Summary Guide
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Natural Resource Governance Institute

# Mongolia Macro-Fiscal Model

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## INTRODUCTION

Mongolia holds enormous mineral wealth for a country with a population of 3 million. Beneath its vast territory are some of the largest untapped coking and thermal coal deposits on the planet, as well as the world's largest new copper and gold mine. At the beginning of the 2010s, when commodity prices were high, the prospects of potentially large future resource revenues led some watchers to say that Mongolia could become the Saudi Arabia or Kuwait of Central Asia.

But this vision seems elusive. Mongolia is, for now, a middle-income country, heavily dependent on the limited revenues it currently generates from the sector. While minerals and petroleum account for 90 percent of all exports, they only cover one third of budget expenditures. Instead of putting aside the revenues from exhaustible minerals for rainy days and for future generations, the government has accumulated new debt at a rate that far outpaces savings.

Mongolia has also experienced very strong economic booms and busts over the last decade. These were driven partly by commodity swings. They were also aggravated by excessive borrowing and consumption during boom times. Mongolia rebounded from a balance of payment crisis followed by an International Monetary Fund (IMF) bailout in 2009. Now it faces renewed short-term financial pressures amid growing public debt.

The opportunities and challenges created by the mining sector highlight the need for careful planning and a solid policy framework that promotes economic sustainability. The Mongolian government took multiple important steps in this direction. In 2010, the parliament adopted a set of fiscal rules as part of the Fiscal Stability Law setting ceilings on expenditure growth, structural budget deficits and on the stock of government debt. In 2017, the government is establishing a new sovereign wealth fund, the Future Heritage Fund, to accumulate a proportion of natural resource revenues for future generations.

But are these rules meeting their objectives? NRGI built a Mongolia macro-fiscal model in order to monitor progress and analyze challenges.

### How the model works

The model provides an open, simple and user-friendly model of the Mongolian economy. It was developed to project a baseline scenario and describe how different shocks or policy changes would impact the trajectory of key macroeconomic and fiscal variables over a 30-year horizon.

The macro-fiscal model is comprised of three main sections: the macroeconomic model, the mineral sector block and the fiscal block. A small-scale, semi-structural macroeconomic model provides key calculations estimating the complex relationships among a variety of aggregate economic variables. These include consumption, investment, economic output, budget deficit, and national and international prices.

The model separates the economy into three economic sectors: mineral, agricultural and the core sector, which represents industrial and service sectors.

Due to its economic significance and distinct features, the mineral sector is modeled from the bottom up. It uses simplified project-level financial models of the country's five largest mines, which are then aggregated alongside a linear projection of the remainder of the mineral sector.

The fiscal block provides detailed projections across the main tax and expenditure categories, as well as most important fiscal aggregates, such as various measures of the deficit and debt.

Combining these sections allows for the capture of key linkages between the mineral sector, the budget and the overall economy. Users can test the impact of shocks in the mining sector or monitor how changes in fiscal policy might affect the country's debt sustainability outlook and Mongolia's compliance with its fiscal rules.

No model can do everything. This model is not designed to be a forecasting tool; it won't answer questions about what the country's optimal growth-enhancing strategy might be. Rather, it allows users to assess sustainability implications of various scenarios compared to a pre-defined baseline scenario. These estimates are based on a theoretically consistent framework and calibrated using observations of Mongolia's economy between 2000 and 2015. Chapters 2-6 of the model guide describes the detailed workings of the model.

## Why is this novel?

Macro-fiscal models with similar aims have been regularly built by public agencies (Mongolia's central bank and ministry of finance), international organizations (IMF, the World Bank) and by the private sector (investment banks, think tanks). In 2012, the Economic Research Institute of Mongolia[1] evaluated the risk of "Dutch disease." Also that year, the World Bank published short-term forecasting[2] and long-term growth models.[3] The IMF in 2015 analyzed optimal public investment strategy for Mongolia.[4]

However, this model has a number of innovative features that make it distinct both within and outside Mongolia.

Macroeconomic models are used regularly in OECD economies; far fewer have been used in developing countries. Difficulties in obtaining reliable data, more limited resources to build and maintain such tools, and less experience in how they can be best used might all be potential contributing reasons for that. We hope this tool will support regular analysis of Mongolia's economic sustainability.

1 ERI CGE model: http://eri.mn/Discussion-Paper/DPS1-2.pdf
2 WB short-term DSGE model: https://www.mof.gov.mn/wp-content/uploads/resource/MONGOLIAN%20BUSINESS%20CYCLE%20ECONOMIC%20POLICY_DSGE%20BAYES.pdf
3 WB long-term Solow growth model: https://www.mof.gov.mn/wp-content/uploads/resource/LONG%20TERM%20GROWTH%20and%20MACROECON.%20STABILITY%20MONGOLIA.pdf
4 IMF DSGE model of Mongolia: https://www.imf.org/external/pubs/ft/wp/2015/wp1590.pdf

Most such models do not adequately address the significance and particularities of the natural resource sector. While many other sectors experience volatility, changes in expansion plans, tax terms, or the delays in mining mega-projects can have very large ramifications. By incorporating simplified financial models from the country's five largest mines, we are building a bridge between the growing repository of financial models of mines, such as the open model of the Oyu Tolgoi mine[5] and macroeconomic models.

