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Negative Interest Rate Risk. Atavism or Normalization of Central Banks' Monetary Policy

Abstract: In the face of the global financial crisis, central banks have used unconventional monetary policy instruments. Firstly, they implemented the interest rate policy, lowering base interest rates to a very low (almost zero) level. However, in the following years they did not undertake normalizing activities. The macroeconomic environment required further initiatives. For the first time in history, central banks have adopted Negative Interest Rate Policy (NIRP).

The main aim of the study is to explore the risk accompanying the negative interest rate policy, aiming at identifying channels and consequences of its impact on the economy. The study verifies the research hypothesis stating that the risk of negative interest rates, so far unrecognized in Theory of Interest Rate, is a consequence of low effectiveness of monetary policy normalization and may adopt systemic nature, by influencing – through different channels – the financial stability and growth dynamics of the modern world economy.

Keywords: negative interest rate risk, negative interest rate policy, non-standard monetary policy, modern central bank

JEL: E52, E58, G21

1. Introduction

In response to the global financial crisis, central banks of the modern world economy have implemented unconventional monetary policy instruments, widely analyzed in research works and publications (Sotomska-Krzysztofik, Szczepańska, Pawliszyn, 2004; Bini Smaghi, 2009; Borio, Disyatat, 2009; Murray, 2009; Pyka, 2010b; Przybylska-Kapuścińska, 2012a; Cour-Thimann, Winkler, 2013; Pyka, Nocoń, Cichorska, 2016; Nocoń, 2016; 2018). These instruments are still in use, despite the world economy entering the path of economic growth. The lack of central banks' monetary policy normalization expected in the global economy, along with the concept of *exit strategy*, is an important justification for this problem's further development.

The negative interest rate risk is the main subject of this research. In the initial period of the global financial crisis central banks of modern world economy have implemented rapid and significant interest rate cuts, bringing them to a near-zero level in the short term. Some of them decreased base interest rates below this limit, expecting higher effectiveness of their extraordinary monetary policy. Return to their normalization is not only difficult, as the past experience of the largest central banks, including the Fed, Bank of Japan or ECB shows, but again it generates risk within the financial system and the economy.

The main aim of this study is to explore the risk accompanying the negative interest rate policy, aiming at identifying channels and consequences of its impact on the economy. The content of the article was subordinated to the above objective. Firstly, previous scientific achievements within the Theory of Interest Rate have been analyzed, searching for the fundamental principles of the negative interest rate policy. Next, the premises accompanying implementation of negative interest rates are evaluated, constituting an important basis for drawing conclusions and formulating recommendations in the field of monetary policy normalization.

Subsequent points of the study concentrate on the characteristics and features of various risk types connected to negative interest rates, their consequences and an impact on financial system and the real economy. The summary focuses on the indication of particular areas for monitoring and possible methods of negative interest rate risk assessment that can be used in empirical research.

The study verifies the research hypothesis stating that the risk of negative interest rates, so far unrecognized in Theory of Interest Rate, is a consequence of low effectiveness of monetary policy normalization and may adopt systemic nature, by influencing – through different channels – the financial stability and growth dynamics of the modern world economy.

2. Literature review

The level of interest rates within the economy and a mechanism of their regulation are the subject of analysis of many economic theories. In classical economics, an interest rate was the remuneration for usability that brings lender the last monetary unit in the last use and was treated as the real economy value, dependent on a level of investment and savings in the economy (Turgot, 1927: 73; Caminati, 1981; Szydło, 2005: 53).

A particular development within the Theory of Interest Rate is connected with the Keynesian concept of liquidity preference (Keynes, 1936; Duwendag et al., 1995: 55). J.M. Keynes defines an interest rate as a price that balances supply of money with demand for money. Therefore, the interest rate level determines whether demand for money and money supply remain in equilibrium. In Liquidity Preference Theory, the explanation of changes in the interest rate level is reflected in the structure of demand for transactional, precautionary and speculative money. However, speculative money resources in the economy were mainly associated with an interest rate (Duwendag et al., 1995: 56–59). Therefore, the Keynesian Preference Theory considers an interest rate, as opposed to classical economics, as a monetary (financial) and macroeconomic category. Supply of money is determined exogenously by a central bank, while demand for money – reported by economic entities and dependent on their expectations about the direction of changes of market interest rates – adapts to the level of money supply. A central bank, by changing money supply, has a significant impact on the interest rates level. However, in the Keynesian theory, a liquidity trap is acceptable if changes in money supply are unable to influence the interest rates level. This is why, a central bank should conduct a “prudent” money supply changing policy, appropriate to the course of the business cycle (Jędruchiewicz, 2013: 3–10).

