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ICELAND

SELECTED ISSUES

June 2025

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May 30, 2025

Approved By
European Department

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CONTENTS

ASSESSING THE MONETARY POLICY IMPLICATIONS OF CHANGES IN OWNER-OCCUPIED HOUSING COST MEASUREMENT: INSIGHTS FROM ICEQMOD

A. Introduction

1. Conducting monetary policy in a shock-prone and evolving economy presents significant challenges. Iceland is a small, advanced economy with a floating exchange rate and a significant degree of trade openness. The CBI operates under an inflation-targeting framework, with a mandate to maintain inflation at a target rate of 2.5 percent. However, since the inflation target was set in 2001, inflation has averaged 4.9 percent. The large discrepancy between the target and realized inflation underscores the challenges in formulating effective monetary policy in a shock-prone economy undergoing significant structural transformation.

2. We introduce a new Iceland-specific Quarterly Projection Model (QPM) called IceQMod. The QPM is one of the IMF's workhorse models for forecasting and policy analysis, especially monetary policy. QPM is a medium-sized semi-structural model that strikes a balance between the theoretical rigor of microfounded models and the practical necessity of data representation. A model such as the QPM can significantly help the monetary policy process by quantifying the size and speed of policy rate adjustments in response to various economic shocks. Additionally, the rational expectations foundation of the model makes it robust to the Lucas critique; it is therefore a valuable tool for forecasting and conducting "what if" policy scenario analysis. IceQMod is calibrated to Icelandic data and tailored to capture the essential features of the economy.

3. We use the model to assess the implication of a change in the methodology for calculating the cost of housing services received by homeowners in the CPI. The housing component in the CPI includes three sub-components: (i) actual rent paid by renters; (ii) imputed rent which is measure of the housing services costs received by homeowners; and (iii) and maintenance and repair of housing. The imputed rent subcomponent carries a hefty 20 percent weight in the CPI and can be measured in different ways. The original approach in Iceland was based on the "user cost" approach which implicitly treats housing services as a return on an asset. The imputed rent sub-component under this approach contributed an average 1.8 percentage point to headline CPI inflation between 2001 and mid-2024, thus opening a large and persistent gap between headline CPI inflation and CPI inflation excluding housing. This sparked two related debates about (i) the most suitable inflation measure for defining the monetary policy inflation target; and (ii) the most suitable methodology for estimating the imputed rent subcomponent (IMF, 2006; and Herbertsson and Mishkin, 2006, CBI, 2016, Task Force on Monetary Policy, 2018). It was finally decided to change the methodology for calculating imputed rent to the "rental equivalence" approach effective June 2024. This approach estimates the amount a homeowner would pay if they

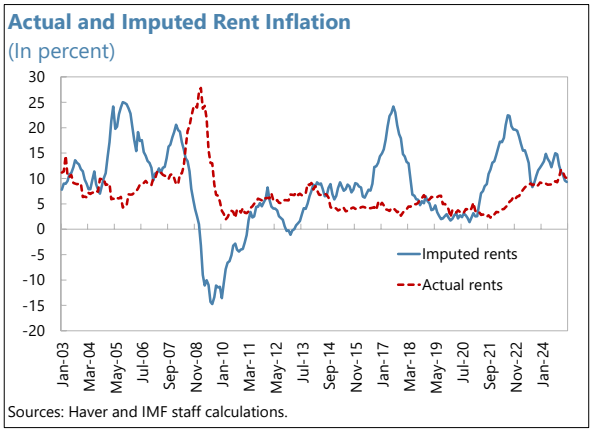
rented their property instead of owning it. We assess the implications of the change in the methodology for inflation, monetary policy and the broader economy using IceQMod in Section C.