Most such models are not public. While some include a description of the model, main equations employed, key results and some parameters describing the robustness of the results, in very few instances is the full model made public. By making our model public, we open it up to wider reuse, scrutiny and adaptation.

Most such models are made with proprietary and hard-to-access software. The computationally heavy nature of the undertaking led to a flourishing of dedicated tools for experts. These tools are both expensive and difficult to learn. This model, available in XLSX format and with a user-friendly interface, will reach new users inexperienced with macroeconomic models.

5 For example OpenOil`s model of the Oyu Tolgoi mine: http://openoil.net/oyu-tolgoi-model-and-narrative-report

## KEY FINDINGS

Mongolia's economy is in severe shock. Financial and economic indicators started deteriorating in 2015 and have plunged sharply in 2016. Immediate responses will be needed to address looming debt payments, but these responses need to be developed in tandem with finding adequate responses to medium- and long-term sustainability challenges. Using the model, we arrived at the following findings.

### The baseline

In our baseline scenario, we assume a rapid recovery from the current shock propelled by easing of financial pressures and large expansion of the Oyu Tolgoi copper and gold mine. Growth rate accelerates gradually from near 0 to 8 percent by 2020 and remains this high until 2024. After this peak, growth stabilizes at 4 percent to 5 percent, occasionally interrupted by mine shut-downs. Our long-term growth outlook is built on the assumption that the mining and agricultural sectors will gradually decrease in significance compared to the industrial and service sector, which is driven by a 1.5 percent population growth, a 5 percent capital stock growth and a 3 percent productivity growth.

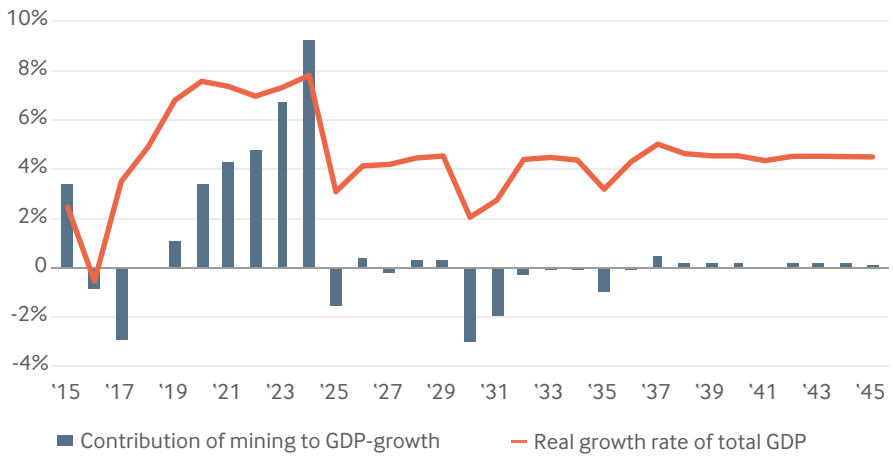



Figure 1. Real GDP growth (baseline scenario)

After pressing financing challenges are resolved along this brightened medium-term growth outlook, our model projects a considerable improvement in revenues collection fueled partly by mining sector expansion. Nevertheless, primary expenditures (which exclude interest payments) are permanently above overall revenues. Therefore, interest expenditure (the gap between primary expenditures and total expenditures) increases steadily.

Because of worsening deficit and accruing interests, the level of debt to GDP ratio (which includes government guarantees on private debts) is on an unsustainable trajectory, growing rapidly throughout the projection horizon, even during the period of rapid economic expansion until 2024. This baseline is further susceptible to negative shocks, such as mining project delays, or adverse commodity price shocks.

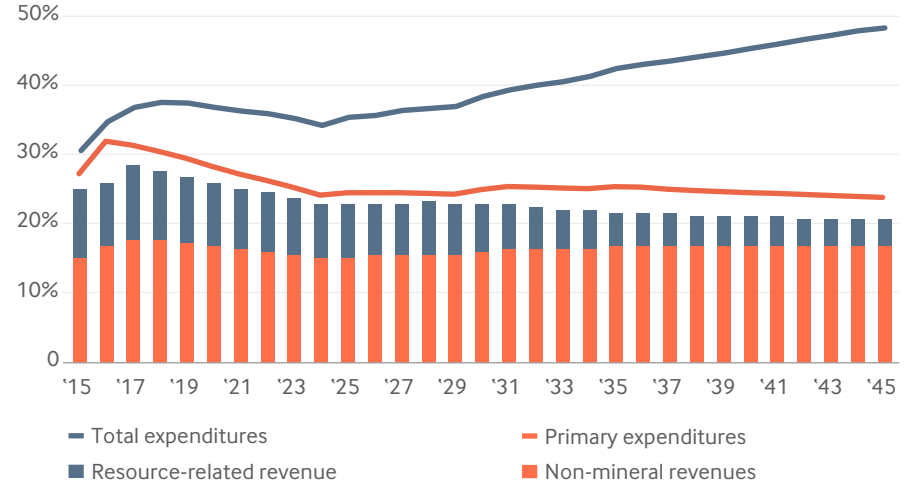



Figure 2. Fiscal variables (baseline scenario)

