Macroeconomic modeling for optimal stabilization policy in Mongolia

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Macroeconomic modeling for optimal stabilization policy in Mongolia[1]

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Abstract

This paper develops three macroeconomic models such as large structural VAR, DSGE-based structural VAR and GAP models for Mongolia, a developing and commodity-exporting economy. All models are estimated using Bayesian methods on the quarterly data. Results suggest that (i) external shocks (i.e., China's economic activity, commodity prices and FDI) are important sources of macroeconomic volatility in Mongolia, (ii) combining macroprudential and monetary policy measures is important in welfare loss by ensuring both macroeconomic and financial stability, and (iii) equilibrium values for inflation, growth, unemployment rate and real interest rate are estimated as 6 percent, 5 percent, 8 percent, and 3.5 percent for Mongolia, respectively. The paper also provides recommendations for macroeconomic stabilization policy.

Keywords: External shocks, Open economy macroeconomics, Optimal stabilization policy, Bayesian analysis.

JEL classifications: C11, C32, C51, E58, E63, F4.

[1] It is the abstract of a dissertation submitted for the degree of Doctor of Science (Sc.D.) in Economics. Scientific consultants are T.Dorj /Academician, Sc.D./ and S.Nyamzagd / Academician, Sc.D./, Official opponents are R.Rinchinbazar /Professor, Sc.D./, R.Enkhbat /Professor, Sc.D./, L.Oyuntsetseg /Professor, Sc.D./, Opponent organization is National Development Agency of Mongolia, and Scientific Secretary of the Council for the defense of Sc.D. in Economics is A.Davaasuren /Professor, Sc.D./. I would like to extend my gratitude and appreciation to each of scientific consultants, official opponents, opponent organization and scientific secretary of the council.

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The views expressed herein are those of the author and do not necessarily reflect the views and policies of the Bank of Mongolia.

1. Introduction

Rationale for choosing the topic

Macroeconomic stability alone is not a sufficient condition for social prosperity, however it is a necessary condition for sustainable and inclusive economic growth. In the 30 years since Mongolia's transition to a market economy, it has faced many economic business cycles. The business cycle fluctuations have led to high costs. Frequently asked questions by researchers and policy makers may include what are the internal and external factors influencing the economic cycle, are the macro-policy combinations fully fulfilling their function of stabilizing the economy, and are the analytical methods reflecting the characteristics of the economy being used in policy development and implementation. Therefore, there is still a need to identify an "optimal" policy to stabilize the Mongolian economy based on a theoretical and practical basis, and to propose an analytical framework that reflects the characteristics of the country.

An economy is a "living" and "complex" system that evolves over time and whose internal components are interconnected. Therefore, models that fully reflect the structural relationships between the variables in the system are important for policy analysis, including estimating the effects of policy instruments, examining the validity of competing theories, conducting economic forecasting, and predicting the impact of shocks in key social and economic indicators (G.Bårdsen and R.Nymoen 2010). Empirical macroeconomic modelling is unique in that it allows for both theoretical and practical rationale. Hence, model-based economic policy analysis is essential for the successful formulation and implementation of forward-looking, counter-cyclical macroeconomic policies. Today, macroeconomic models are widely recognized as a powerful tool to help make better decisions and policy analysis in a more coherent and comprehensive manner.

However, Mongolian government agencies (except the Bank of Mongolia) still do not have a sufficient level of practice in economic forecasting based on macroeconomic models, conducting policy analysis on a regular basis, and informing the public about the results of the analysis. Ministries of finance in other countries (e.g., Australia, Czech Republic, Denmark, Sweden, Finland, the Netherlands, USA, Canada, UK, European Commission, Norway) employ macroeconomic models such as vector autoregression (VAR) and dynamic stochastic general equilibrium (DSGE) models for economic forecasting, budget revenue and expenditure planning, and they focus on incorporating the characteristics of own economies into the models

and training their staffs on a regular basis. Ministry of Finance of Mongolia has developed a variety of models (e.g., DSGE model and T21 model,) with the technical assistance of international organizations, however the human resource policy to continue to use, train model operators and work on a sustainable basis has been abandoned.

Research and financial institutions in Mongolia are not doing well enough to assess the economic situation, conduct economic forecasting and inform their results to the public. In addition, no monograph or significant research has been conducted on assessing the effectiveness of Mongolia's economic stabilization policy[3] over the past 30 years and identifying optimal policies using macroeconomic models and methodologies that have been widely used in recent years.

Therefore, in choosing the research topic, we have considered the following facts: 1) lack of localization of theory, economic modeling and analytical techniques that have recently been widely used internationally in planning and policymaking by government agencies, 2) dearth of methodology for quantitatively measuring the impact of internal and external factors on the economy and their use in policy analysis, 3) absence of systematic research and development of methodologies using economic modeling of optimally combined policies aimed at stabilizing the economy, and 4) no significant work has been done to study and maintain the dynamics of economic equilibrium.

Literature review

The first versions of the macroeconomic models that have become commonplace today have been developed since the 1980s, overcoming the criteria of theoretical development and realism. These include the VAR models first developed by K.Sims (1980) and R.Litterman (1980, 1986a, 1986b) and macroeconomic classic models with the micro-foundations and rational expectations (e.g., the real business cycle (RBC) model and the DSGE model) first developed by F.Kidland and E.Prescott (1982). In the early stages of the development of empirical macroeconomic modeling, classical econometric methods were used to evaluate and analyze model parameters. However, the Bayesian econometrics has been widely used in recent

[3] Stabilizing the economy can be defined as maintaining the balance of aggregate supply and demand in the economy to reduce inflationary pressures and improve the balance of payments.

years due to the need to perform large-scale model analysis even with short sample, to reflect the uncertainty of model parameters in policy analysis, and to improve forecasting accuracy.

Along with macroeconomic modeling, methodological development, and progress, significant progress has also been made in policy analysis. J.Tinbergen (1936, 1939) originated economic forecasting and policy analysis based on econometric models. H.Theil (1956) introduced the optimization in policy analysis. A.Phillips (1954, 1957) advanced the dynamic nature and uncertainty of the economic system into policy analysis and laid the foundation for the development of the theory of economic stabilization in a dynamic and stochastic environment. In doing so, he used feedback control methods, a basic engineering concept, for macroeconomic stability.

In recent years, the role of monetary policy in stabilizing the economy has become more important. It was initiated by W.Poole (1970) who used the dynamic stochastic version of Hicks's IS-LM model to identify the optimal choice of monetary policy instruments based on the Tinbergen-Theil approach. However, since the 1990s, when New Keynesian theories prevailed and central banks began to pursue inflation-targeting framework, they began to pay more attention to the rules of monetary policy instruments to stabilize the economy. The first idea to use similar rules came from works by A. Phillips (1954, 1957). D. Henderson and W. McKibbin (1993) and Taylor (1999) developed the first empirical rules of monetary policy in which the policy rate is a linear reaction function of the output gap and inflation. Since then, monetary policy in macroeconomic models has been modeled by Taylor's rule. Clarida et al. (1999) used the Tinbergen-Theil approach to monetary policy based on the New Keynesian paradigm and conducted a fundamental analysis to identify optimal monetary policy rules and policy options to mitigate the adverse effects of shocks. According to this standard, fiscal and macroprudential policy instruments are also defined by specific rules in macroeconomic models.

At the academic level, many studies have aimed to construct models for the Mongolian economy and conduct policy analysis (e,g., T.Dorj and L.Gurjav 1975, 1979, T.Dorj 1990, T.Dorj and V.Natsagdorj 2000, S. Nyamzagd (2001a, 2001b, 2003), L.Nyambat (2010), Ts.Sukhbaatar (2017), D.Byambasuren (2019). In the case of Mongolia, Ts. Batsukh, P. Avralt-Od, and D. Tuvshinjargal (2011) and S. Dulbadrakh (2016) conducted analysis to determine the optimal monetary policy using the DSGE models of small and open economies.

A series of studies such as D.Gan-Ochir (2011a,b,c,d,e), D.Batnyam, D.Gan-Ochir, and L.Tomash (2009), D.Gan-Ochir and D.Dulamzaya (2014), D.Gan-Ochir and K.Kalirajan (2016), D.Gan-Ochir and B.Undral (2018), D.Gan-Ochir and L.Davaajargal (2017, 2019), D.Gan-Ochir and G.Munkhbayar (2020) modeled dynamics of the main macroeconomic indicators (i.e., inflation, economic growth, exchange rate, interest rate, monetary aggregates) using new methods such as ARIMA, VAR, Bayesian VAR, Structural VAR, New Keynesian structural model, DSGE model, and Dynamic Moving Averaging, examined the effects of monetary and macroprudential policies and their transition mechanisms, and established empirical evidence on the relationship among the macroeconomic indicators.

However, in the case of Mongolia, there is also no monograph or research solely focused on economic stabilization policies and developing Bayesian estimated macroeconomic models that reflect unique characteristics of the economy.

Research purpose and objectives

The purpose of the research is to develop interrelated macroeconomic models[4] that reflect the characteristics of the Mongolian economy, to identify optimal macroeconomic policies to stabilize the economy, and to seek opportunities to maintain economic dynamic equilibrium.

To achieve this purpose, the following objectives have been set and resolved. These include:

1. Review the progress made in macroeconomic modeling and stabilization policy theory and methodology, and evaluate the feasibility of using the latest advanced models and mythologies in the case of Mongolia;
2. Identify the characteristics of the Mongolian economy, evaluate the implementation of stabilization policies, and determine opportunities and grounds for incorporating them into macroeconomic models;
3. Incorporate the key characteristics of the economy into three macroeconomic models on a theoretical basis and use them for policy analysis and forecasting;
4. Identify the effects of domestic and external shocks on the Mongolian economy, study their transmission mechanisms, and determine empirical evidence;

[4] These include the Large Bayesian VAR, the structural model based on linearized equations of New Keynesian DSGE, and the New Keynesian GAP model.

5. Quantify the roles of monetary, fiscal and macroprudential policies in stabilizing the economy;
6. Identify an optimal combination of policies to stabilize the economy in a dynamic environment with domestic and external shocks[5] and propose a methodology used in identifying the optimal mix of macroeconomic policies;
7. Develop a methodology to estimate the equilibrium dynamics of the Mongolian economy (equilibrium growth, equilibrium interest rate, equilibrium inflation) and assess effects of external factors on them, and measure the monetary policy stance and determine the possibility of maintaining the equilibrium dynamics;
8. Develop policy proposals and recommendations aimed at maintaining economic stability and improving economic modeling and analysis in Mongolia.

