ECONOMIC RESEARCH INSTITUTE

“FISCAL POLICY INDEX”

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Contents

Introduction

The Mongolian economy has been caught in a boom-bust cycle for the past few years. In 2016, Mongolia nearly experienced a financial crisis when the fragile stability of the economy began to unravel due to low commodity prices and decrease in FDI. In April 2016, Mongolia borrowed externally at double digit interest rates and then in June, the newly elected government announced that the fiscal deficit was going to reach 17 percent of GDP. Over the following six months, the exchange rate depreciated by 20 percent.

In response to the pending financial crisis, authorities sought and received some financial aid packages in early 2017. The IMF approve a three-year arrangement for Mongolia under the Extended Fund Facility (EFF) program for approximately 440 million USD. This arrangement was part of a 5.5 billion USD multi-donor financing package that supported the authorities' program of policy adjustment and structural reforms to stabilize the economy and lay the basis for sustainable, inclusive growth. The first investment of 100 million USD was funded by Asian Development Bank (ADB) in August 2017.

The EEF program requires the GoM to follow through on a range of public financial management, fiscal, public expenditure, monetary and banking sector reforms with fiscal discipline of the utmost importance. The GoM is required to developed a medium-term reform road map that aims to reinstate fiscal discipline. The factors that led to fiscal instability were political and institutional imbalances, a lack of checks and balances and accountability, and weakness in organizational core-processes, which was caused by a lack of clarity and understanding of the future fiscal implications of current fiscal and public expenditure decisions.

In this circumstance, a fiscal policy index (FPI) can provide some much needed coherence and direction. The FPI we proposed looks at the current fiscal stance of a country based on a comparison of the government's specific target of the debt-GDP ratio for a given finite horizon with a forecast of the debt-GDP ratio. This index is different from the other fiscal sustainability tools which are usually based on past performances. The index is a measure of the fiscal stance for the near future, so making accurate macro-economic forecast is the main tasks here. FPI's purpose is to provide the GoM an useful and simple economic and public-sector management and monitoring tool in short and mid-term. The FPI will facilitate and enable the GoM to better comply with its fiscal and macro-economic reform program. The agreement between GoM and IMF-EFF requires restoration of fiscal discipline and the FPI will be a critical instrument to verify if the actual fiscal policy and public expenditure decisions support the enhanced fiscal discipline.

1. Literature Review

There are numerous studies on monetary policy and until the recent financial crisis, there were fewer fiscal policy studies. However, now fiscal policy has become a popular area of study. While there are a number of static fiscal sustainability tests used to evaluate fiscal policy in literature, another popular method to assess fiscal policy utilizes vector autoregression (VAR) models.

There are a multitude of different types of VAR models with numerous variations to suit specific research needs. For example, when assessing the effects of fiscal policy in Germany, Hoppner (2001) employed a structural VAR, as did Lendvai (2007) and Perotti (2004) when studying Hungary and OECD countries, respectively. Meanwhile, Caldara and Kamps (2008) used a reduced form VAR analysis to study the United States while Alfonso and Sousa (2009) used a Bayesian structural VAR when studying various countries such as the United Kingdom, the United States, Germany, Italy and Portugal. Each of these approaches have their own advantages and disadvantages. For instance, the Bayesian structural VAR models have a narrow scope of study, while structural VARs cannot be utilized at all times as it cannot be used to estimate over periods with breaks in the conduct of policy. A more detailed cons and pros of different variations of VAR models are provided in a table in the Appendix.

For Mongolia, a Bayesian VAR would be most effective in calculating the FPI, considering relatively short series of data. Most prominently used by Polito and Wickens (2006) in their paper looking at fiscal policy in the United States, United Kingdom and Germany, this method provides a forward looking measure of fiscal stance. Polito and Wickens (2006) make sure to differentiate between fiscal sustainability and fiscal stance, defining fiscal stance as the current fiscal situation while fiscal sustainability looks at the past history of debt and deficients, linking them to the current situation and putting importance in how they will affect the future fiscal state of the country should they continue on infinitely. While this comprehensive view is important, as Polito and Wickens (2006) points out, this approach might not actually have any direct bearing on the current fiscal stance. It is difficult to calculate and also provides little guidance to policy implementation in the short run. As such, looking at fiscal stance rather than fiscal stability using VAR models would be much more worthwhile in this case.

2. Methodology and Data

In calculating the FPI using a Bayesian VAR (BVAR), the main objective is to compare a target level of debt-GDP ratio for a given set amount of time with a forecast of the debt-GDP ratio based on a BVAR that utilizes the government budget constraint. In this report, the target level of debt-GDP ratio is selected to be 70 percent which is close to the target on the Extended Fund Facility (EFF) program set forth by the International Monetary Fund (IMF) for the Mongolian government. Following the program guidelines and accomplishing the stated objectives are vital to continue receiving IMF assistance, making the targeted ratio based on the IMF goals would not only be ideal but necessary.

As for calculating the forecasted index based on the budget constraint, the model plans to employ the following variables: government revenue and expenditure, government foreign and domestic debt, average interest rate on foreign and domestic currency bonds, economic growth, current account, exchange rate. This list is closely based on the research paper by Polito and Wickens (2006). Based on the same methodology, Unalmis (2007) did a similar study on Turkey with the addition of exchange rate as a variable. This variable would make the index more realistic as the debt of Mongolia, and in most developing countries, is usually based on a foreign currency and greatly reliant on fluctuations in the exchange rate.

One of the largest advantages of using a BVAR model to calculate the FPI lies in the fact that once calculated, it can easily be automated. The ERI team developed a MS Excel tool which automatically runs an Eviews statistical software to get the forecasted values of the main macroeconomic variables and calculates FPI. This means that based on the frequency it needs to be updated, the Ministry of Finance staff can easily re-calculate and use the index. It also uses a relatively limited number of factors, not looking in depth into past debt and financial factors but rather, focusing on a short term forecast, making it ideal to provide a guideline for short term policy implementation. It will be a simple, but much needed, intuitive index that can be easily used to augment policy decisions. The results of the index can also be published regularly, a fact that would provide much needed stability and confidence for the public on the short term economic situation of Mongolia.

For the index, it would ideal to use quarterly data for as long as a time frame as possible. However, for certain variables such as government debt and average interest rate on debt, data is available from only 2006. We use the methodology used by Unalmis (2007), which added to Polito and Wickens (2006) by adding exchange rate and current accounts as variables and divided debt and debt payments into domestic and foreign.

The data needed was collected from the National Statistics Office (NSO) of Mongolia, the Bank of Mongolia, and the Ministry of Finance. As we are working with limited data, our model only has quarterly data from 2006 onwards. We also chose a BVAR model instead of a simple VAR model for improving forecasts. The BVAR model was used to forecast the main macro variables which in turn were used for FPI calculation.

In Appendix, we present the main findings of using annual data based on the methodology used by Polito and Wickens (2006) paying special attention to his construction of a German FPI. The annual data we used includes: GDP, GDP deflator, money in circulation, government expenditure and revenue, total government debt and interest payments.

3. Constructing the Fiscal Policy Index

Government Budget Constraint

The fiscal policy index is created by first considering the nominal government budget constraint (GBC). One of the key assumptions is that the primary budget deficit is financed by domestic and/or foreign borrowing and money creation.

The nominal GBC is shown below:

Equation 1.

$$P_t g_t + (1 + R_t^d) B_{t-1}^d + (1 + R_t^f) B_{t-1}^f S_t = B_t^d + B_t^f S_t + \Delta M_t + P_t T_t$$

Where P_t is the price level, g_t is the real government expenditures including real transfers to households, T_t is the total real taxes and M_t is the nominal money stock, B_t^d is the nominal value of government bonds issued in domestic currency at the end of period *t*, B_t^f is the nominal value of government bonds issued in foreign currency at the end of period *t*, S_t is the nominal

exchange rate, R_t^d and R_t^f are average interest rate on domestic and foreign currency bonds, issued at the end of period *t-1*, respectively. $R_t^d B_{t-1}^d$ is the total interest payments of the domestic debt stock for the period *t* and $R_t^f B_{t-1}^f$ is the total interest payments of foreign debt stock in domestic currency for period *t*.

