), Sims (2011), and Woodford (2011). Second, monetary and fiscal policy interactions may have important international spillovers that may influence or even weaken the domestic impact of the policy shocks, see Pesaran et al. (2004), Dees et al. (2007), Gali (2008), and Pesaran and Smith (2012). Therefore, this thesis aims to capture interactions among Algerian monetary and fiscal policy actions, and its impact on select macroeconomic variables "the output, inflation, interest rate, Debt and employment".

Main results revealed that:

The main findings of this chapter are consistent with the suggestions of the related literature.

First, we show that a 1.0 per cent negative resource-price shock contracts output, depreciates the real exchange rate and increases inflation. In response, the central bank embarks on contractionary monetary policy while primary deficit increases. We find evidence of active

monetary policy and passive fiscal policy over the full sample. This is consistent with the policy mix characterised under region 1 of Leeper (1991) and in line with the monetary dominance view. Contrary to expectation, taxes respond negatively to debt under our benchmark model. Thus, government consumption plays a more significant role than taxes in stabilising debt.

Moreover, we find that the values of structural and policy parameters are generally consistent with those found for most resource-rich countries. The parameter estimates show that the monetary authority reacts to inflation in an active way and only weakly responds to the output gap. The difference between prior and posterior distributions demonstrates that data is informative for most policy parameters. We also find significant fiscal policy feedbacks on debt for both spending and tax rules. We show that fiscal policy has contributed to the debt stabilisation but we did not find any evidence on active stabilisation of output gap by fiscal means. Estimation results of the Phillips curve reveals that past and expected future inflations are key factors in determining current inflation and backward-looking behaviour remains predominant. Despite successful disinflationary attempts, the inflation in Algeria still has some degree of persistence.

A contractionary monetary policy may require additional debt to be issued to pay higher interest rates on the public debt. This policy shock can generate inflation if rational forward-looking agents believe that the debt will not be fully backed by future taxes. Thus, a monetary contraction can lead to an increase in nominal government debt through higher interest rates. As (Sims, 2011) explains, this monetary policy-generated increase in the interest rate can increase inflation through a positive wealth effect. An increase in the interest rates can affect bondholders' disposable income. The impact would intensify when interest expenses are a major part of the government budget due to a fiscal-induced increase in the interest expenditure share of government debt. If agents perceive that the rise in government's debt would be financed by issuing further bonds or seigniorage rather than taxes, it would increase the aggregate demand by encouraging private expenditure. This can cause a higher inflation rate and output, see Davig and Leeper (2007, 2011), (Sims, 2011), (Leeper & Walker, 2012), and (Leeper, 2013).

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Appendix 1: First order conditions

Households

Ricardian consumers

$$\max_{C_{R,t},K_{t+1}^P,U_t,I_t^P,B_{t+1}} E_t \sum_{t=0}^{\infty} \beta^t \left[\frac{\left(C_{R,t} - \phi_c C_{R,t-1}\right)^{1-\sigma}}{1-\sigma} - \frac{L_{R,t}^{1+\varphi}}{1+\varphi} \right] \quad (A.1)$$

subject to,

$$P_t(1+\tau_t^c)\left(C_{R,t}+I_{no,t}^P\right) + \frac{B_{t+1}}{R_t^B \mu_t} + \frac{\epsilon_t B_{t+1}^*}{R_t^* \mu_t^*} = W_t L_{R,t}\left(1-\tau_t^l\right) + R_{no} U_t K_h^P\left(1-\tau_t^k\right)$$

$$-P_t K_h^P \left[\Psi_1(U_t-1) + \frac{\Psi_2}{2}(U_t-1)^2\right] + B_t + \varepsilon_t B_t^* + \omega_R P_t TRANS_t \quad (A.2)$$

with the law of motion of capital,

$$K_{t+1}^P = (1-\delta)K_t^P + I_t^P \left[1 - \frac{\chi}{2}\left(\frac{I_t^P}{I_{t-1}^P} - 1\right)^2\right] \qquad (A.3)$$