B. Overview of IceQMod

4. IceQMod is a semi-structural model gap model of the Icelandic economy. The short run dynamics of the model, underpinned by New Keynesian theory that incorporates sticky wages and prices, has been modified and extended to better represent specific characteristics of the Icelandic economy. The model can be represented in a state-space format, allowing the Kalman filter algorithm to effectively break down key macroeconomic variables into gap and trend components. The model incorporates Iceland's economy features. Thus, the export equation within the demand block reflects the dominance of the fisheries, aluminum and tourism sectors. The import equation captures Iceland's low dependence on energy imports, while the trade equations capture the openness of the economy. Population growth, significantly bolstered over the past decade, is a crucial factor influencing the substantial rise in real estate prices. Access to the labor market for citizens of EU countries, in light of higher wages compared to most EU nations, results in a highly elastic labor supply, as evidenced by strongly procyclical immigration. The outsized contribution of house prices is reflected in separate Phillips curves for housing and non-housing inflation, with housing component having a different response to demand and exchange rate shocks, and a higher trend inflation rate. Furthermore, the UIP condition is adapted to reflect the strong connection to euro-denominated financial markets and well as the high level of capital mobility. A detailed description of IceQMod is available in the appendix to this paper.

C. How Would Inflation and Monetary Policy Have Differed if Imputed Rent had Always Been Estimated Using the "Rental Equivalence" Approach?

5. Estimating the cost of housing services for homeowners is challenging. In the case of renters, an estimate of the cost of housing services is relatively straightforward as rent paid is a good approximation of the cost of consuming housing services. This is more challenging for homeowners because the home serves both as an investment and a consumption good, and incurred housing expenses, such as mortgage payments can be attributed to both investment and consumption.



6. There is no consensus on the best approach for measuring imputed rent. Statisticians have devised three broad approaches (Consumer Price Index Manual, 2004). These are:

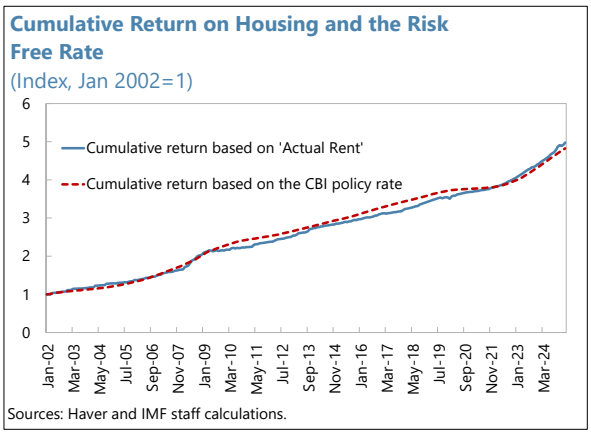
- **User cost.** This approach emerges from the theory that the return on investing in a house should equal the opportunity cost of investing in a similar asset. Estimates of "user cost" typically includes the mortgage cost, taxes, maintenance costs, and the depreciation cost base on the

current market value of the home minus the expected capital gain. House prices and mortgage payments tend to dominate estimates of the imputed rent under this approach. Iceland used a version of this approach until May 2024.

- **Rental equivalence.** This is an estimate of the rent that households in owner-occupied homes would have paid if their homes were available on the rental market. "Rental Equivalence" is suitable in countries with an active rental market with properties that can serve as a proxy for owner-occupied homes. Iceland adopted this methodology from June 2024.

- **Acquisitions.** This approach looks at the cost of purchasing and owning a dwelling, including renovations, home insurance, maintenance, and transfer costs.

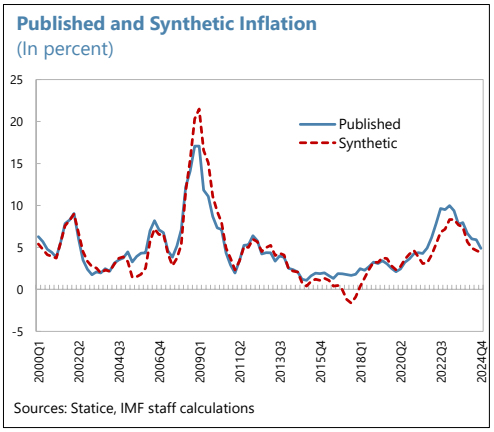
7. In theory, the "user cost" and the "rental equivalence" methods should generate the same estimate of imputed rent. The "user cost" approach is based on the principal that the return from investing in a house should closely match the opportunity cost of that investment. If this alignment does not occur, market forces would drive housing prices or rents up or down to achieve that equivalence. The total costs of owning a home include the borrowing costs, repairs and maintenance, depreciation and taxes. These expenses should equal the rental income, adjusted for the expected capital gain for the landlord. Given that rents are considered a reliable estimate of the price of housing services, the equivalence between user costs and the rents implies that user cost is a good estimate of the price of housing services. If the data were perfect and the economy was frictionless, the rental equivalence and the user cost approaches should generate the same result (National Academy of Sciences, Engineering, and Medicine, 2022). In Iceland, the index for the actual rent sub-component of CPI has moved in tandem with the return of an investment that is aligned to the central bank policy rate.