The development of neoclassical theories, alternative to Keynesian economics, has contributed to the enrichment of knowledge about interest rates and their mechanism in the economy. The new version of Quantity theory has been developed by Milton Friedman in the demand for money analysis (Friedman, 1959). In this theory, the nominal value of total assets of a specific economic entity includes all financial and tangible assets, giving the basis for an analysis of the interest rates structure and bringing it into the microeconomic dimension (Duwendag et al., 1995: 64). In Friedman's theory, an interest rate on the entirety of assets, understood as the weighted average of rates of return from various forms of deposits, is an unobservable amount. On the other hand, assuming that in the process where economic entities are choosing the structure of assets, a real interest rate plays an important role. The relation between this rate and a nominal interest rate expresses the expected price growth rate, the so-called *inflation rate* (Friedman, 1963). That is why, conclusions from Friedman's Theory of Demand for Money

are varied. However, they result in a reduction of the interest rates' role as a monetary policy parameter. M. Friedman points out two main reasons for abandoning the monetary policy based on the use of interest rate changes in order to impact the economy. Among them he includes problems related to the determination of a natural rate of unemployment level, conditioning an increase of interest rates and delays occurring in monetary policy. On the other hand, the Theory of Demand for Money emphasizes the importance of inflation in achieving economic balance and macroeconomic parameters (Sławiński, 2011: 30–32).

The further development of economic theory has undoubtedly contributed to the enrichment of knowledge about interest rates, although it did not clearly explain their essence and mechanism of changes. An interest rate remains a multi-functional category, dependent on a number of primary variables. In the microeconomic plane, an interest rate is a price that a debtor has to pay to a creditor for temporary transfer and use of an asset value in a fixed period or for temporary transfer of monetary value of capital (Jajuga, 2007: 13, 65; Pyka, 2010a: 70–71). On the macroeconomic scale, based on the Theory of Money, interest rates shape the level and structure of savings and investments within the economy, impact the consumer demand and the level of corporate profitability, affect the level of production, employment and national income, but also regulate the demand for credit money and express the value of domestic money, remaining in close correlation with the exchange rates level (Pyka, 2010a: 70; NBP, 2011).

Thus a central bank, determining money supply, not only decides about its level, but through the demand for money adjustment mechanism, determines the structure of interest rates in the economy (Gruszczyńska-Brozbar, 1997). It affects money supply through changes of the short-term interest rates, which – in time – are followed by the long-term interest rates. By assumption, the short-term nominal interest rates level should fluctuate around the natural interest rate (Pyka, Nocoń, 2017a: 187). However, although the natural interest rate is a theoretical and unobservable value, its amount is determined by the real interest rate, at which inflation is stable. On the other hand, each deviation of a nominal interest rate (market, short-term interest rate) from the natural interest rate, changes inflation expectations in the economy, by launching a mechanism of changing the term structure of interest rates. The reason for this is that the long-term interest rates level is largely a reflection of expectations regarding future average short-term interest rates level. Thus, the structure of short- and long-term interest rates reflects financial markets' expectations about future inflation and central bank's monetary policy (Sałata, 2011: 239). However, when the natural interest rate deviates strongly from nominal, market interest rates, the mechanism of direct central bank influence on short-term interest rates is considered to be defective (Pyka, Nocoń, 2017a: 186–187).

Central banks determine indirectly and directly a level of short-term base rate. Designating it indirectly, they control supply of bank money, to which demand for

money should adapt at an acceptable real interest rate level. However, in the 90s, the relation between monetary aggregates (money supply) controlled by central banks and price level dynamics (inflation) was disturbed, due to the rapid development of banking products. For this reason, central banks used basic interest rates as a direct instrument to control real cost of bank loans. By reducing basic interest rates, central banks expected to decrease the cost of loans, in particular when a reduction effect was strong enough to outweigh the possible drop of inflation expectations.

Thus, a base interest rate became an important, if not the main, instrument of modern monetary policy. Central banks, lowering or increasing a short-term interest rate, make a choice between better inflation stabilization and worse production stabilization, or vice versa (Pyka, Nocoń, Cichorska, 2016: 66–67).

Until the global financial crisis, central banks – under the standard monetary policy – pursued interest rate cuts policy, never decreasing their nominal threshold below 2% or less. This level of interest rate was considered as safe, due to the fact that in conditions of high uncertainty, central bank's decision to lower interest rates could cause a risk of deflation (Ahearne et al., 2002; Bernanke, 2002; Rzońca, 2014: 19) and limit central banks' ability to stabilize the economy through short-term interest rates, increasing the volatility of inflation and production (Brzoza-Brzezina, Kolasa, Szetela, 2015: 5). In the BRIC countries (Brazil, Russia, India and China) as well as in emerging or transition countries, interest rate reductions were a direct effect of monetary policy tightening and were a method of controlling the level of economic inflation (Szelągowska, 2013: 593). On the other hand, central banks in the United States, in the United Kingdom and in Japan maintained interest rates at low levels, attaching more importance to stimulating economic growth and employment (Szelągowska, 2013).