$$\mathcal{L} = E_t \sum_{t=0}^{\infty} \beta^t \left\{ \left[\frac{\left(C_{R,t} - \phi_c C_{R,t-1}\right)^{1-\sigma}}{1-\sigma} - \frac{L_{R,t}^{1+\varphi}}{1+\varphi} \right] \right.$$
$$-\lambda_{R,t}\left[P_t(1+\tau_t^c)\left(C_{R,t} + I_t^P\right) + \frac{B_{t+1}}{R_t^B} - W_t L_{R,t}\left(1-\tau_t^l\right)\right.$$
$$-R_t U_t K_t^P\left(1-\tau_t^k\right) + P_t K_t^P\left[\Psi_1(U_t - 1) + \frac{\Psi_2}{2}(U_t - 1)^2\right]$$
$$-B_t - \omega_R P_t TRANS_t]$$
$$\left.\left. -Q_t\left[K_{t+1}^P - (1-\delta)K_t^P - I_t^P\left[1 - \frac{\chi}{2}\left(\frac{I_t^P}{I_{t-1}^P} - 1\right)^2\right]\right]\right\}\right. \qquad (A.4)$$

where $\lambda_{R,t}$ is the Lagrange multipliers associated with household budget constraint

Q_t is the law of motion for capital.

In order to derive the first-order conditions, we set the partial derivatives of $\mathcal{L}$ with respect to $C_{R,t}, B_{t+1}, B_{t+1}^*, K_{h,t+1}, I_{no,t}, \lambda_{C,t}^R$ and Q equal to zero.

We arrive at the following first-order conditions:

$$\frac{\partial \mathcal{L}}{\partial C_{R,t}} = \left(C_{R,t} - \phi_c C_{R,t-1}\right)^{-\sigma} - \lambda_{R,t}P_t(1+\tau_t^c)$$
$$-\phi_c\beta\left(E_t C_{R,t+1} - \phi_c C_{R,t}\right)^{-\sigma} = 0 \qquad (A.5)$$

$$\frac{\partial \mathcal{L}}{\partial K_{t+1}^P} = \beta E_t\{\lambda_{R,t+1}R_{t+1}U_{t+1}\left(1-\tau_{t+1}^k\right) - \beta\lambda_{R,t+1}P_{t+1}$$
$$\left[\Psi_1(U_{t+1} - 1) + \frac{\Psi_2}{2}(U_{t+1} - 1)^2\right]$$
$$-Q_t + \beta Q_{t+1}(1-\delta)\} = 0 \qquad (A.6)$$

$$\frac{\partial \mathcal{L}}{\partial U_t} = \lambda_{R,t}R_t K_t^P\left(1-\tau_t^k\right) - \lambda_{R,t}P_t K_t^P \Psi_1$$
$$-\lambda_{R,t}P_t K_t^P \Psi_2(U_t - 1) = 0 \qquad (A.7)$$

$$\frac{\partial \mathcal{L}}{\partial I_t^P} = -\lambda_{R,t}P_t(1+\tau_t^c) + Q_t\left[1 - \frac{\chi}{2}\left(\frac{I_t^P}{I_{t-1}^P}-1\right)^2 - \chi\frac{I_t^P}{I_{t-1}^P}\left(\frac{I_t^P}{I_{t-1}^P}-1\right)\right]$$

$$+ \chi\beta E_t\left[Q_{t+1}\left(\frac{I_{t+1}^P}{I_t^P}\right)^2\left(\frac{I_{t+1}^P}{I_t^P}-1\right)\right]$$

$$= 0 \qquad\qquad (A.8)$$

$$\frac{\partial \mathcal{L}}{\partial B_{t+1}} = -\frac{\lambda_{R,t}}{R_t^B \mu_t} + \beta E_t\lambda_{R,t+1} = 0 \qquad\qquad (A.9)$$

$$\frac{\partial \mathcal{L}}{\partial B_{t+1}} = -\frac{\lambda_{R,t}\epsilon_t}{R_t^*\mu_t^*} + \beta E_t\lambda_{R,t+1} = 0 \qquad\qquad (A.10)$$

From equation (A.5),

$$\lambda_{R,t} = \frac{(C_{R,t}-\phi_c C_{R,t-1})^{-\sigma}}{P_t(1+\tau_t^c)} - \phi_c\beta\frac{(E_t C_{R,t+1}-\phi_c C_{R,t})^{-\sigma}}{P_t(1+\tau_t^c)} \qquad\qquad (A.11)$$

The Euler equation is derived from the combination of equations (A.5) and (A.9:

$$\frac{1}{R_t\mu_t} = \beta E_t\left[\left(\frac{C_{t+1}^R-\phi_c C_t}{C_t^R-\phi_c C_{t-1}}\right)^{-\sigma}\frac{1}{\pi_{t+1}}\right] \qquad (A.12)$$

