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The Effects of Monetary Policy on Output and Inflation in Afghanistan: A Dynamic Stochastic General Equilibrium Approach

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Abstract

The consequences of the decisions and policies taken for the reconstruction of Afghanistan during the past decade, showed that there should be paid more attention to the monetary policies. There is also a question that whether monetary policies have the potential to affect the production and inflation in Afghanistan or not. The aim of this paper is to explore this effect by designing a new Keynesian dynamic stochastic general equilibrium (DSGE) model.

The DSGE model used in this paper is taken from the new Keynesian theoretical foundations. It has been addressed to the role of households, firms, the monetary policy of Da Afghanistan Bank, as well as aids of international institutions as shocks that have been able to allocate a particular role in the Afghanistan's economy to itself, with regard to nominal rigidities and monopoly competition in this model. The results show the impulse response functions of production is negative to the external aid shock, financial shock, exchange rate shock, technology shock and external shock and is positive to the monetary shock and cost-shock. An impulse response function of inflation is positive for all shocks except for technology shock.

Keywords: Dynamic Stochastic General Equilibrium, International Institutions' Aid, Monetary Policy, Nominal Rigidity.

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1. Introduction

Billions of dollars have come to Afghanistan as donations during the past decade with the arrival of the United States and its allies to

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rebuild and expand Afghanistan's economic growth. Following these donations and assistances, various private companies with professional operations have been keen to play a positive role in Afghanistan’s reconstruction. The Afghan government and international institutions were determined to enable economic growth of Afghanistan, and so they brought up the free market economy in the country constitution. So a foreign investor was allowed to get their trade license within 24 hours.

The amount of the international donations is a major contributor to the country's current and developmental budget[1], and it increases the real value of domestic money. Consequently, it resulted in reducing the production of tradable goods, and the extension of non-tradable goods sector. This meant unbalanced growth of the services sector at the expense of decline in growth of the agriculture and industry sectors, where the share of agriculture sector of gross domestic product (GDP) has been reduced from 43 percent in 2002 to 22 percent in 2015. The industry sector’s share has not changed significantly over the course of this decade, and its share has been remained constant about 22 percent of gross domestic product (despite the country's need to produce and recruit unemployed people that should have been grabbed from the agriculture sector). Unlike the industry sector, the service sector's share of gross domestic product has been grown from 34 percent in 2002 to 52 percent in 2015, mostly because the international donations that entered Afghanistan's economy through the state treasury, have become current expenditures in the country rather than investment in infrastructures and production, due to the lack of efficient management and lack of attention to monetary and fiscal policies; especially these donations have been spent for the salaries of state employees. This has been resulted in an unemployment rate of 39 percent in 2016 (CSO Central Bureau of Statistics, 2016). In addition, it has led to migration of around 380000 young people to overseas in 2015 (World Bank, 2015).

On one hand, the donations have led to an increase in total demand, and on the other hand, due to the war in the last three decades and the

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1. 45 percent of the regular budget, and 86 percent of the destructive budget for Afghanistan's 2017 budget, have been funded by international donations.

lack of necessary infrastructures, the total supply, which is the outcome of domestic products, has not been able to give a satisfactory answer to the made demand. This has led to an increase in the general level of prices, and also has grown the country's problems due to the recession and unemployment.

The level of production, inflation, and unemployment in Afghanistan, has made authorities to pay more attention to the policies on people's maintenance of life and welfare. In addition, the economic viewpoint in recent years to solve the problems and move towards a high economic growth has caused to pay more attention to the monetary policies and the way they are used. Monetary policy, as one of the economic policies, is the legislation by which the central bank and/or the monetary authority of the country control the money supply and other monetary variables. These policies are usually used to achieve a set of goals for economic growth, which include price stability and low unemployment rate.

The formulation of a monetary policy that can suit to the economic situation of Afghanistan has faced various considerable shocks, and certainly it is essential to use new suitable models. Da Afghanistan Bank as the Central Bank of this country, which was established in 1939, has had a relatively good reputation among the neighboring countries' central banks. It is obligated to use the dynamic stochastic general equilibrium model and the principles of microeconomics, which are able to explain the general economic phenomena in the country such as the economic growth, business cycles, and the effects of fiscal and monetary policies. Furthermore, Da Afghanistan Bank is obligated to analyze the impact of Afghan monetary policies on production and inflation.

The remainder of this paper is organized as follows. Section 2 introduces the theoretical principle, and explains the research background. In section 3 the research model is cleared up. Section 4 provides an estimation of the model parameters, and section 5 concludes the paper.

2. Theoretical Principles and Research Background

2.1 Theoretical Principles

New classics in 70s built macroeconomic models based on the principles of microeconomics. They argued that the economic units adopted optimizing behavior, while the production units aimed at maximizing profits. Households seek to maximize utility according to the constraints they face, markets are always settled, the expectations are formed rationally, and prices and wages are fully flexible. Moreover, new classics take into consideration the concept of random shocks in their analysis.

The result of the classical school view is summarized in work of Sargent and Wallace (1975), who believed that under the conditions of rational expectations, regular and permanent monetary policy is not related to production and employment. This is because the predictable monetary policy will lead to predictable inflation, and thus will have no effect on unemployment and the production level. While unpredictable monetary policy leads to unpredictable inflation, it temporarily puts unemployment below its normal rate and will result in higher levels of production through lower unemployment.

Following these discussions, the theory of the real business cycles was raised by the study of Kydland and Prescott (1982) for the first time. The main purpose of this theory was to focus on this issue those non-monetary factors had a key role in creating the business cycle. Therefore, these studies somehow separated the macroeconomics from the monetary economy (Wallers, 2003). Kydland and Prescott designed an economic model that the economic units acted in a competitive manner, and sought to maximize their profitability and utility over the long run. In this model there is no rigidity in prices. Also, they used a method called 'calibration' to test some of their models in which, the numerical values that were obtained on the basis of the microeconomic evidences, would be put within the parameters of the model. Then, it identifies the process for technological shocks, and followed by it, is the prediction of the model which is compared with the variance and covariance of the various series with what is in the statistics.

Nelson and Plosser (1982) in their studies considered the real shocks as important to the monetary shocks, and believed that those models that considered monetary shocks as sources of fluctuations would likely not be able to show deviations of product. In contrast, the real factors' changes can explain the fluctuations of product-level. In order to make the long story short, in the theory of the real business cycle, unpredictable monetary policies were replaced by supply-side shocks, including stochastic technological changes. And since there is a relationship between real product and money demand, the stochastic supply shock with increasing product growth, leads to demand for money and ultimately increases the rate of money growth.

The new Keynesian economic view was raised following the failure of the new classical models to explain the fluctuations in the product, employment and inflation. In this perspective, the emphasis was on modeling by the rationale foundations and the general equilibrium models of classics for macroeconomics, and they did modeling in the face of non-conforming information of heterogeneous economic units, incomplete markets, and non-competitive conditions and rigidity of wages and prices.

Fischer (1983), and Phelps and Taylor (1987) proved that nominal demand disturbances were capable of creating real effects in models that took into account the rational expectations, but forgot the assumptions of continued transparency of the new classical market. In such models, systematic monetary policies help stabilize the economy. Other economists who believed in this view, including Mankiw, Blanchard, and Akerlof (1979), Romer (1990) and Greenwald (1987) stated that the disturbances arising from the demand side, was a result of the effect of monetary policy, and affected the actual price variables due to the rigidity of prices and wages, and thus monetary policy were unpredictable, and predicted monetary policy would have real effects on production and employment (Gorji, 2014).

The expression of analysis requires having the right tools in the light of all these developments that have taken place in the world of economy and by the 60s the macroeconomic models were being used as analytical tools.

Lucas (1976) claimed that the findings of the econometric methods, should not be employed for political policy recommendations, because when a policy is recommended for the economy, the basic macroeconomic parameters will be affected and change, and after that, it will be impossible to redefine that policy recommendation. This viewpoint led the 80s and 90s economists of the real business cycle to design the models based on Valerasie's models, with an emphasis on general equilibrium theory, which later altered to dynamic stochastic general equilibrium (DSGE) (Romer, 2006).

A micro-based model of DSGE consists of a set of economic agents such as households, firms and the government, and have been able to consider the influence of all economic variables on each other, rules and relations between them in an equation system, and then analyze the effects of each shock on the economy and on any variable in the system. In fact, its methodology has been able to explain the general phenomena of the economy, such as economic growth, business cycles, and the effects of fiscal and monetary policies, using the principles of microeconomics (Tovar, 2008).