8. We create a synthetic historical CPI to assess the impact of the change in methodology for measuring imputed rent. Ideally, one would want to assess the implications of the change in methodology on the CPI by replacing the imputed rent estimate that was based on the "user cost" methodology with the "rental equivalence" measure. However, this is not feasible because the expanded HMS database that underpins the "rental equivalence" methodology has only recently

been established.[1] As a second best, we recreate the historical series by assuming that the imputed rent sub-component mirrors the existing actual rent sub-component. This is conceptually appealing given that the actual rent sub-component is a measure of housing services for those that rent a home. There are, however, important caveats. First, the actual rents sub-component is based on a database that includes both private rents as well as rentals for social housing and students. By contrast, the "rental equivalence" approach includes private rentals only. Second, the types of properties that are typically occupied by owners could be very different from the stock of rental properties, resulting in a housing mix in the actual rents sub-component that is not representative of the stock of owned homes.

9. The synthetic measure of CPI based on the "rental equivalence" approach has at times diverged significantly from the published CPI. Our synthetic CPI tends to follow published CPI closely, although there have periods, such as in 2005–06, 2008 and 2022–24 when the two measures have diverged quite significantly. This divergence was particularly noticeable between 2015 and 2019 when the synthetic measure of inflation was approximately 1 percentage point lower than published inflation (1.2 percent versus 2.2 percent). Periods of divergence between these two measures of inflation reflect episodes of rapid house price inflation or deflation.



10. The synthetic measure of CPI is lower on average than published CPI, but more volatile. The synthetic measure of CPI has averaged 4.7 percent since 2002 compared with 4.9 percent for headline CPI.

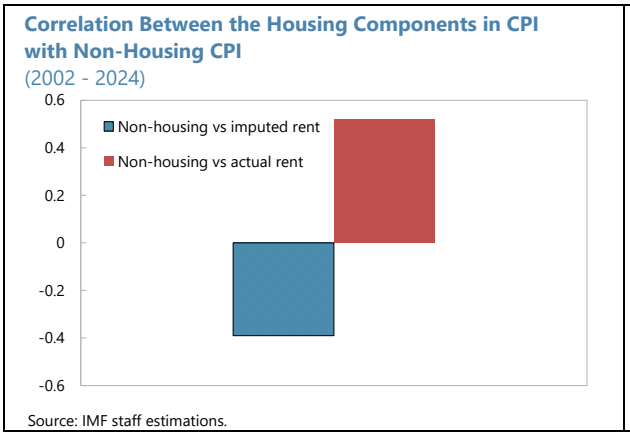
Text Table 1. Published and Synthetic CPI

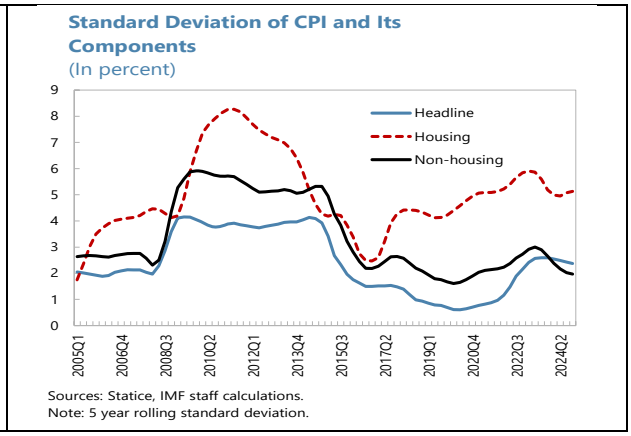
Since 2002	Published CPI	IMF Synthetic CPI
Average	4.9	4.7
Standard deviation	3.3	4.1