The demand for foreign bonds is derived by combining equations (A.5) and (A.10) to yield:

$$\frac{1}{R_t^*\mu_t^*} = \beta E_t\left[\frac{\varepsilon_{t+1}}{\varepsilon_t}\left(\frac{C_{t+1}^R-\phi_c C_t}{C_t^R-\phi_c C_{t-1}}\right)^{-\sigma}\frac{1}{\pi_{t+1}}\right] \qquad (A.13)$$

where $\pi_t = \frac{P_t}{P_{t-1}}$. Substituting for $\lambda_{C,t}^R = \frac{1}{P_t(C_t^R-\phi_c C_{t-1})^\sigma}$

From equation (A.6),

$$Q_t = \beta E_t\{(1-\delta)Q_{t+1} + \lambda_{R,t+1}R_{t+1}U_{t+1}(1-\tau_{t+1}^k)$$
$$-\lambda_{R,t+1}P_{t+1}\left[\Psi_1(U_{t+1}-1)+\frac{\Psi_2}{2}(U_{t+1}-1)^2\right]\} \qquad (A.14)$$

From equation (A.7),

$$\frac{R_t}{P_t} = \left(\frac{1}{1-\tau_t^k}\right)[\Psi_1 + \Psi_2(U_t-1)] \qquad\qquad (A.15)$$

From equation (A.8),

$$\lambda_{R,t}P_t(1 + \tau_t^c) - Q_t\left[1 - \frac{\chi}{2}\left(\frac{I_t^P}{I_{t-1}^P} - 1\right)^2 - \chi\frac{I_t^P}{I_{t-1}^P}\left(\frac{I_t^P}{I_{t-1}^P} - 1\right)\right]$$

$$= \chi\beta E_t\left[Q_{t+1}\left(\frac{I_{t+1}^P}{I_t^P}\right)^2\left(\frac{I_{t+1}^P}{I_t^P} - 1\right)\right] \qquad (A.16)$$

Determining non-Ricardian household consumption

As with the Ricardian households, this type of agent makes decisions differently since they are non-optimizers, their entire disposable income is used to purchase consumption goods. The Lagrangian for this problem can be written as:

$$\max_{C_{N\pi,t}} E_t \sum_{t=0}^{\infty} \beta^t\left[\frac{(C_{NR,t} - \phi_c C_{NR,r-1})^{1-\sigma}}{1-\sigma} - \frac{L_{NR,t}^{1+\psi}}{1+\varphi}\right] \qquad (A.18)$$

subject to,

$$P_t(1 + \tau_t^c)C_{NR_t t} = W_t L_{NR,t}(1 - \tau_t^t) + (1 - \omega_R)P_t TRANS_t \qquad (A.19)$$

Using the Lagrangian to solve the non-Ricardian household problem:

$$\mathcal{L} = E_t \sum_{t=0}^{\infty} \beta^t\left\{\left[\frac{(C_{NR,t} - \phi_c C_{NR,t-1})^{1-\sigma}}{1-\sigma} - \frac{L_{NR,t}^{1+\varphi}}{1+\varphi}\right]\right.$$
$$-\lambda_{NR,t}\left[P_t(1 + \tau_t^c)C_{NR,t} - W_t L_{NR,t}\left(1 - \tau_t^l\right)\right.$$
$$\left.\left.-(1 - \omega_R)P_t TRANS_t\right]\right\} \qquad (A.20)$$

Solving the previous problem, we arrive at the following:

$$\frac{\partial \mathcal{P}}{\partial C_{NR,t}} = \left(C_{NR,t} - \phi_c C_{NR,t-1}\right)^{-\sigma} - \lambda_{NR,t}P_t(1 + \tau_t^c)$$
$$-\phi_c\beta\left(E_t C_{NR,t+1} - \phi_c C_{NR,t}\right)^{-\sigma} = 0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots (A.21)$$

From equation (A.18),

$$\lambda_{NR,t} = \frac{\left(C_{NR,t} - \phi_c C_{NR,t-1}\right)^{-\sigma}}{P_t(1 + \tau_t^c)} - \phi_c\beta\frac{\left(E_t C_{NR,t+1} - \phi_c C_{NR,t}\right)^{-\sigma}}{P_t(1 + \tau_t^c)} \qquad (A.22)$$