As such, the left side of Equation 1 highlights the expenditures of the government budget while the right side shows the government's assets.

In order to manipulate Equation 1 to find the real GBC, we divided all the terms by the price level P_t. This creates the following equation:

Equation 2.

$$g_t + (1 + r_t^d) b_{t-1}^d + (1 + r_t^f) b_{t-1}^f S_t = b_t^d + b_t^f S_t + m_t - \frac{1}{(1 + \pi_t)} m_{t-1} + T_t$$

Where the lowercase counterparts of the variables represent the real values of the original variables divided by price level, and real interest rate is defined as $(1 + r_t) = \frac{1+R_t}{1+\pi_t}$ and inflation is defined as $\pi_t = \frac{\Delta P_t}{P_{t-1}}$.

The real GBC found in Equation 2 can then be further divided by real GDP y_t such that we can get the real GBC as a proportion of real GDP.

Equation 3.

$$\frac{g_t}{y_t} + \frac{(1 + R_t^d)}{(1 + \pi_t)(1 + \gamma_t)} \cdot \frac{b_{t-1}^d}{y_{t-1}} + \frac{(1 + R_t^f)(1 + \% \triangle S_t)}{(1 + \pi_t)(1 + \gamma_t)} \cdot \frac{b_{t-1}^f}{y_{t-1}} S_{t-1} = \frac{b_t^d}{y_t} + \frac{b_t^f}{y_t} S_t + \frac{m_t}{y_t} - \frac{1}{(1 + \pi_t)(1 + \gamma_t)} \cdot \frac{m_{t-1}}{y_{t-1}} + \frac{T_t}{y_t}$$

Where the total nominal government deficit, or public sector borrowing requirement (PSBR), is defined as:

Equation 4.

$$P_t D_t = P_t g_t + R_t^d B_{t-1}^d + R_t^f B_{t-1}^f S_t - P_t T_t - \Delta M_t$$

As the PSBR must be equal to the change in government debt stock between t and t-1, we get the following equation.

Equation 5.

$$\frac{D_t}{y_t} = \frac{b_t^d}{y_t} + \frac{b_t^f}{y_t} S_t - \frac{1}{(1 + \pi_t)(1 + \gamma_t)} \frac{b_{t-1}^d}{y_{t-1}} + \frac{(1 + \% \triangle S_t)}{(1 + \pi_t)(1 + \gamma_t)} \frac{b_{t-1}^f}{y_{t-1}} S_{t-1}$$

In order to get the primary balance from this equation, we subtracted the interest rates of domestic and foreign debt from nominal PSBR.

Equation 6.

$$P_t d_t = P_t D_t - R_t^d B_{t-1}^d - R_t^f B_{t-1}^f S_t$$

We can then divide the primary balance by the nominal GDP and use this value to create a ratio with Equation 5 as follows:

Equation 7.

$$\frac{d_t}{y_t} = \frac{b_t^d}{y_t} + \frac{b_t^f}{y_t} S_t - \frac{1}{(1+\pi_t)(1+\gamma_t)} \frac{b_{t-1}^d}{y_{t-1}} - \frac{(1+\%\triangle S_t)}{(1+\pi_t)(1+\gamma_t)} \cdot \frac{b_{t-1}^f}{y_{t-1}} S_{t-1} - \frac{R_t^d}{(1+\pi_t)(1+\gamma_t)} \cdot \frac{b_{t-1}^d}{y_{t-1}} - \frac{R_t^f (1+\%\triangle S_t)}{(1+\pi_t)(1+\gamma_t)} \cdot \frac{b_{t-1}^f}{y_{t-1}} S_{t-1}$$

If we assume $(1+\rho_t^d) = \frac{(1+R_t^d)}{(1+\pi_t)(1+\gamma_t)}$ and $(1+\rho_t^f) = \frac{(1+R_t^f)(1+\%\Delta S_t)}{(1+\pi_t)(1+\gamma_t)}$ as a kind of discount factor, Equation 7 can be written as:

Equation 8.

$$\frac{b_t^d}{y_t} + \frac{b_t^f}{y_t} S_t = \frac{d_t}{y_t} + (1+\rho_t^d) \frac{b_{t-1}^d}{y_{t-1}} + (1+\rho_t^f) \frac{b_{t-1}^f}{y_{t-1}} S_{t-1}$$

Using the methodology proposed by Polito and Wickens (2006) and using the variations made by Unalmis (2007) for emerging markets, we account for a time-varying discount rate by using a log-linear approximation of the GBC. In order to use the log-linear approximation, we must make all the variables positive, thus we need to transform Equation 8 into the equation below:

Equation 9.

$$\frac{b_t^d}{y_t} + \frac{b_t^f}{y_t} S_t = \frac{g_t}{y_t} - \frac{v_t}{y_t} + (1+\rho_t^d) \frac{b_{t-1}^d}{y_{t-1}} + (1+\rho_t^f) \frac{b_{t-1}^f}{y_{t-1}} S_{t-1}$$

Where $g$is non-interest government expenditure and v is government revenue defined as $\frac{v_t}{y_t} = \frac{m_t}{y_t} - \frac{1}{(1+\pi_t)(1+\gamma_t)} \cdot \frac{m_{t-1}}{y_{t-1}} + \frac{T_t}{y_t}$.

Following the Taylor series approximation rule wherein $h(x) = exp[lnx_t]$ about lnx is $h(x) \simeq x[1 + (lnx_t - lnx)]$, we can rewrite Equation 9 as shown below:

Equation 10.

$$\frac{b^d}{y} ln \frac{b_t^d}{y_t} + \frac{Sb^f}{y} ln \frac{b_t^f S_t}{y_t} = (1+\rho^d) \frac{b^d}{y} ln \frac{b_{t-1}^d}{y_{t-1}} + (1+\rho^f) \frac{b^f S}{y} ln \frac{b_{t-1}^f S_{t-1}}{y_{t-1}} + k_t$$

Where $k_t = -A + \frac{g}{y} ln \frac{g_t}{y_t} - \frac{v}{y} ln \frac{v_t}{y_t} + (1+\rho^d) \frac{b^d}{y} ln(1+\rho_t^d) + (1+\rho^f) \frac{b^f S}{y} ln(1+\rho_t^f)$ and $A = \left(-\rho^d ln \frac{b^d}{y} - \rho^f ln \frac{b^f S}{y} - \frac{g}{b} ln \frac{g}{y} - \frac{v}{b} ln \frac{v}{y} - (1+\rho^d) ln(1+\rho^d) - (1+\rho^f) ln(1+\rho^f)\right)$

The sign of the coefficient ρ determines whether or not Equation 10 is stable and if we assume that $\rho^d = \rho^f > 0$ at the steady state, we can solve Equation 10 forwards, getting the following equation:

Equation 11.

$$\frac{b^d}{y} ln \frac{b_t^d}{y_t} + \frac{Sb^f}{y} ln \frac{b_t^f S_t}{y_t}$$
$$= (1+\rho)^{-n} \frac{b^d}{y} E_t \left(ln \frac{b_{t+n}^d}{y_{t+n}} \right) + (1+\rho)^{-n} \frac{b^f S}{y} ln \left(\frac{b_{t+n}^f S_{t+n}}{y_{t+n}} \right)$$
$$- \sum_{m=1}^{n} (1+\rho)^{-m} E_t(k_{t+m})$$

Assuming the the transversality conditions for domestic and foreign debt stocks holds:

$$\lim_{n\to\infty} ((1+\rho))^{-n} \frac{b^d}{y} E_t \left(ln \frac{b_{t+n}^d}{y_{t+n}} \right) = 0 \quad \text{and} \quad \lim_{n\to\infty} ((1+\rho))^{-n} \frac{b^f S}{y} E_t \left(ln \frac{b_{t-1}^d S_{t-1}}{y_{t-1}} \right) = 0$$

the following equation will be derived:

Equation 12.