However, the synthetic measure is more volatile than the published CPI, even though the synthetic measure includes rental inflation which is more stable than house prices. The reason that published CPI is less volatile than synthetic CPI is that house prices in Iceland are negatively correlated with CPI

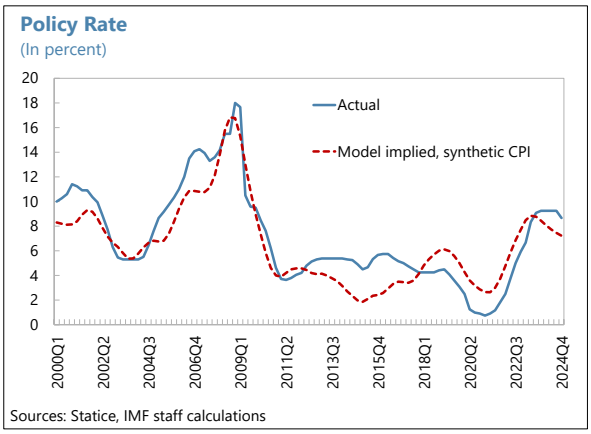
[1] A change in the law in 2022 mandated landlords to register lease agreements with the Housing and Infrastructure Agency (HMS). This resulted in a major expansion in the database of leased houses. The public database of rental properties covers around 22,000 properties. Statistics Iceland estimate the pool of rental properties at 26,000–32,000 representing around 20–25 percent of the total stock of 130,000 homes in Iceland. The database covering these 22,000 rental properties is used to estimate the cost of housing services for the 98,000–104,000 homes in Iceland that are owner-occupied.

excluding housing. House prices in Iceland have tended to move in tandem with the exchange rate, while inflation excluding housing has done the opposite. For example, house price inflation has been high when the exchange rate is strong, and low when the exchange rate is weak. A stronger exchange rate, however, exerts downward pressure on CPI through import prices, offsetting the upward pressure on CPI from high imputed rent inflation, resulting in stable headline CPI inflation. The negative correlation between imputed rent based on the historical "user cost" methodology and CPI excluding housing (non-housing) from 2002 is shown in the chart below. The chart also shows that CPI excluding housing is positively correlated with the actual rent sub-component of the CPI.





11. In a counterfactual experiment, we ask how monetary policy would have been set had imputed rent always been based on the "rental equivalence" approach. We replace actual CPI in IceQMod with our synthetic measure of CPI, while keeping the model parameters unchanged.[2] Additionally, we make the policy interest rate unobservable and assess it using the Kalman filter. The chart illustrates two policy rates: the actual policy rate set by CBI (Actual) and the policy rate from IceQMod based on our synthetic measure of inflation (Model implied, synthetic CPI). There were significant differences between the actual policy rate and the policy rate prescribed by the synthetic measure of inflation between 2005–08 and 2013–21, which were periods of robust house price inflation. For most of these two periods, the synthetic measure of inflation (which unlike headline inflation does not include house prices) would have been consistent with a lower policy rate, implying that monetary policy may effectively have been "leaning against the wind" on asset prices. However, the differences are likely too small to have had an impact on the decision making of the Monetary Policy Committee. While not shown, it is likely that house price inflation would have been higher if monetary policy had followed the synthetic measure of inflation. In such a scenario,



[2] It may be optimal to increase the persistence coefficient in the policy reaction function if inflation is more volatile.

the central bank could have used macroprudential measures more aggressively if higher house prices were considered a risk to financial stability.[3]

12. If these results remain true moving forward, the measurement change in CPI could have implications for monetary policy. For an unchanged inflation target, a methodological change which reduces average inflation would allow the central bank to maintain a looser monetary policy stance rate for a period of time. Moreover, the change in the methodology for measuring imputed rent entails an increase in the equilibrium nominal interest rate.[4] However, given that the equilibrium real interest rate is unchanged this has no bearing on the real economy.[5] Finally, given that the revised methodology does not include house prices, monetary policy could be looser that previously during periods of growing house prices and tighter during periods of weakness; this assumes that the CBI's monetary policy reaction function does not change.