Labour supply and wage setting

The labour-aggregating firm uses the following technology:

$$L_{j,t} = \left[\int_0^1 L_t(j)^{\frac{\psi_w - 1}{\psi_w}} dj \right]^{\frac{\psi_w}{\psi_w - 1}} \quad (A.23)$$

and aims to maximise a profit function given by:

$$\max_{N_t(j)} \Pi_{w,t} = W_t L_t - \int_0^1 W_t(j) L_t(j) dj \quad (A.24)$$

Placing equation (A.23) into (A.24) yields:

$$\max_{N_t(j)} \Pi_{W,t} = W_t \left[\int_0^1 L_t(j)^{\frac{\psi_w - 1}{\psi_w}} dj \right]^{\frac{\psi_w}{\psi_w - 1}} - W_t(j) \int_0^1 L_t(j) dj \quad (A.25)$$

The labour aggregating firm's demand for differentiated labour is obtained after solving the first order condition of the above problem with respect to $L_t(j)$:

$$L_t(j) = \left[\frac{W_t(j)}{W_t} \right]^{-\psi_w} L_t \quad (A.26)$$

Substituting equation (A.26) into (A.23), we can derive the aggregate wage level as:

$$W_t = \left[\int_0^1 W_t(j)^{1 - \psi_w} dj \right]^{\frac{1}{1 - \psi_w}} \quad (A.27)$$

Following Calvo (1983), we assume that $1 - \theta_w$ fraction of households optimally define their wages while the remaining fraction, θ_w, follows a rule that enables them to retain the wage level in the previous period as follows:

$$W_t(j) = W_{t-1}(j)$$

The problem with the definition of wages possesses the same novelty as the consumption decision, namely the inclusion of taxes. As there is no distinction between labor offered by Ricardians (R) and non-Ricardians (NR), the problem of definition of wages is singular $-x = \{R, NR\}$

$$\max_{W_{j,t}^*} E_t \quad \sum_{i=0}^{\infty} (\beta\theta_W)^i \left\{ -\frac{1}{1+\varphi} \left[L_{x,t+i} \left(\frac{W_{t+i}}{W_{j,t}^*} \right)^{\psi_W} \right]^{1+\varphi} \right.$$

$$\left. +\lambda_{x,t+i} \left[W_{j,t}^* L_{x,t+i} \left(\frac{W_{t+i}}{W_{j,t}^*} \right)^{\psi_W} \left(1 - \tau_{t+i}^l \right) \right] \right\} \qquad (A.28)$$

Resulting in the following first-order condition:

$$0 = E_t \sum_{i=0}^{\infty} (\beta\theta_W)^i \{ \psi_W \left[L_{x,t+i} \left(\frac{W_{t+i}}{W_{j,t}^*} \right)^{\psi_W} \right]^{\varphi} L_{x,t+i} \left(\frac{W_{t+i}}{W_{j,t}^*} \right)^{\psi_W} \frac{1}{W_{j,t}^*}$$

$$+ \quad (1-\psi_W)\lambda_{x,t+i} L_{x,t+i} \left(\frac{W_{t+i}}{W_{j,t}^*} \right)^{\psi_W} \left(1 - \tau_{t+i}^l \right) \}$$

or,

$$0 = E_t \sum_{i=0}^{\infty} (\beta\theta_W)^i \left\{ \psi_W L_{x,j,t+i}^{\varphi} \frac{1}{W_{j,t}^*} + (1-\psi_W)\lambda_{x,t+i} \left(1 - \tau_{t+i}^l \right) \right\}$$

With some mathematical operations we arrive at the equation for the definition of optimal wages by the households chosen for this purpose:

$$W_{j,t}^* = \left(\frac{\psi_W}{\psi_W - 1} \right) E_t \sum_{i=0}^{\infty} (\beta\theta_W)^i \left[\frac{L_{x,j,t+i}^{\varphi}}{\lambda_{x,t+i} \left(1 - \tau_{t+i}^l \right)} \right]$$

Thus,

$$W_{j,t}^* = \left(\frac{\psi_W}{\psi_W - 1} \right) E_t \sum_{i=0}^{\infty} (\beta\theta_W)^i \left[\frac{L_{R,j,t+i}^{\varphi}}{\lambda_{R,t+i} \left(1 - \tau_{t+i}^l \right)} \right] \qquad (A.29)$$

$$W_{j,t}^* = \left(\frac{\psi_W}{\psi_W - 1} \right) E_t \sum_{i=0}^{\infty} (\beta\theta_W)^i \left[\frac{L_{NR,j,t+i}^{\varphi}}{\lambda_{NR,t+i} \left(1 - \tau_{t+i}^l \right)} \right] \qquad (A.30)$$