During the global financial crisis, central banks drastically reduced the level of base interest rates at a rapid pace and almost simultaneously, in order to deal with financial instability and recession of the global economy of the 21st century (see Chart 1).

Central banks have maintained interest rates close to zero, also in a long run, because they have not withdrawn from their non-standard monetary policy so far. Indeed, it is assumed that they will return to pre-global financial crisis monetary policy, considering *exit strategies'* assumptions, set by the Financial Stability Board in 2009 (Financial Stability Board, 2009), however the stepwise nature of monetary policy normalization does not guarantee a rapid change of their attitudes to Low Interest Rate Policy (LIRP) (Nocoń, 2018). At the same time, taking into account that the Zero Interest Rate Policy (ZIRP) of the largest central banks affects the level of interest rates of other central banks of the modern world economy and that some central banks have even implemented negative interest rates (Negative Interest Rate Policy, NIRP), Theory of Interest Rate undoubtedly requires updating and extensive empirical research.

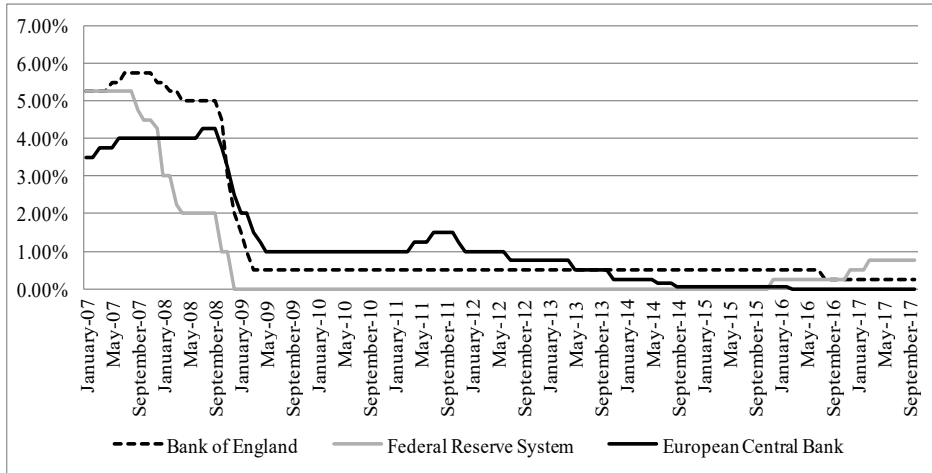


Chart 1. Base interest rates of major central banks in the world in the years 2007–2017

Source: own work

In the theoretical plane, it is undoubtedly important to resolve the “normality” paradigm of modern monetary policy. So far, it has not been decided whether “normality” is a conviction about the rightness of the old economic models, and the “new normal” is their rejection, which allows one to observe many new phenomena that were absent in the past models (Solarz, 2017: 25) or if there is a serious risk that unconventional monetary policy actions will become a conventional response to recurring crises (Rzońca, 2014: 18). Assessing empirical research relating to the environment of low or negative interest rates (Borio, Gambacorta, 2017; Borio, Hofmann, 2017; Kurowski, Rogowicz, 2017: 195–206), one can get an impression that unconventional interest rate policy becomes policy of normality. The adopted assumptions have become a confirmation of this normality, which refers to a full acceptance of the nature of research and assessment of the consequences of negative interest rate environment in the financial system and modern economy. Taking into account that the pre-crisis monetary policy lacked the symmetry between lowering and raising of the interest rates, the framework of monetary policy conducted after the outbreak of the global financial crisis may be treated as an extension of the unconventional way in which it was conducted before the crisis (Rzońca, 2014: 18).

In the background of monetary policy normalization, it is necessary to clarify whether the objective of low and then negative interest rates is determined solely by the fear of deflation. Does the “excessively” low level of interest rates always make it more profitable to keep money in cash rather than in the form of deposits, and does the low cost of holding high liquid reserves by banks lead to a sharp drop of monetary multiplier? And finally what is the cost of deflation and whether

in any case it is a serious limitation of the Low (but Positive) Interest Rate Policy conducted by central banks (Rzońca, 2004: 38)? After all, a very important problem of the normality of the modern low interest rate policy is the role of *quantitative easing* (QE), implemented by central banks during the global financial crisis to strengthen the effect of the drastic reduction of main interest rates. QE policy has broken the assumptions contained in the Jackson Hole agreements that central banks should not control financial asset prices, and therefore try to break asset bubbles, although they have the ability to prevent their effects (Pyka, 2010a: 67; Clarida, 2012).

Exploration of the monetary policy “normality” also requires a clear definition of the concept of central bank’s low interest rate policy. Previous central banks’ experience has shown that interest rate cuts may encounter various limitations. Therefore, as part of the low interest rate policy, the banks conduct positive, zero or negative interest rate policy (see Diagram 1).