Fair (1984) argued that the DSGE model was formed based on the structural parameters, such as the parameters related to preferences elasticity of substitution between periodic and stochastic processes related to technological and preference shocks. The rules of optimal decision-making, driven from the maximization problem-solving, form the complex functions of macro variables, and mainly are approximated around the steady state values of the macro variables, in order to eventually form a linear logarithmic system of rational expectations equations with retrospective and prospective components.

This approach guarantees the accumulation balance by using the general equilibrium framework, although the traditional econometrics models emphasize only on the current balance. Moreover, extracting the economic relations from the periodic method of maximization, provides a theoretical basis for this model, while the econometrics models do not have such a characteristic (Woodford, 2003).

Unlike econometrics models, DSGE models simultaneously explain the long-term relationships between variables, and the reactions of macroeconomic variables to shocks. The pros and cons of DSGE models depend on the different structure of the model. In the DSGE model, it is assumed that all economic agents are the same (such as “typical household” and “typical enterprise”), but the opponents of this approach consider this assumption to be false.

2.2 Research History

DSGE model, after applying nominal rigidity and monopoly competition, has made a good place in scientific research on monetary policy, and provided a ground for further expanding use of these models. In following some studies on the subject matter will be introduced.

2.2.1 Foreign Studies

Kim (2000) evaluated the business cycles of macroeconomic variables in the US, by assuming the existence of real and nominal rigidity in the DSGE model. Results showed that when there was no rigidity in the model, a momentum equal to the standard deviation of the monetary policy, would have a positive impact on the nominal interest rate, and a negative effect on the product, and would increase inflation. The simultaneous existence of nominal and real rigidities in the model, and the effects of liquidity on production, are clearly evident, that is, the increase of production.

Laurence and Dean (2003) tested the extent of the predicted monetary and fiscal policy capability on the real and expected amounts of production and inflation variables through the change in the real reserves of the Federal Bank during the period of 1968–1995. Results showed that the policy shocks affected the real production more than the expected production. The results of this study reject the hypothesis of logical expectations. This model assumes that the economic units, systematically predict the effects of shocks on total demand, less than the expected limit, and thus helps explain the real effects of monetary policy.

Liu (2006) explored the New Zealand monetary policy, and designed DSGE model in its small economy. Result showed that the cost of production decreases due to increased productivity impulse. With the help of appropriate monetary policies, monetary authorities can push inflation to zero.

Peiris and Saxegaard (2007) analyzed the monetary policy in low-income countries by using DSGE model. Three different rules of exchange rate fixation, stabilization of CPI inflation, and inflation stabilization of nonexchangeable goods, have been explored by this study. According to the results, in all three studied systems, production has increased with technology improvement, but the employment changes depend on the pursued monetary policy.

2.2.2 Internal Studies

Ebrahimi (2010) evaluated the effects of monetary policies in Iran economy in the form of a stochastic dynamic New Keynesian model. Results showed that in the absence of any rigidity of the model, the money growth shock had no effect on the real variables such as non-oil production, and consumption and private investment, and only affected inflation. Results of the estimation after the occurrence of nominal rigidities in the model of the effect of monetary shocks on the volatility of the real variables in the economy are very evident.

Fakhr Hosseini (2011) analyzed the impact of monetary policy on macroeconomic variables in a dynamic equation, with emphasis on production and inflation. In this research, having designed a new Keynesian dynamic equilibrium model for Iran economy, the role of monetary policy in transferring oil shocks was explored. Results showed that the presented model could simulate a big state to explain events and shocks which affect macroeconomic variables. The impulse response function of inflation increases unlike all other impulses (except for the technology impulse), and non-oil productions increases in contrary to technological , oil prices, government expenditures and money supply impulse.

Tavakolian (2013) studied Iran monetary policy, by using Markov switching approach, the Kalman filter, and the DSGE model. Results indicated that there had been monetary policies in the late 1970s and early 1980s, which in most cases, inflation was a tacit goal higher than the inflation target of the five-year plan. Also, results of optimal monetary policy showed that applying this approach in monetary policy was the only way to achieve the inflation target of five-year development plan.

3. Model

The model designed for the Afghanistan economy in this study, includes the household sector, final and intermediate goods producers, the government as a fiscal authority, and Da Afghan Bank as a monetary authority. The main framework of the model has been provided based on the studies of Ireland (2004) (Dib and Phaneuf, 2001; Walsh, 2003; Dennis, 2007; Medina and Soto, 2007; Senbeta, 2011).

According to the model's characteristics, DSGE price rigidity and monopoly competition conditions have been designed to better illustrate the impact of monetary policy on the model. Price rigidity has been defined using the Calvo method (1983), and the base model has been adopted from the monopoly competition from the standard of Dixit and Stiglitz (1977).

3.1 Households

It is assumed that there are many households in the economy. The typical household has infinite horizon life in this model, and has maximized his preferences based on the budget constraints. The household obtains utility from consuming goods, C_t, the real money balances, $\frac{M_t}{P_t}$, and the real dollar balances, $\frac{S_t M_{F,t}}{P_t}$, and disutility of work, L_t, which reduces the leisure time (Walsh, 2003).

Households' utility function is as follows:

$$E_t \sum_{t=0}^{\infty} \beta^t U\left(C_t, \frac{M_t}{P_t}, L_t, \frac{S_t M_{F,t}}{P_t} \right)$$

$$E_t \sum_{t=0}^{\infty} \beta^t \left[\frac{C_t^{1-\sigma}}{1-\sigma} - \chi \frac{L_t^{1+\eta}}{1+\eta} + \frac{\varpi}{1-b} \left(\frac{M_t}{P_t}\right)^{1-b} + \frac{\varpi}{1-bF} \left(\frac{S_t M_{F,t}}{P_t}\right)^{1-bF} \right] \quad (1)$$

In the equation 1, E_t is the expectations operation, $0 \leq \beta \leq 1$ is the discount factor, $\sigma > 0$ is the inter-temporal elasticity of substitution of consumption , $\eta > 0$ is the inverse of the labour supply elasticity, b is the inverse of interest elasticity of demand for real money balances , and bF is the inverse of elasticity of demand for dollar.

In an open economy, households obtained utility of domestic consumption goods $C_{D,t}$ and consumption goods imported $C_{F,t}$. In this model, the total consumption has been considered as follows:

$$C_t \equiv \left[a_c^{\frac{1}{\gamma}} C_{D,t}^{\frac{\gamma-1}{\gamma}} + (1-a_c)_c^{\frac{1}{\gamma}} C_{F,t}^{\frac{\gamma-1}{\gamma}} \right]^{\frac{\gamma}{\gamma-1}} \quad (2)$$

γ stands for the substitution elasticity between consumer goods produced inside and outside the country. The total $(1-a_c)$ is the weight of imported goods in total consumption. In other words, the amount of $(1-a_c)$ is the economy's openness degree index, and the budget constraints facing the household are as follows.

$$P_t C_t = P_{D,t} C_{D,t} + S_t P_{F,t} C_{F,t} \quad (3)$$

Where P_t is the consumer price index, $P_{D,t}$ is the domestic prices, S_t is the nominal exchange rate (the ratio of foreign exchange to domestic exchange), and $P_{F,t}$ is the external price to the domestic exchange of consumer goods imports, and is obtained from the equation 4:

$$P_{F,t} = S_t P_t^* \quad (4)$$

Where P_t^* is the price of foreign goods at the price of foreign exchange rate. Also, the real exchange rate, e_t, results from the following equation:

$$\frac{P_{F,t}}{P_t} = \frac{S_t P_t^*}{P_t} = e_t \quad (5)$$

In order to optimize household utility of goods consumption, the equation 3 is minimized by the equation 2, and the following results are obtained:

$$C_{D,t} = a_c \left(\frac{P_{D,t}}{P_t}\right)^{-\gamma} C_t \quad (6)$$

$$C_{F,t} = (1 - a_c) \left(\frac{P_{F,t}}{P_t}\right)^{-\gamma} C_t \quad (7)$$

Equation 6 denotes the demand function of the domestic consumable commodity, and the equation 7 represents the demand function of imported consumer goods.

The household maximizes its preferences than budget constraint to the following budget that forms from the equality of income and expenditures, in order to maximize utility.

$$C_t + I_t + \frac{M_t}{P_t} + \frac{B_t}{P_t} + \frac{S_t M_{F,t}}{P_t} + T_t \le w_t L_t + R_{t-1} k_{t-1} + \frac{(1+r_{t-1}) B_{t-1}}{P_t} + \frac{S_t M_{F,t-1}}{P_t} + \frac{M_{t-1}}{P_t} + D_t \quad (8)$$

w_t is the real wage rate , R_{t-1} is the real interest rate , r_{t-1} is the nominal yield on bonds, T_t is lump-sum tax payment of households, P_t is the aggregate price level, D_t is the dividend of intermediate goods manufacturing enterprises, M_{t-1} is the real balance of the period t, K_{t-1} is the unit capital of the period t, $M_{F,t-1}$, t is the exchange unit of the period t which household holds for exchange, and B_{t-1} is the bonds of the period t.