Equations (A.29) and (A.30) define the labour supply by Ricardian and non-Ricardian households, respectively. By law of large numbers, the aggregate wage level (equation A.31) can be written as:

$$W_t = \left[\theta_W W_{t-1}^{1-\psi_W} + (1-\theta_W)W_t^{*1-\psi_W}\right]^{1-\frac{1}{-\psi}W} \qquad (A.31)$$

Finally, consumption demand and hours of Ricardian and non-Ricardian households can be aggregated as follows:

$$C_t = \omega_R C_{R,t} + (1-\omega_R)C_{NR,t}$$
$$L_t = \omega_R L_{R,t} + (1-\omega_R)L_{NR,t} \qquad (A.32)$$

where for Ricardian households, $C_t^R = \int_0^1 C_t^R(j)dj$ and $L_t^R = \int_0^1 L_t^R(j)dj$. For non-Ricardian

households, $C_t^{NR} = \int_0^1 C_t^{NR}(j)dj$ and $L_t^{NR} = \int_0^1 L_t^{NR}(j)dj$.

Final-goods producers:

The representative final goods producer seeks to maximize its profit given by:

$$\Pi_{h,t}(g_h) = P_{h,t}Y_{h,t} - \int_0^1 P_{h,t}(g_h)Y_{h,t}(g_h)dg_h \qquad (A.33)$$

subject to the constant returns to scale bundling technology:

$$Y_{h,t} = \left[\int_0^1 Y_{h,t}(g_h)^{\frac{\vartheta_h-1}{\vartheta_h}}dg_h\right]^{\frac{\vartheta_h}{\vartheta_h-1}} \qquad (A.34)$$

To describe the firm's optimization problem, we put equation (A.33) into (A.32) as follows:

$$\max_{Y_{h,t}(z_h)} \Pi_{h,t}(g_h) = P_{h,t}\left[\int_0^1 Y_{h,t}(g_h)^{\frac{\vartheta_h-1}{\vartheta_h}}dg_h\right]^{\frac{\vartheta_h}{\vartheta_h-1}} - \int_0^1 P_{h,t}(g_h)Y_{h,t}(g_h)dg_h$$

Compelling the partial derivative of equation (AC.34) with respect to $Y_{H,t}(g_h)$ yields:

$$\frac{\partial \Pi_{h,t}}{\partial Y_{h,t}(g_h)} = (Y_{h,t})^{-1}Y_{h,t}(g_h) - \left[\frac{P_{h,t}(g_h)}{P_{h,t}}\right]^{-\vartheta_h} = 0 \qquad (A.35)$$

$$Y_{h,t}(g_h) = \left[\frac{P_{h,t}(g_h)}{P_{h,t}}\right]^{-\vartheta_h}Y_{h,t}$$

The final goods pricing rule is derived by replacing equation (A.35) into equation A.33 to get:

$$P_{h,t} = \left[\int_0^1 P_{h,t}(g_h)^{1-\epsilon_h} dg_h \right]^{\frac{1}{1-\vartheta_h}} \quad (A.36)$$

Intermediate-goods producers:

Intermediate goods producer chooses optimal quantities of factor inputs to employ by minimizing cost:

$$\min_{N_t(z_h),K_{h,t}(z_h),O_t(z_h)} W_t L_t(g_h) + R_{h,t} K_{h,t}(g_h) + R_{G,t} K_{G,t}(g_h) \quad (37)$$

subject to a constant returns to scale Cobb-Douglas technology:

$$Y_{h,t} = A_{h,t}(K_{h,t}^G)^{\alpha_{h,1}}(K_{h,t}^P)^{\alpha_{h,2}}(L_{j,t}^{No})^{\alpha_{h,3}} \quad (A.38)$$

The Lagrangian for the firm's optimization problem is represented as:

$$\mathcal{L} = -[W_t L_t(z_h) + \quad R_{h,t} K_{h,t}^P(z_h) + R_{G,t} K_{h,t}^G(z_h)]$$
$$+\lambda_t^g(z_h)P_{h,t}\left[A_{h,t}(K_{h,t}^G)^{\alpha_{h,1}}(K_{h,t}^P)^{\alpha_{h,2}}(L_{j,t}^{No})^{\alpha_{h,3}} - Y_{h,t}(z_h) \right] \quad (A.39)$$