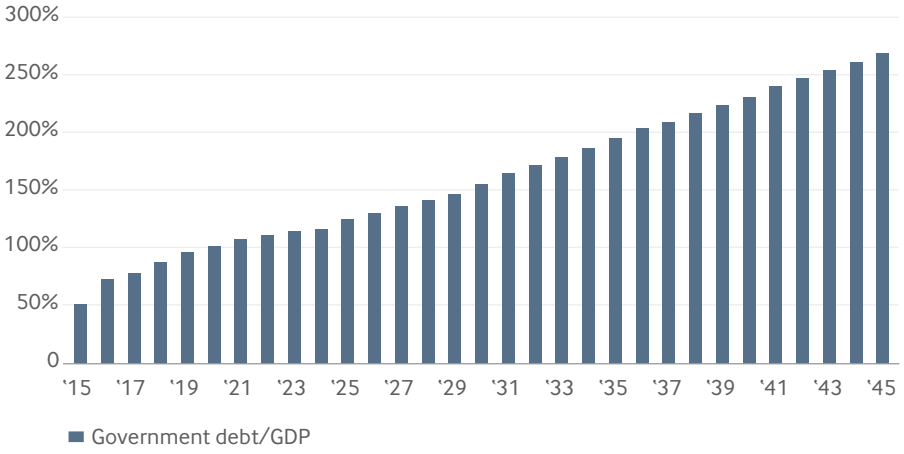



Figure 3. Government debt (baseline scenario)