In this constraint, the total consumption, investment, real money balance, lump-sum tax, foreign currency held by the household and bonds that show spending should be smaller or equal to household revenues. In each period, taking into account the capitalization of households and the existence of depreciation, $0 \leq \delta \leq 1$, the size of the capital of the economy varies in the following way.

$$K_t = I_t + (1 - \delta)K_{t-1} \tag{9}$$

From the maximization of the utility function, according to the household budget, it will be established the real money demand equation, the power supply equation of labor, the Euler equation of governor, and the relation between the rental rate of capital and the nominal yield of bonds, as well as the relation between the exchange maintenance and the rate of capital lease, that will be obtained by taking a portfolio of household assets. The calculations related to maximizing this issue will be presented in appendix 1, paragraph 1-1.

3.2 Final Goods Producing Firm

It is assumed that $y_t(j)$ as the unit of intermediate goods produced by firms under monopolistic competition conditions, is bought by the firm producing final goods at the price of $p_t(j)$. The goods are distinct and imperfect substitute with each other, while the constant elasticity of substitution production function, θ, is located between them. The manufacturer of the final goods Y_t produces the final good unit using the Dixit-Stiglitz aggregator, according to the following equation.

$$\left[\int_0^1 y_t(j)^{\frac{\theta-1}{\theta}} dj\right]^{\frac{\theta}{\theta-1}} \geq Y_t \quad , \quad \theta \in (1, \infty) \ , \ j \in [\,0\,, 1] \tag{10}$$

The firms producing final good operate in competitive output market and maximize profits with the following problem:

$$\text{Max} \ \ P_t Y_t - p_t(j) y_t(j)$$

$$s.t. \qquad \left[\int_0^1 \ y_t(j)^{\frac{\theta-1}{\theta}} dj\right]^{\frac{\theta}{\theta-1}} \geq Y_t \tag{11}$$

By solving this optimization, the demand of the consumer goods of the j manufacturing intermediary firm is as follows:

$$y_t(j) = \left(\frac{p_{D,t}(j)}{P_{D,t}}\right)^{-\theta} Y_t \quad \text{for} \quad j\epsilon[\,0\,,1] \tag{12}$$

Also the zero profit condition of the final good producer represents the price index of the final domestic good as follows:

$$P_{D,t} = \left[\int_0^1 p_{D,t}(j)^{1-\theta}\, dj\right]^{\frac{1}{1-\theta}} \tag{13}$$

The price of the final domestic good is determined based on the weighted average price of the domestic intermediate goods.

3.3 Intermediate Goods Producing Firms

The economy has been formed by the chains of monopolistic competition firms at the intermediate goods producer sector. Each of the firms produces the intermediate goods using the Cob-Douglas function.

$$y_t(j) \leq a_t K_{t-1}(j)^{\alpha} L_t(j)^{1-\alpha} \tag{14}$$

That $K_{t-1}(j)$ is the unit of capital, $L_t(j)$ is the unit of labor employed to produce, $y_t(j)$ is the intermediate goods unit, $\alpha \in (\,0\,,1)$ is the capital contribution, and a_t is the impulse of the technology which follows the first-order autoregressive process AR(1).

$$\log(a)_t = \rho_a \log(a_{t-1}) + \varepsilon_t^a \qquad \varepsilon_t^a \overset{iid}{\sim} N(0\,,\sigma_a^2) \tag{15}$$

In the DSGE model, there are two commonly methods for considering price rigidity assumptions: The Calvo method (1983) and the Menu Cost. In this study, price rigidity is modeled based on the early one. In this way, it has been assumed that the random ratio $(1-\xi)$ percent of the views in time t, can adjust the price of the intermediate goods, and ξ percent of the rest of the firms are not able to adjust the price of their intermediary goods, and thus decide only in a relationship with their capital and labor power.

Some of the firms can adjust their consumer goods prices in the period t. Capital $K_{t-1}(j)$, labor $L_t(j)$, and the price level $p_t(j)$, as well as w_t, the rental rate, R_t, the general price level, and p_t, the demand function of the firm's fees, are chosen to minimize the real wage rate. According to Christiano, Eichenbaum and Evans (2005), it is assumed that in each period $(1-\xi)$ percent of the total firms determine their price optimally. ξ firms moderate their prices based on the observed latest inflation rate so that $p_t(j) = \pi_{t-1}p_{t-1}(j)$ moderates. So the issue of minimizing the cost of intermediate goods manufacturer firms will be as follows:

$$\min \Xi_t = w_tL_t(j) + R_tK_{t-1}(j) + \emptyset_t(j)[y_t(j) - a_t[K_{t-1}(j)]^{\alpha}L_t(j)^{1-\alpha}] \quad (16)$$

In the above equation, $\emptyset_t(j)$ is the Lagrange coefficient of the total cost of the production of a j[th] intermediate product, $mc_t(j)$. According to the first-order conditions for this issue, the relationship between labor power and capital, as well as the relation of final cost to intermediary good-producing enterprises is obtained. The calculations for this minimization will be given in appendix 1, paragraph 2-1.

Considering the final cost of getting $(1-\xi)$ percent of firms that are able to adjust their prices, the maximization problem of the total present value of future firms earnings is as follows:

$$E_t\sum_{j=0}^{\infty}(\xi\beta)^j\frac{\lambda_{t+j}}{\lambda_t}[p_t(j) - mc_t(j)]\left(\frac{p_t(j)}{P_{D,t+j}}\right)^{-\theta_t}Y_{t+j} \text{ v} \quad (17)$$

If it is assumed that the symmetric competitive equilibrium is as follows:

$$\frac{p_t(j)}{p_t} = \frac{p_{t-1}}{p_t}, \forall j\epsilon[0,\xi) = p_t^{\#}, \forall j\epsilon[\xi,1)$$

and also under these conditions for all j, we have:

$$y_t(j) = y_t, L_t(j) = L_t, K_{t-1}(j) = K_{t-1}$$

From the maximization of the equation 17, and the demand function for the product of the intermediate firm, equations 12 and 18 are as follows:

$$\frac{p_t^{\#}}{p_t} = \left(\frac{\theta_t}{1-\theta_t}\right)\frac{E_t\sum_{n=0}^{\infty}(\xi\beta)^n\lambda_{t+n}\emptyset_{t+n}(j)Y_{t+n}\left(\frac{p_{t+n}}{p_{D,t}}\right)^{\theta_t}}{E_t\sum_{n=0}^{\infty}(\xi\beta)^n\lambda_{t+n}Y_{t+n}\left(\frac{p_{t+n}}{p_{D,t}}\right)^{\theta_t - 1}} \quad (18)$$

where $p_t^{\#}$ is the firm’s optimal price at time t. Due to the price rigidity in the Calvo method, the average price at the period t will be as follows:

$$P_t^{1-\theta_t} = (1-\xi\,)(P_t^{\#})^{1-\theta_t} + \xi\, P_{t-1}^{1-\theta_t} \tag{19}$$

Now, according to the presented explanations, the equations 18 and 19 can be approximated around zero, and the linear logarithm of the new Phillips Keynesian curve will be determined based on the following equation:

$$\hat{\pi}_{D,t} = \frac{1}{1+\beta}\hat{\pi}_{D,t+1} + \frac{\beta}{1+\beta}E_t\hat{\pi}_{D,t+1} + \frac{(1-\xi)(1-\xi\beta)}{\xi}m\hat{c}_t + \hat{\theta}_{p,t} \tag{20}$$

where $\theta_{p,t} = \frac{\theta_t}{1-\theta_t}$ is the mark-up shock follows an AR(1) process:

$$\log(\theta_{p,t}) = \rho_{\theta_p}\log(\theta_{p,t-1}) + \varepsilon_t^p$$

3.4 Government and Da Afghanistan Bank

In Afghanistan, like many developing countries, the Central Bank does not have the government independence. So in the modeling of the present study, the government and Da Afghanistan Bank have been considered in one framework.

The government needs a budget to continue the activities. The budget includes government expenditures and revenues. The government’s expenditures are either payments of some interest on bonds, or government expenditures including current and development spending. Government revenues are tied to the taxes on the purchase of donations and bonds, as well as grants that have been contributed by the international community in the specific circumstances of Afghanistan, over the past 15 years. It should be noted that this amount initiates a large portion of the state budget.