The first-order condition with respect to $L_t(g_h)$:

$$\frac{\partial \mathcal{L}}{\partial L_t(g_h)} = -W_t + \lambda_t^g(g_h)\alpha_{h,3}P_{h,t}\frac{Y_{h,t}(g_h)}{L_t(g_h)} = 0$$
$$\frac{W_t}{P_t} = mc_t \alpha_{h,3} p_{h,t}\frac{Y_{h,t}(g_h)}{L_t(g_h)} = w_t \quad (A.40)$$
$$L_t(g_h) = \frac{mc_t \alpha_{h,3} p_{h,t} Y_{h,t}(g_h)}{w_t} \quad (A.41)$$

where $mc_t = \frac{MC_t}{P_t}, p_{h,t} = \frac{P_{h,t}}{P_t}, w_t = \frac{W_t}{P_t}$. The intermediate firm's demand for labour is given by equation (A.41). Similarly, the first-order condition with respect to $K_{h,t}^P(z_h)$ is:

$$\frac{\partial \mathcal{L}}{\partial K_{h,t}^P(z_h)} = -R_{h,t} + \lambda_t^g(z_h)\alpha_{h,2}P_{h,t}\frac{Y_{h,t}(z_h)}{K_{h,t}(z_h)} = 0$$
$$\frac{R_{h,t}}{P_t} = mc_t \alpha_{h,2} p_{h,t}\frac{Y_{h,t}(z_h)}{K_{h,t}^P(z_h)} = r_{h,t} \quad (42)$$
$$K_{h,t}^P(z_h) = \frac{mc_t \alpha_{h,2} p_{h,t} Y_{h,t}(z_h)}{r_{h,t}} \quad (43)$$

where $w_t = \frac{R_{h,t}}{P_t}$. From equation (A.42), the real rental rate is derived, while the intermediate firm's demand for capital is given by equation (A.43).

we obtain the intermediate firm's input combinations as follows:

$$\frac{K_{h,t}(z_h)}{N_t(z_h)} = \frac{\alpha_h^k w_t}{\alpha_h^n r_{h,t}}$$

$$\frac{O_{h,t}(z_h)}{N_t(z_h)} = \frac{\alpha_h^o w_t}{\alpha_h^n p_{ro,t}}$$

By putting equations (C.41), (C.43) and (C.44) into the production function (equation C.38), we obtain the firm's marginal cost as:

$$MC_{j,t} = \frac{1}{A_t K_{j,t}^G \alpha_3} \left(\frac{W_t}{\alpha_2}\right)^{\alpha_2} \left(\frac{R_t}{\alpha_1}\right)^{\alpha_1}$$

Price setting by domestic firms:

An intermediate firm that qualifies to optimally reset its price, $P_{h,t}^{\cdot}(j)$, for home goods to be sold in the domestic market does so by maximising profit:

$$\max_{P_{h,t}^*(z_h)} E_t \sum_{s=0}^{\infty} (\beta \theta_h)^s Y_{h,t}(z_h) \left[P_{h,t}^{\cdot}(z_h) - P_{h,t+s} mc_{t+s}\right] \quad (A.47)$$

subject to the demand for its product:

$$Y_{h,t+s}(z_h) = \left[\frac{P_{h,t}(z_h)}{P_{h,t}}\right]^{-\vartheta_h} Y_{h,t+s}. \quad (A.48)$$

The optimal reset price is obtained by solving:

$$\max_{P_{h,t}^*(z_h)} E_t \sum_{s=0}^{\infty} (\beta \theta_h)^s Y_{h,t+s} \left[\frac{P_{h,t}(z_h)}{P_{h,t+s}}\right]^{-\vartheta_h} \left[P_{h,t}^{\cdot}(z_h) - P_{h,t+s} mc_{t+s}\right] \quad (A.49)$$

Since firms face the same marginal cost, we can suppress the index (z_h), and write the first-order condition as:

$$(1 - \vartheta_h)\big(\dot{P}_{h,t}\big)^{-\vartheta_h} E_t \sum_{s=0}^{\infty} (\beta\theta_h)^s \quad P_{h,t+s}^{\vartheta_h} Y_{h,t+s}$$

$$+\epsilon_h\big(\dot{P}_{h,t}\big)^{-\vartheta_h-1} E_t \sum_{s=0}^{\infty} (\beta\theta_h)^s P_{h,t+s}^{1+\vartheta_h} mc_{t+s} Y_{h,t+s} = 0. \quad (A.50)$$

