Appendix 1 The monetary policy response to the Noral Project

In February this year a question was put in parliament to the Prime Minister concerning possible Central Bank countermeasures to offset the impact of the Noral Project (to build an aluminium smelter and hydropower production facilities) on domestic demand and inflation (parliamentary document no. 726 – matter no. 455). The Bank's reply states that its policy interest rate would need to be raised somewhat initially and during the first half of the construction phase in order to dampen the demand pressure and inflation which would inevitably accompany such a shock to the Icelandic economy.

Despite the indefinite postponement of this project, the main ideas behind this answer deserves to be explained, as it reflects important factors that underpin monetary policy decisions at any time and will therefore reflect the Bank's response to other shocks which have as extensive an impact as the Noral Project was expected to have.

As the Bank stated in its reply, it did not have the opportunity to make an independent evaluation of the economic impact of the project within the assigned deadline, and it also lacked access to all the necessary data for making an independent assessment of the macroeconomic effects of the project. For these reasons, major parts of the Bank's reply are based on the National Economic Institute's (NEI) earlier studies of the project's impact on the domestic economy. It is important to bear in mind that the Central Bank took the NEI's findings as given and did not make an independent evaluation of them.

The Bank's calculations were therefore more or less based on the assessment by the NEI of the project's impact on inflation and the output gap, assuming unchanged fiscal and monetary policy stance. The Bank's task was then to evaluate the likely responses of monetary policy to the impact of the project on the domestic economy. The inflation and output gap developments calculated by the Central Bank are therefore not the same as those in the NEI's calculations. The main reason is that the NEI does not assume any monetary policy response, while the Bank's calculations allow for interest rate changes to affect output gap and inflation developments.

However, as in the NEI model, no responses of fiscal policy are assumed. In the Bank's calcultions, monetary policy therefore always bears the brunt of responding to the shocks casued by the project. Had a fiscal policy response been allowed for, e.g. a cut in government expenditure for the duration of the construction phase, the monetary policy would not need to be as tight as shown here.

The evaluation of the monetary policy response to the impact of the Noral Project on the domestic economy used the Taylor rule, which is a simple description of the response by central bank policy rate to inflation and output gap developments (see discussion in Box 5 on p. 23). This rule states that a central bank will raise its policy rate above a certain equilibrium interest rate if inflation exceeds the Bank's inflation target and if there is a positive output gap, since the latter leads to greater inflation pressures in the future. The rule has been considered to provide a good description of interest rate decisions of leading central banks at a time of successful monetary policy implementation, and it is invariably used for estimating monetary policy response to different types of economic shocks.

Evaluation of the extent to which the Central Bank of Iceland's policy rate deviates from the equilibrium policy rate was based on the NEI assessment and the economy's responses to the Bank's interest rate changes, using the findings of a multivariant time series analysis of the impact of the Bank's policy rate on demand and inflation, as discussed in Thórarinn G. Pétursson's article in *Monetary Bulletin* 2001/4.[1] Those calculations assume that monetary policy first begins to exert an effect on demand and inflation after approximately one year, and that the effect gradually fades out and has more or less disappeared after 4-5 years.