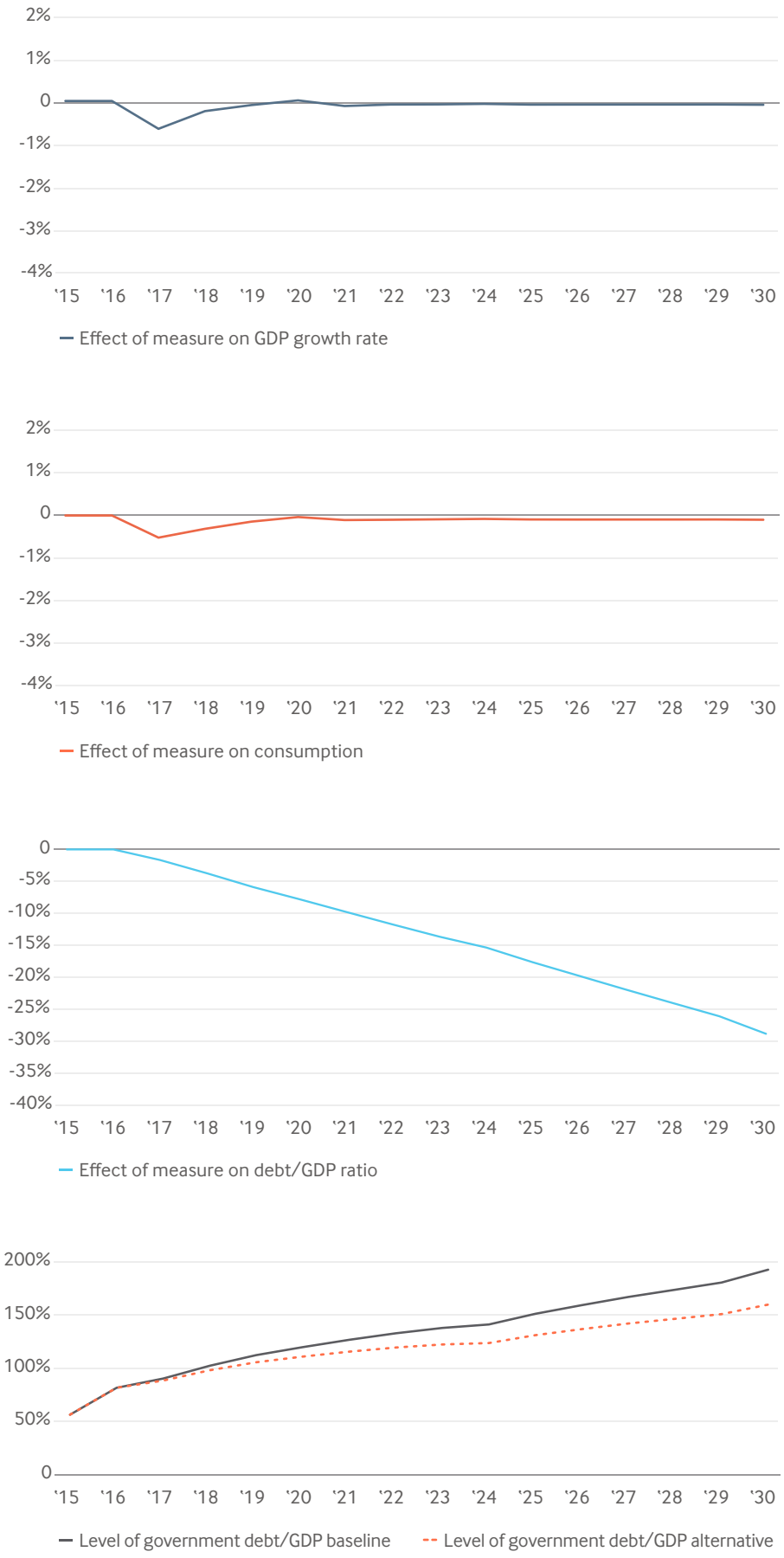
## SCENARIOS

There are important trade-offs between different fiscal measures the government can take to bring down the short-term fiscal deficit.

### Increasing taxes on labor

Increasing the currently 10 percent personal income tax rate by 10 points would reduce the primary deficit by 1.8 percent. By substantially reducing the incentive to work, however, this would lead to slower GDP growth and a smaller reduction in the debt-to-GDP ratio. The positive snowball effect of reducing the interest expenditures would also contribute to a 30 percent decrease of the debt-to-GDP ratio by 2030, compared to the baseline.