Solving equation (A.50) for $\dot{P}_{h,t}$, we obtain the optimal reset price as:

$$\dot{P}_{h,t} = \frac{\vartheta_h}{\vartheta_h - 1} \frac{E_t \sum_{s=0}^{\infty} (\beta\theta_h)^s P_{h,t+s} Y_{h,t+s} mc_{t+s}}{E_t \sum_{s=0}^{\infty} (\beta\theta_h)^s Y_{h,t+s}} \quad (A.51)$$

Solving analogously for the optimal reset price for export-bound intermediate goods yields:

$$\dot{P}_{h,t}^{*} = \frac{\vartheta_h}{\vartheta_h - 1} \frac{E_t \sum_{s=0}^{\infty} (\beta\theta_{hf})^s P_{h,t+s}^{*} Y_{h,t+s}^{*} mc_{t+s}}{E_t \sum_{s=0}^{\infty} (\beta\theta_{hf})^s \varepsilon_{t+s} Y_{h,t+s}^{*}} \quad (A.52)$$

Import-goods retailers

A set of competitive assemblers combine a continuum of differentiated imported varieties, $Y_{f,t}(z_f)$ to produce a final foreign good, $Y_{f,t}$, using a Dixit-Stiglitz aggregation technology given by:

$$Y_{f,t} = \left[\int_0^1 Y_{f,t}(z_f)^{\frac{\vartheta_f - 1}{\vartheta_f}} dz_f\right]^{\frac{\vartheta_f}{\vartheta_f - 1}} \quad (A.53)$$

In order to determine their demand for differentiated imported goods, these firms maximize:

$$\Pi_{f,t}(z_f) = P_{f,t} Y_{f,t} - \int_0^1 P_{f,t}(z_f) Y_{f,t}(z_f) dz_f \quad (A.54)$$

subject to equation (A.53) above. In order to solve the firm's optimization problem, we put equation (A.53) into (A.54) as follows:

$$\max_{Y_{f,t}(z_f)} \Pi_{f,t}(z_f) = P_{f,t} \left[\int_0^1 Y_{f,t}(z_f)^{\frac{\vartheta_f - 1}{\vartheta_f}} dz_f\right]^{\frac{\vartheta_f}{\vartheta_f - 1}} - \int_0^1 P_{f,t}(z_f) Y_{f,t}(z_f) dz_f \quad (A.55)$$

Taking the partial derivative of equation (C.56) with respect to $Y_{f,t}(z_f)$ yields:

$$\frac{\partial \Pi_{f,t}}{\partial Y_{f,t}(z_f)} = (Y_{f,t})^{-1}Y_{f,t}(z_f) - \left[\frac{P_{f,t}(z_f)}{P_{f,t}}\right]^{-\vartheta_f} = 0$$
$$Y_{f,t}(z_f) = \left[\frac{P_{f,t}(j)}{P_{f,t}}\right]^{-\vartheta_f} Y_{f,t} \qquad (A.56)$$

where equation (C.56) is the firm's demand for differentiated foreign goods, $Y_{f,t}(z_f)$. The final goods pricing rule is derived by substituting equation (A.56) into the bundling technology (equation A.53) to yield:

$$P_{f,t} = \left[\int_0^1 P_{f,t}(z_f)^{1-\vartheta_f}dz_f\right]^{\frac{1}{1-\vartheta_f}}. \quad (A.58)$$

Price setting by import goods retailers: An intermediate firm that qualifies to optimally reset its price, $P_{f,t}^{\cdot}(z_f)$ does so by solving:

$$\max_{P_{f,t}^*(z_f)} E_t \sum_{s=0}^{\infty} (\beta\theta_f)^s Y_{f,t}(z_f)[P_{f,t}^*(z_f) - \epsilon_{t+s}P_{f,t+s}^*] \quad (A.59)$$

subject to the demand for its product:

$$Y_{f,t+s}(z_f) = \left[\frac{P_{f,t}(z_f)}{P_{f,t}}\right]^{-\vartheta_f} Y_{f,t+s} \quad (A.60)$$

Substituting equation (A.60) into (A.59) yields:

$$\max_{P_{f,t}^*(j)} E_t \sum_{s=0}^{\infty} (\beta\theta_f)^s Y_{f,t+s} \left[\frac{P_{f,t}(z_f)}{P_{f,t+s}}\right]^{-\vartheta_f} [P_{f,t}^*(z_f) - \epsilon_{t+s}P_{f,t+s}^*] \quad (A.61)$$