D. Conclusions

13. The change in methodology for measuring imputed rent could result in lower but more volatile inflation. We construct a synthetic measure of inflation by replacing the imputed rent sub-component in the CPI index with the actual rent sub-component. Our synthetic measure of inflation is on average 0.2 percentage points lower than published inflation over the period 2002 to 2024. Synthetic inflation is also more volatile compared with published inflation over this period. Whether or not this remains true moving forward is unclear given the caveats mentioned above. However, this could be a fruitful area for future analysis.

14. The change in methodology may have implications for monetary policy moving forward. The synthetic CPI measure we construct is subject to a number of caveats, suggesting that the results of this study should be treated with caution. Nevertheless, if it is true that average CPI inflation is lower moving forward, the central bank may be able to keep monetary policy looser than would have been the case for a period of time. Additionally, the policy rate could be lower during periods of high house price inflation, and conversely, higher during periods of very low house price inflation if the central bank's monetary policy reaction function remains unchanged.

[3] The CBI responded to the overheated housing market from 2021 with a wide range of macroprudential measures, including a reduction in the LTV ratio, introducing and progressively tightening the debt service to income requirements, and raising the CCyB.

[4] In 2003, the UK Government announced that the Bank of England would target CPI inflation instead of RPIX inflation. CPI inflation was, on average, 0.8 percentage points lower than RPIX inflation. To account for this difference the Chancellor revised the inflation target from 2.5 percent to 2.0 percent. The decision not to revise the inflation target by the full 0.8 percentage points resulted in a de facto 0.3 percentage point rise in the level of inflation that is consistent with the inflation target (Nickell, 2003). The equilibrium nominal interest rate also rose, by 0.3 percentage points as result of the switch.

[5] The switch in methodology, whatever the level of the inflation target, will have no long-run real impact on the economy. This includes the true real interest rate, which will be primarily influenced by potential GDP growth which is unaffected by the change (Nickell, 2003).

15. There may be an increased need to adopt macroprudential measures to manage excessive movements in house prices. By focusing on an inflation measure that was, until recently, significantly impacted by house price inflation, the Monetary Policy Committee (MPC) was implicitly "leaning against the wind" on asset prices. Moving forward there may be a need to implement macroprudential measure more actively if increased fluctuations in house prices are viewed as a risk to financial stability, alongside other measures (e.g., housing supply and taxation) to address imbalances in the housing market.

Annex I. IceQMod Core Structure

A. Model Structure

1. Real sector. The output gap (IS curve) is determined by domestic and foreign factors:

$$\widehat{Y}_t = \alpha_1 \cdot \widehat{Y}_{t-1} - \alpha_2 \cdot MCI_t + \alpha_3 \cdot \widehat{Y_t^F} + \alpha_4 \cdot FI_t + \alpha_5 \cdot \widehat{TOT_t} + \epsilon_t^Y \quad (1)$$

where $\widehat{Y}_t$ – output gap, MCI_t – monetary conditions index, $\widehat{Y_t^F}$ – foreign GDP gap, FI_t – fiscal impulse, $\widehat{TOT_t}$ – commodities relative prices gap, and ϵ_t^Y – GDP gap shock.
The monetary conditions index is a composite of real interest rate gap and exchange rate gap, where the latter plays the role of price competitiveness indicator – exchange rate depreciation makes export more attractive for external agents and import more expensive for domestic agents. The interest rate gap reflects costs of money, the positive value stimulates savings and discourages consumption.
The monetary conditions are represented by weighted combination of real interest rate gap and real exchange rate gap:

$$MCI_t = \mathrm{w} \cdot \widehat{RR}_t + (1 - \mathrm{w}) \cdot \hat{Z}_t$$

The private consumption, export and import of goods and services, which complement the demand block are constructed in a similar to output gap manner.