$$\frac{b^d}{y} ln \frac{b_t^d}{y_t} + \frac{Sb^f}{y} ln \frac{b_t^f S_t}{y_t} = - \sum_{m=1}^{n} (1+\rho)^{-m} E_t(k_{t+m})$$

Constructing the Index

When constructing the index, we will use Equation 11 to compare the forecasted change in debt to GDP ratio with forecasted primary balance. To do this, we need to rewrite Equation 11 into the following:

Equation 13.

$$\left[\sum_{m=1}^{n} (1+\rho)^{-m} E_t(k_{t+m}) \right]$$
$$= \left[(1+\rho)^{-n} \frac{b^d}{y} E_t \left(ln \frac{b_{t+n}^d}{y_{t+n}} \right)^* + (1+\rho)^{-n} \frac{b^f S}{y} ln \left(\frac{b_{t+n}^f S_{t+n}}{y_{t+n}} \right)^* \right]$$
$$- \left[\frac{b^d}{y} ln \frac{b_t^d}{y_t} + \frac{Sb^f}{y} ln \frac{b_t^f S_t}{y_t} \right]$$

Where $\left(ln \frac{b_{t+n}^d}{y_{t+n}} \right)^* + ln \left(\frac{b_{t+n}^f S_{t+n}}{y_{t+n}} \right)^*$ is the targeted debt stock. In this case, the left-hand side of the equation is the desired change in debt stock for the defined period *n* while the right-hand side of the the equation is the required discounted future primary surpluses needed to achieve the targeted debt stock.

As the generated surplus could either be higher or lower than the required surplus, the following equation holds true:

Equation 14.

$$FP(t,n) = (1+\rho)^{-n}\frac{b^d}{y}E_t\left(ln\frac{b^d_{t+n}}{y_{t+n}}\right)^* + (1+\rho)^{-n}\frac{b^f S}{y}ln\left(\frac{b^f_{t+n}S_{t+n}}{y_{t+n}}\right)^* - \left[\frac{b^d}{y}ln\frac{b^d_t}{y_t} + \frac{Sb^f}{y}ln\frac{b^f_t S_t}{y_t}\right] - \left[\sum_{m=1}^{n}(1+\rho)^{-m}E_t(k_{t+m})\right] \gtreqless 0$$

If the government wants to keep its total debt stock constant, the equation above can defined as Equation 15 when calculating the FPI.

Equation 15.

$$FP(t,n) = ((1+\rho)^{-n} - 1)\left(\frac{b^d}{y}ln\frac{b^d_t}{y_t} + \frac{Sb^f}{y}ln\frac{b^f_t S_t}{y_t}\right) - \sum_{m=1}^{n}(1+\rho)^{-m}(k_{t+m}) \gtreqless 0$$

Based on Equation 14 or 15, we can define the fiscal policy index as follows:

Equation 16.

$$FPI(t,n) = exp[FP(t,n)] \gtreqless 1$$

- If $FPI(t,n) > 1$, the expected increase in debt stock is greater than the expected primary surplus. In such a case, the debt stock would continue to increase.
- If $FPI(t,n) = 1$, the expected increase in debt stock is equal to the expected primary surplus.
- If $FPI(t,n) < 1$, the expected increase in debt stock is less than the expected primary surplus. In such a case, the debt stock would continue to decrease.

Forecasting the Fiscal Variables

The calculations above provide a way to calculate the fiscal stance, however in order to accurately forecast the variables needed to create an accurate FPI, we need to employ the BVAR model. By using the BVAR model, the following vector to be forecasted:

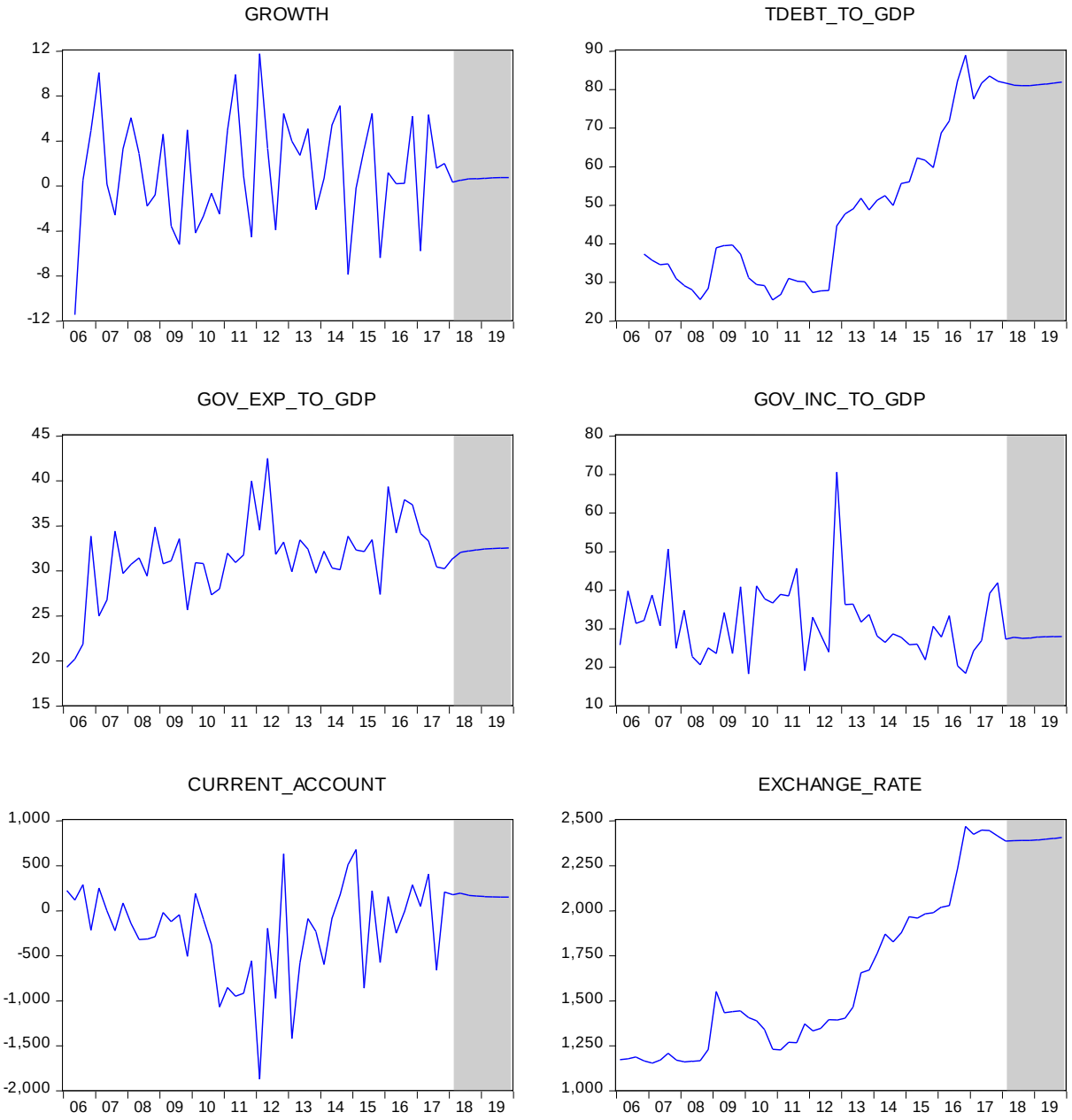
$$x_t = \left\{ln\frac{b^d_t}{y_t}, ln\frac{b^f_t S_t}{y_t}, ln\frac{g_t}{y_t}, ln\frac{v_t}{y_t}, ln\left(1+\rho^d_t\right), ln\left(1+\rho^f_t\right), \frac{ca_t}{y_t}, S_t, growth_t\right\}$$

Where $ln\frac{b^d_t}{y_t}, ln\frac{b^f_t S_t}{y_t}, ln\frac{g_t}{y_t}, ln\frac{v_t}{y_t}, ln(1+\rho^d_t), ln(1+\rho^f_t)$ are as previously defined. $\frac{ca_t}{y_t}$ is the current account to GDP ratio, S_t is the nominal exchange rate and, $growth_t$ is the economic growth rate. The latter three variables are added in order to improve the forecasting accuracy of the model and to provide .