These government receipts and payments are subject to the overriding objective of the budget that has been achieved. In this regard, the DAB also acts in a way that the government reaches its goal. Since the aim of the DAB is to maintain the stability of the prices and economic growth of Afghanistan, it is also trying to help the government achieve its goals by making monetary policy.

As long as the above conditions are met, and the government spending is made up by its income sources, the creation of money in society is not necessary, and DAB is able to apply its monetary policy, regardless of the government's budget constraints. But if, despite government revenue sources, a deficit occurs in the state budget, the government will finance its budget deficit by borrowing from Da Afghanistan Bank or withdrawing its deposits from DAB, which means creating money.

It should be noted that the huge amount of international donations in dollars which are sold by the government, will be reflected for the monetary base. Hence, monetary base changes in the state budget, is the combination of recapitalization granting foreigners, and withdrawing government deposits from Da Afghanistan Bank as follows:

$$G_t + (1 + r_{t-1})\frac{B_{t-1}}{P_t} = T_t + \frac{B_t}{P_{\square}} + \frac{(M_t - M_{t-1})}{t} \tag{21}$$

Where MB_t is the monetary base and G is the government expenditures.

The Afghanistan's government expenditures relies on the amount of foreign aid, in which in the case of increasing external aids provided by international institutions, it increases its spending on project development, and in the case of reducing the amount of aid, reduces its expenditures. Therefore, foreign aid impulse of international institutes is substituted in the equation of government expenditures as follows:

$$\log G_t = \rho_G \log(G_{t-1}) + (1 - \rho_G)\log G + \varepsilon_t^G + \varepsilon_t^D\,,$$
$$\varepsilon_t^G \overset{iid}{\sim} N(0\,,\sigma_G^2) \tag{22}$$

In DAB, the monetary base has been considered as follows:

$$M_t = DC_t + S_t FR_t \tag{23}$$

where DC_t is the net domestic credit, FR_t is the net foreign reserves of the Da Afghanistan Bank, and S_t is the nominal exchange rate. By dividing the equation 23 on price level, the real monetary base is achieved.

$$m_t = dc_t + e_t fr_t \tag{24}$$

It is also assumed that the accumulation of foreign assets of the Da Afghanistan Bank, is acquired based on the following rule:

$$FR_t = FR_{t-1} + D_t - P_t^* C_{F,t} - M_{F,t}$$

D_t is the amount of foreign aids for Afghanistan. By dividing the above relation into the foreign price level, the accumulation of real foreign assets is obtained as follows:

$$fr_t = \frac{fr_{t-1}}{\pi_t^*} + d_t - c_{F,t} - \frac{m_{F,t}}{e_t} \tag{25}$$

It is presumed that π_t^* as the inflation rate is extraneous, and also it is assumed that the dollar, due to an autoregressive process of the first model, is given in the form of a linearized logarithm:

$$\hat{d}_t = \rho_d \hat{d}_{t-1} + \varepsilon_t^d, \qquad \varepsilon_t^d \overset{iid}{\sim} N(0, \sigma_0^2) \tag{26}$$

The foreign exchange system in Afghanistan is the floating management exchange system. Therefore, the linearized logarithm of the exchange rate is as follows:

$$\hat{e}_t = \hat{x}_t + \hat{\pi}_t^* + \hat{\pi}_t + \hat{e}_{t-1} \tag{27}$$

where $x_t = \frac{S_t}{S_{t-1}}$ is the exchange rate depreciation, and the exchange policy for this model is as follows:

$$\hat{x}_t = \rho_x \hat{x}_{t-1} + \theta_\pi \hat{\pi}_t + \theta_y \hat{y}_t + \theta_e \hat{e}_t + \varepsilon_t^x$$

In order to enter monetary policy in the New Keynesian model for the Afghanistan economy, the monetary policy tool provided by DAB is chosen, which is based on the growth rate of money (monetary base). It is also assumed to be a function of the monetary policy, the response is in a way that according to that, policymaker determines the money growth rate in order to obtain its goals, namely, the diversion of output from potential production and the diversion of inflation from the desired inflation.

The foreign rate of inflation follows a first-order autoregressive process, which is presented in log-linearized form as follows:

$$\hat{\pi}_t^* = \rho_{\pi^*} \hat{\pi}_{t-1}^* + \varepsilon_t^{\pi^*}, \qquad \varepsilon_t^{\pi^*} \overset{iid}{\sim} N\left(0, \sigma_{\pi^*}^2\right) \tag{29}$$

$$\widehat{m}_t = \rho_m \widehat{m}_{t-1} + \lambda_\pi \hat{\pi}_t + \lambda_y \hat{y}_t + \lambda_e \hat{e}_t + v_t \tag{30}$$

In the above equations, $\widehat{m}_t$ is the deviation percentage of the monetary base growth from its steady state, $\hat{\pi}_t$ is the percentage of the inflation diversion from its steady state during the period t. The deviation of the real exchange rate is from its stable value in period t. $\hat{e}_t$ is the production gap, and v_t is the monetary shock that has been supposed to follow a first-order autoregressive process as follows:

$$v_t = \rho_v v_{t-1} + \varepsilon_t^{mb}\ , \ \ \varepsilon_t^{mb} \overset{iid}{\sim} N(0\,, \sigma_{mb}^2) \tag{31}$$

In this model, the elimination condition of the commodity and services market for macroeconomics by combining household budget constraints and budget constraints is achieved as follows:

$$Y_t = C_t + I_t + G_t - C_{F,t} \tag{32}$$

3.5 Log-Linearization and Model Estimation

By maximizing the utility function of consumer, equation 1, subject to the budget constraint in equation 8, requires to obtain a real money balances, labor supply, the standard Euler equation, and the relationship between the rental rate of capital and the return on debt securities, as well as the relationship between the amount of exchange and rental rate obtained from the decision of the household assets portfolio. These five relations are in linearized logarithms (assuming that x_t means the logarithmic deviation $\bar{X}$ of the steady state).

$$\widehat{m}_t = \frac{\sigma}{b}\hat{c}_t - \frac{1}{b}\hat{r}_t \tag{33}$$

$$\widehat{w}_t = \eta \hat{l}_t + \sigma \hat{c}_t \tag{34}$$

$$\hat{c}_t = E_t\hat{c}_{t+1} - \frac{1}{\sigma}\{\hat{r}_t - E_t\hat{\pi}_{t+1}\} \tag{35}$$

$$\hat{R}_t = \frac{1+k}{\delta+k}(\hat{r}_t - E_t\hat{\pi}_{t+1})\ , \qquad k = \frac{1-\beta}{\beta} \tag{36}$$

$$\widehat{m}_{F,t} = \frac{\sigma}{bF}\hat{c}_t + \frac{1}{bF\bar{r}}E_t\hat{x}_{t+1} - \frac{\sigma}{bF\bar{r}}\hat{c}_t - \frac{1}{bF(1+\bar{r})}\hat{r}_t \tag{37}$$

In the problem of maximizing the producer profits of the intermediate consumer goods and the final goods producer, the new Phillips Keynesian Curve, labor demand, and the total cost of producing an intermediate product unit, which together with the production functions, the equation of technology impulse, and the principle of capital flow, form relations with production. These seven logarithmically linearized equations are respectively:

$$\hat{\pi}_{D,t} = \frac{1}{1+\beta}\hat{\pi}_{D,t+1} + \frac{\beta}{1+\beta}E_t\hat{\pi}_{D,t+1} + \frac{(1-\xi)(1-\xi\beta)}{\xi}m\hat{c}_t + \hat{\theta}_{p,t} \qquad (38)$$

$$m\hat{c}_t = \alpha\hat{R}_t + (1-\alpha)\hat{w}_t - \hat{a}_t \qquad (39)$$

$$\hat{l}_t = \hat{R}_t - \hat{w}_t + \hat{k}_{t-1} \qquad (40)$$

$$\hat{y}_t = \alpha\hat{k}_{t-1} + (1-\alpha)\hat{l}_t + \hat{a}_t \qquad (41)$$

$$\hat{a}_t = \rho_a\hat{a}_{t-1} + \varepsilon_t^a, \qquad \varepsilon_t^a \overset{iid}{\sim} N(0\,,\sigma_a^2) \qquad (42)$$

$$\hat{k}_t = (1-\delta)\hat{k}_{t-1} + \delta\,\hat{\imath}_t \qquad (43)$$

$$\hat{\theta}_{p,t} = \rho_{\theta_p}\hat{\theta}_{p,t-1} + \varepsilon_t^p, \qquad \varepsilon_t^p \overset{iid}{\sim} N\left(0\,,\sigma_p^2\right) \qquad (44)$$