Figure 4. Effects of 10 percent increase in personal income tax



## Increasing tax on consumption

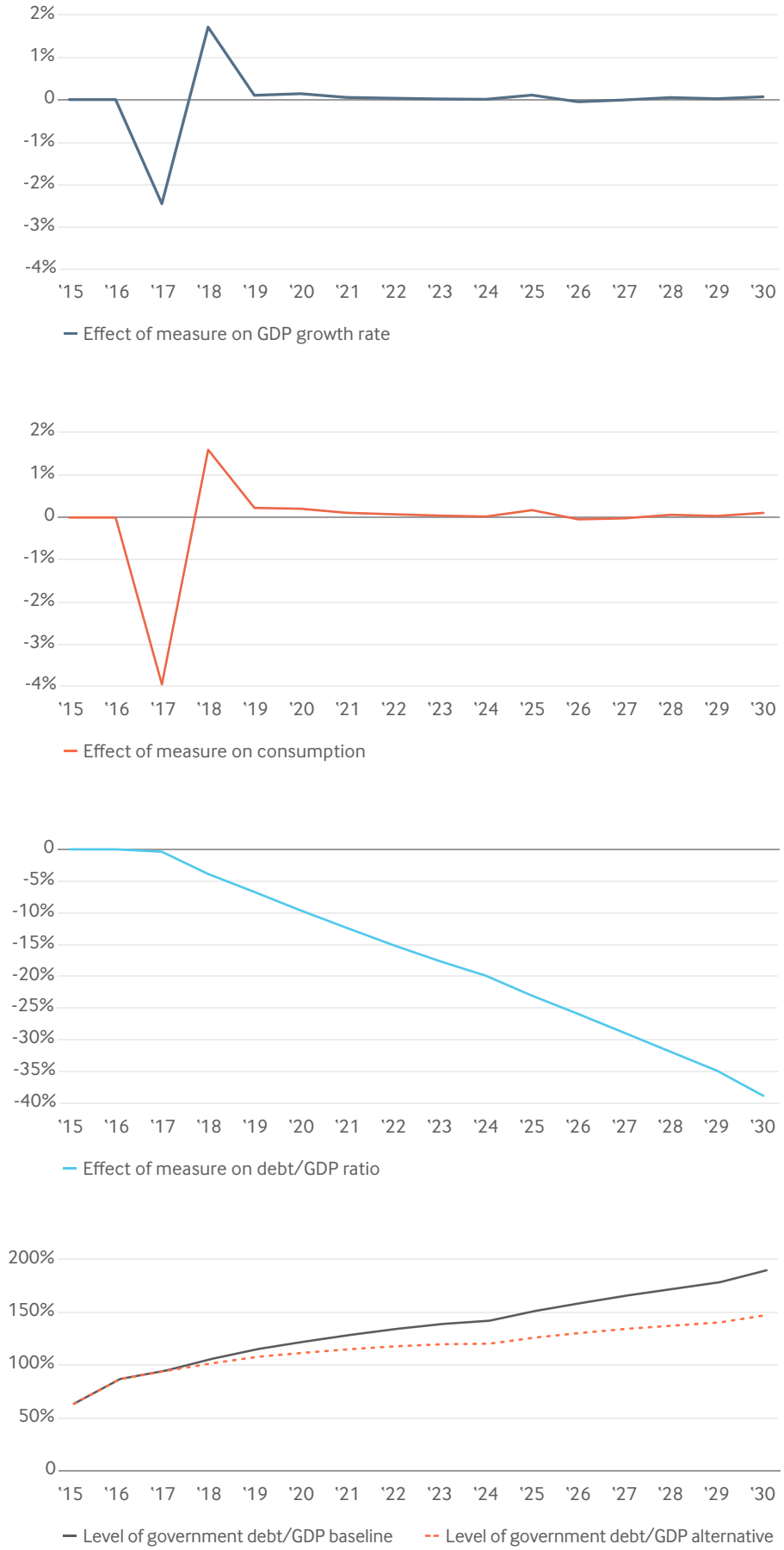


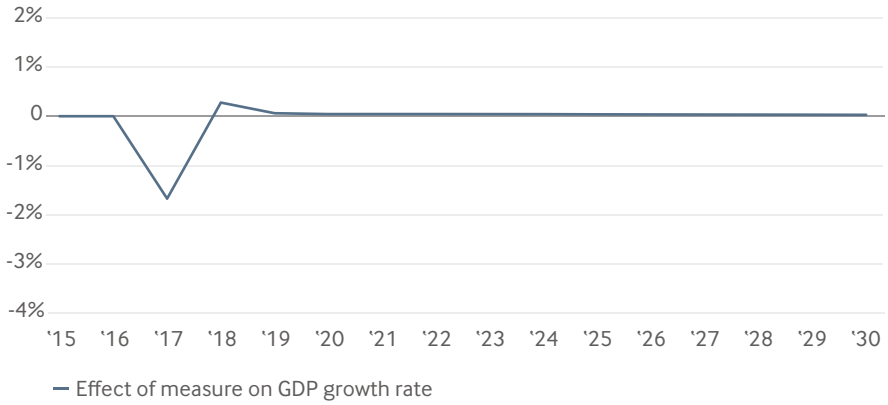

Figure 5. Effects of 5 percentage point increase in VAT



## Different expenditure cuts

A 5 percent increase of the current 10 percent VAT rate (excluding mines where VAT rates are fixed in long-term contracts) would lead to an approximately 2 percent amelioration in the primary deficit. The VAT hike is beneficial for private savings and investment, as it reduces the propensity to consume. Its negative short-term effects on GDP growth, therefore, are outweighed by its positive effects on the medium- to long-term period. The positive snowball effect of reducing the interest expenditures would also contribute to close to 40 percentage point decrease of the debt-to-GDP ratio by 2030, compared to the baseline.

Government expenditures are classified in three categories: government consumption, government investment and social transfers. Cutting investment is usually the politically easiest fiscal adjustment: it has smaller negative effects on household consumption, but its long-term negative effect on growth substantially reduces its overall effect on fiscal sustainability. Cutting transfers helps the most to reduce the debt-to-GDP ratio, but it also reduces private consumption the most. A cut of 2 percent of GDP (MNT 500 billion) in government expenditures can reduce the debt-to-GDP ratio by 2030 compared to the baseline by 15 percent if it falls on government investments but by 21 percent if it decreases subsidies and transfers.



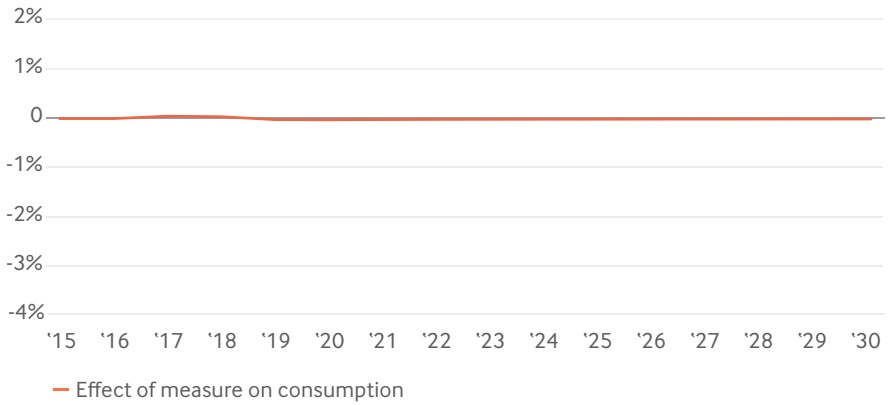
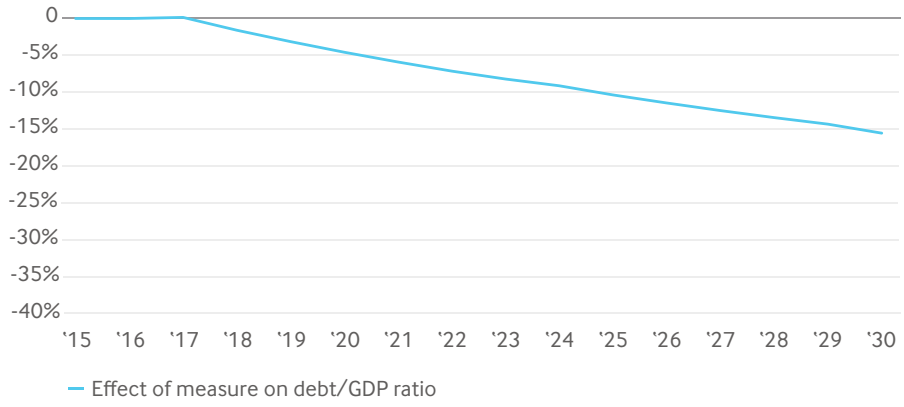
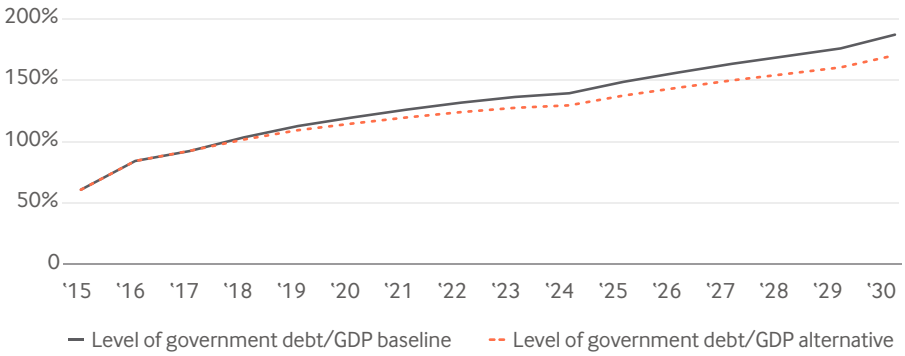