2. Research methodology and contribution

The theoretical and methodological basis of the research is the works of Mongolian and international scientists and researchers in the field of economic, social and mathematical modeling. This paper employs systematic approaches, statistics, econometric modeling and other methods, including advanced monetary, international and macroeconomic theories and methodologies. The research objectives are solved based on the models (Bayesian estimated structural VAR, New Keynesian DSGE, GAP models) built on the theories and expanded to reflect the characteristics of the Mongolian economy. Structural VAR model has the advantage of incorporating economic structural relationships into the system, recognizing exogenous shocks, and estimating their effects, so that empirical evidence can be obtained before developing a theoretical model. The New Keynesian DSGE model has various advantages, which include estimating the effects of macroeconomic policies and structural shocks, determining their transmission mechanisms, checking the validity of theoretical assumptions, identifying optimal policy combinations and making economic forecasting. In the case of the GAP model, it allows to distinguish the equilibrium and cyclic components of variables, model the relationship between them, and calculate the equilibrium dynamics of variables simultaneously.

[5] In this paper, the term structural shock, commonly used in macroeconomic research, is represented by the term 'sudden change' or 'factor'.

These macroeconomic models have been expanded and localized to suit the characteristics of the economy, using system approach methods and mathematical methods such as dynamic optimization, log-linearization, and system stability analysis. The Bayesian method is used in all numerical analysis, such as parameter estimation, simulation analysis, variance and historical decompositions. In this context, a combination of advanced probability theory, statistical and econometric methods and techniques is used. Kalman smoother is employed to calculate the dynamic equilibrium values of variables, while the loss function optimization technique is used to identify the optimal mix of macroeconomic policies. MATLAB, EViews, and Dynare are used to solve and estimate the large-scale dynamic stochastic models used in this paper. To estimate the models and conduct analysis, own codes are written and processed in the programs. The method of comparison with historical facts is used to interpret empirical results.

Contribution and novelties of the research

The paper contributes to the literature in several ways. It develops new macroeconomic models that reflect characteristics of the Mongolian economy and conducts validation tests of the models using the data. Moreover, it finds novel empirical evidence and recommends own version of theory and methodology to stabilize the economy and achieve dynamic equilibrium.

Novelties of the research can be summarized as follows:

1. We systematically study methodological approaches of macroeconomic modeling and stabilization policy and make the assessment of the possibility of using the modern approaches in the case of Mongolia.
2. We document the characteristics of the economy, analyzes the business cycles that have taken place in the 30 years since the transition to a market economy and the results of stabilization policies, and suggest potential ways to reflect them in macroeconomic models.
3. We develop three new interrelated empirical models that reflect key elements and progress in the development of macroeconomics and main characteristics of the Mongolian economy and evaluate model fits using statistical and econometrics methods. These models are used in policy analysis to stabilize the economy.
4. The models are estimated and empirically evaluated using the Bayesian econometric method, which is widely used around the world today. As far as I am aware, it is one of

the first research that employs Bayesian methods to three different macroeconomic models in the case of Mongolia.

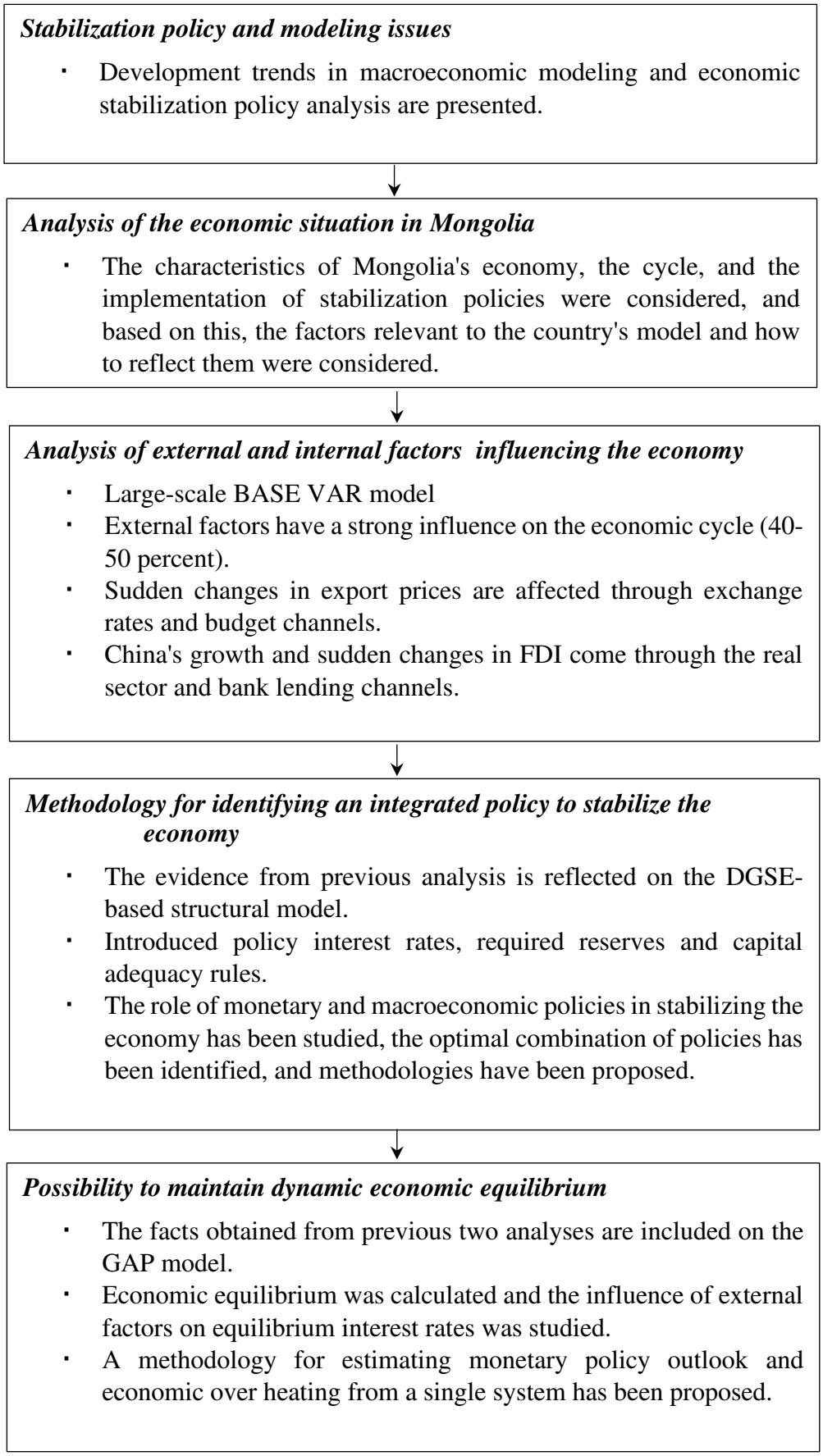
5. Large Bayesian VAR model is used to examine effects of external factors such as commodity demand, commodity prices, FDI and global demand on a commodity-exporting economy (Mongolia as an example). This is one of the first studies in this field[6]. Therefore, it makes an important contribution to identifying optimal policies to maintain macroeconomic stability in resource-abundant developing countries.
6. A new DSGE-based structural model reflecting the characteristics of the commodity-exporting economy is developed and the model is used to examine effects and of transmission mechanisms macroeconomic policies and identify the optimal combination of policies to stabilize the economy. This is one of the first studies in identifying an optimal mix of macroeconomic policies and proposing a methodology in ensuring macroeconomic and financial stability in a commodity-exporting economy.
7. It is one of the first studies which develop The New Keynesian GAP model of a small open commodity-exporting economy and measure equilibrium values of key macroeconomic variables, business cycles, and effects of external factors based on the model. The empirical analysis is applied to Mongolia, a net exporter of minerals, and it focuses in maintaining dynamic economic equilibrium over time. This research provides novel findings and empirical evidence that commodity price, export demand, and FDI shocks have a significant impact on the equilibrium interest rates in the commodity-exporting economy.
8. Based on the newly developed macroeconomic models, it firstly studies causes of business cycles and transmission mechanisms of shocks, proposes an optimal mix of macroeconomic policies to stabilize the economy, and seeks to maintain the dynamic equilibrium. Therefore, based on the results, it provides novel and evidence-based suggestions and recommendations to develop new models and to implement macroeconomic policy options.

Structure and logical sequence of research work

The relationship between the key issues covered in this paper is shown in Figure 1.

[6] The exercise extends the literature in two ways. First, use of large Bayesian VAR approach to examine the transmission of external shocks in a commodity-abundant country is in its novelty in the literature. Second, since the analysis includes a large number of variables and shocks, it provides comprehensive analysis examining macroeconomic effects of external shocks in commodity-exporting developing economies.

Figure 1. Interrelation of issues covered in the paper



3. Summary of the research and empirical results

In the last 90 years, significant progress has been made in the development of macroeconomic theory in line with the changes and evolution of the world economy. During this time, classical economic theory, Keynesian theory, and monetary theory gained momentum over time, however in the 1990s they merged on the micro-founded New Keynesian approach (also called neo-classical synthesis). Empirical studies conducted in Mongolia show that wages and consumer prices are sticky, and this implies that the basic assumption of the New Keynesian approach is hold.

The developments of economic theory and econometrics have been reflected in macroeconomic modeling, and VAR and New Keynesian DSGE-based models are now widely used to analyze the effects of policies and structural shocks. Bayesian econometric method is extensively used to accurately estimate parameters of the models and improve forecasting accuracy. However, theories and models originally developed based on the economic structure and markets of developed countries cannot be directly copied in the form of worship. As the basic assumptions of the models are being fulfilled, there is a possibility to incorporate the characteristics of the economy into the models and estimate parameters using the country data instead of directly calibrating them.

The topic of stabilizing economic fluctuations through macroeconomic policy has been actively studied for more than 80 years. To study economic stabilization policy, there is a tendency to model it as a dynamic system and set up optimal rules for policy instruments. Practical standards have been established for identifying optimal policy instruments that minimize the social loss function (or maximize the social utility function) when incorporating empirical rules for policy instruments into the model and formulating optimal macroeconomic policies.