Due to limited data, we run a BVAR models with fourth degree of lags and didn't include inflation and dummy variables. The data used in the BVAR model is quarterly from 2006 Q1 to 2017 Q4 or 48 observations. Based on the estimation, the main macro variables were forecasted for 8 quarters from 2018 Q1 to 2019Q4.

In Figure 1, historic dynamics of the main variables between 2006 and 2017 and forecasted eight-quarters projections (in shaded area) are shown. These are just direct results of the BVAR (4) model which used available performance data of from 2006 Q1 to 2017 Q4.

Figure 1. Seasonally adjusted value of the main macro variables



In the graph, most of the quarterly indicators are irregularly fluctuating after seasonal adjustments. In contrast, debt-GDP ratio and exchange rate increased sharply between 2012 and 2017 as the government spent huge amount of money in large infrastructure projects, local investments and cash transfers by issuing bonds in foreign and domestic currencies. The government income ratio is more dispersed than the government expenditure ratio because the government income includes the change in money supply (specifically, the change in government net deposit at the State Fund) as well as it depends more on commodity cycle or business cycle. In the last quarter of 2012 by issuing the Chinggis bond, the government's net deposit at the State Fund has increased by MNT1.8 trillion. As a result, the calculated share of government income in GDP reached almost 70 percent in 2012 Q4 after seasonal adjustments.

The projected values of the main variables in 2018 to 2019 are shown in the table below.

Table 1. Projections of the main macroeconomic variables

Indicators	2018Q1	2018Q2	2018Q3	2018Q4	2019Q1
Domestic debt/GDP	18.5%	19.1%	19.3%	19.6%	19.8%
Foreign debt/GDP	62.2%	61.7%	61.5%	61.4%	61.3%
Total debt/GDP	80.6%	80.8%	80.9%	81.0%	81.2%
Gov.expend/GDP	31.7%	31.9%	32.0%	32.2%	32.3%
Gov.inc/GDP	25.6%	25.3%	25.0%	25.2%	25.2%
Adj.int.rate on dom.bond	1.2%	1.4%	0.6%	0.3%	-0.1%
Adj.int.rate on for.bond	-1.0%	-0.1%	-0.4%	-0.4%	-0.4%
Curr.acc. (mln.USD)	297	204	184	171	161
Exch.rate (MNT/USD)	2394	2391	2388	2388	2392
Quarterly growth	0.4%	0.2%	0.4%	0.5%	0.5%

In the baseline forecasts, we did not consider government plans and potential macroeconomic shocks. This study focuses only on constructing the Fiscal Policy Index instead of creating an exact macroeconomic forecast. Moreover, as we mentioned above, the length of macro-economic data is only 11 years. In effect, uncertainties are quite high in the model. This fact may affect the accuracy of the forecasting.

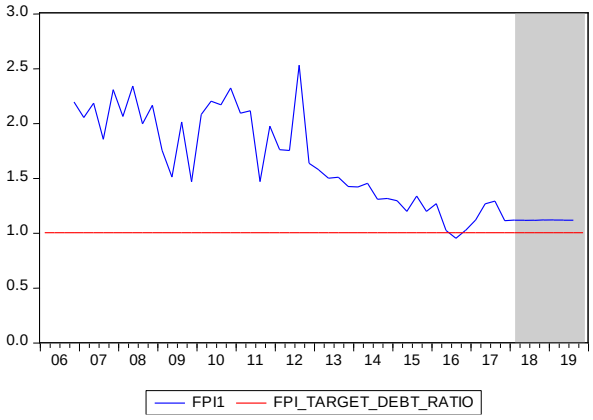
4. Fiscal Policy Index of Mongolia

In the BVAR (4) model, one-quarter, two quarters and five-quarters horizons were considered to obtain the measures of the Fiscal Policy Index as reported in Figure 2. Here, we assumed that the target debt-to-GDP ratio is 70 percent. Depending on the definition and the availability of data, this target can be selected differently in the model.

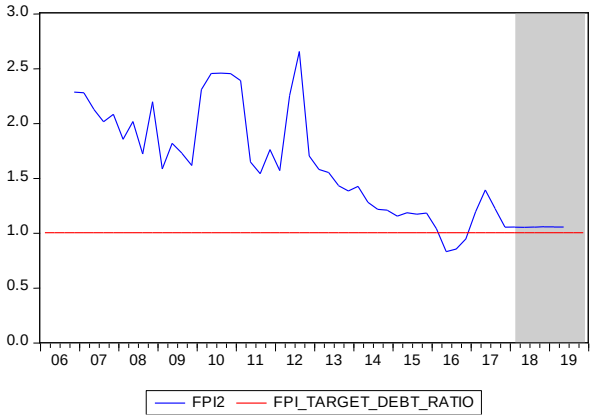
As discussed in the constructing the index section, if $FPI > 1$, the expected increase in debt stock is greater than the expected primary surplus and the debt stock would continue to increase. If $FPI = 1$, the expected increase in debt stock is equal to the expected primary surplus. However, if $FPI < 1$, the expected increase in debt stock is less than the expected primary surplus.

Figure 2. Fiscal Policy Indexes at different horizons.

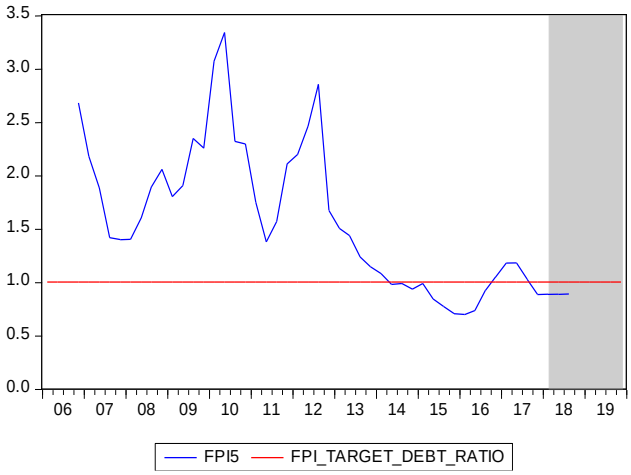
a. FPI at one-quarter horizon



b. FPI at two-quarters horizon



c. FPI at five-quarters horizon



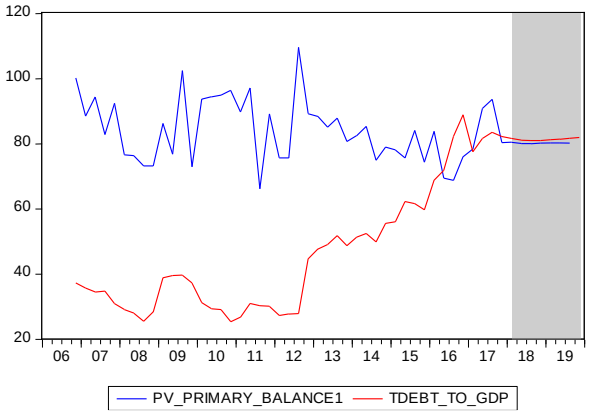
In all panels of Figure 2, the FPI has been much higher than the unity until 2012. This means that the debt-GDP ratio was far below the target 70 percent during the period. In the last quarter 2012, the index grew sharply due to the dramatic increase in money supply measured by the change in the government net deposit at the State Fund. However, as debt-GDP ratio has increased since 2012, FPI has continued to fall mainly due to deficits of government primary balance and consequently accumulating debt.

The index was even below the target level for some period. If we look at panel (a) Figure 2, except 2016 Q3, the index has been grater than the target. It implies that the debt-GDP ratio is forecasted to be below target at one-quarter horizon. In panel (b), the index is less than unity in the period between 2016 Q2 and 2016 Q4, while in panel (c) the index is less than unity in more longer period between 2014 Q4 and 2016 Q4.