Figure 6. Effects of MNT 500 billion cut in government investments

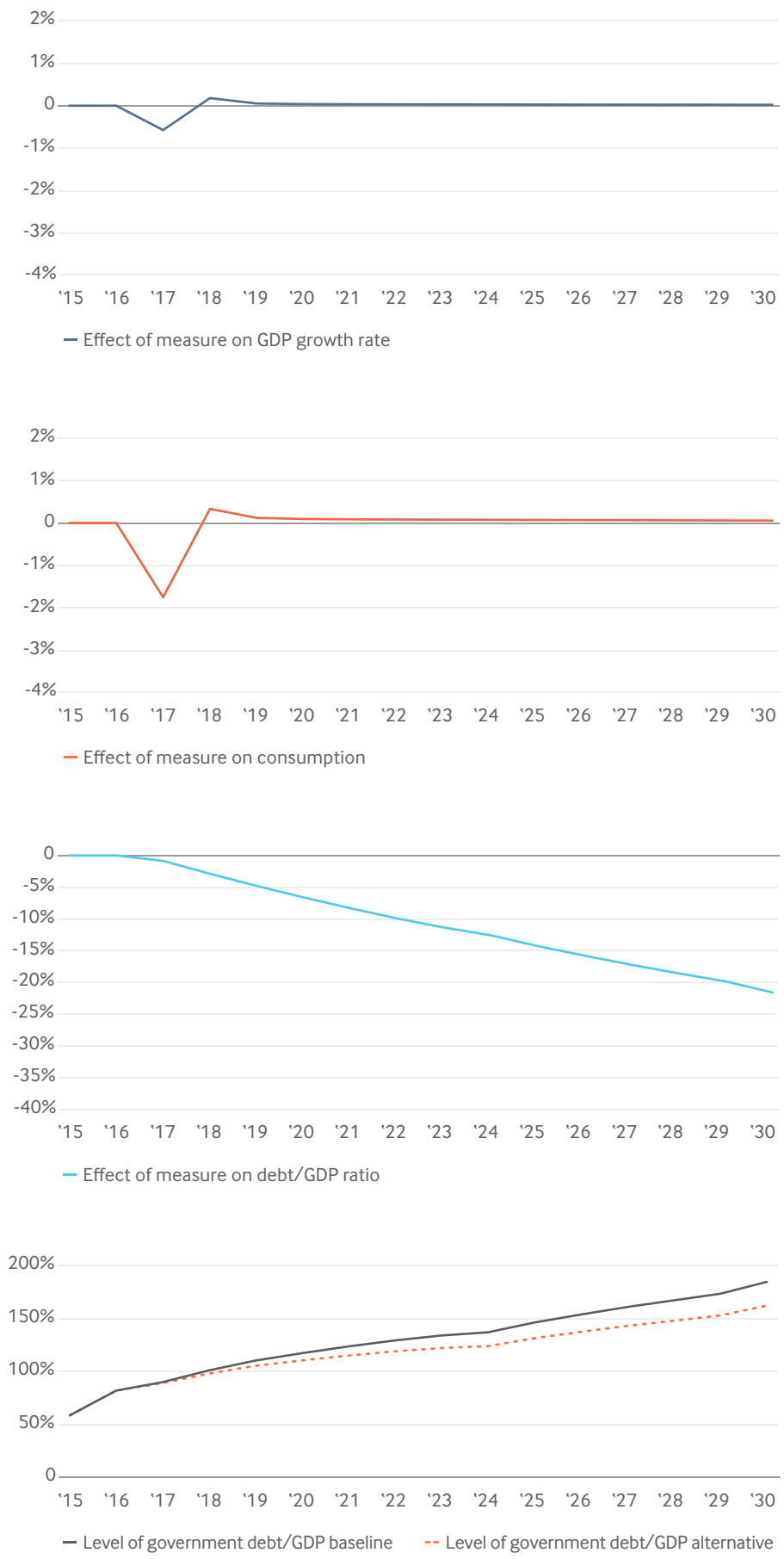



Major expenditure cuts or tax hikes to cut the deficit will hurt growth and household consumption, but are unlikely to restore debt to a sustainable path on their own. Detailed results of the model provide some insight into how a combination of deficit reducing and growth enhancing measures can be more effective in helping to restore fiscal sustainability.