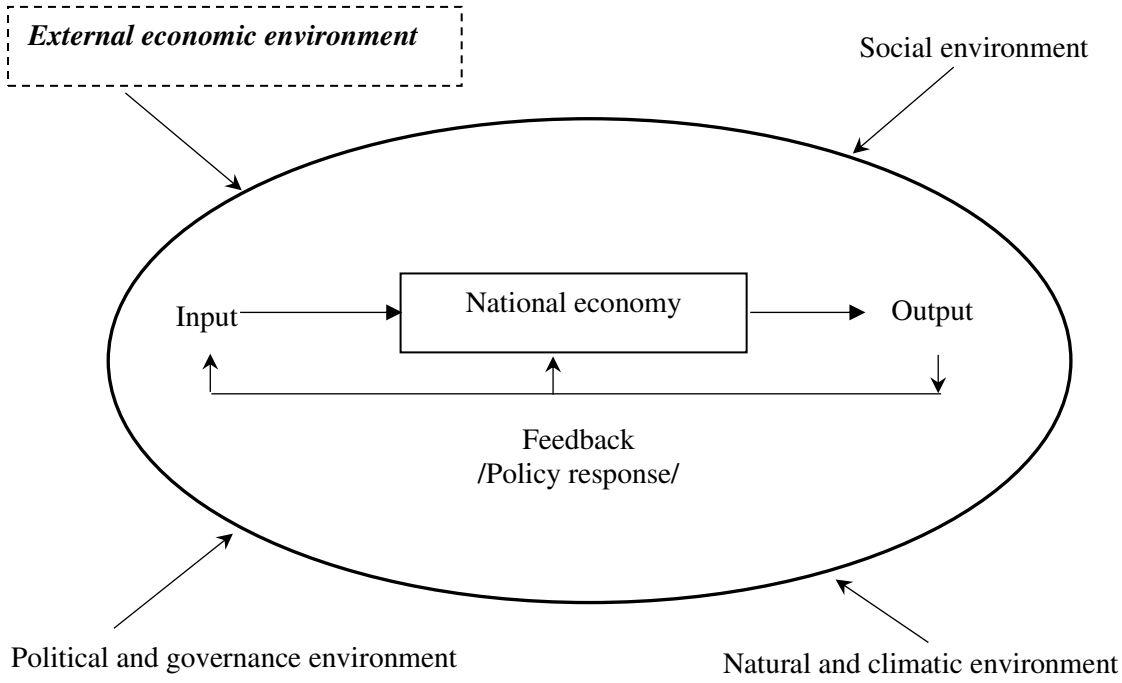
In the case of Mongolia, there are currently no studies that identify the optimal combination of economic stabilization policy tools policy instruments and find novel empirical facts on business cycles and dynamic equilibrium based on Bayesian estimated VAR, DSGE, and GAP models.

This paper is partly related to the economic cybernetics, which has become increasingly popular in Mongolia following the work of T.Dorj and L.Gurjav (1975, 1979). In particular, it is in line with the idea proposed by S. Nyamzagd (2001b, 2003) that the Mongolian economy

is a relatively independent system under the influence of many external environments. In this context, the Mongolian economy can be considered as a navigable system as shown in Figure 2. In other words, the Mongolian economy is capable of self-regenerating and sustaining itself under the influence of changes in the external economic environment, social environment, political and governance environment, and natural and climatic environment, hence can be considered as a system with input, output, feedback, and strategic management (policy response).

The system is sustainable through strategic steering or policy response. Phillips (1954, 1957) firstly introduced the basic concept of feedback control to stabilize the macroeconomy using a system similar to that shown in Figure 2.

Figure 2. Economic system and its environments



This research examines the impact of the external economic environment on the system (the national economy), and the national strategic management (macro policy response, optimal policy combination) to ensure the system stability. The research differs from the work of S. Nyamzagd (2003) in the following ways:

- Focuses on estimating the impact of the external economic environment, identifying optimal policy choices for economic stabilization, and ensuring the dynamics of economic equilibrium.

- The relatively independent system of the national economy is under the influence of domestic and external shocks (waves). The national economic system is modelled by structural VAR, DSGE, and GAP models, and it allows to estimate effects of structural domestic and external shocks.
- Extends the view that strategic parameter is the savings rate by introducing reaction functions of policy rates, reserve requirement ratio, and capital adequacy ratios, which are "deep" determinants of savings and investments.
- Foreign exchange reserves and flexible exchange rate play the compensator[7] role in the system.
- A navigable national economy is represented by a system of linear differential equations.
- Bayesian econometric method is used to estimate parameters of the models, allowing it to be a system that fully reflects the characteristics of Mongolia.

It is now almost 70 years since the first foundations for economic stabilization policy were laid. During the period, research techniques have evolved to go beyond the selection of a single policy instrument to the optimal combination of multiple policy instruments. In the case of Mongolia, policy instruments to stabilize the economy have been developing for the last 30 years. These policy instruments have been actively used to stabilize the economy based on macroeconomic analysis for more than a decade. However, research on the optimal combination of policy instruments using macroeconomic models and techniques used in stabilization policy analysis has not yet been conducted.

Based on the facts, we conclude that it is necessary to develop Bayesian estimated the VAR and New Keynesian DSGE models tailored with the country's characteristics to examine effects of domestic and external shocks on the Mongolian economy, to identify optimal economic stabilization policies, and to measure the dynamics of economic equilibrium.

The paper also covers the analysis on the economic situation in Mongolia. Mongolia's economy has its own unique characteristics creating both challenges and opportunities. While it is challenging how to incorporate some specific characteristics into economic modeling, on the other hand, conducting research and analysis in a way that reflects those characteristics is

[7] The term is used for subsystems that store a constant value of one of the system's parameters (or set of parameters) when external conditions change.

important to produce realistic results and provide new knowledge to academic research and policymaking. Therefore, when using new approaches of economic modeling and analysis, it is important to reflect the specifics of the country on a theoretical basis. In this way, the results of research and analysis will be realistic, and policies to stabilize the economy will be "grounded".

In the last 30 years, along with the market economy, Mongolia's economy has faced five business cycles. Two cycles in the first 10 years were the result of a "top-down" liberal transition to a market economy, while three cycles in the last 20 years were driven by external shocks as the result of a shift to a mining-based economy. Though economic stabilization policies have been implemented in the context of fiscal and monetary policies, they have been pro-cyclical, incoherent and ineffective. Therefore, there is a need to clarify what factors have influenced the business cycles, how strong the effect of stabilization policy instruments is, and how to optimally combine policy instruments and improve their effectiveness.

It is becoming more important to use all possible models and theories to identify and address issues that hinder economic stability and development, rather than to rely on a few established models. Regardless of which development model is declared to be 'replicated', Mongolia's new development model should focus on creating a diversified economy and improving the quality of life of its people. Development strategies and principles is to transfer natural resources to economic development (from a mining economy to a knowledge-based, labor-intensive, multi-pillar economy), particularly to improve human capital and intelligence, and to increase labor productivity and value, and to create value-added, export-oriented products and services.

In the absence of economic stability and the consequent favorable financing environment, the ability to meet major development goals will be limited. Therefore, the identification and effective implementation of macroeconomic stabilization policies is a prerequisite for economic development.

To this end, it is necessary to reflect the specifics of the economy and the current situation in macroeconomic models such as VAR model, DSGE-based structural model and GAP model to study effects of economic stabilization policies and to find the optimal mix of policy instruments. In this context, we conclude that the following facts and characteristics should be reflected in the models as a matter of priority: i) Mongolia's economy is small, open, highly

dependent on the mineral sector and vulnerable to external factors (demand for export, commodity prices and FDI inflows), ii) FDI is concentrated in the minerals sector, iii) foreign demand is highly dependent on China's economic activity, iv) the share of imported goods in the CPI basket is relatively high, v) domestic economic ties (inter-sectoral turnover) are weak, vi) due to the small amount of domestic savings, the current account deficit is financed by external debt, vii) the state budget has been implemented in a "wasteful" manner, viii) the banking sector plays a key role in financial intermediation, ix) The Bank of Mongolia (BOM) uses the policy rate as a main instrument in pursuing a flexible inflation-targeting monetary policy framework, and x) the BOM has started to implement prudent macroeconomic policies.

To reflect these facts and characteristics of the country in VAR modeling, it is recommended to include all possible macro variables that capture the transmission mechanism of external factors in the model system, and to identify exogenous changes in factors based on small open economy macroeconomics.

Next section of the paper examines effects of external shocks and their transmission mechanisms in the Mongolian economy using a large Bayesian VAR model. The model is based on the approach proposed by Banbura et al. (2010), and nine structural shocks (five external and four domestic shocks) are identified using a recursive ordering. The following four important results are obtained from this analysis. First, external shocks (i.e., China's economic activity, commodity prices and FDI) are important sources of macroeconomic volatility in Mongolia. For instance, external shocks account for 40-50 percent of real GDP fluctuations and 40-55 percent of CPI fluctuations. In particular, China's economic growth (5-10 percent), FDI inflows (20-25 percent) and copper price (12-15 percent) shocks play an important role in the business cycle fluctuations. In terms of domestic shocks, budget expenditures, money supply and supply shocks contribute to domestic output and consumer price fluctuations (Table 1).

Table 1. Variance decomposition of BVAR (4) with 16 variables, in percent

	Structural shocks	Real GDP	CPI
External shocks	China's GDP growth shock	5	32
	Copper price shock	12	21
	Coal price shock	6	2
	Oil price shock	3	1
	FDI shock	20	1
	Total	46	57
Domestic shocks	Budget expenditure shock	6	1
	Money supply shock	11	1
	Exchange rate shock	1	1
	Cost/supply shock	6	20
	Total	24	23
Other factors		30	20
Total		100	100

Second, transmission mechanisms of external shocks depend largely on nature of the shock. For instance, commodity price shocks affect the economy through exchange rate and budget expenditure channels, while China's growth and FDI shocks are primarily transmitted through the real sector and bank lending channels (Figure 3 and Figure 4).