In evaluating the Taylor rule, eight different variations of the rule were calculated for the Central
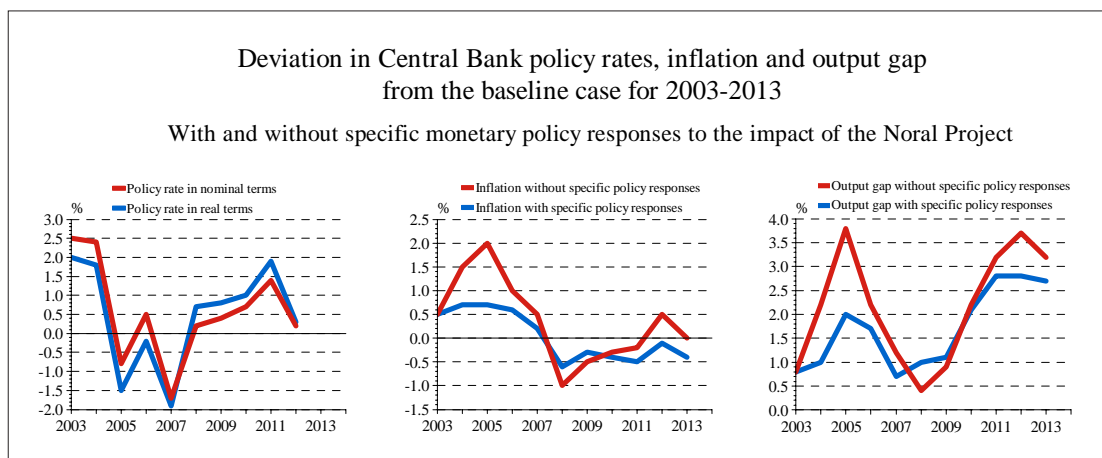
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1. Thórarinn G. Pétursson, "The transmission mechanism of monetary policy", *Monetary Bulletin*, 2001/4, pp. 62-77. An Okun's law relationship with a parameter of 0.3 is used to produce a value for the effect of interest rate changes on GDP instead of employment.

Bank's policy rates, based on different assumptions concerning the effects of the construction phase on output gap developments and the formation of the Taylor rule. Some estimates assumed that the construction phase would raise the output gap one for one, while others allowed for a temporary increase in potential output, e.g. due to temporary import of labour. In that case, the output gap was only assumed to rise by a half. Policy responses were either calculated using contemporary values of inflation and the output gap or a one year ahead forecast of these variables.[2] The calculations also allow for interest rate smoothing by the Bank, as suggested by theory and empirical results (see the discussion in Box 5).

Based on the average of different formulations of the Taylor rule using one year ahead values of inflation and the output gap, the Central Bank's policy rate would have needed to be about 2½ percentage points higher than in the baseline case over the period 2003-4. In real terms the Bank's policy rate would therefore be 2 percentage points higher than in the baseline case over this period. Because the baseline assumes a considerable economic downturn in 2007-8, the Bank would begin to ease its monetary policy stance after 2005 and over the period 2005-7 its policy rate would be on average roughly ½-1 percentage point lower than in the baseline case, which makes 1-1½ percentage points lower in real terms. In 2008, the monetary policy stance would gradually tighten again and over the period 2008-12 the Bank's interest rate would be on average about ½-1 percentage points higher than in the baseline, giving a 1-1½ percentage points higher policy rate in real terms.

As a result, the Bank would manage to bring down inflation and the output gap compared with the NEI results. Inflation would always remain within the ±1½% tolerance limit of the Central Bank's inflation target, while the NEI results suggested that inflation would temporarily exceed it. The Central Bank's response would also dampen inflation and output gap fluctuations considerably compared to the NEI results. The standard deviation of inflation in that case was around 1% over the period 2003-2013, but only ½% after taking the monetary policy

Deviation in Central Bank policy rates, inflation and output gap from the baseline case for 2003-2013

With and without specific monetary policy responses to the impact of the Noral Project

responses into account. The standard deviation of the output gap in the NEI calculations is around 1.2%, but 0.8% after allowing for the monetary policy responses.

The chart shows the development of the Central Bank's policy rate in nominal and real terms compared to the baseline case, the deviation in inflation and output gap from the baseline according to the NEI's calculations, where no specific monetary policy responses are assumed, and the calculations de-

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2. It should be noted that these are not true forecasts, as the calculations assume that the Bank has perfect knowledge concerning the future developments of inflation and the output gap. The results suggest that by responding to future variables instead of considering contemporary ones, the Bank will be more successful in smoothing movements in inflation and the output gap. In reality, the Bank does not possess such information, so it is unclear which type of policy response will give better results. Research seems to give conflicting results, but in general the Taylor rule is defined on the basis of contemporary aggregates, which are usually considered to be good for forecasting their future developments. See further the discussion in Box 5 on pp. 25-27.

scribed here, which take into account possible monetary policy responses.