If $\bar{X}$ represents the steady state of the variable X_t , the log-linearized form of market clearing condition will be as follows:

$$\hat{y}_t = \frac{\bar{c}}{\bar{y}}\hat{c}_t + \frac{\bar{\imath}}{\bar{y}}\hat{\imath}_t + \frac{\bar{g}}{\bar{y}}\hat{g}_t - \frac{\overline{c_f}}{\bar{y}}\hat{c}_{F,t} \qquad (45)$$

According to the equation 6 and 7, the log-linear forms of, $\hat{c}_{D,t}$ and $\hat{c}_{D,t}$ are as follows:

$$\hat{c}_{D,t} = \hat{c}_{t-}\gamma\hat{x}_{D,t} \qquad (46)$$

$$\hat{c}_{F,t} = \hat{c}_{t-}\gamma\hat{x}_{F,t} \qquad (46)$$

$$\hat{x}_{F,t} = (\hat{x}_t + \hat{\pi}_t^*) - \hat{\pi}_t \qquad (47)$$

and the linearized logarithm of $x_{D,t} = \frac{P_{D,t}}{P_t}$ is as follows:

$$\hat{x}_{D,t} = \hat{\pi}_{D,t} - \hat{\pi}_t + \hat{x}_{D,t-1} \qquad (48)$$

With regard to the consumption of imported goods, equation 7, logarithmic linear $\hat{c}_{F,t}$ is as follows:

$$\hat{c}_{F,t} = \hat{c}_{t-}\gamma\hat{e}_t \qquad (49)$$

The equation of funds appropriated in the budget (22) that is in the form of a linearized logarithm, will be as follows:

$$\hat{g}_t = \rho_G\hat{g}_{t-1} + \varepsilon_t^G + \varepsilon_t^d, \qquad \varepsilon_t^G \overset{iid}{\sim} N(0\,,\sigma_G^2) \qquad (50)$$

The equations for the DAB balance sheet and its components (25, 24, and 26) are in the forms of linear logarithms as follows:

$$\widehat{m}_t = \frac{\bar{d}c}{\bar{m}}\hat{d}c_t + \frac{\bar{e}\bar{f}r}{\bar{m}}\left(\hat{e}_t + \hat{f}r_t\right) \tag{51}$$

$$\hat{f}r_t = \hat{f}r_{t-1} - \hat{\pi}_t^* + \frac{\bar{d}}{\bar{f}r}\hat{d}_t - \frac{\bar{c}_F}{\bar{f}r}\hat{c}_{F,t} - \frac{\overline{m_F}}{\bar{e}\bar{f}r}(\widehat{m}_{F,t} - \hat{e}_t) \tag{52}$$

$$\hat{d}_t = \rho_d \hat{d}_{t-1} + \varepsilon_t^d, \qquad \varepsilon_t^d \overset{iid}{\sim} N(0\,,\sigma_d^2) \tag{53}$$

Equations 27 to 31 and equations 32 to 53, along with the definition of the relation for the growth of money supply, equations 54 forms the DSGE model equations form this study.

$$\dot{m}_t = \widehat{dc}_t - \widehat{dc}_{t-1} + \hat{\pi}_t \tag{54}$$

At last, the inflation will be

$$\hat{\pi}_t = a_c \hat{\pi}_{D,t} + (1 - a_c)(\hat{x}_t + \pi_t^*) \tag{55}$$

4. Calibration of Model Parameters

After the log-linearization of the equations, some of the parameters should be calibrated based on model and data. If the research purpose is to explain economic facts or the acquisition of dynamic properties of the model, calibration can be used rather than the estimation methods of econometrics (Kidland and Prescott, 1982).

Calibration is the usual method used in these types of researches, based on DSGE model. The values in this method are found for the parameters in the economics world, which have been expanding since the success of this method in recent decades.

According to Hoover (1995), a dynamic model is set when its coefficients are chosen from other empirical or econometric studies (even unrelated), or generally by the researcher, so that the model is capable of rebuilding some of the real-world characteristics. As Canova (1994) states, the calibration method is an econometric method in which coefficients are estimated using statistical criteria rather than econometric criteria.

As researches conducted with new scientific methods in the case of Afghanistan have been largely less due to inappropriate social phenomena in recent decades, therefore, some of the coefficients such as the number of ratios in the equilibrium situation, are calculated using the annual data of the Afghanistan economy for the period of 2005–2015 based on the maximum information available after decommissioning using the Hedrick-Prescott Filter method (table 1).

Table 1: Calibrated Indicators of Model Based on Afghanistan Economy Data

$\frac{\bar{c}}{\bar{y}}$	$\frac{\bar{i}}{\bar{y}}$	$\frac{\bar{g}}{\bar{y}}$	$\frac{\overline{c_f}}{\bar{y}}$	$\frac{\bar{d}c}{\bar{m}}$	$\frac{\bar{e}\bar{f}r}{\bar{m}}$	$\frac{\bar{d}}{\bar{f}r}$	$\frac{\bar{c}_F}{\bar{f}r}$	$\frac{\overline{m_F}}{\bar{e}\bar{f}r}$	$\bar{r}$	δ
0.029	0.08	-1.4829	1.1836	0.4770	0.5824	0.4176	0.4877	0.2861	0.1794	1.0222

Source: Research findings

4.1 Estimation of the Parameters

In order to maximize matching of simulation data with the actual data of the Afghanistan economy, and to obtain an appropriate empirical analysis, the Bayesian method with the assumption of uniform distribution of parameters was used. By this way, the necessary information is provided from the actual data of the Afghanistan economy. The prior distribution, its mean, and standard deviation of parameters are considered after this, according to the obtained information. Therefore, considering the initial values for the mean and standard deviation of the parameters, to estimate these parameters, Bayesian method can be used which has been provided by Dynare software. Distribution, prior and posterior means and results from the Bayesian estimation of parameters, are presented in table 2.

The prior distribution for each parameter is chosen based on parameter characteristics and the characteristics of the desired distribution. The beta distribution that has a high and low bound, is used for parameters that are within a certain range. Gamma distribution has also been used for parameters that are bounded on one side, and on the other hand are infinite. Normal distribution is used for variables that are distributed in an infinity range. Prior distribution and posterior distribution of estimation of model indices have been reported in figure 1.

Table 2: Prior Distribution and Posterior Distribution Estimation of Model Indices

Index	Distribution	Prior mean	Source	Estimation
ξ	beta	0.5	Tavakolian (2013)	0.446
α	beta	0.42	Tavakolian (2013)	0.453
ρ_G	beta	0.8	–	0.767
λ_π	normal	-1.5	–	-2.26
λ_y	normal	-0.5	Tavakolian (2013)	-0.52
ρ_v	beta	0.8	–	0.563
ρ_{π^*}	beta	0.8	–	0.720
ρ_d	beta	0.8	–	0.630
ρ_a	beta	0.8	–	0.881
λ_e	normal	-1	–	-1.01
ρ_x	beta	0.5	–	0.483
θ_π	normal	-1.05	Taqipour (2015)	-1.007
θ_y	normal	-0.5	–	-0.507
θ_e	normal	-0.7	–	-0.355
$\rho_{\_p}$	beta	0.8	–	0.774

The criterion for the correctness of the Monte Carlo diagrams model answers is with MCMC chain (1998). The Dynare software runs a 200,000-bit Metropolis-Hestingz algorithm, and the results of these chains are for the third mean, variance, and moment in appendix 2 and are ultimately converged to a steady amount. Therefore, by using the MCMC method, the results of the Bayesian approach are well-proven.

