Refinancing Rate as an Impact on Global Economic Development

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***Abstract*—The article is devoted to the problem of understanding the role and application of refinancing of banking systems in order to stimulate economic growth. Differences in the impact of refinancing instruments of central banks on the economic performance of 13 countries are considered. Countries with different levels of economic development and different banking systems, as well as refinancing mechanisms were selected for the study. The article assesses the possibility of central banks' impact on GDP and GNI by changing the refinancing rate. In this way, an attempt was made to contribute to the discussion on the role of refinancing of central banks in the development of the country's economy and industry. In order to obtain the results, the authors used a new mathematical analysis apparatus, taking into account aspects of the quality assessment of the impact of monetary policy instruments on macroeconomic indicators not taken into account in classic econometric models The authors suggest that the main instrument of influence on economic indicators is behavioral responses, rather than the fact of changing the refinancing rate. Excessive information openness to the instruments used to implement monetary policy leads to predictable behavioural responses.**

Keywords—refinancing rate; GDP; monetary policy; GNI; economic development

I. INTRODUCTION

Changing the parameters of this instrument by the central bank is an important aspect of refinancing, as the private sector receives a signal that there has been a change in the current monetary policy targets. Through the refinancing mechanism, the authorities also set an interest rate target for the financial market. The most striking examples of the signaling function of refinancing are the Reserve Bank of India and the Bank of Russia, where the refinancing rate is an indicator, not a financial instrument.

The refinancing mechanism has two drawbacks. Reports of changes in the terms of refinancing of the banking sector may be misinterpreted by market participants. Frequent adjustment of the refinancing rate also leads to excessive volatility of money market rates, which leads to unplanned changes in refinancing volumes and cash supply. The result is a weakening of the effectiveness of monetary policy.

The authors believe that it is particularly important to identify correlations between the refinancing rate and the economic development indicators of a number of countries and their characteristics in order to determine the role of refinancing instruments in achieving economic growth.

II. LITERATURE REVIEW

Reference [1] analyzes the reaction of the issue and the prices of monetary policy shocks at various intervals (3 to 60 months). On the basis of this, they formed an idea of the behavior of variables at different time segments. In the short term, output growth was revealed after a restrictive shock, which contradicts the theory that output should be reduced. In the medium term, according to the author, in most cases output falls.

Reference [2] believes that the change in the credit policy of commercial banks affects the equilibrium of lending volumes and therefore affects the volume of investment and output in the economy.

Reference [5] found no impact of quantitative easing in a number of countries (Japan, England, Europe) on GDP growth and expresses fears that this measure will cause inflation and give the impression that the constant pumping of money into the economy is normal and can lead to moral risk.

Reference [8] uses the BVAR (Bayesa Vector Autoregression) model, which includes monthly GDP data, consumer price index, asset prices and long-term rates, and demonstrates that buyback assets reports have a statistically significant impact on prices and GDP in both the US and the UK.

Reference [11] has proven that expanding the coverage of central bank interest liabilities increases well-being. These results are important not only for U.S. monetary policy, but also for any monetary policy per se.

Among the most notable studies on non-traditional effects on macroeconomic variables is [6] that provides evidence in favor of the moderate positive effects of such unconventional U.S. actions on GDP and a smaller impact on inflation.

Reference [4] believes that U.S. monetary policy affects output in China.

Reference [3] claims that monetary policy in China has some impact on future inflation and real output. Changes in the interest rate have little impact on both the level of inflation and the real output.

Reference [7] confirms that the ECB's unconventional methods have led to an average increase in output and inflation. They also provide evidence that smaller output gaps and higher inflation were caused by unconventional regulatory practices in the US, UK, Japan and the euro area.

III. RESEARCH METHODS

A. Mathematical Model

A mathematical apparatus based on econometrics is used to obtain forecasts and to establish the influence of some factors on others. At the same time, the creation of regression models is used both for interpolation and for approximation of data.

Interpolation in this case is seen as the task of establishing dependencies and correctly determining the values of the dependent variable of interest to the researcher on the "internal" currents of many values of independent variables describing control factors. Approximation in this case is used to predict a dependent value.

Thus, to determine the impact of a change in one (X) on another (Y) function is usually built

$$Y=f(X, z1, z2,\ldots zn)$$

where Y - study macroeconomic indicator, X - a monetary policy tool, which is implied as a control parameter, z1, z2,..., zn - a set of factors that allow to predict Y adequately.