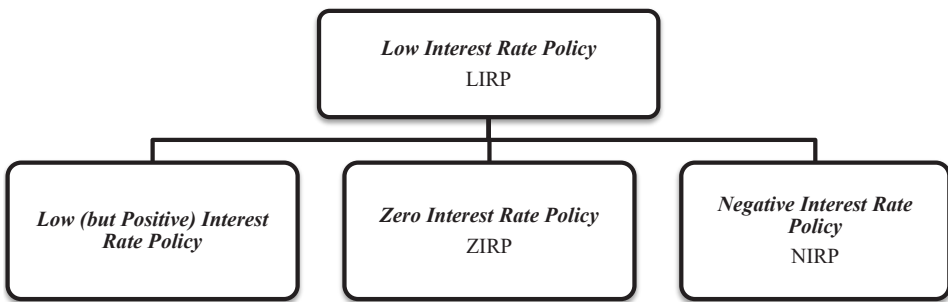


Diagram 1. The concepts of central bank's low interest rate policy

Source: own work

Low but Positive Interest Rate Policy means that the central banks aim at reducing main interest rates below the 2% level. When their level approaches 0%, central banks carry out Zero Interest Rate Policy (ZIRP) (Rzońca, 2014: 19). An extreme form of low interest rate policy, analyzed in this study, is the Negative Interest Rate Policy (NIRP), where the main interest rates are reduced even further – to a negative level. Negative Interest Rate Policy, which is the main subject of the study, is a relatively new research area, although increasingly undertaken in scientific research and publications (Kimball, 2015; Jordan, 2016; Klepacki, 2016; Palley, 2016; Angrick, Nemoto, 2017; Arseneau, 2017; Dong, Wen, 2017; IMF, 2017; Pyka, Nocoń, 2017b; 2017c; Yoshino, Taghizadeh-Hesary, Miyamoto, 2017; Nocoń, 2018). Literature studies indicate that the central banks’ motives for its implementation vary. A. Jobst and H. Lin argue that through a decrease of nominal interest rate, a central bank influences an increase of inflation expectations (in a situation of low inflation rate well below the inflation target), an increase of aggregate de-

mand (AD) and finally contributes to flattening of the yield curve. Negative interest rates can also effectively reduce a level of interbank interest rates and thus encourage commercial banks to take higher risk and restore balance of their portfolios (Jobst, Lin, 2016: 7). It is also noted that negative interest rates in a given country favor the transfer of capital to countries with higher rate of return, while counteracting appreciation of a national currency (Jobst, Lin, 2016: 7). The aim of negative interest rate policy may also include limitation of commercial banks' incentives to maintain reserves in cash at a central bank (Jobst, Lin, 2016: 38). In turn, J. Alsterlind points out that lowering interest rates below zero (overcoming 0% "threshold") is a kind of psychological barrier, the crossing of which may foster greater credit and investment activity of banks (Alsterlind et al., 2015). Ultra-low level of interest rates also promotes consumption and investment growth, as well as an increase of the aggregate demand (Jobst, Lin, 2016: 11).

Diversification of objectives of the negative interest rate policy of modern central banks, its strengthening by *quantitative easing*, or unclear limits compared to low interest rate policy are undoubtedly important reasons for assessing consequences and quantification of risk caused by it in the financial system and economy.

3. Objectives and causes of Negative Interest Rate Policy during the global financial crisis

Central banks implemented the negative level of interest rates for the first time in the second decade of the 21st century (see Table 1). These decisions questioned, the previously existing view about central banks' inability to lower nominal interest rates to a negative level (Borio, Disyatat, 2009; Przybylska-Kapuścińska, 2012b; Nocoń, 2016; Pyka, Nocoń, Cichorska, 2016)¹.

In July 2012, the central bank of Denmark (Danmarks Nationalbank), in response to deteriorating macroeconomic conditions, decided to change the marginal boundary of base interest rate (*certificates of deposit rate*) – below 0%. Moreover, following the current needs of national economies, the central banks of Sweden (Sveriges Riksbank), Switzerland (Swiss National Bank) and Japan (Bank of Japan) have also implemented negative interest rates – see Chart 2.

The main goal of the negative interest rate implementation by the central bank of Denmark was the stabilization of the Danish crown in relation to other major currencies in the world. The central bank has tried to deal with the appreciation of the Danish crown since mid-2011. The debt crisis in the euro zone has caused

1 The justification for interest rate cuts to stop at the zero level is that this gives the possibility to exchange reserves (in the case of banks) or deposits (in the case of households and companies) into cash, i.e. assets with zero interest rate.

a great interest of investors with Danish crown, perceived as a very safe currency. In order to counteract tendency to strengthen domestic currency, the National Bank of Denmark has been conducting large-scale foreign exchange purchases since August 2011. Furthermore, it decreased main interest rates due to the ECB's interest rates cuts. The differences in the levels of interest rates between Denmark and the euro zone have a strong impact on the exchange rate between Danish crown and the euro.