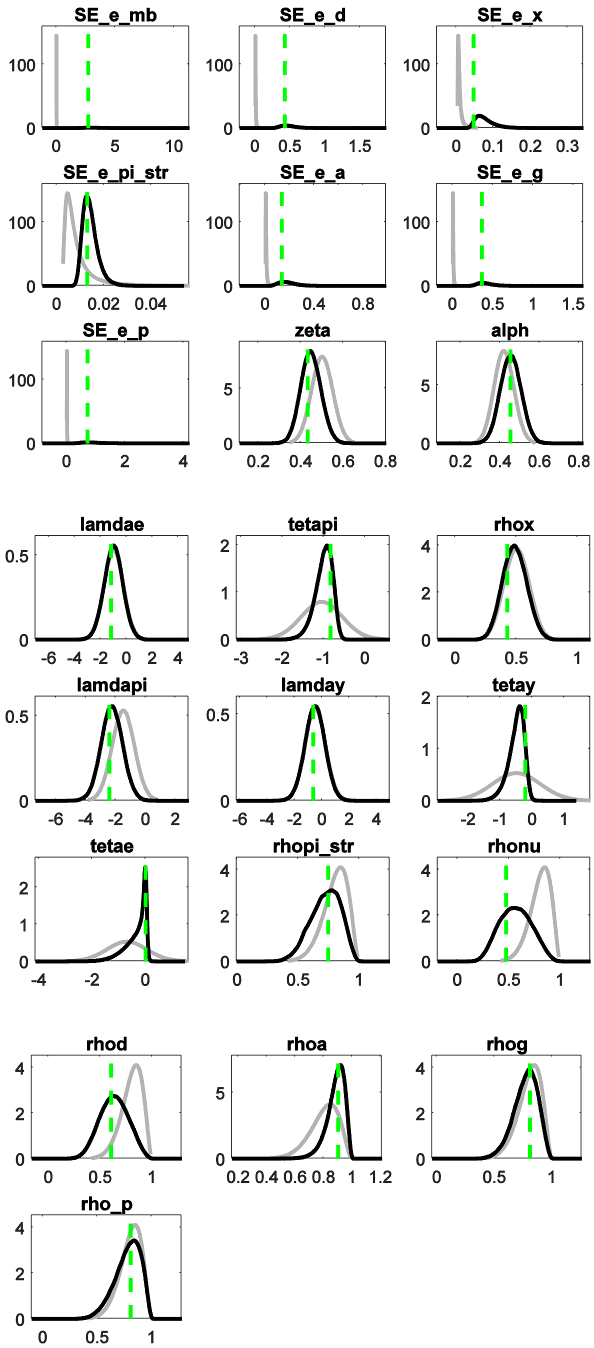

Figure 1: Prior and Posterior Distributions of Model Indicators
Source: Research findings

4.2 The Impulse Response Functions

The impulse response functions show the dynamic behavior of the model variables over time when a shock hits variables. Figure 2 shows the IRFs based on a positive shock to international institutions. It indicates that with the onset of the shock, the amount of foreign aid to Afghanistan has increased, and in the first place, it has had a positive effect on the government's monetary policy, and as an index, has grown the government expenditure by about 50 percent. In other words, the positive shock in foreign aid will give the government a fiscal expansion policy, which will allow increasing its investment in development projects. Consequently, it has affected production and, in the first place, represented a positive impact by as much as six percent in GDP. By reducing the impact of this shock over time, its effects on government production expenditures reach their steady state.

Foreign aid in the first place, having a net increase in government deposits with DAB, has lowered the monetary base by a magnitude of -0.2. Of course, after a long time, due to an increase in the accumulation of DAB foreign assets, this reduction is offset on the monetary base, and gradually comes closer to a steady state. In terms of the effect of this shock on inflation, due to Afghanistan's rough decades, the country has not yet been able to provide the production structures to the minimum required to meet domestic demand, that is, the supply side is not in the suitable situation. By increasing foreign aids, the demand for goods and services goes up. But there is no possibility of responding to this domestic demand, and as a result, inflation will increase by as much as 8 percent, which is moving downward over time.

Floating exchange rate management is the exchange rate policy governed by DAB. Due to a shock in foreign aid, and the negative impact of production and inflation on the exchange rate depreciation, this variable is initially decreased to -0.1, which over time approaches to its steady state. In addition, an increase in the external aid shock increases the amount of international institutions' aids and this means an increase in currency volume that we have in Afghanistan. An increment in the currency supply increase leads to a decrease in exchange rate.

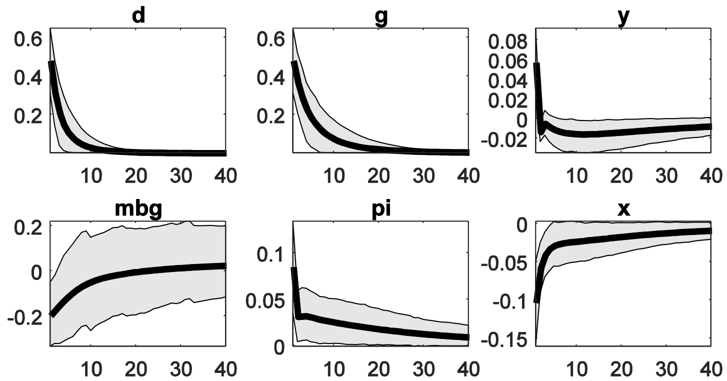

Figure 2: Impulse Response Functions of an External Aid Shock as a Standard Deviation for Different Time Delays
Source: Research findings

Figure 3 shows the impulse response function of the variables to a monetary shock, as equivalent to a standard deviation. With the reception of a monetary shock, the growth rate of money gets high, and will gradually become closer to the steady state. In conjunction with the impact of this shock on inflation, the domestic inflation rate is as high as 0.22 in the first phase, with an increase in the next period to 0.35, but after this, it begins to decrease.

In the first period, the impact of this shock on output is zero. The reason could be the lack of financial markets that could stock this shock, and create a positive change in production. But in the next period, the output decreases, and reaches the lowest level of -5 percent in a few years. The important cause is the lack of an effective mechanism to support the production, as well as the lack of regulation in the impact of monetary policy on the real sector.

With an increase in the monetary shock of Afghanistan’s imports, accounting for about 80 percent of foreign trade strengthened again, and negatively affected the domestic production. The effect of this shock was positive on inflation and negative on output, and in both case, the exchange rate dropped to -0.2 at the beginning of the shock period, which continues to last for two to three periods, and then changes to a steady state. Also, when the monetary authorities adopts the policy, inflation is caused and the authorities tries to control this inflation using foreign currency rate, and thus, wants to have a control on foreign exchange rate to support the national currency.

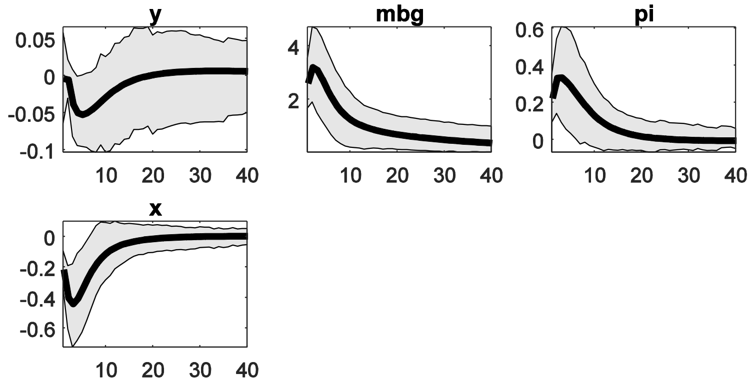

Figure 3: An Impulse Response Functions of Monetary Shock Equivalent to a Standard Deviation for Different Time Delays
Source: Research findings

Figure 4 shows the impulse response of the variables to exchange rate shock of one standard deviation, and shows that in the event of this shock, the production initially has had a positive mutation. The reason is that in the first year, exchange rate shock will raises the exports, decrease the imports, and increases the production in the first year. But because the export capacity in Afghanistan is very small and most consumer goods are imported, this reaction will change over the next year negatively, and will come to its steady state next year, and this trend will continue.

The exchange rate shock, with the emphasis on exports, makes the consumable goods price rise within a positive leap in the first year. This inflation in the first year also results in an increase in the final cost of each import unit; because most consumer goods are imported and the imported flow forms a part of the inflation of the whole country. Finally, the country inflation in the first year will increase by 0.04, but in the second year it will decrease, while in the fourth year, the inflation will be in its steady state.

The monetary base growth rate will also be affected by the exchange rate shock. With the increase of the exchange rate, the central bank reacts to the inflationary conditions resulted from the exchange shock through the exchange rate function, and reduces the growth rate of the monetary base. But this situation is not long lasting, and the monetary base growth rate goes upward but with a gentle slope.

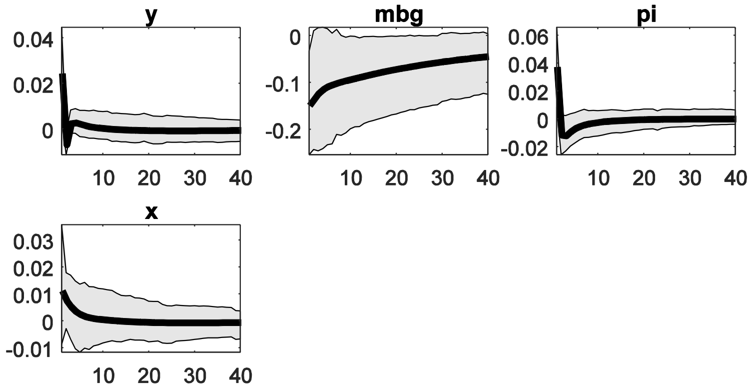

Figure 4: An Impulse Response Functions of an Exchange Rate Shock Equivalent to a Standard Deviation for Different Time Delays
Source: Research findings

The occurrence of a positive shock in government spending, leads to an expansionary fiscal policy and a widespread adoption of a more productive economy by the government. The result is an increase in the implementation of projects, the supply of public goods and services in the community, which also increases the demand for goods and services that at the end as shown in Figure 5, shows an increase in the first year. These changes in output cause the exchange rate depreciation under the influence of fiscal shocks.