In the case of a successful modeling result, the authors point to y's dependence on the x control variable under conditions defined by z1, z2,..., zn.

However, there are a number of drawbacks to this approach of dependency. First, the presence of z1, z2,..., zn factors indicates that the X factor may not be guiding. Second, econometric dependencies establish a dependency of factors, but do not allow for a management (unless there is a precise lag of changes in one quantitative value relative to another). It should be called the X factor guiding if its changes in a certain direction leads to a change in the led parameter in a predetermined zone.

The following approach is used to determine how monetary policy tools influence macroeconomic performance.

To establish the fact of the existence of management, we will build correlational dependencies depending on the time setting. The correlation function is determined for each moment of t time, which is the correlation ratio of the two factors over a period of time T from the [t, t+Δ], Δ=3 years;

$$F=F(t, \Delta)=Corr(\{xt, xt+1/12, xt+2/12,\ldots,xt+ \Delta\}, \{yt, yt+1/12, yt+2/12,\ldots,yt+ \Delta\})$$

The Corr designation refers to the operation of calculating the selective correlation of the two sequences.

The use of this approach is limited in those time intervals during which there is no change in the values of the monetary policy indicator. Indeed, if the behavior of the macroeconomic indicator under study is changing and there is no change in the monetary policy in the same period, it can be considered that this monetary policy indicator is not control.

However, the established values of monetary policy can be basic or background, guaranteeing the trend of economic performance dynamics. Thus, in order to interpret the results, it is necessary to assess the "credibility" of the model's conclusions, taking into account the fact that the monetary policy indicator changes over a three-year period. If there have been no changes during this period, it makes no sense to consider the issue of controllability.

Similarly, if the implementation of "control " (i.e. changes in the monetary policy indicator) the macroeconomic indicator under study does not change its trend and dynamics, that is, does not respond to disturbance, and the schedule of correlation lies in values (in bands of about 1 or 1), we believe that the conclusion about "controllability" is not correct. In this case, the "negative" correlation results observed at this time interval, such as changing the function sign, approximating the graph to zero, are not significant. To obtain an adequate analysis, we provide graphs of the dynamics of monetary policy indicator.

The selection of the period during which correlation dependence (3 years) is considered is explained by the following. Average, cleared from random fluctuations, GDP dynamics is described as an exponential function. for a short period of time, the exponential curve at insignificant GDP growth rates is well approximated by linear function. This means that the change in the factor responsible for the monetary policy tool will be fixed by the correlation factor. (Indeed, the non-linear effects "noise" the correlation effect as an indicator of the dependence of two values and the value of 1 cannot be achieved even in the case of functional dependence of two values associated with nonlinear function).

On the other hand, some sustained GDP growth can be considered normal. Its reduction will indicate the problems of the economy, and its deviation in a large way means successful development and good economic conditions. Such a deviation for geopolitical reasons would be rather temporary, and therefore, the task of managing the monetary policy instrument to achieve such a goal was not set by the State. Therefore, there can be only two tasks: the first is to reach some economically sound rate of GDP growth, and the second is a correction of the indicator, which deviated from the reasonable rate of GDP growth.

B. Economic Interpretations of Possible Modelling Results. Possible Results and Their Interpretation

The ideal result is a situation when the graph of the function F=F(t, Δ) will oscillate in the vicinity of one (less than one) or minus one (more than minus one). This means that at all the time period t on which the graph is plotted, the X factor is controlling. Depending on the position of the graph, the impact is either positive (with the increase in the magnitude of X, the Y indicator also increases, with the decrease of X, the Y rate decreases), or negative (with the increase in the magnitude of X, the indicator Y decreases, with the decrease of X).

The worst result is high-amplitude oscillation in a band containing both a set in a negative and a positive half-flat. This means that variable X cannot be selected as a control variable. Even if the function value module is close to 1 at some point, it will be impossible to accurately predict the moment at which the oscillation wave will move the chart to another half-plane. Practically, this will mean that the control taken leads to exactly the opposite results.

The economic interpretation of this phenomenon is described by a situation in which the indicator at some point "reacted" to the change of the tool, but was then adjusted. If during this correction there were additional changes in the instrument, in the case when these changes were not expected, they were ignored, and if the economic situation could allow an available explanation for the change in the rate refinancing,

then there was a resonance effect, which did not allow fluctuations of correlation function to fade for a long time.