Multiplying things out in equation (A.60) and recalling the definition of the law of one price, $\Psi_t = \epsilon_t P_t^*/P_{F,t}$, we can write the first-order condition as (after suppressing the index (z_f), since all import goods retailers face similar marginal cost):

$$(1 - \vartheta_f)(P_{f,t}^{\cdot})^{-\epsilon_f} E_t \sum_{s=0}^{\infty} (\beta\theta_f)^s P_{f,t+s}^{\vartheta_f} Y_{f,t+s}$$
$$+\epsilon_f(P_{f,t}^*)^{-\epsilon_f-1} E_t \sum_{s=0}^{\infty} (\beta\theta_f)^s P_{f,t+s}^{\epsilon_f+1} Y_{f,t+s}\Psi_{t+s} = 0 \qquad (A.62)$$

Solving equation (A.62) for $P_{f,t}^{\cdot}$, we obtain the optimal reset price for imported goods as:

$$P_{f,t}^* = \boldsymbol{\vartheta}_f \frac{E_t \sum_{s=0}^{\infty} (\beta\theta_f)^s P_{h,t+s} Y_{h,t+s} \Psi_{t+s}}{E_t \sum_{s=0}^{\infty} (\beta\theta_f)^s Y_{f,t+s}} \qquad (A.63)$$

By law of large numbers, the pricing rule for imported goods based on equation (A.58) is given by:

$$P_{f,t} = \left[\theta_f P_{f,t-1}^{1-\vartheta_f} + (1-\theta_f)(P_{f,t}^{\cdot})^{1-\vartheta_f} \right]^{\frac{1}{1-\vartheta_f}} \qquad (A.63)$$

Oil-producing firms

The oil firm seeks to maximize its profit:

$$\Pi_{o,t} = \epsilon_t P_{o,t}^* Y_{o,t} - R_{o,t} K_{o,t} - W_{h,t} L_t \quad (A.64)$$

subject to the production technology given as:

$$Y_{o,t} = A_{o,t} K_{o,t}^{\alpha_o^1} L_t^{\alpha_o^2} \qquad (A.65)$$

Substituting equation (C.65) into (C.66), the firm's optimization problem can be written as:

$$\max_{K_{o,t}, M_t} \Pi_{o,t} = \varepsilon_t P_{o,t}^* A_{o,t} K_{o,t}^{\alpha_{o,t}^k} M_t^{\alpha_o^m} - R_{o,t} K_{o,t} - W_{h,t} L_t \qquad (A.66)$$

In line with the expression for the optimal demand for oil-related capital by the oil firm, the first order conditions with respect to oil related capital, $K_{o,t}$ yields:

$$\begin{aligned} \frac{\partial \Pi_{o,t}}{\partial K_{o,t}} &= \alpha_o^1 \epsilon_t P_{o,t}^* \frac{Y_{o,t}}{K_{o,t}} - R_{o,t} = 0 \\ K_{o,t} &= \frac{\alpha_o^1 q_t p_{o,t}^* Y_{o,t}}{r_{o,t}} \end{aligned} \qquad (A.67)$$

while the first order condition with respect to materials input is:

$$\frac{\partial \Pi_{o,t}}{\partial L_t} = \alpha_o^2 \epsilon_t P_{o,t}^* \frac{Y_{o,t}}{L_{o,t}} - W_{h,t} = 0 \qquad (A.68)$$

$$L_t = \frac{\alpha_o^2 q_t p_{o,t}^* Y_{o,t}}{W_{h,t}} \qquad (A.69)$$

where $p_{o,t}^* = \frac{P_{o,t}^*}{P_t}, r_{o,t} = \frac{R_{o,t}}{P_t}, p_{h,t} = \frac{P_{h,t}}{P_t}$ and RER$_t$ is the real exchange rate. As explained in the

text, the process for the accumulation of oil-related capital, $K_{o,t}$, is given by:

$$K_{o,t} = (1 - \delta_o)K_{o,t-1} + FDI_t \quad (A.70)$$

while oil-related foreign direct investment (FDI_t) and international price of oil evolve as follows:

$$
\begin{aligned}
FDI_t &= (FDI_{t-1})^{\rho_{fdi}}\big(P_{o,t}^*\big)^{1-\rho_{fdi}} \quad (A.80)\\
P_{o,t}^* &= \big(P_{o,t-1}^*\big)^{\rho_o} \exp\left(\xi_t^{p_o^*}\right) \quad\quad (A.90)
\end{aligned}
$$