Table 1. Overview of Central Banks with Negative Interest Rates

Central Bank	Objective	Policy Rates (in basis points)			Date of Introduction
		Overnight Lending	Open Market Operations	Deposit Facility	
Danmarks Nationalbank	Counteracting safe-haven inflows and exchange rate pressure	5	0	-65	July 2012 – April 2014, September 2014
European Central Bank	Price stability and anchoring inflation expectations	25	0	-40	June 11, 2014
Magyar Nemzeti Bank	Price stability and counteracting exchange rate	115	90	-5	March 23, 2014
Bank of Japan	Price stability and anchoring inflation expectations	10	0	-10	February 16, 2016
Norges Bank	Price stability	150	50	-50	September 24, 2015
Sveriges Riksbank	Price stability and anchoring inflation expectations	25	-50	-125	February 12, 2015
Swiss National Bank	Reducing appreciation and deflationary pressures	50	n.a.	-75	January 15, 2015

Source: own work based on: Jobst, Lin, 2016: 6

Lack of expected results caused the Danmarks Nationalbank to implement a negative base interest rate (*certificates of deposit rate*) – at a level of -0.2% . Negative interest rate on deposit certificates proved to be an effective instrument for stopping of the appreciation of the crown. The Danish crown ceased to gain in value, and over a certain period it even lost some of its value.

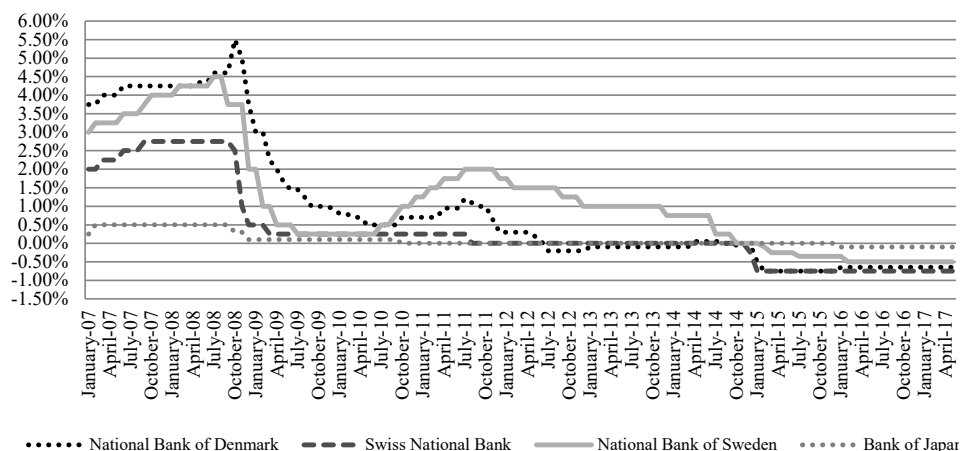


Chart 2. Base interest rates of central banks which implemented negative interest rate policy in the years of 2007–2017

Source: own work

In December 2014, Swiss National Bank (SNB) decided to reduce the base interest rate to a negative level of -0.25% for funds at the current accounts in CHF exceeding the limit of at least 10 mln CHF and set up individually for each of the central bank's counterparty. A 3-month LIBOR CHF was set between -0.75% and 0.25% . At that time, Swiss National Bank also confirmed that the minimum CHF exchange rate would remain at 1.20 EUR. This decision – just like in Denmark – was determined by an attempt to counteract strong appreciation of the national currency. In January 2015, the central bank of Switzerland unexpectedly decided to cease protection of the CHF/EUR minimum exchange rate at 1.20. It was considered that maintaining the fixed exchange rate was no longer justified, given the significant weakening of the Euro to the US dollar, which in turn caused the weakening of the Swiss franc to the dollar. Thus, the SNB has abandoned its policy of protecting the minimum exchange rate of the Euro and the Swiss franc. In addition, the central bank lowered its base rate to -0.75% again and set a 3-month LIBOR CHF between -1.25% and -0.25% . The main objective of SNB negative interest rate policy was to halt the strengthening of the domestic currency, which at the same time would weaken economy's competitiveness. The appreciation of the franc would destabilize conditions for Swiss exporters.