If part of the graph at some t values is in a positive half-flat of Y>0 and close enough to the unit, and then the graph of this function becomes negative for a long time, it indicates that for some time the control is significant. Further, as a result of the change in external conditions, the level of such control changes. (This is also true if the graph from the set of {Y<0} goes to the {Y>0}). Poorly interpretable is a situation in which graphs fluctuate around zero. This indicates that values do not correlate and management is not observed or significant.

If the graph "broke" the t axis and then returned to the previous localization area, it means a lack of information. We will ignore such "jumps" of the graph, assuming that the temporary deviation is a correction of the macroeconomic factor or the effect of poor information.

C. Analysis of the Raw Data

We selected 11 countries for the study: The United States, Japan, Norway, South Africa, Brazil, the United Kingdom, Canada, China, Australia and India. Countries with different levels of development of both banking systems and economic systems were selected. Data from the central bank websites of the above countries were used for analysis and were subject to the following changes.

The data on refinancing rates were presented in the monthly cut. GDP data are quarterly. To bring the data to one cut, the missed periods were filled by the last significant. The data period was selected from January 1, 2000 to January 1, 2017. (Later results for some countries were unavailable by the time the study began.)

Data pairs (refinancing rate; indicator) must be pre-selected. The correlation ratio for each pair must be calculated at a time interval from January 1, 2000 to January 1, 2017. If its value is smaller than the specified threshold module, the pair is excluded as irrelevant for further analysis.

This selection is based on the fact that researchers adopting classical methods of correlation analysis have also abandoned such material.

The study selected data on local currency GDP for New Zealand, Norway, Brazil; on U.S. dollars GDP for Canada, USA, India; on real GDP for South Africa, Australia; on GNI in local currency for Brazil, the UK; U.S. dollars GNI for South Africa, India; on U.S. dollars GNI per capita for Canada.

IV. RESULTS OF THE STUDY

A. Preliminary Analysis Results

Preliminary analysis of the data identified the following pairs (refinancing rate; indicator) with a threshold of 0.7:

- Refinancing rate and GDP for New Zealand, Norway, Canada, USA, South Africa, Brazil, India, Australia.
- Refinancing rate and GNI for Canada, South Africa, Great Britain, Brazil, India.

B. Impact of Refinancing Rate on GDP or GNI

The study identified certain patterns in some countries. Thus, the behavior of the graphs of the dynamics of the correlation of the refinancing rate and GDP (GNI) for New Zealand, Norway, Canada, the USA, South Africa, Brazil, Great Britain were determined by oscillation.

When specifying the degree and nature of the impact of the refinancing rate on GDP (GNI), we identified time periods during which correlation dependence was high (by module). In these intervals, we clarified whether this correlation value was the result of the rate dynamics.

The results of the study are presented in Table.1.

The time period table describes a boolean variable (yes/no) indicating the presence of a rate change in that period or absence.

TABLE I. THE STUDY OF CHANGES IN RATES FOR "SIGNIFICANT" CORRELATION

Country	Indicator	Positive Correlation	Negative Correlation
New Zealand	GDP (volume)	**2002-2006(yes)** 2011-2012(no)	**2013- 2018(yes)**
Norway	GDP (volume)	**2004-2008(yes) 2015 -2018(no)**	2001-2002(no) **2009-2011(no)**
Canada	GDP at current prices	**2003-2005(no)** 2009(no)	-
Canada	GNI per capita	**2003-2005(no)** 2009(no) **2012-2014(no)**	-
USA	GDP (volume)	**2002-2005(yes) 2013-2018(no)**	-
SA	Real GDP	2010-2011 (no)	2002-2003 (yes) 2005-2006 (no) 2008-2009 (yes) 2013 (no)
SA	GNI (volume)	**2004-2007 (yes)**	**2001-2004 (yes) 2008-2010 (yes)**
Brazil	GNI (volume)	2000-2001 (no) 2009 (no) **2012-2014 (yes)**	2004-2005 (no) 2010-2011 (no) **2015-2018(yes)**
Brazil	GDP (volume)	2000-2001 (no) 2009 (no) **2012-2014 (yes)**	2004-2005 (no) 2010-2011 (no) **2015-2018(yes)**
Great Britain	GNI (volume)	2000-2001 (no)	2002-2003 (no) 2005 (no)
Australia	Real GDP	**2001-2006 (no)** 2009 (yes)	**2010-2018(yes)**
India	GDP (volume)	-	**Constant negative correlation from 2000 to 2018 (yes)**
India	GNI (volume)	-	**Constant negative correlation from 2000 to 2018 (yes)**

*The bold font in the table highlights the longest periods during which the correlation ratios of the refinancing rate and the country's economic growth rates were significant.