2. Prices and inflation. The headline CPI P_t consists of housing P_t^H and non-housing P_t^{XH} components:

$$\Delta P_t = \delta \cdot \Delta P_t^{XH} + (1 - \delta) \cdot \Delta P_t^H + \psi_t^{CPI}$$

The non-housing CPI inflation:

$$\pi_t^{XH} = \beta_1 \cdot \pi_{t-1}^{XH} + (1 - \beta_1 - \beta_3) \cdot \pi_{t+1}^{XH} + \beta_2 \cdot RMC_{XH} + \beta_3 \cdot \pi_t^{imp,xh} + \epsilon_t^{XH}$$

where π_t^{imp} – imported inflation, RMC_{XH} – real marginal costs for non-housing, and ϵ_t^{XH} – shock.
The housing inflation is assumed to be higher compared to non-housing due to impact of productivity growth (Balassa-Samuelson effect for non-tradable goods). The housing prices inflation steady state is set to 3.25 and non-housing is 2.25 percent, thus constituting total inflation at 2.5 percent as per central bank inflation target. Given the housing inflation indicator construct it is assumed to be procyclical to the monetary policy stance using real interest rate gap (housing costs increase with higher short-term interest rate as it translates into higher mortgage interest rates):

$$\pi_t^H = c_1 \cdot \pi_{t-1}^H + (1 - c_1) \cdot \pi_{t-1}^H + c_2 \cdot RMC_t^H + c_3 \cdot \widehat{RR}_t + \epsilon_t^{CPIH}$$

where π_t^H – housing inflation, RMC_t^H – real marginal costs for housing, $\Delta\overline{RPH}_t$ – trend of real housing price, and ϵ_t^{CPIH} – shock.

3. Monetary policy. The monetary policy reaction is represented by the Taylor-type function:

$$RN_t = \gamma_1 \cdot RN_{t-1} + (1 - \gamma_1) \cdot \left(\overline{RR}_t + \pi_t^{tar} + \gamma_2 \cdot (\pi_{t+3} - \pi_t^{tar}) + \gamma_3 \cdot \widehat{Y}_t\right) + \epsilon_t^{RN}$$

where RN_t– nominal interest rate, RN_{t-1} – lagged nominal interest rate, $\overline{RR}_t$– neutral real interest rate, π_{t+3} – expected annual inflation, $\widehat{Y}_t$ – output gap, and ϵ_t^{RN} is a shock.

4. Exchange rate and UIP. Given the importance of EU, the key bilateral exchange rate, utilized in UIP condition is ISK/EUR:

$$S_t = S_t^e + \frac{(RN_t^F - RN_t + PREM_t)}{4} + \epsilon_t^S$$

where S_t – nominal exchange rate, S_t^e – expected exchange rate, RN_t^F – foreign nominal interest rate, RN_t – domestic nominal interest rate, $PREM_t$ – risk premium, and ϵ_t^S – shock.
The expected exchange rate:

$$S_t^e = \omega S_{t+1} + (1-\omega)(S_{t-1} + 2/4 \cdot \Delta\bar{S}_t)$$

where $\Delta\bar{S}_t$ – nominal exchange rate trend.
The fiscal impulse FI_t is the main channel of the fiscal policy and comprises of shock to the structural balance (including permanent discretionary items) and one-off discretionary component:

$$FI_t = \varepsilon_t^{PDEF,STRUCT} + PDEF_t^{DISCR}$$

Both, structural and discretionary, are parts of primary balance, together with cyclical component:

$$PDEF_t = PDEF_t^{STRUCT} + PDEF_t^{CYC} + PDEF_t^{DISCR}$$

where $PDEF_t$ is the primary, $PDEF_t^{STRUCT}$– structural, $PDEF_t^{CYC}$– cyclical component, and $PDEF_t^{DISCR}$ – one-off discretionary component of the balance.