Sveriges Riksbank – the oldest central bank in the world, also decided to implement negative interest rate policy. In July 2009, it decreased the deposit rate to a negative level of -0.25% . The central bank's decision was determined by the fact that commercial banks preferred to keep funds at a low interest rate on a safe deposit account at the central bank rather than provide loans on the market. The

negative level of the deposit rate was maintained until September 2010. Then, the National Bank of Sweden began to increase the main interest rates. The next phase of interest rate cuts began in December 2011, along with the central bank's desire to motivate commercial banks to expand their lending, which in turn was supposed to translate into higher inflation. Decisions on systematic reductions of all main interest rates of the central bank of Sweden caused another deposit rate decrease below zero (to -0.50%) in July 2014. As a result of lower and lower interest rate policy, the basic interest rate (*repo rate*) was also reduced below zero. These operations were aimed at increasing the expansiveness of monetary policy while maintaining activity on the interbank deposit market (NBP, 2015: 4). In February 2015, the *repo rate* was decreased to -0.10% . In the following months, the Swedish central bank continued the negative interest rate policy. In February 2016, the *repo rate* was at a level of -0.50% , and the deposit rate was equal to -1.25% . The negative interest rate policy combined with the growing scale of the asset purchase program, implemented by Sveriges Riksbank, were aimed at ensuring further growth of the Swedish economy and boosting inflation to 2% (due to prolonged period of inflation rate clearly below the target). At the same time, the central bank assured that the *repo rate* would stay at a negative level as long as inflation did not reach its inflation target.

In January 2016 Bank of Japan, as the first non-European central bank, decided to implement a negative interest rate at a level of -0.1% . Interest rate cuts were aimed at inducing banks to increase lending, and thereby boost the Japanese economy and raise inflation towards the inflation target (2% per annum). The negative interest rate policy had to correlate with the BoJ's Quantitative and Qualitative Easing (QQE) program, which was largely determined by the problem of too low inflation maintenance in the economy.

Due to recession and deflationary pressure, subsequent European central banks significantly reduced their interest rates, deciding to bring the deposit rates below zero. Apart from Sveriges Riksbank, the European Central Bank and the National Bank of Hungary also implemented negative deposit rates (see Chart 3).

The lowering of the ECB *deposit rate* below zero occurred simultaneously with a drop of the refinancing rate to 0.15% , and then to 0.05% . The goal of reduction of the ECB *deposit rate* to a negative level (-0.1% in June 2014) was to increase lending activity in a banking system and create conditions for the investment of a larger part of the banks' liquid reserves outside the central bank. The *Euro Interbank Offered Rate* (EONIA) is more influenced by the ECB *deposit rate* rather than the refinancing rate. The negative deposit rate was also intended to provide medium-term price stability, which was a prerequisite for sustained economic growth in the euro area. The negative interest rate policy in the euro area was connected with monetary policy easing through the increase of the scale of asset purchases under Quantitative Easing.

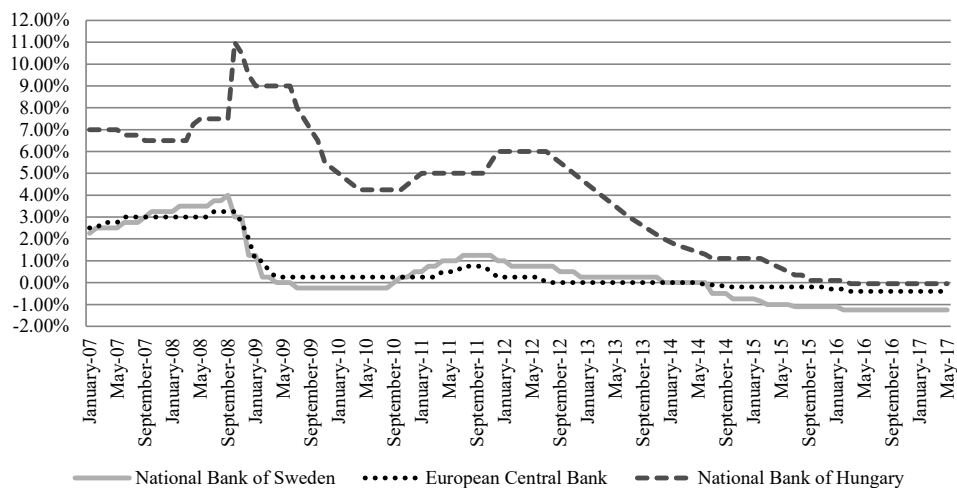


Chart 3. Deposit rates of selected central banks in the years of 2007–2017

Source: own work

National Bank of Hungary, as the first in Central and Eastern Europe, decided to implement a negative deposit rate (at a level of -0.05% in March 2016), aimed at stimulating inflation and economic growth. Inflation rate in Hungary has remained well below the inflation target which was 3% (with 1% tolerance). A too low inflation threatened lower income to the state budget from VAT and the risk of excessive government deficit.