Figure 3. Impulse response functions to a positive copper price shock

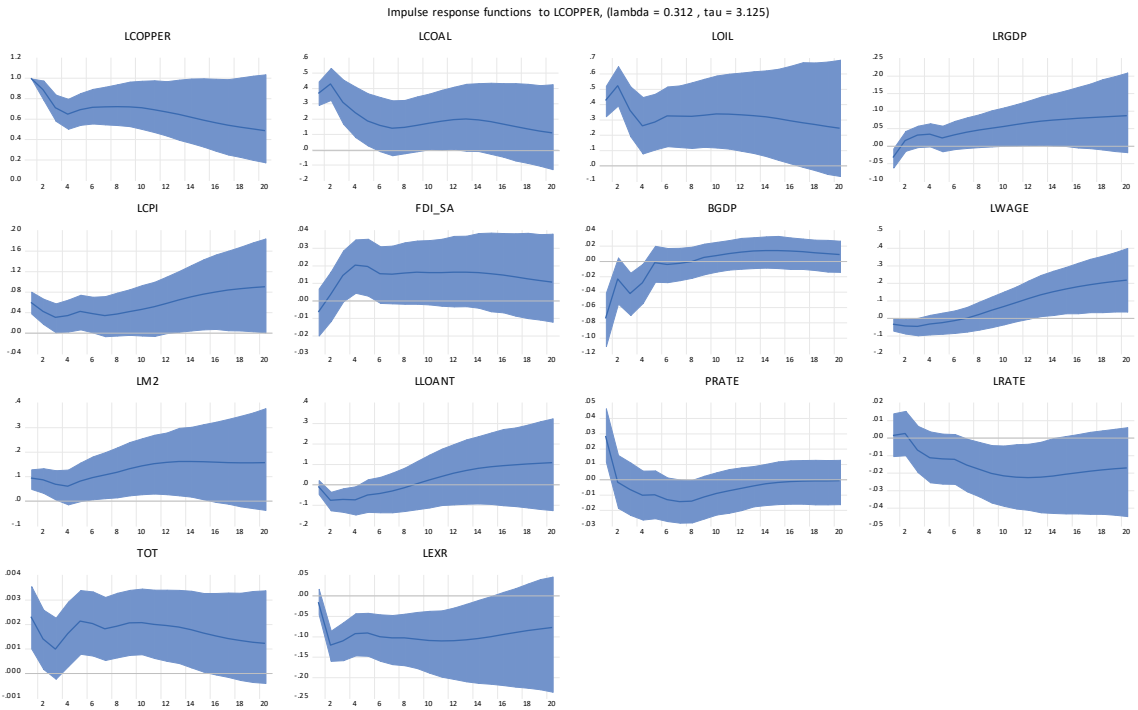
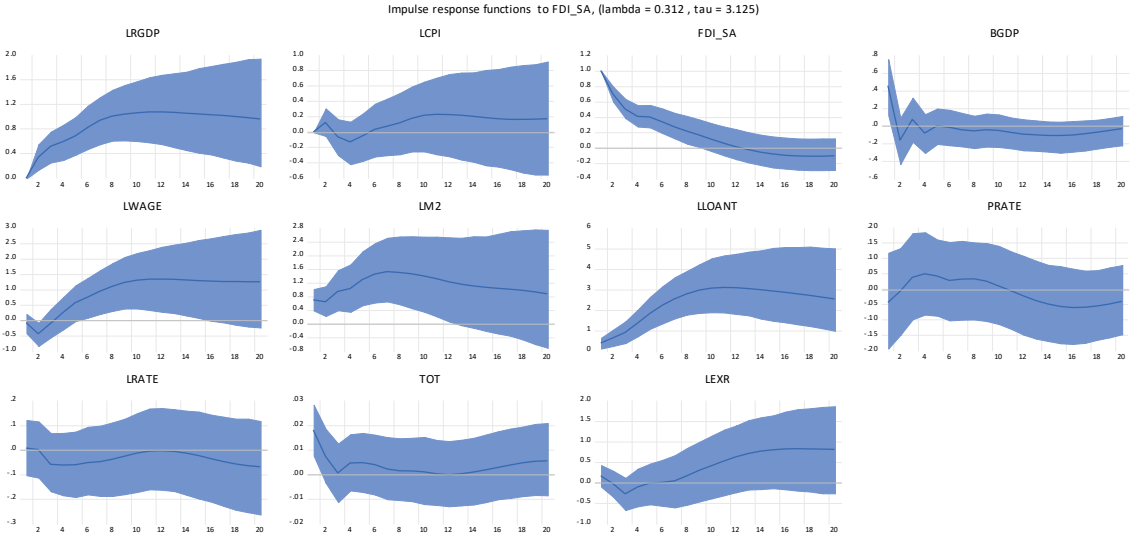
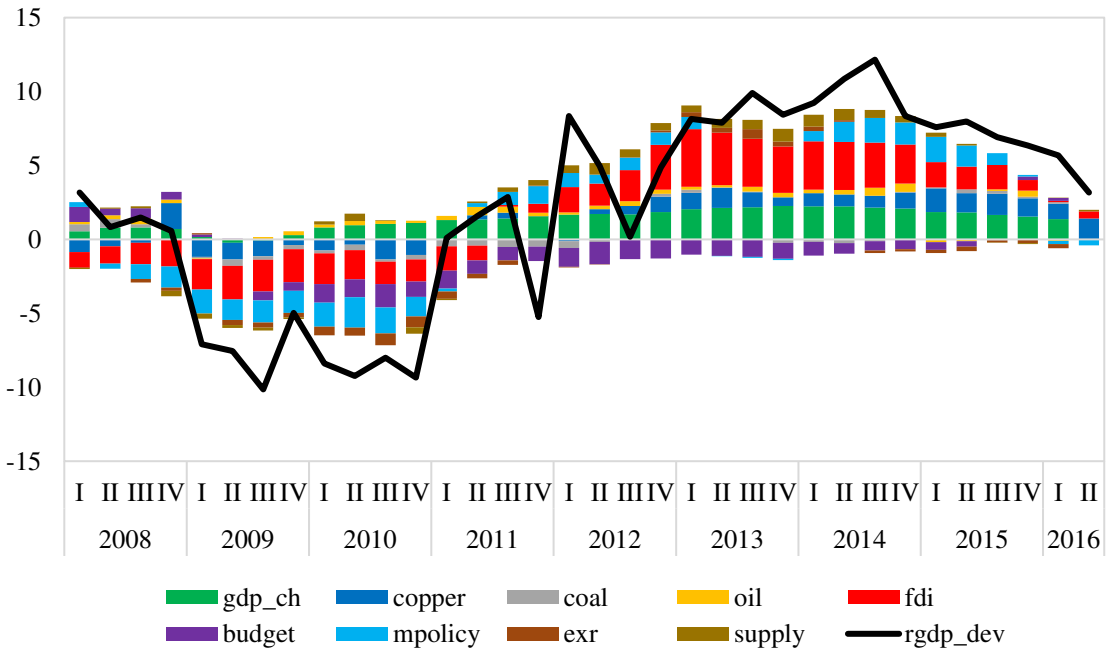


Figure 4. Impulse response functions to a positive FDI shock



Third, macroeconomic policies (monetary, exchange rate and fiscal policies) have been pro-cyclical. This leads to exacerbation of economic volatility driven external shocks (3ypar 5). These results are robust regardless of the size of the model (i.e., changes in time lag and the number of variables) and shock identification methods.

Figure 5. Historical decomposition of real GDP, in percent



Fourth, the expansion in budget expenditures has negatively affected real GDP. This may be due to inefficient budget spending, inadequate and flattened social welfare policies. The government's over-expansion of social welfare creates a desire and opportunity for citizens to

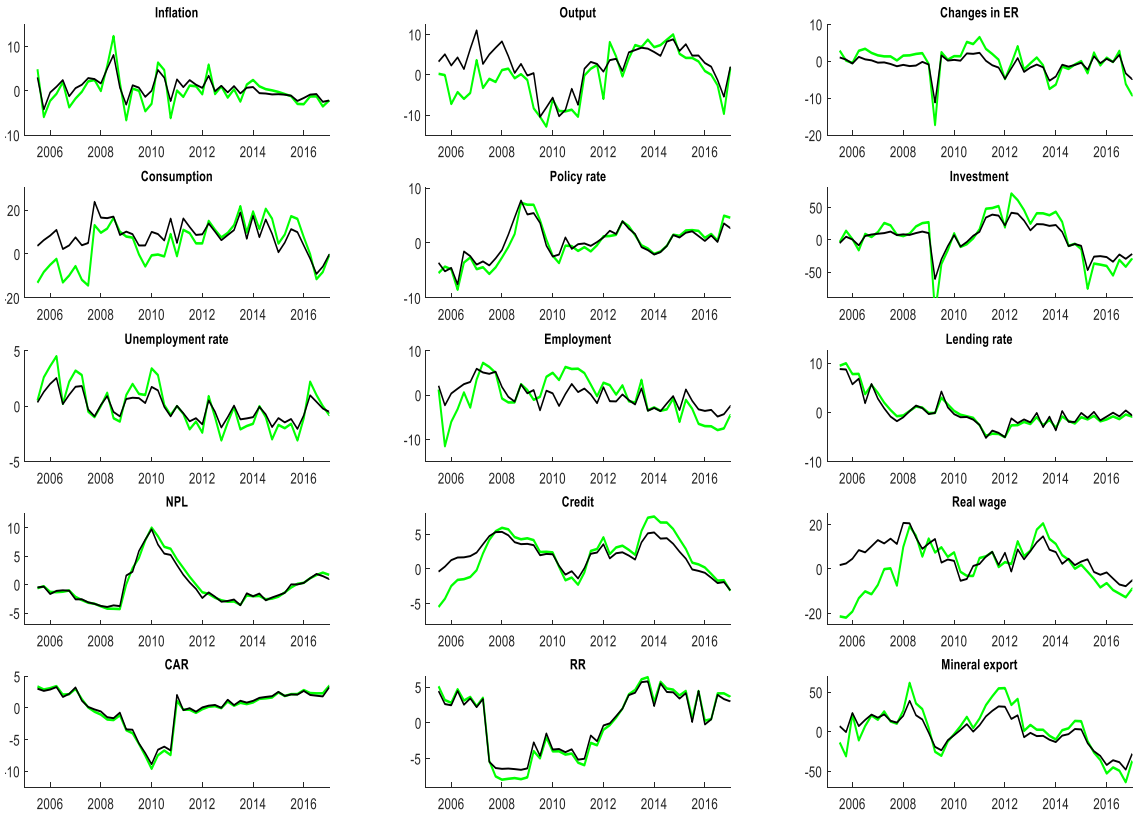
receive a wide range of benefits, creates a “passive” mentality, and reduces their interest in employment. On the other hand, the spending on social welfare limits the opportunities for creating quality jobs, building infrastructures and attracting private investment. Therefore, there is a need to allocate budgets and implement policies to support employment rather than social welfare transfer.