The important point is that this shock occurs because of the international donations to Afghanistan. These donations were annually, and knowing this led to the cross-sectional effect of this policy. This policy affects the assumption that since expansionary fiscal policy is the result of foreign aid, it may not occur in the next year, and so the effect of shock will be zero in the next year, or even decline slightly in the next few years from a steady state. This is mostly because of the kind of thinking in Afghanistan, which is dependent on donations and the scope of any change in the amount of aid. The United States and the contributing countries use this trick to constantly guide their thoughts and seek help for next year. Thus, people look at the production in short term, and pursue activities that are more effective in the short term, and this short-lived impact is generated from the fiscal shock.

An increase in government spending causes inflation because assuming the other factors remain constant, these expenditures as one of the most important components of the overall demand, will generally enhance the price level.

The impact of fiscal shock through the negative relationship between the increase in production, and inflation and the growth of the monetary base, affected the growth of the monetary base in the first year, and reached -0.1. In the following years, the monetary base has had grown to a positive rate, but it has had a negative slope to steady state with a slight slope.

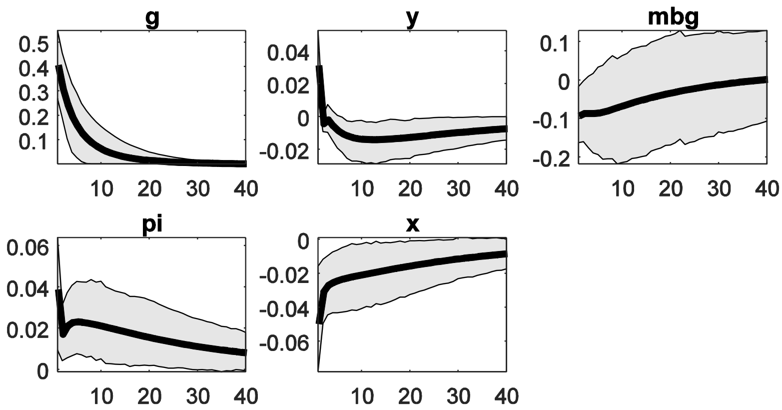

Figure 5: An Impulse Response Functions of a Fiscal Shock to a Standard Deviation for Different Time Lags
Source: Research findings

The response of the functions to the technology shock, has been shown in figure 6 as a standard deviation, and shows that its impact on production is positive. Furthermore, in the first year it increased output by 0.1 and for the second year by 0.2. It seems that the reason for the shock of the first and second periods as a positive leap, is the difference between the provinces in Afghanistan because of the type of technology released. This means that a technology shock will emerge in the first few years in a number of large provinces, and after an interruption, it can be extended to other provinces, which will have a positive effect in the next period, as in the first period.

The shock has also reduced the general price level. Of course, the inflation after a period has returned to its steady state. The shock has also had a positive impact on the growth of monetary base and the exchange rate depreciation.

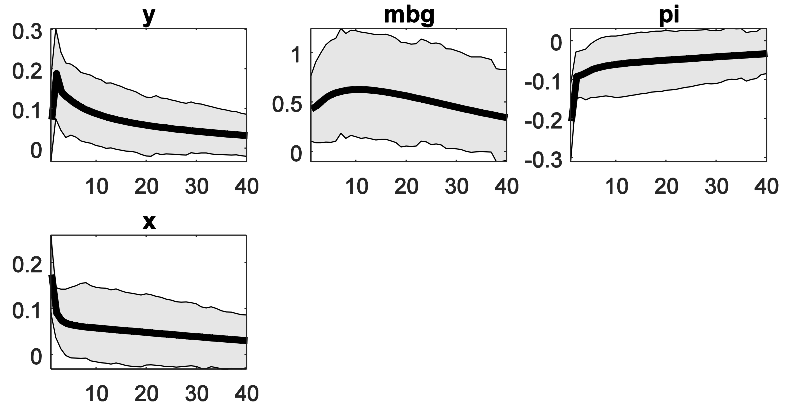

Figure 6: An Impulse Response Functions a Technology Shock Equal to a Standard Deviation for Different Time Delays
Source: Research findings

Figure 7 shows the impulse response functions of a cost-push (mark-up) shock, indicating that at the beginning of the shock hit, the firm is affected by this shock in maximizing its profits, and the production cost increases. By higher costs, the firm would be able to take this cost-push into the goods price, and transfer it to the household. This also reduces output and monetary authority reacts to both negative output gap and positive inflation through reducing monetary base growth rate and appreciation. Since monetary authority has reduced the growth rate money base and exchange rate, one can see easily that inflation is more important than output for him.

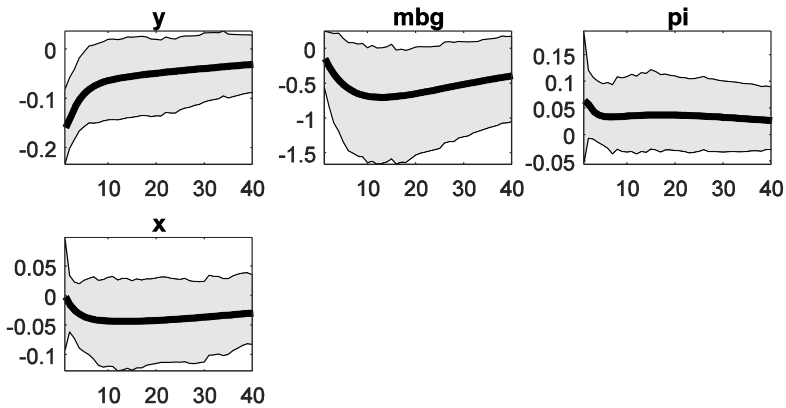

Figure 7: An Impulse Response Functions a Cost-Shock as a Standard Deviation for Different Time Delays
Source: Research findings

Figure 8 shows the impulse response functions of the foreign inflation shock as a standard deviation. The shock had come from outside of Afghan economy, and has had a great impact on the economy of Afghanistan; because this economy is small and open, relying on foreign aids. If the foreign price inflation shock occurs, because about 80 percent of the trade is by import, the shock caused by imports has had an impact on Afghanistan domestic inflation, which has pushed up inflation altogether. Also, the impact of the first phase of the shock on domestic production has led to stronger domestic imports than exports, with higher output and gross domestic product growth in the first period; but in the second period, due to the lack of capacity to fill the vacant space of imports by domestic production, the effect on production has fallen to zero.

As a result of this shock, the growth of the monetary base initially declined, and continued to grow steady state. Since foreign inflation increase while domestic one decreases, the domestic currency also appreciates.

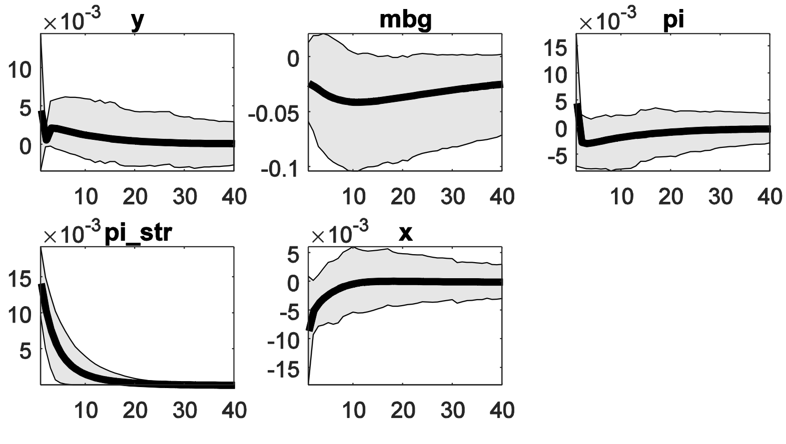

Figure 8: An Impulse Response Functions of an External Shock as a Standard Deviation for Different Time Delays
Source: Research findings

5. Conclusion

Due to the government's reliance on foreign aids in Afghanistan and as a result of a positive change in foreign aids, the government's adoption of an expansionary monetary policy has heavily influenced on fiscal policy. Also, foreigners' aid strengthens the impact of production on a permanent basis. Whenever the rate of aid in Afghanistan grows, the output in the country increases, and the impact of this shock on the growth rate of monetary base is also viable. In addition, the role of this support is very clear in the impact of DAB policies.