5. Labor market. The unemployment gap:

$$\widehat{UNEMP}_t = c_1 \cdot \widehat{UNEMP}_{t-1} - c_2 \cdot \widehat{Y}_t + \epsilon_t^{UNEMP}$$

where $\widehat{UNEMP}_t$-- unemployment gap, $\widehat{Y}_t$ -- output gap, and ϵ_t^{UNEMP} -- unemployment shock.
NAIRU:
The unemployment trend (NAIRU):

$$\overline{UNEMP}_t = c_1 \cdot \overline{UNEMP}_{t-1} + (1-c_1) \cdot \overline{UNEMP}_{ss} + \epsilon_t^{UNEMP}$$

where $\overline{UNEMP}_t$ -- unemployment trend, $\overline{UNEMP}_{ss}$is the steady-state rate of unemployment, and ϵ_t^{UNEMP} -- shock.

6. External economy. The economies of partner countries are represented through equations for the output gap, inflation, and exchange rates of key partners, where major trade partner and counterpart in UIP condition is European Union; United States is significant partner in services, particularly tourism, United Kingdom: together, these partners account for approximately 85 percent of total exports.

7. The model is partially calibrated, with most parameters estimated using a Bayesian approach. The calibrated parameters include steady states (such as potential output, inflation target, real exchange rate depreciation, and real interest rate) and shares/weights (including housing/non-housing inflation, external trade, monetary conditions and marginal costs):

- Potential output growth steady state is set at 2.7 percent, as per historical data and production function growth analysis.
- Iceland's inflation target per Central bank of Iceland policy is set at 2.5 percent.
- Real exchange rate depreciation is set to 0 percent (historical average over last two decades), real neutral interest rate is set to 2.7 percent—to balance yield of financial assets with potential output growth.
- The key economic partners have inflation target in 2 percent, the real neutral interest rate for key bilateral partner, EA, is set to 0.5 percent.
- The other parameters, including standard deviations, are estimated using data from the 2001 to 2024 period.

8. Selected equations parameters. The rest of parameters were estimated using Bayesian approach, with priors for the models being defined according to the information collected within surveillance work of IMF's Iceland team, models for peer countries, Iceland's Central Bank Quarterly Macroeconomic Model (QMM) and others.

IS curve (Eq. 1)

α_1	α_3	α_3	α_4	α_5
0.485	0.225	0.70	0.45	0.025

Headline CPI (Eq. 2) and non-housing inflation (Eq.3)

δ	β_1	β_2	β_3
0.8	0.55	0.285	0.04

Interest rate rule (Eq. 4)

γ_1	γ_2	γ_3
0.675	1.275	0.25

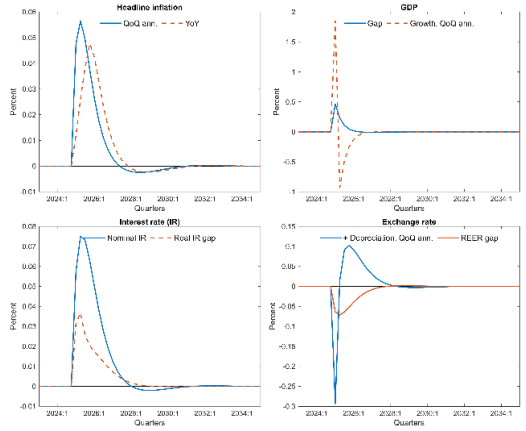
B. Model Properties

The model properties analysis includes impulse response function, forecast error variance decomposition and in-sample historical simulations. Such analysis allows to compare model with other models, in particular, the QMM which is used for regular forecasting by Central bank of Iceland and validate the model structure and estimations.