The negative interest rate policy, carried out in the analyzed central banks of the modern world economy, was not homogeneous. Central banks were motivated by different goals:

- 1) counteracting too low inflation (European Central Bank, Bank of Japan, National Bank of Sweden),
- 2) counteracting appreciation of the national currency (National Bank of Denmark, Swiss National Bank),
- 3) mitigation of side effects resulting from the use of unconventional monetary policy instruments – Quantitative Easing policy (Mircheva et al., 2016).

Thus, the central banks' experience shows that there is a technical possibility of bringing the interest rates level below zero. Due to the existence of delays in transmission mechanism of monetary policy, it is still difficult to unequivocally assess the effectiveness of maintaining interest rates at a low level in achieving the above presented goals. All the more so because it is impossible to separate the effects of negative interest rate policy from the results of other implemented non-standard instruments, arising almost at the same time. However, it has been observed that, so far, commercial banks have only to a limited extent passed costs of negative interest rates on reserves in central banks onto the depositors. Therefore, there is no significant ex-

change of deposits into cash. It seems that this exchange could take place in the situation of further lowering of the central banks' interest rates below zero. Business entities are able to accept a slightly negative interest rate on their funds but after exceeding a certain interest rate limit, outflow of money into cash might be significant.

The secular trend of close to zero interest rates, as well as negative interest rates in the modern world economy, has a number of sometimes very specific causes. Usually, they include constantly low dynamics of economic growth internationally, lack of lasting premises for financial stability of the world economy, high systemic risk, low dynamics of economic investments or persistent deflationary threats (Bean et al., 2015). The largest central banks determine a change of attitude towards low interest rate policy from their disappearance, while countries that do not experience such economic problems (e.g. Poland) maintain low interest rates, expecting an exit from unconventional monetary policy. Differences in the approach to low interest rate policy also arise in the background of high public debt struggle within some states (e.g. some euro area countries) or fears of speculative capital inflow. This situation means that the receding outlook for return to monetary policy normalization, regardless of its target framework, favors growing risk of low interest rates in the financial system and the global economy, including the risk of negative interest rates.

4. Negative interest rate risk types and their characteristics

The negative interest rate risk is undoubtedly a new type of financial risk, which is a direct consequence of unconventional monetary policy of central banks, deciding to decrease the key interest rates below zero. In the monetary policy normalization process, the interest rates should return to their level above zero, just as in the case of positive interest rates close to zero or equal to zero. The fundamental difference in their return to normality is that, in the case of negative interest rates, this transition requires a "longer run" which may intensify their side effects. According to the Theory of Risk, these side effects accumulate over time (Fischer, 2016).

The European Systemic Risk Board (ESRB), considering an impact of low interest rate environment on the financial system, drew attention to the possibility of associated risks occurrence in two separate scenarios (ESRB, 2016):

- 1) protracted low interest rate environment accompanied by low economic growth – the Low for Long scenario (LfL),
- 2) gradually increasing interest rates in the medium term and an economic recovery – the Back to Normal scenario (BtN),

assuming that a return to pre-crisis level of interest rates implies less serious sources of risk for the financial system compared to LfL (long-term period of low interest rates and low economic growth).

Considering:

- 1) that the consequences of long-term persistence of low interest rates in the future, combined with falling rate of economic growth due to continuation of unconventional monetary policy of the largest central banks, were mostly identified,
- 2) and that only the unexpected effects of the risk are a serious systemic threat, it is difficult to share this view.

The study assumes that the threats appearing in the BtN scenario are as important as the ones appearing in the LfL scenario, if not more significant (NBP, 2016: 115). In particular, the risk of negative interest rates has a number of specific features (Klepacki, 2016: 726):

- 1) low or very low predictability of consequences that may occur,
- 2) differentiated risk materialization time (short-, medium- or long-term),
- 3) no historical reference (comparable sequence of events) in a linear approach,
- 4) it is accompanied by centralization phenomena and contagion effect,
- 5) its appearance creates many new secondary types of risk.

These characteristics make it largely an “immeasurable uncertainty” (Knight, 1921: 20), and therefore a type of financial risk in the economy that is extremely difficult to quantify and model. The key issue is undoubtedly its neutral nature, which “entails the possibility of any (not necessarily negative) deviations from the expected result” (Jajuga et al., 2015: 17). The consequences of the negative interest rate risk may partly compensate themselves and, in some cases, even completely balance themselves out. Therefore, it is extremely difficult to recognize the risk within negative interest rates environment, also potentially caused by the interest rates’ increase.

Moreover, the consequences of the negative interest rates risk are very similar to the effects of the low interest rates risk, they are very strongly related to each other and depend on procedure and nature of the “exit strategy” (Pyka, Nocoń, 2017c). Therefore, central banks’ prolongation of the low and negative interest rate policy, persisting expansionary monetary policy aimed at *quantitative easing* (new securities issuance programs), deflationary threats on a global scale but also in individual countries, or the final framework of the “new normality”, favors intensification of the negative interest rates’ effects, resulting both from a decrease and an increase of interest rates within the economy.