The large Bayesian VAR methodology can be used to empirically examine effects of domestic and external shocks on economic sectors (i.e., mining, trade, services, transportation and manufacturing sectors) and components of GDP expenditure breakdown (i.e., consumption, investment and exports and imports). This is because the methodology allows all these variables to be included in the model system to extract important information and to pursue empirical analysis. In addition, the findings, such as external shocks have a strong impact on the business cycle and the expansion in budget spending has a negative effect on output, are novel empirical evidence for the economy. Therefore, the evidence should be reflected in Mongolia's macroeconomic modeling and policy analysis. In the next section, we incorporate the empirical evidence, the financial sector and policy instruments into DSGE-based structural models.

Next section aims to propose a methodology for identifying a comprehensive policy to stabilize Mongolia's economy. In this context, the effects of monetary and macro prudential policies and their optimal combinations are studied using the New Keynesian structural model of a small open economy estimated by Bayesian method. The model is built on D.Gan-Ochir (2016) and is unique in the sense that it incorporates commodity prices, export demand and FDI, as well as macroprudential policy instruments (reserve requirement ratio and capital adequacy ratio).

As the in-sample fit of the estimated model, the estimation results can be used for structural analysis (Figure 6). Considering the Bayes factor as evaluation criterion, the hypothesis that the Bank of Mongolia responds to changes in the nominal exchange rate through the policy rate is confirmed, while the hypothesis that CAR and RR respond to the business cycle and credit cycle fluctuations cannot be fully rejected, but also cannot be accepted. However, the estimation of monetary policy rule shows that the policy rate responds to inflation and considers output, but the estimated coefficients are lower than in other inflation-targeting countries (i.e., Australia and New Zealand). This implies that monetary policy is not active and does not directly follow Taylor-type rules.

Figure 6. Selected data and one-sided predicted values



Notes: Black and green lines indicate that data and predicted values, respectively.

The results show that external and domestic demand shocks play important role in the business cycle. Historical decomposition analysis has confirmed that external shocks have been the main sources of the macroeconomic fluctuations (Figure 7). The external and government spending shocks play predominant roles in the fluctuations, however, impacts of unanticipated change in monetary and macroprudential policy tools have been weak in recent years. For instance, external and domestic demand shocks respectively account for 25 percent and 40 percent of the forecast error variance of GDP, while unanticipated shocks of monetary and macroprudential policy jointly explain less than 1 percent of the variance (Table 2). However systematic and countercyclical monetary and macroprudential policy actions are important to smooth the macroeconomic and financial market fluctuations.

Figure 7. Historical decomposition of the selected variables: contribution of external shocks

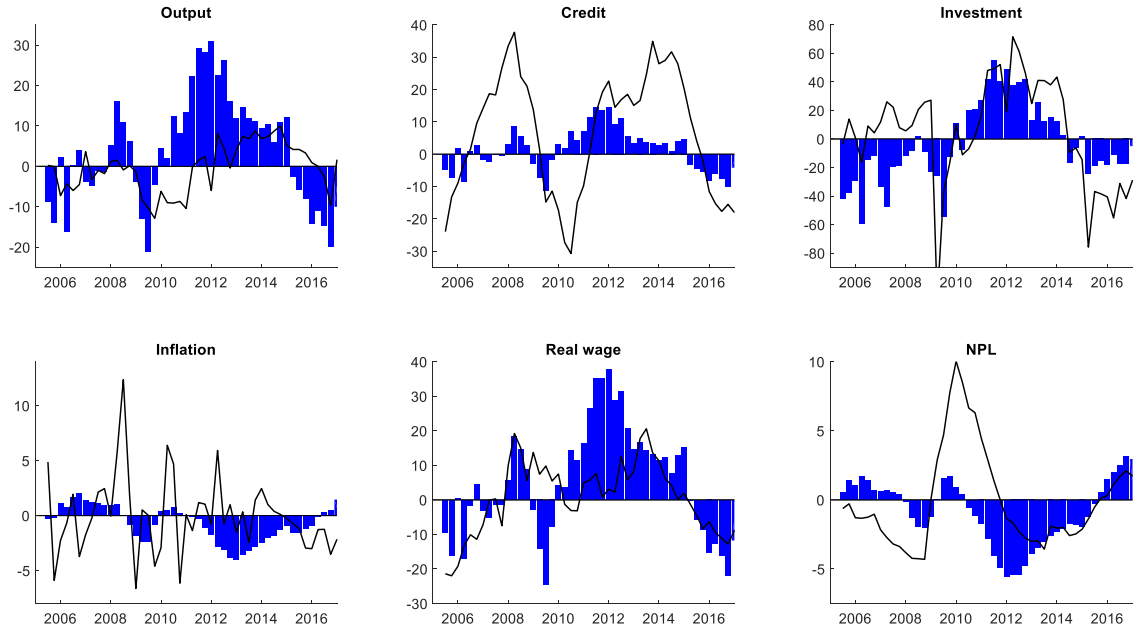


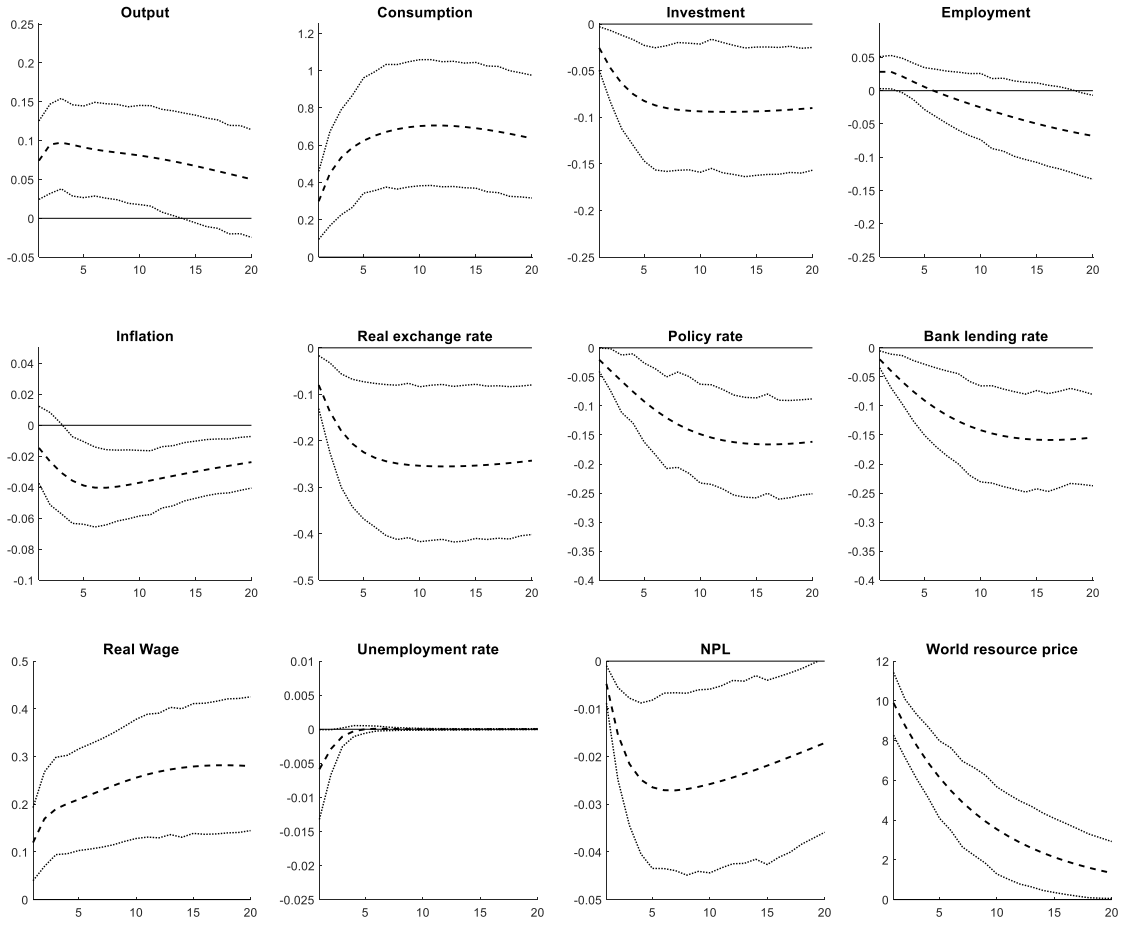
Table 2. Unconditional variance decomposition of selected observed variables

	External shocks	Risk premium shock	Supply shocks	Demand shocks	Financial shocks
y_t	25.4	0.2	15.0	58.1	1.4
c_t	14.1	6.6	9.4	61.7	8.3
i_t	36.1	0.4	2.2	57.4	3.9
l_t	20.4	0.4	23.6	54.5	1.1
s_t	25.3	1.2	34.0	38.3	1.3
q_t	20.6	6.7	32.5	35.2	4.9
n_t	20.4	0.4	23.1	55.0	1.1
rw_t	24.5	0.5	23.1	50.4	1.6
cr_t	2.5	0.1	1.5	6.0	89.9
npl_t	18.9	0.7	9.9	33.9	36.5
π_t	9.9	4.8	64.6	15.0	5.8
$4 * r_t$	23.4	33.0	17.2	13.4	13.0
de_t	15.5	27.2	17.3	23.0	17.1
$\pi_{H,t}$	8.5	1.8	69.3	17.6	2.9
u_t	4.6	0.0	79.3	16.0	0.1
$r_{l,t}$	10.4	13.5	4.3	11.2	60.6
car_t	14.6	0.1	7.3	26.0	52.0
rr_t	5.6	0.0	3.0	10.1	81.3

Notes: The numbers are in percent and correspond to the mean of the posterior distribution of the variance decomposition. In this table, shocks are classified as follows. External shocks: $\epsilon_{com,t} + \epsilon_{fdi,t} + \epsilon_{P^*_{com},t} + \epsilon_{y^*,t} + \epsilon_{r^*,t} + \epsilon_{\pi^*,t}$; Risk premium shock: $\epsilon_{rp,t}$; Supply shocks: $\epsilon_{p^F,t} + \epsilon_{p^H,t} + \epsilon_{\omega,t} + \epsilon_{a,t} + \epsilon_{n,t}$; Demand shocks: $\varepsilon_{c,t} + \varepsilon_{i,t} + \varepsilon_{g,t}$; Financial shocks: $\epsilon_{r,t} + \epsilon_{lr,t} + \epsilon_{Hcr,t} + \epsilon_{Fcr,t} + \epsilon_{Hnpl,t} + \epsilon_{Fnpl,t} + \epsilon_{rr,t} + \epsilon_{car,t}$.

The results reconfirm the conclusion that policy responses to external shocks should be different depending on nature of the shock. For instance, commodity price shocks lead to more symptoms of the "Dutch disease" in the Mongolian economy, while commodity demand and FDI shocks could induce "overheating" in the economy (Figure 8).