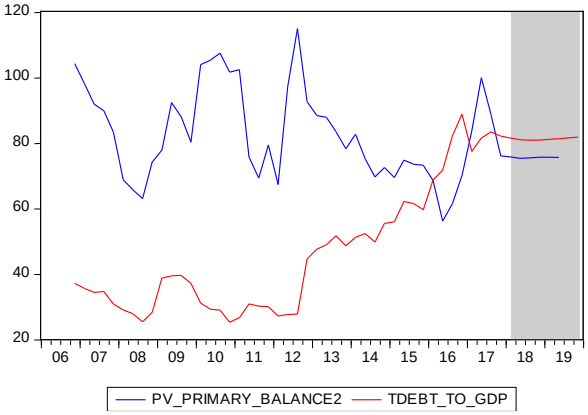
To explain the historical changes in Fiscal Policy Index, we can look at the main components of the index such as debt-GDP ratio and present value of future primary surpluses. Figure 3 shows the two components of the calculated index at different time horizons.

Figure 3. The two components of Fiscal Policy Indexes at different horizons

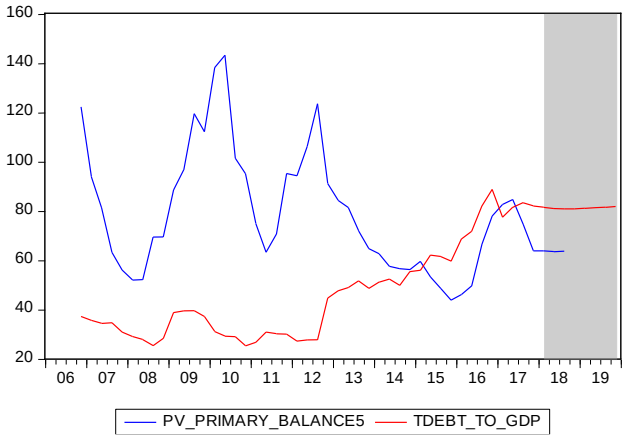
a. One-quarter horizon



b. Two-quarters horizon



c. Five-quarters horizon



The expected value of the index is shown in the table below. The index calculated in any horizon is expected not to change and stay at the level of 2017 Q4. For instance, the index was 1.13 in 2017 Q4 and is expected to be 1.12 in 2018 Q1. As time horizon increases, the index will be lower, but there will be no change at the level of the index.

Table 2. Fiscal Policy Index

Time horizons	2017Q4	2018Q1	2018Q2	2018Q3	2018Q4	2019Q1
1-quarter horizon	1.11	1.12	1.11	1.11	1.12	1.12
2-quarters horizon	1.05	1.05	1.05	1.05	1.05	1.05
3-quarters horizon	0.99	0.99	0.99	0.99	1.00	0.99
4-quarters horizon	0.93	0.94	0.94	0.94	0.94	
5-quarters horizon	0.88	0.88	0.88	0.89		

The main reason of the keeping its value of the index in 2018 is that the main variables are projected to be almost at the level of 2017 Q4 in the next quarters. It should be noted again that the forecasts are based on estimates of the BVAR(4) for the quarterly sample of 2006 Q1 to 2017 Q4.

Further analysis of FPI

To get more insight of the index, we can compare an alternative case with the baseline case presented the previous section. Let us analyze the case of MNT depreciation by 10 percent in 2018 Q3 as an alternative case.

In Table 3, the simulation of change in forecasted variables in alternative case is shown. After local currency depreciated by 10 percent or ~ MNT 240 in 2018 Q3, debt-GDP ratio and current account are expected to increase while government income and expenditure ratios and economic growth are expected to decrease in the next periods.

Table 3. Percentage and absolute changes in the projected variables after MNT depreciation

Indicators	2018Q3	2018Q4	2019Q1	2019Q2	2019Q3
Domestic debt/GDP	-	0.9%	1.5%	2.0%	2.3%
Foreign debt/GDP	-	2.0%	3.5%	4.5%	5.2%
Gov.expend/GDP	-	- 0.1%	0.0%	- 0.1%	0.0%
Gov.inc/GDP	-	0.1%	-0.1%	- 0.2%	-0.3%
Adj.int.rate on dom.bond	-	0.1%	0.0%	- 0.2%	- 0.3%
Adj.int.rate on for.bond	-	0.5%	0.7%	0.7%	0.7%
Curr.acc. (mln.USD)	-	67	88	94	101
Exch.rate (MNT/USD)	239	239	236	232	227
Quarterly economic growth	-	- 0.3%	- 0.4%	- 0.3%	- 0.2%

Consequently, the exchange rate shock will affect the Fiscal Policy Index. As shown in Table 4, the Index is expected to decrease in any time horizon of the calculation. As longer as the projection is made, the drop in the index is greater.

Table 4. Change in the Fiscal Policy Index in alternative case

Time horizons	2017Q4	2018Q1	2018Q2	2018Q3	2018Q4	2019Q1
1-quarter horizon	-	-	-	0.00	- 0.02	- 0.03
2-quarters horizon	-	-	0.00	- 0.00	- 0.02	- 0.04
3-quarters horizon	-	0.00	- 0.00	- 0.01	- 0.03	- 0.04
4-quarters horizon	0.00	- 0.00	- 0.01	- 0.01	- 0.03	
5-quarters horizon	- 0.00	- 0.01	- 0.01	- 0.02		

The main reason of the decrease in the Index is the decrease in the primary balance and the overall balance of the government. The expected changes in the government balances after the exchange rate shock are shown in the table below.

Table 5. The government balances in the reference and the alternative cases

	2017Q4	2018Q1	2018Q2	2018Q3	2018Q4	2019Q1
Overall balance/GDP in reference	11.6%	-4.2%	-4.4%	-4.8%	-4.8%	-4.7%
Overall balance/GDP in alternative	11.6%	-4.2%	-4.4%	-4.8%	-4.6%	-4.7%
Change in overall balance	-	-	-	-	0.2%	-0.1%
Primary balance/GDP in reference	11.6%	-4.2%	-4.4%	-4.8%	-4.8%	-4.7%
Primary balance/GDP in alternative	12.5%	-4.4%	-4.2%	-4.8%	-5.0%	-5.2%
Change in primary balance	1.0%	-0.2%	0.2%	0.0%	-0.2%	-0.5%

5. Conclusion and Suggestion

In this study, we replicated the construction of a Fiscal Policy Index proposed by Polito and Wickens (2006) and Unalmis (2007). The index is based on the government inter-temporal budget constraint and uses log-linear approximation to the government budget constraint.

Limited availability of data is the main constraint of the study. Initially, to get better forecasts from the model, we planned to use quarterly macroeconomic and fiscal data from 2000 to 2017 at least. However, due to the lack of available data, our analysis covered the data from 2006 to 2017. To improve the quality of the forecast, we use a bayesian VAR model instead of a simple VAR suggested in our research proposal.

Using forecast values, we constructed the Fiscal Policy Index from 2006 to 2018. To summarize, there is a clear evidence of a break in fiscal policy from 2012 that has resulted in a rising debt-GDP ratio in various horizons of projections. In 2017 Q4 the index is between 0.88 and 1.11 depending on the forecasting horizon. It means that the debt-GDP ratio is expected to be around the target level of 70 percent. In 2018, the index is expected to stay at the level of 2017 Q4 in any forecasting horizon.

Using the model, an additional fiscal analysis can be made. In this study we simulated an alternative case of the local currency depreciation. As expected, the forecasted economic growth and fiscal balances deteriorated, and the government debt increased after the shock. As a result, the fiscal policy index decreased.

It should be noted that the construction of the forecast of the index may not be completely accurate due to limited availability of macroeconomic data. The accuracy of forecasted variables increases as the level of frequency and time period increases. It would then also be possible to include addition variables such as optimal lag periods, inflation and export and import price index.

References

Economics, University of Bonn.

Ibrahim, U. (2007). A Fiscal Policy Index Proposition for Emerging Markets.

Lendvai, J. (2007, November 22). The Impact of Fiscal Policy in Hungary. *ECFIN Country Focus*.

Perotti, R. (2004). Estimating the effects of fiscal policy in OECD countries.

Polito, V., & Mickens, M. (2006, July). Measuring the Fiscal Stance. *University of York*.