It needs to be borne in mind that these calculations only meant to give an idea about the the possible monetary policy responses to a shock on the scale of the Noral Project. In reality, the Central Bank needs to look at far more data than is reflected in the simple Taylor rule which is used to calculate the policy responses reported here. Nonetheless, these findings suggest that projects such as Noral would entail considerable pressure on monetary policy, especially if they were not followed by fiscal policy measures to reduce demand pressures which inevitably accompany a project on such a scale. For the first years, monetary policy is tackling a conventional demand-driven expansion, i.e. where inflation and the output gap increase. The policy response is also conventional: the monetary policy stance is tightened and interest rates are raised while excess demand is eliminated from the economy. Given the lags in the transmission mechanism, however, the Central Bank clearly needs to begin to tighten its monetary policy stance somewhat before the actual construction phase begins, in particular if this has an effect on public expectations, which could cause an increase expenditure because of the project before actual work on it commences. According to the NEI's assessment, inflation pressures decrease considerably around the middle of the period, but increase again in the second half. Once again the monetary policy response is conventional. The stance is eased when the slack begins, then tightened when pressures build up anew. Due to lags, the Bank needs to be prepared to ease its monetary stance some time before the slack is formed, and to tighten it again before new pressures are formed. This is easy to incorporate into simulations such as these, where the Bank has full knowledge of the timing and magnitude of the business cycle. In reality this would obviously be much more difficult to deal with and there is a risk that it would put monetary policy under great strain.

It should be reiterated that these results are subject to great uncertainty. The effect of the project would depend to a very large extent on the state of the economy at the time when the construction phase begins, and on other external effects experienced by the economy for its duration. If sizeable pressures exist in the domestic goods and labour markets when the construction phase commences, the effect on domestic price and wage developments could be much stronger than shown here.

Similarly, great uncertainty surrounds the basline case on which the NEI findings are based. The major turnaround envisaged in its results for the middle of the period, with a considerable fall in inflation even though a positive output gap is still present, cannot be considered particularly credible. The fact that the results reported here by and large build upon this assessment inevitably affects the calculations shown here.

There is likewise much uncertainty about the impact of interest rate decisions on inflation and the output gap, and the timing of these effects. The less the effects of monetary policy actions, or the longer they take to be transmitted, the more that interest rates clearly need to be altered. Furthermore, it should be mentioned that the calculations do not assume any fiscal policy countermeasures. If such measures are taken, monetary policy is likely to come under less strain than described here.

One of the greatest uncertainty, however, concerns the effect that construction work on the project and the subsequent monetary policy measures would have on the exchange rate of the króna. The NEI calculations assume an unchanged exchange rate, which must be considered highly unlikely although admittedly it is extremely difficult to assess what the effect would actually be, to say nothing of timing it with any degree of certainty. For example, the exchange rate of the króna could rise substantially early on during the construction phase, then depreciate afterwards. These exchange rate swings would probably have a considerable effect on the real exchange rate and the competitive position of the export sector and import-competing industries. In turn, this would probably have a sizeable impact on the NEI's calculations, and on the calculations shown here.

Finally, it should be pointed out that the NEI calculations and those shown here do not assume that the project will have any special impact on public expectations. Taking such effects into account, it is conceivable that the project, and thereby the monetary policy response to it, will have a somewhat different impact from that assumed here. One example could be that expectations of a positive income shock could serve to increase demand in the economy by

more than the equivalent of the direct impact of the construction phase, and this effect could be felt before the actual construction work begins. The monetary policy stance could therefore need to be even tighter than stated here. It is important to bear in mind the enormous scale of this construction project, and the difficulty of evaluating its effects using models based on historical data, since there is little in the way of precedents. Nobel Prize winner Robert Lucas, for example, has pointed out the limitations of conventional macroeconomic models for assessing the impact of economic shocks which are likely to have a major impact on public expectations.