Figure 8. Impulse response functions to a positive commodity price shock



Comparison of responses to different policy shocks indicates that the policy rate is important in controlling inflation and exchange rate, while capital and reserve requirements provide a potential way of curbing credit growth without appreciating the exchange rate. Therefore, when economic and financial cycles move in opposite direction, the policy rate is helpful in achieving the macroeconomic stability, while macroprudential tools such as capital and reserve requirements can serve as complements to the policy rate in ensuring financial stability (Table 3). Moreover, macroprudential policy instruments are more effective to stabilize economic fluctuations driven by commodity price shocks, while the combination of macroprudential instrument and policy rate is useful in responding to FDI and commodity demand shocks.

Thus, the use of macroprudential policy instruments to manage effects of capital flows can increase monetary policy independence, hence monetary policy can be implemented in a counter-cyclical manner.

Table 3. Quantitative impact of policy instruments, at posterior mean

	Policy rate shock		Reserve requirement shock		Capital adequacy shock	
Lending rate	+1	pp	+1	pp	+1	pp
Total credits	-0.12	p	-0.34	p	-0.32	p
Inflation	-2.10	pp	-0.05	pp	-0.06	pp
GDP	-3.25	p	-0.35	p	-0.36	p
Policy rate	5.90	pp	-0.07	pp	-0.08	pp
Reserve requirement	-0.34	pp	3.50	pp	-0.06	pp
Capital requirement	-0.50	pp	-0.06	pp	2.00	pp

Notes: p and pp stand for percent and percentage points, respectively. The numbers shown refer to the response of the variables at the initial stage of the shock (two quarters).

In addition, as the loss function analysis confirms the macroprudential policy measures are welfare enhancing and the combination of the monetary and macroprudential policies in the optimal manner is more effective in stabilizing the whole economy. This result is in line with the conclusion that it is not appropriate for monetary policy alone to respond to financial market variables. A combination of policy rate and reserve requirement is superior to ensure macroeconomic stability, a choice of policy rate and capital requirement is effective in achieving financial stability. For a policy authority that conducts both monetary and macroprudential policies (i.e., the Bank of Mongolia), a combination of policy rate and capital requirement would result in greater loss reduction as long as its financial stability objectives are prioritized no less than its macroeconomic stability objectives (Table 4).

Final section of the paper measures equilibrium values of key macro variables, examines the fundamental drivers and identifies a possible way to achieve the economic equilibrium over time using the Bayesian estimated New Keynesian GAP model for a small open commodity-exporting economy. The model-based methodology developed here also allows for the simultaneous estimates of economic equilibrium (i.e., natural real rate of interest, inflation target, equilibrium growth and equilibrium exchange rate) and cyclical dynamics. The novelty of the model is that it incorporates external factors such as commodity demand, commodity price and FDI in line with open economy macroeconomic theory.

Table 4. Loss function of alternative models: interaction between monetary and macroprudential policies

	Volatility in selected variables[a]					Loss functions		
	π	y	Δe	cr	r_l	$\mathcal{L}^{Macro}$	$\mathcal{L}^{Fin}$	$\mathcal{L}$
Equal weights: $\omega_\pi = \omega_y = \omega_{\Delta e} = \omega_{cr} = \omega_{r_l} = \frac{1}{5}$								
Model 1	5.78	25.07	7.38	4.32	8.61	7.65	2.59	10.23
Model 2	4.45	21.92	6.38	3.59	8.02	6.55	2.32	8.87
Model 3	4.43	20.64	6.73	3.65	7.68	**6.36**	2.27	8.63
Model 4	4.73	24.49	6.66	3.88	8.92	7.18	2.56	9.74
Model 5	4.44	22.66	6.52	3.40	7.83	6.72	2.25	8.97
Model 6	5.18	20.41	6.87	3.03	7.44	6.49	**2.09**	**8.59**
Model 7	4.85	22.61	7.24	6.30	9.03	6.94	3.07	10.01
Model 8	4.16	23.94	6.63	3.67	9.81	6.95	2.70	9.64
Model 9	4.57	22.13	6.09	3.53	8.56	6.56	2.42	8.98
More weights on macroeconomic variables: $\omega_\pi = \omega_y = \omega_{\Delta e} = \frac{2}{8}$ and $\omega_{cr} = \omega_{r_l} = \frac{1}{8}$								
Model 1	5.78	25.07	7.38	4.32	8.61	9.56	1.62	11.17
Model 2	4.45	21.92	6.38	3.59	8.02	8.19	1.45	9.64
Model 3	4.43	20.64	6.73	3.65	7.68	**7.95**	1.42	**9.37**
Model 4	4.73	24.49	6.66	3.88	8.92	8.97	1.60	10.57
Model 5	4.44	22.66	6.52	3.40	7.83	8.41	1.40	9.81
Model 6	5.18	20.41	6.87	3.03	7.44	8.12	**1.31**	9.42
Model 7	4.85	22.61	7.24	6.30	9.03	8.68	1.92	10.59
Model 8	4.16	23.94	6.63	3.67	9.81	8.68	1.69	10.37
Model 9	4.57	22.13	6.09	3.53	8.56	8.20	1.51	9.71
More weights on financial variables: $\omega_\pi = \omega_y = \omega_{\Delta e} = \frac{1}{9}$ and $\omega_{cr} = \omega_{r_l} = \frac{3}{9}$								
Model 1	5.78	25.07	7.38	4.32	8.61	4.25	4.31	8.56
Model 2	4.45	21.92	6.38	3.59	8.02	3.64	3.87	7.51
Model 3	4.43	20.64	6.73	3.65	7.68	**3.53**	3.78	7.31
Model 4	4.73	24.49	6.66	3.88	8.92	3.99	4.27	8.25
Model 5	4.44	22.66	6.52	3.40	7.83	3.74	3.74	7.48
Model 6	5.18	20.41	6.87	3.03	7.44	3.61	**3.49**	**7.10**
Model 7	4.85	22.61	7.24	6.30	9.03	3.86	5.11	8.97
Model 8	4.16	23.94	6.63	3.67	9.81	3.86	4.49	8.35
Model 9	4.57	22.13	6.09	3.53	8.56	3.64	4.03	7.67

Notes:

Model 1. A model without macroprudential policy (no capital and reserve requirements).
Model 2. A model with exogenous capital and reserve requirement.
Model 3. A model with exogenous capital requirement.
Model 4. A model with endogenous capital requirement (only responding to loan).
Model 5. A model with endogenous capital requirement (only responding to output).
Model 6. A model with exogenous reserve requirement.
Model 7. A model with endogenous reserve requirement (only responding to loan).
Model 8. A model with endogenous reserve requirement (only responding to output).
Model 9. A baseline model: capital and reserve requirements endogenously respond to both loan and output.

Considering the Bayes factor as evaluation criterion for comparing alternative models, we find novel evidence that both natural real rate of interest and equilibrium real exchange rate depend on transitory shocks (Table 5). The empirical evidence is line with the result shown by K. Lewis and F. Vazquez-Grande (2018)- the natural real rate of interest is prone to both permanent and transitory shocks.

Table 5. Relative fit of alternative specifications

Models ($\mathcal{M}$)	Log marginal data densities ($ln\, L(Y^T|\mathcal{M}_i)$)	Bayes factor ($\mathcal{BF}$)
$\mathcal{M}_0$: Baseline model (natural rate of interest and equilibrium real exchange rate depend on transitory shocks)	-2376.33	$\mathcal{BF}_{0,0\|Y} = 1$
$\mathcal{M}_1$: Model where natural rate of interest depends on permanent shock	-2379.93	$\mathcal{BF}_{0,1\|Y} = 36.6$
$\mathcal{M}_2$: Model where equilibrium real exchange rate depends on permanent shocks	-2385.16	$\mathcal{BF}_{0,2\|Y} = 6836.3$

Notes: The table reports Bayes factors by comparing the model $\mathcal{M}_0$ to $\mathcal{M}_1$ (or $\mathcal{M}_2$. The log marginal data densities reported here is computed from the posterior draws using the Laplace approximation.

Variance decomposition analysis shows that transitory shocks to equilibrium interest rate and equilibrium exchange rate account for 43 percent of fluctuations in the natural real rate of interest (Table 6).

Table 6. Variance decomposition by selected shocks, in percent

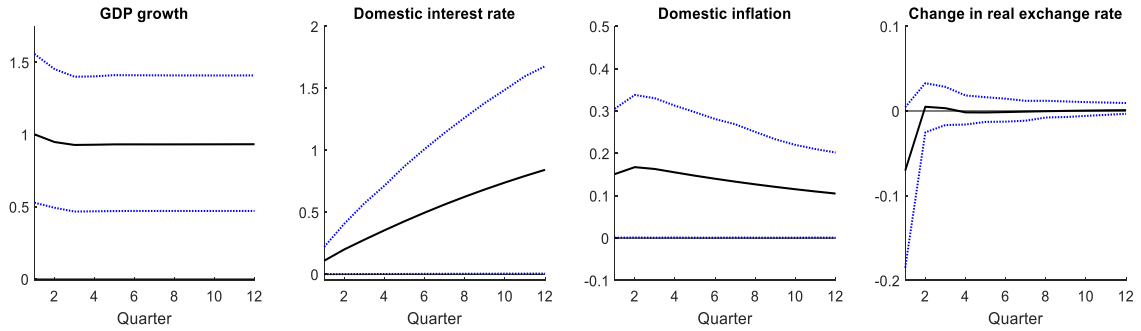
	Observed variables				**Equilibrium variables**	
	g_t	π_t	Δq_t	i_t	r_t^*	q_t^*
$\epsilon_t^{r^*}$	0.3	0.1	0.3	10.6	31.7	0.0
ϵ_t^{y}	65.6	0.1	0.5	3.3	0.0	0.0
ϵ_t^{π}	0.1	95.1	0.2	0.6	0.0	0.0
ϵ_t^{q}	0.0	0.2	8.9	0.9	0.0	0.0
$\epsilon_t^{\Delta q^*}$	0.1	0.0	33.4	3.2	11.2	25.2
ϵ_t^{i}	7.1	1.3	6.7	36.9	0.0	0.0
$\epsilon_t^{g^*}$	12.7	0.1	0.0	7.0	18.7	0.0
$\epsilon_t^{\pi^*}$	0.0	2.0	0.0	5.3	0.0	0.0
$\epsilon_t^{\Delta x^{com,*}}$	0.0	0.0	1.7	0.8	1.5	3.2
$\epsilon_t^{\Delta p^{com,*}}$	0.0	0.3	42.1	19.1	36.2	69.8
$\epsilon_t^{\Delta fdi^*}$	0.0	0.0	0.8	0.4	0.8	1.8
$\epsilon_t^{y,f}$	0.0	0.0	0.0	0.0	0.0	0.0
$\epsilon_t^{\pi,f}$	0.0	0.1	1.0	0.3	0.0	0.0
$\epsilon_t^{i,f}$	0.0	0.4	1.6	1.9	0.0	0.0
$\epsilon_t^{\tilde{x}^{com}}$	5.7	0.2	1.2	3.9	0.0	0.0
$\epsilon_t^{\tilde{p}^{com}}$	4.2	0.1	0.9	3.1	0.0	0.0
$\epsilon_t^{\widetilde{fdi}}$	4.2	0.1	0.7	2.9	0.0	0.0

Notes: The numbers in the table are the posterior mean conditional variance decomposition at period 20, which approximates (long-horizon) stationary variance (or unconditional variance).