Erdenebat, B. (2017), Time series econometrics (in Mongolian)

Appendix

1. VAR model use in fiscal policy analysis

	Model	Description	Variables	Pro	Con	Papers/Countries
1	recursive VAR	constructs error terms in each regression to be uncorrelated with the error term in the preceding equation (Cholesky ordering) estimation of each equation by OLS produces residuals that are uncorrelated across equations	Government expenditure (real government consumption and government investment), private expenditures (defined as total GDP minus government expenditure), household consumption, private investment, private employment, the GDP deflator and external variables, net taxes, public wages, private wages	ordering can control the relations among the variables, thus controling the impact of the reduced-form disturbances and structural disturbances	results depend on the order of the variables	Fatas Mihov (2001)
3	factor-augmented VAR	FAVAR model includes unobserved low-dimensional factors in the autoregression. These factors, which may not be captured by some specific macroeconomic aggregates, are thought to contain the bulk of information about an economy.	real output and income, employment and hours, consumption, housing starts and sales, real inventories, orders and unfilled orders, stock prices, exchange rate,	no degrees of freedom problem can apply identification restrictions: ex. restrictions on the sample or population moments of factor process	very detailed data needed, need to decide what alternative identification schemes and	Bernanke (2004), Bai Li Lu (2016)

		With inclusion of these unobserved factors, the FAVAR model is of rich information, but remains tractable in terms of the number of parameters, owing to the low dimension of the factors	interest rate, money and credit quantity aggregates, price indexes, average hourly earnings		alternative estimation methods	
4	structual VAR	First, the model's reduced form is estimated by standard econometric methods. Then, the structural form is retrieved on the basis of identifying assumptions. Once the structural form is recovered, it is possible to estimate the impact of structural shocks on the economic aggregates included in the model.	Government expenditure (real government consumption and government investment), private expenditures (defined as total GDP minus government expenditure), household consumption, private investment, private employment, the GDP deflator and external variables, net taxes, public wages, private wages	can study the reaction of economic variables to discretionary shifts in government expenditure and in its separate items.	cannot be estimated over periods with breaks in the conduct of policy	Blanchard Perotti (2002), Perotti (2005, 2007), Hungary (2007), Germany (2001)
5	Bayesian VAR	allow efficient summarization of information contained in a large data set, avoiding overparameterization	public revenues, non-interest public spending, GDP, inflation, indicator for stock market, external debt, interest rate	can efficiently summarize the information contained in a large data set, avoid the overparameterization problem, and can allow for time variation in the coefficients and in the volatilities	while its estimates are accurate in the short term, other models are more accurate for long horizon (such as using TVP VAR to forecast	Kadir Keskin (2015)-Turkey. Carriero et al (2012)-US, UK, Germany, France

					government revenues)	
6	time varying parameter FAVAR	The scheme of sampling from the posterior distribution of the stochastic volatility of the TVP-VAR model uses a mixture sampler in the context of the stochastic volatility model in financial econometrics. The mixture sampler draws sample from the approximated posterior density and its approximation error is small enough to implement the overall model.	GDP growth, investment growth, inflation, exchange rate changes, private consumption expenditure growth, government fiscal policy	previous models could not provide a proper analytical framework over time. (previous lack of agreement on the efficiency of fiscal policy in different time and space circumstances can include interruptions in the identification, decision making, implementation and efficiency of fiscal policy.	very detailed data needed, need to decide what alternative identification schemes and alternative estimation methods	Jafari et al (2016)-Iran, Japan
7	reduced form VAR	expresses each variable as a linear function of its own past values and the past values of all other variables being considered and a serially uncorrelated error term	Government expenditure (real government consumption and government investment), private expenditures (defined as total GDP minus government expenditure), household consumption, private investment, private employment, the GDP deflator and external variables, net taxes, public wages, private wages	no big data set or long term dataset required	limitations to accuracy based on limited data	Caldara and Kamps (2008)

8	B-SVAR	using a recursive identification scheme to estimate a bayesian structural VAR mode, accounting for the posterior uncertainity of the impulse-response functions	government's intertemporal budget constraints, interest rate (average cost of debt refinancing), government primary expenditures and government revenues, inflation, GDP, price level, real growth rate of GDP, debt/GDP ratio at the beginning of the period t	includes the feedback from government debt in framework	narrow in scope as its goal is solely to understand the linkages between fiscal policy and asset markets	Afonso Sousa (2009)-UK, US, Germany, Italy; Afonsa Sousa (2009)-Portugal
9	simple VAR	a forward-looking measure of fiscal stance for the immediate future rather than a test for fiscal sustainabiliy that is based on past behaivor. A comparison of a target level of the debt-GDP ration for a given finite horizon with a forecast of the debt-GDP ration based on a VAR formed from the government budget constraint.	gdp, government net financial liabilities, gdp deflator, gross and net gov.t interest payments and receipts, gov.t disbursment, short and long-term interest rates	simplicity forward-looking approach, index is not based on a particular theoretical model of the economy, readily automated,	No published paper Some data availability, relatively small amount of information used by low-dimensional VAR	Polito and Wickens (2006) US, UK, Germany, and Unalmis (2007) Turkey

2. Mongolia's FPI, based on annual data

Forecasting the Fiscal Variables by using annual data

As annual data is shorter, we can use the following BVAR model which has fewer variable than the model used in Section 4:

$$x_t = \left\{ \frac{b_t}{y_t}, \frac{g_t}{y_t}, \frac{v_t}{y_t}, \rho_t \ , \gamma_t, \pi_t \right\}$$

Where $\frac{b_t}{y_t}$ -debt to GDP ratio, $\frac{g_t}{y_t}$ and $\frac{v_t}{y_t}$ are GDP share of government expenditure and revenue respectively, ρ_t -discount rate netted by inflation and growth, γ_t – growth rate and π_t is inflation.

Due to limited data, we run BVAR models with only first and second degree of lags and selected a BVAR(1) as a forecasting model. We also added two dummy variables into the model to control important shifts in government debt policy in 2003 and in 2012.

The data used in the FPI calculation is annually from 2000 to 2017 and the main macro variables are forecasted for five years. In Table 6, Augmented Dickey-Fuller (ADF) tests for the variables are reported.