Among the various policy scenarios, reallocation of expenditures toward efficient government investment and to reduce the risk premium (e.g., improved access to credit, institutional changes or increased transparency) have a positive long-term effect on growth.

Figure 7. Effects of MNT 500 billion cut in subsidies and transfers



## Fiscal rules

The Fiscal Stability Law adopted in 2010 was put in place "for the purpose of ensuring fiscal stability, creating renewable wealth, making investments that support economic development and generating financial savings with mineral revenues for the purpose of ensuring fiscal stability." It sets three clear targets designed to help achieve these goals. The model is able to inform policy decisions by evaluating the distance between the designated fiscal rules and the fiscal path under various scenarios.

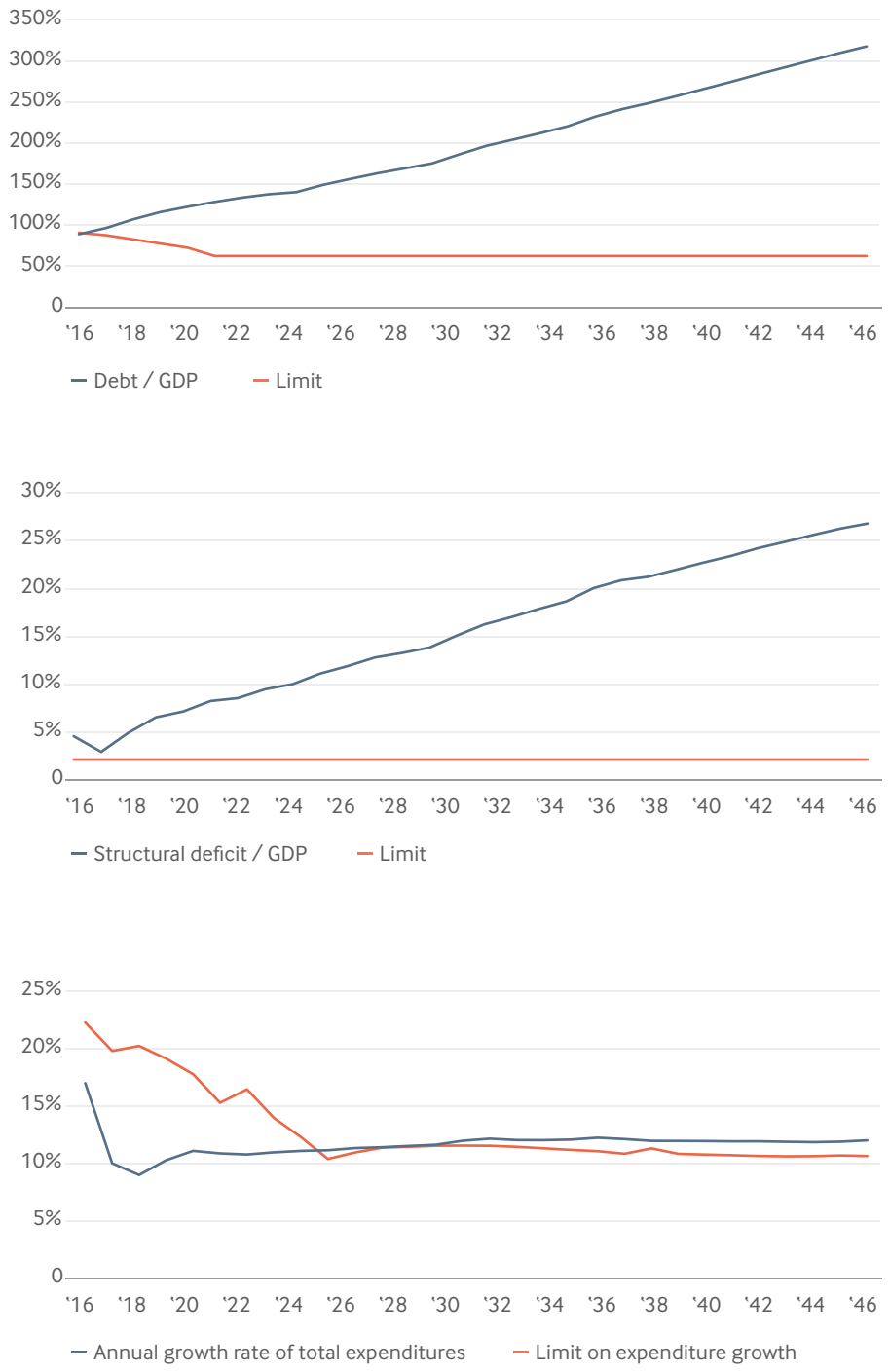



Figure 8. Observance of the fiscal rules (baseline scenario)

The balanced budget rule sets a structural deficit target of 2 percent of GDP, while our baseline scenario shows a deteriorating deficit path. Similarly, the debt rule sets a target of 60 percent of GDP for government debt, while our baseline depicts a rapidly increasing trajectory. The model indicates that very drastic measures and/or positive shocks would be needed to turn these trends around. The expenditure growth rule is observed under the baseline scenario with considerable headroom.