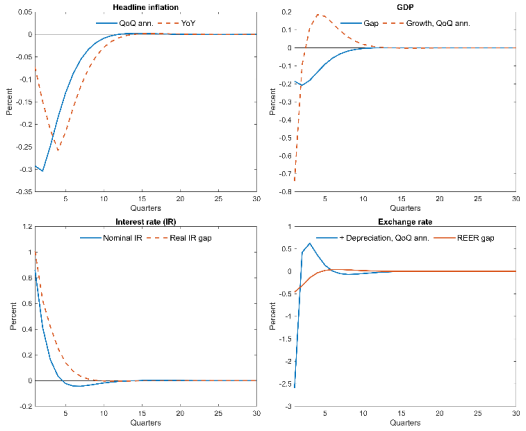
The figures below show responses from key model variables to demand shock represented by fiscal impulse (one time increase in structural deficit) and interest rate shock (one time increase in key monetary policy rate). The results highlight important role of policy regime for both, fiscal and monetary policies. The stabilizing character of the fiscal policy – the fiscal balance returns to its long-term value, produces contraction the next period after the assumed increase in deficit.

Annex I. Figure 1. Iceland: Descriptive Characteristics of Inflation and Inflation Expectations

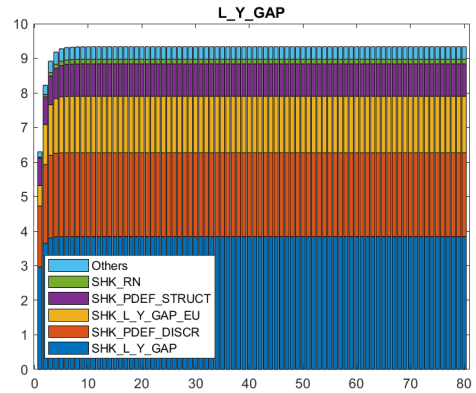
Structural Deficit Shock IRF
(Deviation from steady state)



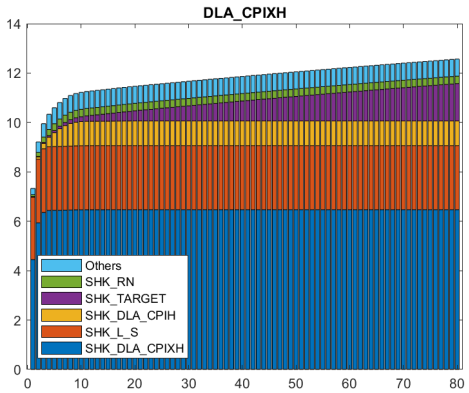
Interest Rate Shock IRFs
(Deviation from steady state)



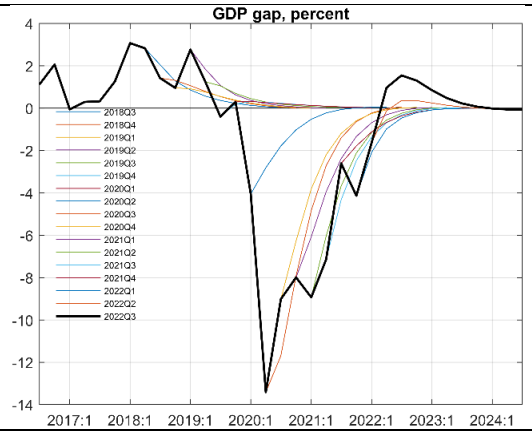
GDP Gap Forecast Error Variance Decomposition
(Percentage points)



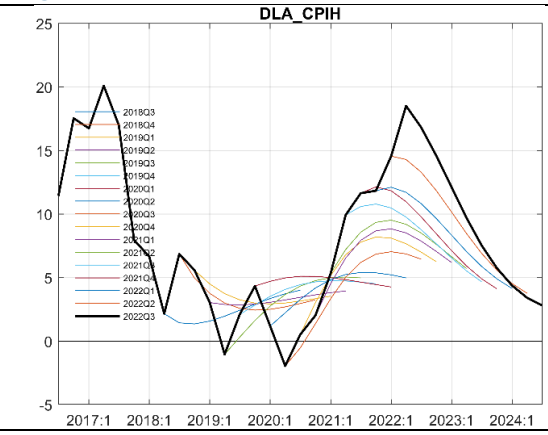
Non-Housing Inflation Forecast Error Variance Decomposition
(Percentage points)



GDP Gap in-Sample Forecasts



Housing Inflation in-Sample Forecasts



Source: IMF staff estimations.

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