Table 6. Augmented Dickey-Fuller tests

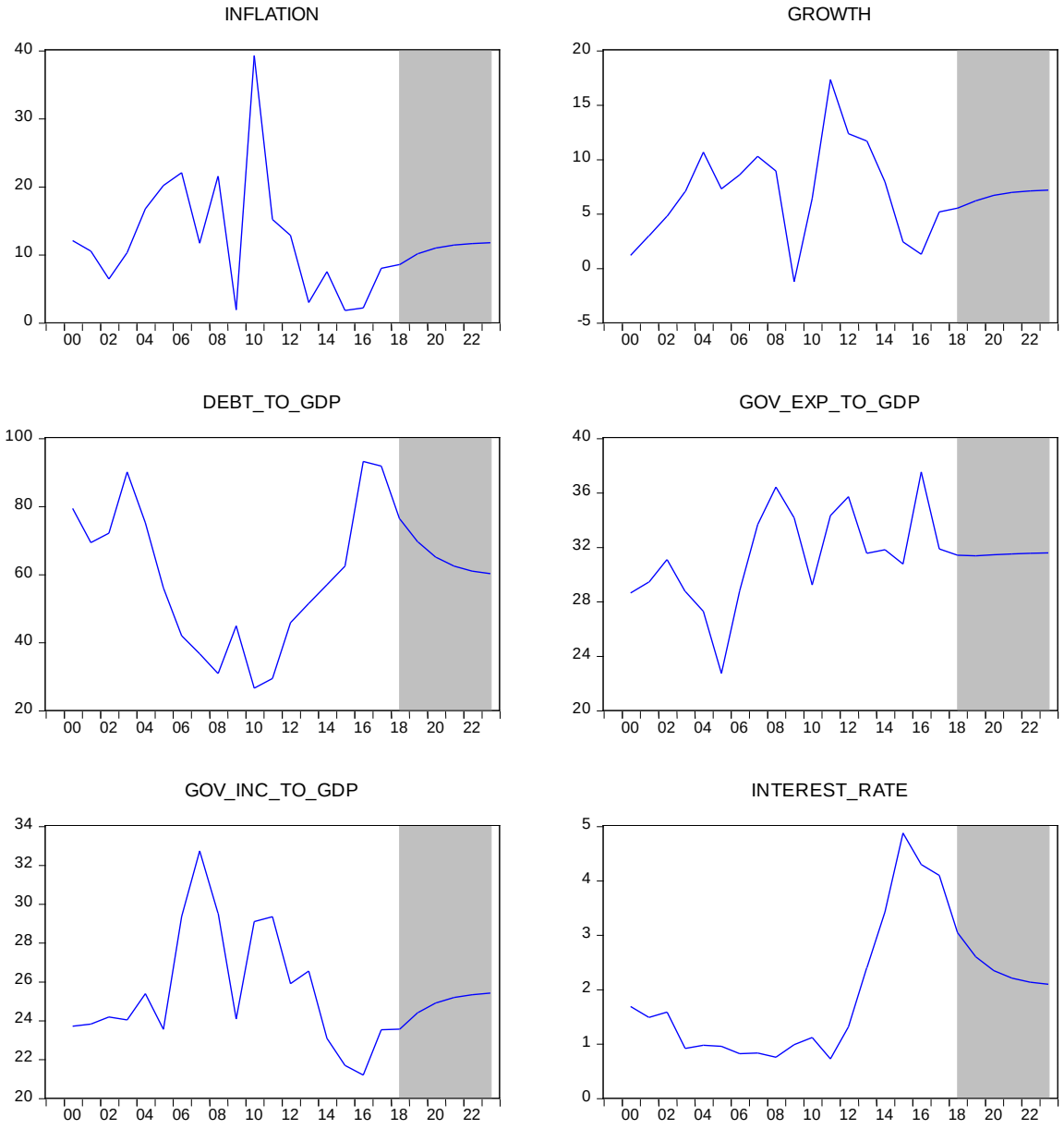
D-lag	b/y	g/y	v/y	r	π	γ
2	-1.149	-1.778	-1.227	-1.670	-1.688	-2.439
1	-1.118	-2.356	-2.071	-0.790	-1.599	-3.301**
0	-1.036	-2.517	-2.056	-0.020	-3.703**	-2.687*

*Note: * denotes significance at the 5% level, * - 10% level*

From the ADF tests in the table above, it can be concluded that all variables have a unit root. However, the BVAR model is only used to forecast and all variables have a unit root in same degree of difference. Therefore, we estimate a BVAR in levels of the variables.

In Figure 4, historic dynamics of the main variables between 2000 and 2017 and forecasted five-years projections are shown. These are just direct results of the BVAR(1) model which used available performance data of from 2000 to 2017.

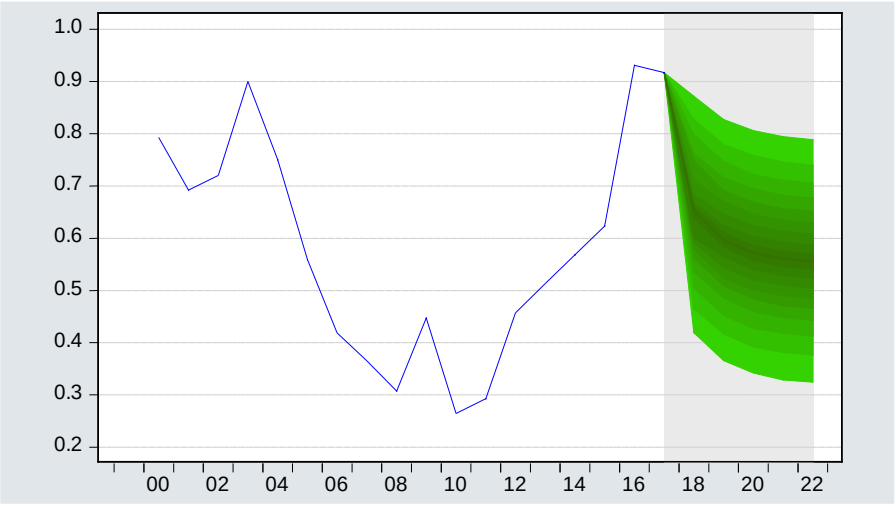
Figure 4. Projections of the main macro variables, in percentages



In the forecasts, we did not consider government plans and targets such as budget proposal of 2018 and economic outlook or projections of other organizations. This study is focused on constructing the Fiscal Policy Index instead of creating an exact macroeconomic forecast.

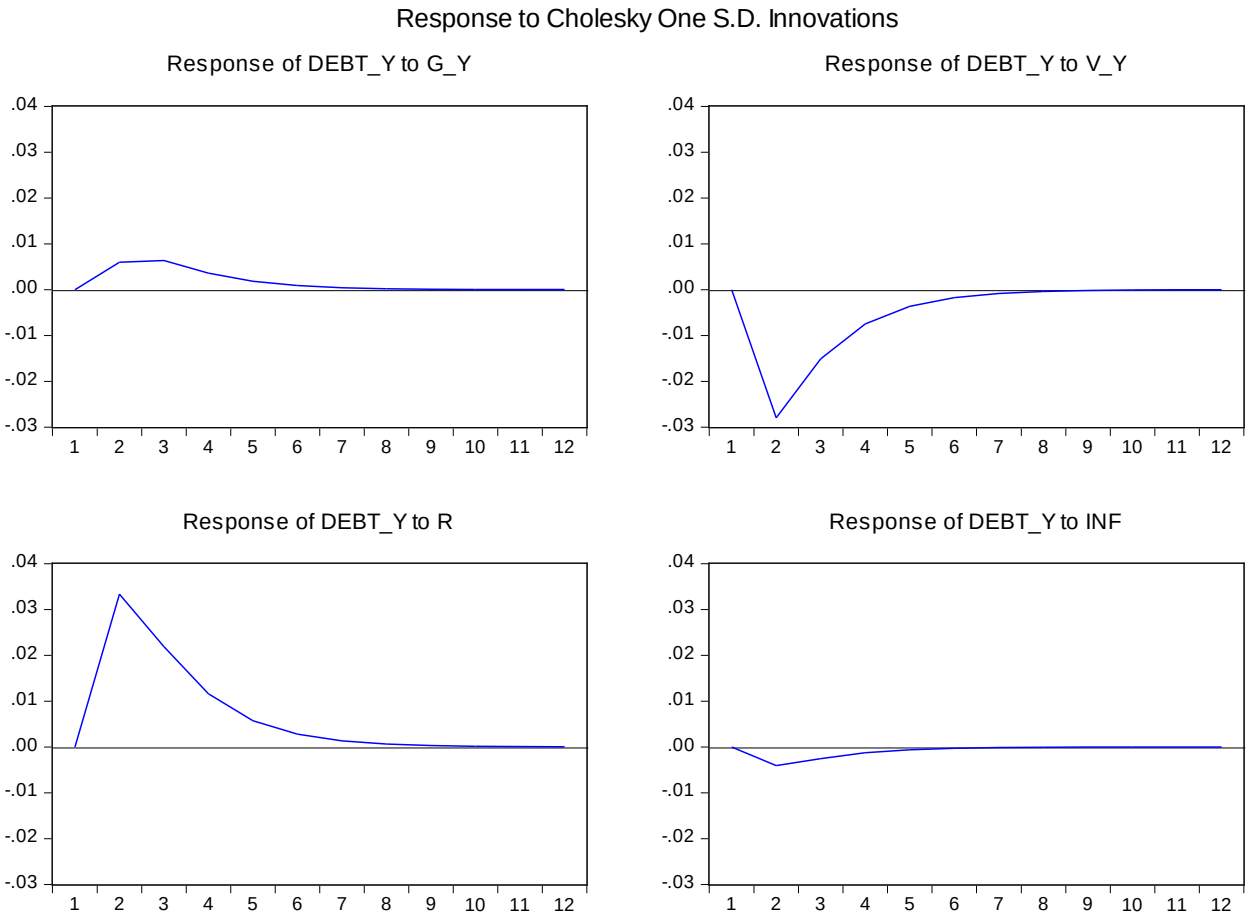
However, as we mentioned above, the length of annual macro-economic data is only 18. As a result, uncertainties are quite high in the model and the confidence interval of the projections is broader. For example, in Figure 5, the 90 percent of confidence interval of debt to GDP ratio projection is shown as a fanchart. The interval is too broad, from 42 to 87 percent in year of 2018. In order to get more accurate projections, we need to have more frequent or longer macroeconomic data.