The research provides novel findings on the macroeconomic effects of shocks to natural real rate of interest, equilibrium real exchange rate and potential growth and appropriate responses of monetary policy to the shocks. According to the estimated Taylor rule, as a response to positive equilibrium variable shocks, a gradual and steady increase in policy rate will help the

economy move to a new equilibrium and stabilize the inflation. The policy rate must be raised faster (the real interest rate will rise faster than the real equilibrium interest rate) to quickly move to the new equilibrium and make the necessary adjustments (Figure 9).

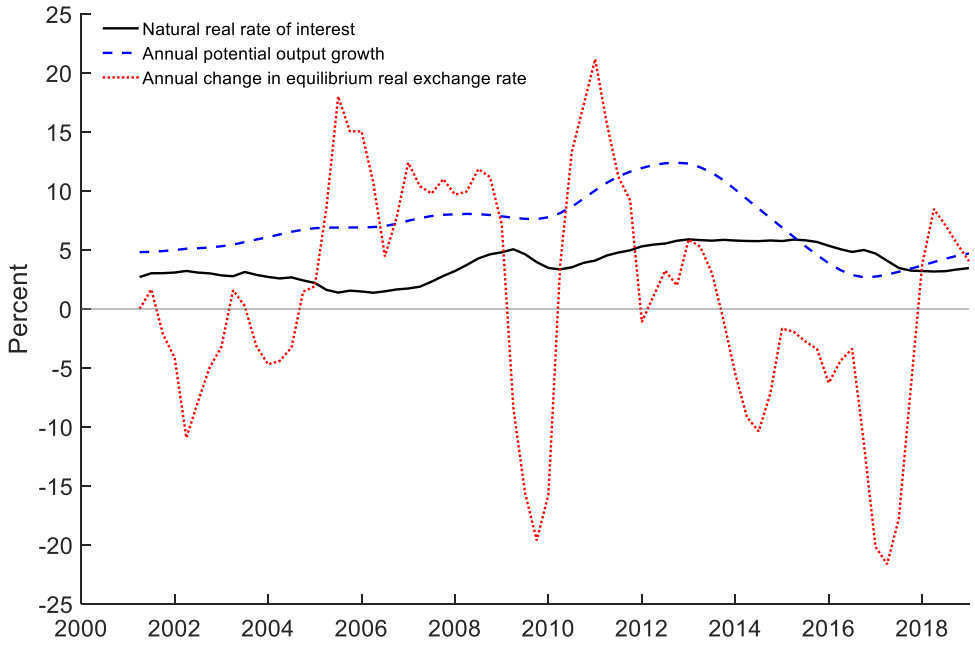
Figure 9. Impulse response functions to a potential growth shock ($\epsilon_t^{g^*}$)



The natural real rate of interest is estimated as procyclical in the Mongolian economy. For instance, it is estimated as 3.5 percent at the end of 2018. The stance of monetary policy has been neutral since the second half of 2017 as real interest rate is within the confidence interval of the estimated natural real rate of interest. The natural nominal rate of interest remains at double-digits (12-13 percent for the period 2012-2015 and about 10 percent at the end of 2018) due to the economy's characteristics and it has been one of key drivers of high interest rate in Mongolia.

The estimated output gap suggests that the Mongolian economy has recovered since 2017 and is still in the expansion path at the end of 2018, building demand pressures on inflation for the period 2018-2019. The estimated equilibrium inflation (inflation target) has been relatively stable at around 6-6.5 percent (at the posterior mean). However, there has been noticeable variation in the potential output growth and equilibrium real exchange rate. The estimated potential growth accelerated during 2010-2012, and reached annualized rate of 12.4 percent, and the growth has sharply declined between 2013 and 2016, reaching annualized rate of 2.5 percent in mid-2016. It has recovered since 2017 and reached 5 percent at the end of 2018 (Figure 10).

Figure 10. Natural real rate of interest (r_t^*), annual potential growth ($y_t^* - y_{t-4}^*$) and annual change in real equilibrium exchange rate ($q_t^* - q_{t-4}^*$)



We also aim to determine the equilibrium dynamics in the labor market, and the natural rate of unemployment rate is estimated at 8 percent when using equilibrium inflation of 6 percent and annual potential growth of 5 percent. The natural rate of unemployment is calculated based on the following modified Phillips curve (where equilibrium inflation and growth are assumed to be $\bar{\pi} = 6\%$ and $\bar{g} = 5\%$, respectively), which is estimated using annual data for 2006-2020:

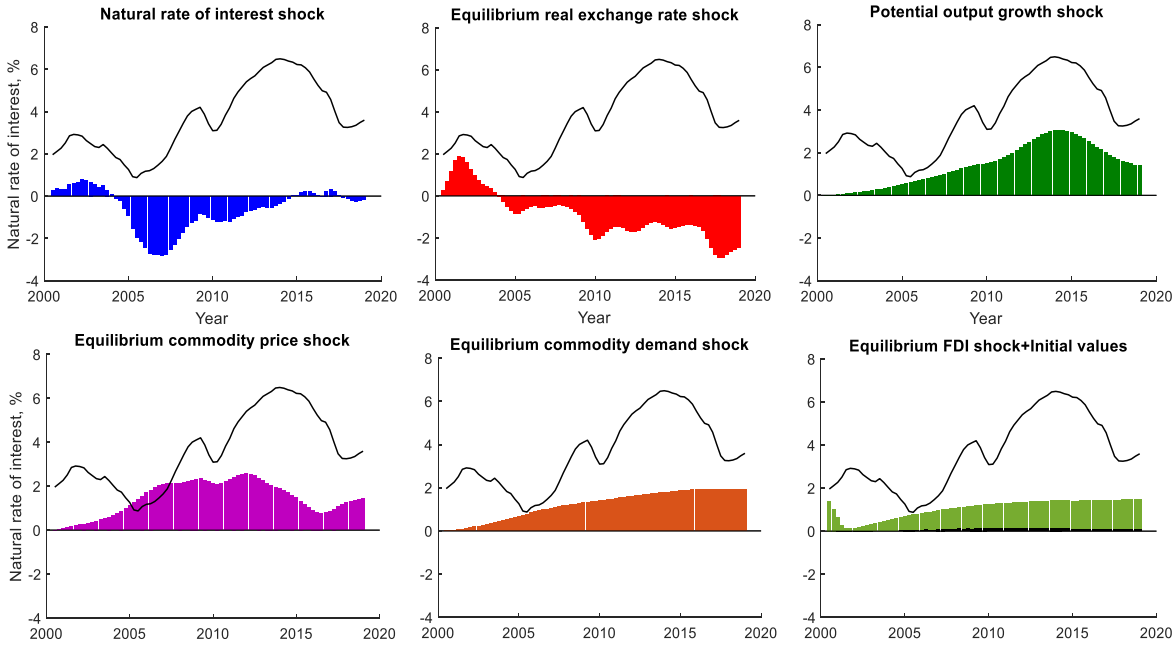
$$\pi_t - \bar{\pi} = 6.0 - 0.73u_t + 0.53(g_t - \bar{g}),\ R^2 = 0.51$$
$$s.e \rightarrow \quad (3.8) \quad (0.42) \quad (0.23)$$

The estimation shows that 1 percent point increase in growth gap rises annual inflation by 0.53 percentage points. 1 percentage point increase in the unemployment rate leads to decrease of 0.73 percentage points in annual inflation.

This research is the first to provide empirical evidence that external shocks drive the natural rate fluctuations. For instance, shocks of equilibrium commodity price, equilibrium demand for commodity exports and equilibrium FDI jointly account for about 40 percent of the natural rate fluctuations. The external shocks mainly transmit through the equilibrium real exchange rate as the shocks account for 75 percent of the equilibrium real exchange rate fluctuations. Shocks of potential growth and equilibrium real exchange rate account for 18.7 and 11.2 percent of fluctuations in the natural rate (Table 6). The natural real rate of interest increased from 2017 mainly due to positive shocks of equilibrium commodity price and commodity

demand. These results suggest that external shocks affect not only the business cycle but also the dynamics of economic equilibrium for the Mongolian economy, which is highly dependent on commodity exports (Figure 11).

Figure 11. Historical decomposition of natural real rate of interest: contribution of shocks



Notes: The numbers in the plot are posterior mean estimate of the natural real rate of interest and posterior mean contributions of shocks. In the last plot of the figure, the black bar and the light green bar represent the contributions of equilibrium FDI shock and initial values, respectively.

Overall a possible way to maintain the dynamic equilibrium of the Mongolian economy is to set an inflation target of around 6 percent and to follow Taylor-type rules to achieve the target. As a result, it is possible to stabilize economic growth at the equilibrium level of 5-6 percent and the natural rate of unemployment at 8 percent.