By increasing foreign aid and aggregate demand, inflation is constantly affected in Afghanistan. Monetary policy does not play role in output, but has a significant effect on inflation.

During the first period, both the exchange and monetary policy, have an impact on production and inflation; yet in the second period, this effect is reduced to zero. Technological changes have a positive impact on inflation and a negative impact on inflation, which in the course of time this impact reduces. It should also be pointed out that output and inflation from external inflation, indicate an openness of the small Afghan economy, and show that it is being impacted by the foreign aids.

References

Blanchard, O. J., & Gali, J. (2008). The Macroeconomic Effects of Oil Price Shocks: Why are the 2000s so Different form the 1970s? *MIT, Department of Economics*, *Working Paper*, Retrieved from https://ideas.repec.org/h/nbr/nberch/0517.html.

Calvo, G. A. (1983). Staggered Price Setting in a Utility-Maximizing Framework. *Journal of Monetary Economics, 12,* 383–389.

Dixit, A. K., & Stiglitz, J. E. (1977). Monopolistic Competition and Optimum Product Diversity. *American Economic Review, 67*(3), 297–308.

Ebrahimi, E. (2010*). Effects of Monetary Policies in Iran Economy in the form of a Stochastic Dynamic New Keynesian Model* (Unpublished Doctoral Dissertation), Tehran University, Tehran.

Fakhr Hosseini, S. F. (2011). *The Impact of Monetary Policy on Macroeconomic Variables in a Dynamic Equation, with Emphasis on Production and Inflation* (Unpublished Doctoral Dissertation), Mazandaran University, Mazandaran.

Ireland, P. (2004). Money`s Role in the Monetary Business Cycle. *Journal of Money, Credit and Banking, 36*(6), 25–46.

Kydland, F. E., & Prescott, E. C. (1982). Time to Build and Aggregate Fluctuations. *Econometrical, 50*(6), 1345–1370.

Peiris, S. J., & Saxegaard, M. (2007). An Estimated DSGE Model for Monetary Policy Analysis in Low-Income Countries. *IMF Working Paper,* Retrieved from https://www.imf.org/external/pubs/ft/wp/2007/wp07282.pdf.

Liu, P. (2006). A Small New Keynesian Model of the New Zealand Economy, Reserve Bank of New Zealand. *Discussion Paper, 03/06,* Retrieved from https://ideas.repec.org/p/nzb/nzbdps/2006-03.html.

Lucas, J. R. (1976*).* Econometric Policy Evaluation: A Critique. Retrieved from http://people.bu.edu/rking/SZGcourse/lucascr.pdf.

Medina, J., & Soto, C. (2007). Copper Price, Fiscal Policy and Business Cycle in Chile. *Central Bank of Chile, Working Papers, 458,* Retrieved from https://ideas.repec.org/p/chb/bcchwp/458.html.

Nelson, C. R., & Plosser, C. I. (1982). Trends and Random Walks in Macroeconomic Time Series: Some Evidence and Implications. *Journal Monetary Econ, 10,* 62–139.

Romer, C. D. (1990). Does Monetary Policy Matter? A New Test in the Spirit of Friedman and Schwartz. *NBER Macroeconomics Annual 1989,* Retrieved from www.nber.org/papers/w2966.

Tavakolian, H. (2013). *Rule US. Discretion in Monetary Policy: Markov Switching, Kalman Filtering and DSGE Model* (Unpublished Doctoral Dissertation), Tehran University, Tehran.

Tovar, C. (2008). DSGE Model and Central Banks. *Bank of International Settlements, Working Paper, 258,* Retrieved from https://www.bis.org/publ/work258.pdf.

Walsh, C. (2010). *Monetary Theory and Policy* (3nd Ed.). London: MIT Press.

---------- (2003). *Monetary Theory and Policy* (2nd Ed.). London: MIT Press.

Woodford, M. (2003). *Interest and Prices: Foundations of a Theory of Monetary Policy.* New Jersey: Princeton University Press.

Appendix 1

p-1-1

$$\Gamma_t = E_t \sum_{i=0}^{\infty} \beta^t \left\{ \left[\frac{C_t^{1-\sigma}}{1-\sigma} - \chi \frac{L_t^{1+\eta}}{1+\eta} + \frac{\varpi}{1-b} \left(\frac{M_t}{P_t} \right)^{1-b} + \frac{\varpi}{1-bF} \left(\frac{S_t M_{F,t}}{P_t} \right)^{1-bF} \right] + \lambda_t \left[w_t L_t + R_{t-1} k_{t-1} + \frac{(1+r_{t-1}) B_{t-1}}{P_t} + \frac{S_t M_{F,t-1}}{P_t} + \frac{M_{t-1}}{P_t} + D_t - C_t - K_t + (1-\delta) K_{t-1} - \frac{M_t}{P_t} - \frac{B_t}{P_t} - \frac{S_t M_{F,t}}{P_t} - T_t \right] \right\}$$

F.O.C

$$\frac{\partial \Gamma_t}{\partial C_t} = C_t^{-\sigma} - \lambda_t = 0 \tag{1}$$

$$\frac{\partial \Gamma_t}{\partial L_t} = -\chi L_t^{\eta} + \lambda_t w_t = 0 \tag{2}$$

$$\frac{\partial \Gamma_t}{\partial \left(\frac{MB_t}{P_t} \right)} = \varpi \left(\frac{M_t}{P_t} \right)^{-b} - \lambda_t + \beta E_t \frac{\lambda_{t+1}}{\pi_{t+1}} = 0 \tag{3}$$

$$\frac{\partial \Gamma_t}{\partial K_t} = \beta E_t \lambda_{t+1} \big(R_t + (1-\delta) \big) - \lambda_t = 0 \tag{4}$$

$$\frac{\partial \Gamma_t}{\partial \left(\frac{B_t}{P_t} \right)} = \beta E_t \frac{\lambda_{t+1}(1+r_t)}{\pi_{t+1}} - \lambda_t = 0 \tag{5}$$

$$\frac{\partial \Gamma_t}{\partial \left(\frac{S_t M_{F,t}}{P_t} \right)} = \varpi_F \left(m_{F,t} \right)^{-bF} + \beta E_t \frac{x_{t+1} \lambda_{t+1}}{\pi_{t+1}} - \lambda_t = 0 \tag{6}$$

So we have:

$$\varpi m_t^{-b} = \left(\frac{r_t}{1+r_t} \right) C_t^{-\sigma} \tag{7}$$

$$\chi \frac{L_t^{\eta}}{C_t^{-\sigma}} = w_t \tag{8}$$

$$\beta E_t \frac{G_{t+1}^{-\sigma}}{\pi_{t+1}} = \frac{G_t^{-\sigma}}{1+r_t} \tag{9}$$

$$R_t + (1-\delta) = E_t \frac{1+r_t}{\pi_{t+1}} \tag{10}$$

$$\varpi_F \left(m_{F,t} \right)^{-bF} = \left[1 - E_t \frac{x_{t+1}}{1+r} \right] C_t^{-\sigma} \tag{11}$$

p-2-1

$$\min \ \Xi_t =$$

$$w_t L_t(j) + R_t K_{t-1}(j) + \emptyset_t(j)[y_t(j) - a_t K_{t-1}(j)^{\alpha} L_t(j)^{1-\alpha}] \qquad (12)$$

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$$\frac{\partial \Xi_t}{\partial L_t(j)} = w_t - \emptyset_t(j)(1-\alpha) a_t K_{t-1}(j)^{\alpha} L_t(j)^{-\alpha} = 0 \qquad (13)$$

$$\frac{\partial \Xi_t}{\partial K_{t-1}(j)} = R_{t-1} - \emptyset_t(j) \alpha a_t K_{t-1}(j)^{\alpha-1} L_t(j)^{1-\alpha} = 0 \qquad (14)$$

$$\frac{\partial \Xi_t}{\partial \emptyset_t(j)} = y_t(j) - a_t K_{t-1}(j)^{\alpha} L_t(j)^{1-\alpha} = 0 \qquad (15)$$

So we have:

$$\alpha w_t L_t(j) = (1-\alpha) R_{t-1} K_{t-1}(j) \qquad (16)$$

$$mc_t(j) = \alpha^{-\alpha}(1-\alpha)^{-(1-\alpha)} a_t^{-1} R_{t-1}^{\alpha} {w_t}^{1-\alpha} \qquad (17)$$

Appendix 2