Figure 5. Fanchart of debt-GDP ratio forecast, 90 percent of confidence interval



In Figure 6, impulse responses of debt-GDP ratio to one standard deviation change in logarithm value of other variables, such as government expenditure-GDP ratio, government income-GDP ratio, real interest rate and inflation.

Figure 6. Responses of debt-GDP ratio to change in macro variables



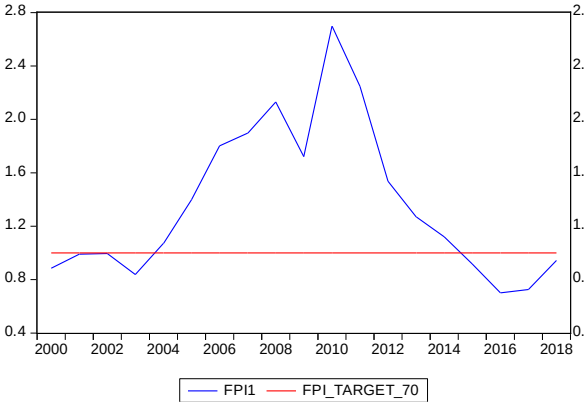
Fiscal Policy Index of Mongolia based on annual data

In the BVAR (1) model, one-year, two-years and three-years horizons were considered to obtain the measures of the Fiscal Policy Index as reported in Figure 4. Here, we assumed that the target debt-to-GDP ratio is 70 percent. Depending on the definition, this target can be selected differently in the model.

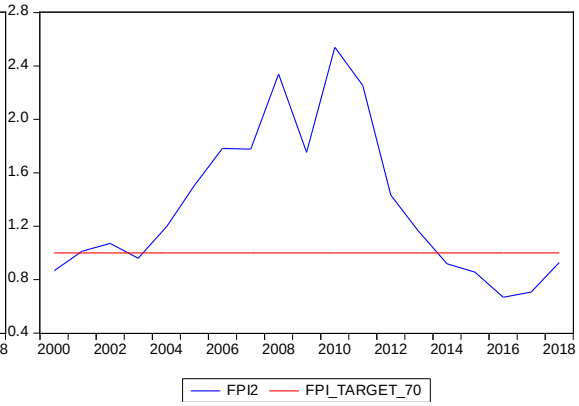
As discussed in the constructing the index section, if $FPI > 1$, the expected increase in debt stock is greater than the expected primary surplus and the debt stock would continue to increase. If $FPI = 1$, the expected increase in debt stock is equal to the expected primary surplus. However, if $FPI < 1$, the expected increase in debt stock is less than the expected primary surplus.

Figure 7. Fiscal Policy Indexes at different horizons based on annual data.

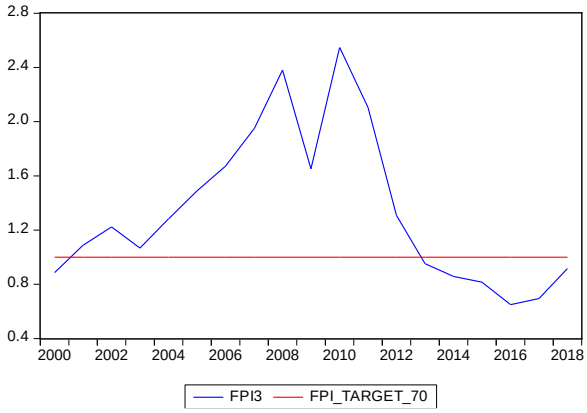
b. FPI at one-year horizon



b. FPI at two-years horizon



c. FPI at three-years horizon



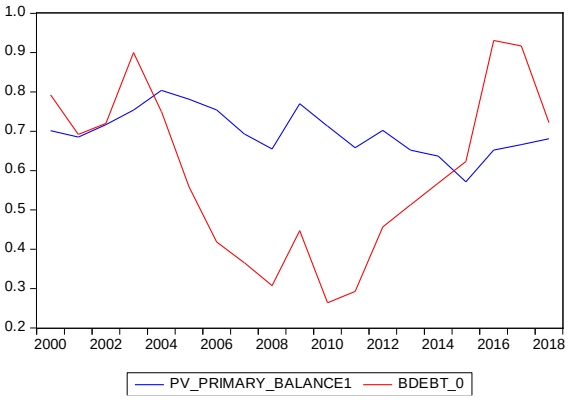
In all panels of Figure 7, the FPI has been much higher than the unity until 2012. This means that the debt-GDP ratio was far below the target 70 percent. However, FPI dropped sharply after 2012 mainly due to huge deficits of government primary balance and consequently accumulating debt.

If we look at panel (a) Figure 7, since 2014 the index has been lower than the target. It implies that the debt-GDP ratio is forecasted to be above target at one-year horizon. In panel (b) and panel (c), the index is less than unity at year of 2013 and 2012, respectively.

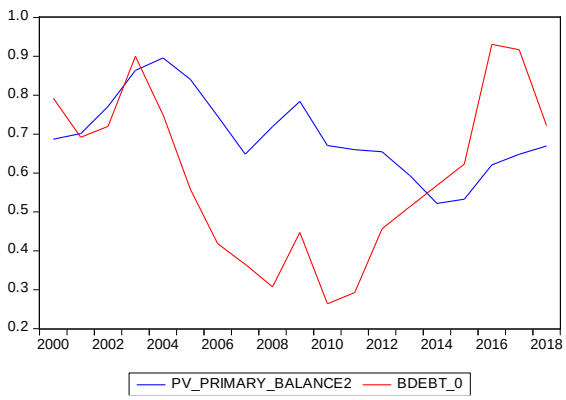
To explain the historical changes in Fiscal Policy Index, we can look at the main components of the index such as debt to GDP ratio and present value of future primary surpluses. Figure 8 shows the two components of the calculated index at different time horizons.

Figure 8. The two components of Fiscal Policy Indexes at different horizons

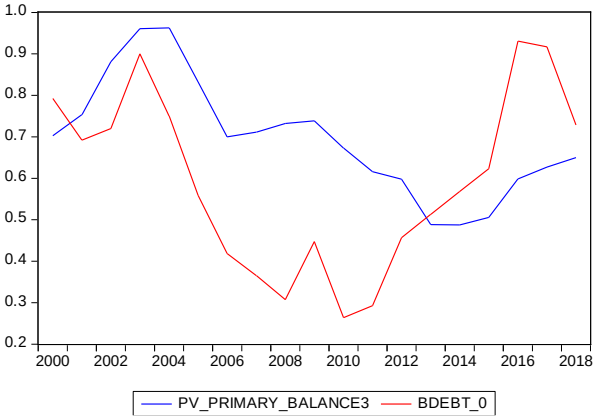
b. One-year horizon



b. Two-years horizon



c. Three-years horizon



Based on one-year forecast (as shown in Figure 4), the index is expected to increase from 0.73 in 2017 to 0.94 in 2018. Similarly, at panel (b) Figure 7, based on the two-years forecast, the index is expected to increase from 0.71 in 2017 to 0.93 in 2018. And at panel (c) Figure 7, based on three-years forecast, the index is expected to increase from 0.70 in 2017 to 0.92 in 2018.

The main reasons of the increasing expected value of the index in 2018 are:

i. Economic growth is projected to gradually increase up to 5.2-6.7 percent in the next five years.

ii. Government expenditure relative to GDP is expected to be stable at 31.5 percent in the period of 2018-2022

iii. Government income relative to GDP is expected to gradually increase from 23.7 to 25.6 percent in that period