4. Conclusions

Based on the results, the following policy and methodology are proposed aimed at stabilizing the Mongolian economy and ensuring an economic equilibrium independent of external factors:

1. According to the results of the estimated models, **macroeconomic economic criteria**[8] for Mongolia's sustainable economic development are: 1) stable inflation at around 6 percent, 2) GDP growth of at least 5-6 percent per year (potential growth rate), and 3) short-term nominal interest rates should be in single-digit, and 4) the unemployment rate should not exceed 8 percent[9]. In other words, the research suggests that a monetary policy framework based on average-inflation targeting and forward-looking nature needs to be effectively localized in Mongolia[10]. This may be a viable option to keep the economy in dynamic equilibrium, and the option can be seen as a prerequisite for creating domestic savings without disrupting the internal balance of the economy, improving resilience to external external shocks and self-sustaining economy.
2. To reflect the results of this research in policy development and practice, **the following amendments are proposed to the Law on the Central Bank (Bank of Mongolia)**: 1) Define monetary policy as the main goal of maintaining domestic price stability or meeting the inflation target; 2) The objectives and activities of the central bank should clearly reflect the regulation that they should be completely independent of politics, independent of the government, and independent of the election cycle; 3) Clarify the differences between monetary policy and other economic policies and objectives; 4) Set out a clear mechanism for evaluating the central bank's performance and accountability in terms of how it meets its core objectives. These measurements will create the basic conditions for the BOM to be politically independent and perform its economic stabilization functions at a professional level, in line with other central banks.

[8] Economic criteria are quantitative indicators of the extent to which basic conditions are met.

[9] It must be noted that these criteria need to be updated periodically, and the criteria mentioned here are calculated as of 2020. However, the inflation target is unlikely to fall below 6 percent in the next five years until the share of products and services with fluctuating prices for food, fuel and other disposable items in the CPI basket falls sharply. The 6 percent target will also allow the Bank of Mongolia to support the economy and ensure the effectiveness of monetary policy.

[10] This flexibility in the inflation targeting allows for nominal GDP to be targeted for certain periods (allowing inflation to rise when real growth is below its potential level), and policymakers to support aggregate demand in times of economic hardship by allowing real interest rates to fall. This 'promise' about future inflation must come true and intends to support the economy. Therefore, the central bank's statement and public relations channel need to be transparent and clear.

3. In the current structure of the economy, which is highly vulnerable to sudden changes in external factors, the choice of "policy rate + reserve requirement ratio" for a measure of macroeconomic stability, and the choice of "policy rate + capital adequacy ratio" for an estimate of financial stability will be an effective and optimal combination of policy options. However, for the BOM, which is responsible for maintaining macroeconomic and financial stability, **the policy rate combined with the capital adequacy ratio would be the optimal choice**, unless the authority's macroeconomic stability objectives are prioritized over its financial stability objectives.
4. **The nature of shocks should be considered in implementing appropriate fiscal, monetary, and macro policy responses** to stabilize the economy in the face of external shocks. Because sudden changes in commodity price shocks are more likely to create the symptoms of a "Dutch disease" in the Mongolian economy, while commodity demand and FDI shocks are likely to cause "overheating" in the short term. Therefore, fiscal and macroprudential instruments will effectively stabilize economic fluctuations driven by commodity price shocks. In contrast, for FDI and commodity demand shocks, in addition to macroprudential policy instruments, policy rates are likely to be an effective.
5. There is a need **to introduce new macroprudential policy instruments** to mitigate the adverse effects of external shocks. Therefore, in the future, it is proposed to use the methodology based on the function of losses due to economic instability, as described in the paper, to determine the optimal combination of policy instruments to ensure overall economic stability (both financial and macroeconomic stability).
6. The Mongolian economy's dynamic equilibrium is highly dependent on temporary and external factors, so it is necessary to consistently implement macroeconomic and structural policies and measures to reduce economic vulnerability and strengthen resilience. Otherwise, relying on "luck" will continue the cycle of economic downturns and developments driven by external shocks. To this end, in terms of macro and structural policies, **buffer reserves should be built in all sectors during the expansion paths of the business cycle (increasing room for budget space, accumulating foreign exchange reserves, and implementing counter-cyclical policies), strengthening the fundamentals to improve resilience, laying the foundation for sustainable growth, increasing productivity and competitiveness and economic diversification are required.** To diversify the economy, it is necessary to diversify exports, diversify FDI and attract it to priority sectors, consider cross-

sectoral indirect effects, and trade and industrial policy as a whole in the diversification strategies. In addition, to make the domestic economy less dependent on foreign markets and diversify the economy, it is necessary to keep pace with the Fourth Industrial Revolution and support the development of information technology, innovation, tourism, and small and medium enterprises. Public policy should not hinder the development and progress of these sectors but provide policy support to ensure inter-sectoral coordination and act as a bridge to foreign markets.

7. **There is a need to support export-oriented industrialization and entrepreneurship to diversify the economy and create quality jobs.** For that, our country needs to reduce financing costs. There are limited opportunities to develop value-added manufacturing, competitive exports, and small and medium enterprises without a low-interest financing mechanism. Lowering interest rates is not just a matter for the banking sector; it will require a wide range of reforms and a series of consistent measures. First and foremost, commitment to keep inflation at a stable low level, increasing foreign exchange reserves, effectively implementing fiscal discipline and inclusive growth, legal reforms to reduce non-performing loans, good governance in the financial sector, and financial regulation necessary for financial intermediation are needed to be followed. As a result, the country's credit rating will be improved, the cost of external resources and the domestic credit risk will be reduced, the base interest rate will be kept low, and the interest rate will be reduced due to normal financial intermediation. With the establishment of low-cost financing mechanisms, export-oriented manufacturing will develop, and domestic financial savings will increase as the balance of payments improves. This will provide a basis for the economy to have self-sustaining savings from domestic sources, which will lead to sustainable economic growth and development.
8. **The main pillars of Mongolia's development are human development and employment.** In this sense, investing in people and minds, improving the use of human resources, increasing labor productivity, and consequently increasing the value of labor will improve people's livelihoods and create internal savings. Furthermore, these savings should enable sustainable growth and development with domestic resources by introducing the next high technology and increased investment. Therefore, the government's economic policy needs to prioritize the creation of 'people-centered, human development-oriented and quality jobs.

9. **The introduction of an integrated macroeconomic policy framework in Mongolia will provide real results in ensuring policy coherence, clarifying the choice of policy instruments, and stabilizing the economy**. In other words, it is necessary to create a system to ensure the coherence and optimal combination of these policies based on the effects of fiscal, monetary, macro-prudential policies, foreign exchange intervention, and policy instruments of capital flow management. In this context, it is possible to extend the basic models developed in this paper by including exchange rate financial channels, budget revenue and expenditure components, export, import, foreign exchange transaction tax rates, foreign exchange intervention rules, loan terms, debt-to-income ratios, loan-to-valuation ratios, and their links to other variables. This expanded policy analysis platform integrates and "ties" the annual development plan, annual budget, and monetary policy guidelines that the Parliament currently approves in a weaker uncoordinated manner and ensures consistency of the economic stabilization goals, realistic planning, and having a clear policy choice in the situation.
10. New policy instruments need to be introduced in Mongolia for capital flow management as part of a comprehensive policy. In this context, **it is possible to introduce and use the Tobin tax**, proposed by the 1981 Nobel Laureate in Economics James Tobin, to suit the specifics of our country.
11. There is a great **need to clarify the role and interrelationship of fiscal and monetary policies in achieving human, social, and economic development goals within the framework of an integrated macroeconomic policy framework**. Although there is currently no legal document that clearly defines the relationship between development policy, fiscal policy, and monetary policy, and policy coherence has not been systematic, proposals from relevant organizations are received and integrated and working groups are established each year. Therefore, the Law on Development Policy, Planning and Management, and other relevant laws should ensure coordination between the state budget and development policy and clarify policy development, implementation, and monitoring mechanisms.
12. Within an integrated policy framework, **it is crucial to identify the optimal combination of fiscal, monetary and macro-prudential foreign exchange intervention and capital flow management tools and establish institutions to ensure policy coherence**. To this end, the models and methodologies developed in this paper can be extended to use fiscal policy, foreign exchange intervention, and capital flow management tools. However, there is a great need for further research and analysis

in this area. In particular, in the current context of the high impact of external factors on the domestic economy, it is vital to consider the feasibility and impact of fiscal policy, including export and import taxes and tariff rates, as further research needs to focus on this.

13. Institutionally, establishing a new Financial Stability Council or a similar Economic Stability Council among policy-making bodies will be essential in ensuring that macroeconomic policies are appropriate and effective for sustainability. In establishing a new Economic Stability Council or institute, **it must be established directly by the Parliament, ensuring the independence of the budget and finances.** Due to limited budget and financial dependence, think tanks are not thriving in our country, the existing institutes do not have strong personnel, and quality works, proposals, and recommendations are not being made.
14. In addition to sound economic policies, sustainable planning, and effective implementation, good governance and strengthening political and economic institutions are crucial for our country to achieve sustainable economic growth and development, which can be seen in the development models and lessons of the Scandinavian countries with rich natural resources and small open economies. **While government regulation is vital to correct market distortions, good governance and institutions are essential to "sustain" government distortions.** From the point of view of political economy, good governance, sound policy, good planning, and quality performance are essential for creating additional wealth and the proper distribution of wealth. When good governance and institutions are in place, economic policy will be politically independent, effective in a cyclical, forward-looking, integrated manner, and lead to sustainable economic growth and development. In this context, monetary, fiscal, macro, and prudential policy objectives must be clarified, and a comprehensive monitoring and accountability system based on results must be established. For instance, the Budget Council and the Monetary Policy Committee should be established by a joint session of the State Great Hural, independent of the standing committees of the State Great Hural, and sufficient conditions should be created for approaching issues in a purely professional manner and be open and transparent to the public. Furthermore, it is crucial for institutions responsible for ensuring the coherence of these policies to develop and use an integrated policy framework based on the models and methodologies developed in this paper and their extensions.

15. It is necessary **to consider the empirical facts of this paper when developing a macroeconomic model that reflects the specifics of Mongolia and for cyclical and policy analysis and forecasting.** For example, the effect of external factors (mineral export demand, mineral prices, FDI, and Chinese growth) must be reflected in the regular calculation of economic equilibrium and cyclical dynamics (equilibrium interest rate, production gap, potential growth, and equilibrium exchange rate), and in conducting policy analysis. Therefore, it is suggested to use the model developed in the paper as part of an integrated methodology, policy analysis, and forecasting system to calculate the dynamic sequence of cyclical and equilibrium dynamics and determine the optimal policy for economic stabilization.

It is suggested to regularly evaluate the three macroeconomic models of Mongolia developed in this paper for the policy analysis and medium-term economic projection. **These models and analyses are fully automated, easy to use, open to the public, and ready to be used by policymakers and researchers.** In particular, it is recommended that the methodology developed in this paper be used in practice to measure the economic cycle, identify the factors influencing its change, estimate the policy impact, make medium-term economic forecasts, and determine the optimal policy combination. In addition, these methods have the advantages of being model-based or aggregating information contained in macro variables and good practical compatibility.

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