In general, the analysis shows the following features of correlations between refinancing rates and GDP and GNI.

The graph of the correlation factor between the base rate of lending and GDP in New Zealand oscillated. Examining the correlation between refinancing rates and GDP and GNI in Norway, it can be noted that from 2001 to 2002 and from 2009 to 2011, Norway has a strong inverse relationship between rate and GDP. Between 2004 and 2008 and 2015–2018 there is a direct strong correlation.

In Canada, there was a high direct correlation between the refinancing rate and GDP between 2003 and 2005, as well as GNI per capita. There is also a significant direct correlation between the refinancing rate and GNI per capita in 2012-2014. It should be noted that the refinancing rate has no significant changes during this period.

A significant direct correlation between the Federal Reserve rate and GDP in the United States can be noted between 2002 and 2005 and from 2013 to 2018.

In Brazil, the dependence of refinancing rates and GDP and GNI is positive in 2012-2014 and then shifts to negative from 2015 to 2018. During these periods, the refinancing rate changed. This indicates the impact of the rate as a driving factor in economic decisions with certain consequences recorded in the calculation of GDP.

It can be concluded that there is a strong inverse relationship between the key rate and GNI in South Africa between 2001 and 2004 and from 2008 to 2010, as well as a positive correlation in 2004-2007. At the same time, there has been a change in the refinancing rate.

The relationship between the refinancing rate and GNI in the UK is short-lived. However, between 2000 and 2001 the correlation was positive; the whole of 2000 it was at 0.9. However, in 2002-2003 and 2005 the relationship was reversed at the level of 0.8.

When examining the dynamics of the GDP and refinancing rate correlation in India, we get a clear result indicating a negative correlation.

The dynamics of the change in the refinancing rate and Australia's GDP are characterized by two temporary periods: from 2001 to March 2005 and after October 2009. If in the first time period we see a steady positive relationship, in the second this relationship is negative.

The authors consider it necessary to note the lack of correlations between refinancing rates and GDP and GNI indicators in European countries such as the Czech Republic and Sweden, as well as in Japan and China, as evidenced in [5].

The authors confirm studies by [9, 10] about the lack of value of the Monetary Policy of the Bank of Japan in stimulating the economy, as well as [3] that the rule on interest rates has no effect expectations of inflation and real output, and changes in the interest rate have little impact on both inflation and real output.

V. CONCLUSION

To sum up, it can be concluded that in most of the countries analyzed (except perhaps India), the refinancing rate cannot be considered a factor in managing GDP dynamics. This does not mean that changes in the rate do not lead to a change in dynamics. Changing the rate without taking into account other factors does not guarantee the achievement of the benchmarks of GDP dynamics.

The fact that at different time intervals after a certain change in the rate we observed completely different scenarios of changes in GDP dynamics, and the change in GDP dynamics could have taken place without the participation of the change in the rate indicates the need to take into account other factors, explaining the development of scenarios. This points to the need for a clear analytical approach to identifying a combination of factors in a large number of economic agents. Consequently, the mechanism of participation of such a monetary policy instrument as the refinancing rate in the management of GDP dynamics is based on the principle of behavioral finance: if market participants are trained with a certain set of signals make the same decisions, such signals will control the generalizing performance indicators of these decisions.

At the same time, there may be a different correlation between changes in the refinancing rate and changes in GDP and GNI, based on the ultimate monetary policy objective. It is the ultimate goal of monetary policy at a particular stage of economic development that is important, it can be either achieving a certain level of inflation or economic growth.

The authors also suggest that if the financial market is well developed and the economy is open, there are a number of significant factors that influence the achievement of economic growth in addition to the refinancing rate. With regard to the refinancing rate, behavioral responses are probably the main instrument of impact on economic performance, rather than the fact that the refinancing rate has changed. Excessive information openness to the instruments used to implement monetary policy leads to predictable behavioral responses.

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