On the whole the baseline (no policy change) scenario is not sustainable, however at least until 2024 the expenditure rule is obeyed; hence theoretically there would be some room for increasing growth enhancing expenditures, if the government decided to restore long term fiscal sustainability through a combination of other means.

Read more of our findings from the model in the Model Guide. Chapter 7 describes the baseline scenario, and Chapter 8 provides a detailed overview of how key variables behave across a variety of potential scenarios.

## Using and improving the model

The model is available in XLSX format on www.resourcegovernance.org under Creative Commons Attribution (open) License.

The model has a user-friendly interface, labeled the "control panel" tab, allowing users to test various scenarios and interpret results. The user can define a hypothetical scenario by inputting key parameters for commodity price and volume shocks (both one-off and permanent), as well as different tax and expenditure measures.

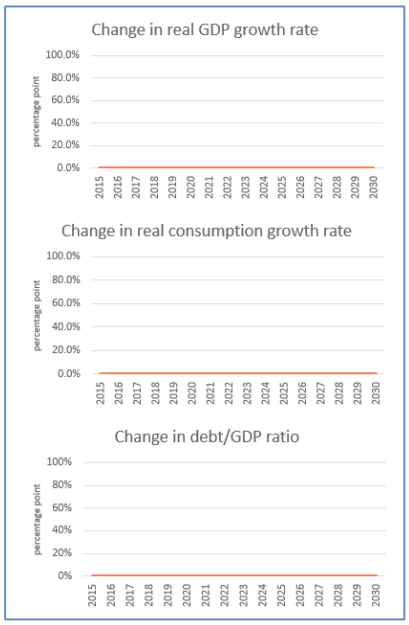
The user can choose one or multiple types of shocks from the list by setting a non-zero value (either positive or negative) for relevant measures. For example, an expenditure increase will be a positive figure, while an expenditure cut will be a negative figure. The user can also adjust the start year for the shock. Appropriate start years range between 2017 and 2030. Another possible shock is to set back the development of the gigantic underground mine of Oyu Tolgoi compared to currently planned production start in 2021.

Figure 9. Control panel of the model

**Select scenario by inputting start year and size of shock**

BASELINE SCENARIO

| | *Measure or shock* | *Start year* | *Size* | |
|---|---|---|---|---|
| *Tax change* | PIT rate increase | 2017 | 0 | %points |
| *Tax change* | VAT rate increase | 2017 | 0 | %points |
| *Expenditure change* | Increase in government consumption | 2017 | 0 | bn MNT (2017 real) |
| *Expenditure change* | Increase in government investment | 2017 | 0 | bn MNT (2017 real) |
| *Expenditure change* | Increase in transfers and subsidies | 2017 | 0 | bn MNT (2017 real) |
| *Export shock* | One-off price increase of the exported commodity | 2021 | 0 | % |
| *Export shock* | Permanent price increase of the exported commodity | 2021 | 0 | % |
| *Export shock* | One-off increase of output in the mining sector | 2021 | 0 | % |
| *Export shock* | Permanent increase of output in the mining sector | 2021 | 0 | % |
| *Export shock* | Delay in the development of Oyu Tolgoi Phase 2 | | 0 | years (0<x<10) |
| *Import shock* | Temporary price increase of the imported commodity | 2021 | 0 | % |
| *Import shock* | Permanent price increase of the imported commodity | 2021 | 0 | % |



Once the data on the size and start year of shocks and policy changes are inputted, the graphs on the right will display metrics of the impact of this alternative scenario compared to our baseline. The "graphical results" and "numerical results" tabs provide further details on the trajectory of key economic and fiscal variables along both the baseline and the alternative scenario. Additional, more complex shocks can be inputted through the "advanced control panel." For further detail on the spreadsheet refer to chapter 9 of the model guide.

This model was built using data from a variety of government, company and international sources collected throughout 2016. All data used is presented in the spreadsheet. It also reflects a series of meetings with experts in Mongolia in November 2016 to refine calculations and clear up ambiguities. Nevertheless, some uncertainties and data gaps remain, most importantly regarding the financial details of the largest mines in the country as well as contingent liabilities of the state. The model is also subject to errors and overlooked information.

For questions or to provide feedback on this model contact:

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NRGI analysts will continue to work with stakeholders in Mongolia to refine and update the model.

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