The main characteristic of the negative interest rate risk is also its occurrence in various forms (see Diagram 2) (Klepacki, 2016: 726–727). Therefore, it is difficult to make an *a priori* assumption that these risks do not externalize in the process of central banks’ attitude change to unconventional monetary policy, more so, that the systemic risk of the global economy is high. The risk, generally con-

sidered to be an event causing loss of economic value or confidence (IMF, 2001: 126), fosters a high level of probability of “contamination” of the global world economy with the negative interest rate risk, materializing through a wide range of combined negative interest rate risk channels.

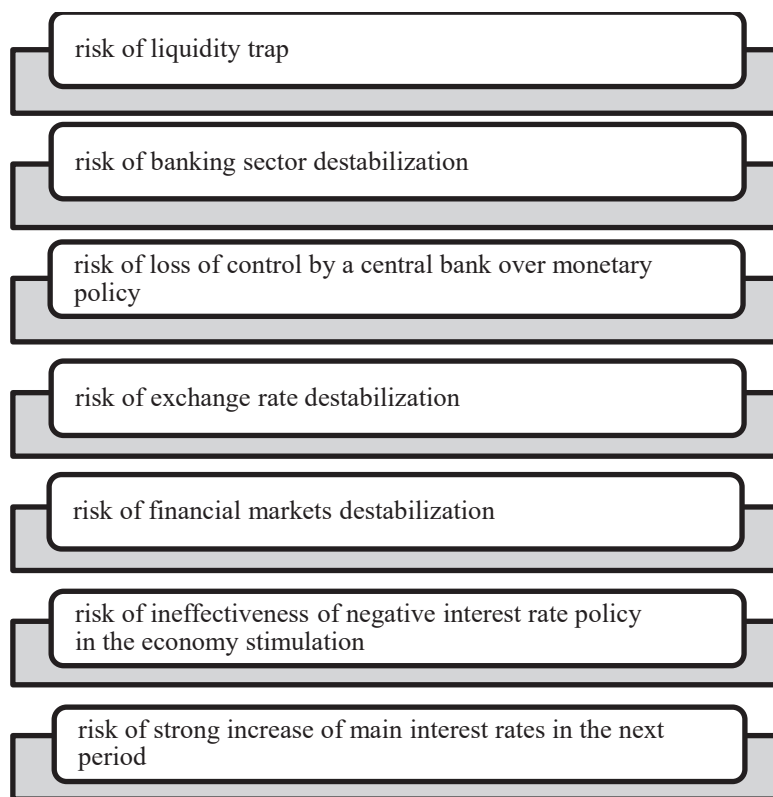


Diagram 2. Types of risks resulting from the negative interest rate policy

Source: own work

When focusing on types of negative interest rates risks, it is worth noting that the risk of liquidity trap, described for the first time by J.M. Keynes in the *The General Theory of Employment, Interest and Money* in 1936 (Keynes, 1936; Tobin, 1947: 124–131), is connected with the Liquidity Preference Theory – i.e. the tendency to keep savings in the most liquid form – in cash (Gruszecki, 2004: 181–184). This results from the unwillingness of market participants to save and deposit their funds in banking institutions. If savings were at a negative interest rate, bank’s customers would move their savings to another bank or even be willing to withdraw their deposits and keep them in cash. Thus, a negative interest rate may reduce propensity to save.

The risk of liquidity trap is inseparably connected with the risk of banking sector's destabilization. The reluctance to save and deposit funds in banks threatens the appropriate functioning of the whole banking sector. Deposits are the primary source of funding of banking activities. Lack of interest in the offer of banking institutions and aversion of market participants to use banking products, due to additional costs connected to depositing funds at a bank (a negative interest rate on deposits), first causes uncertainty among individual banking institutions and finally destabilizes the whole banking sector.

The secular trend of close to zero interest rates of the modern global economy countries makes the risk of losing control over monetary policy by a central bank an important type of negative interest rates risk. This means that one of the main or even the most important monetary policy instrument – how monetary authorities control an inflation rate – may lose its relevance in achieving monetary policy strategy's objective. At the present stage, it is difficult to precisely identify the risks. The negative interest rate policy in each country has a different nature and internal conditions. So far, it seemed that zero interest rate policy was impossible in the long run. However, the experiences of the last few years show that not only it can be implemented effectively, regulating financial stability of the modern world economy, but also it can be continued in the form of negative interest rate policy.

Negative interest rate policy may also create the risk of exchange rate destabilization. Central banks, aggressively decreasing a level of basic interest rates, focus primarily on stimulating economic activity and reducing deflation. However, they often forget about the obligation to also stabilize national currency (Klepacki, 2016: 726–727). Meanwhile, the lack of possibility of intervention rate hike favors destabilization of the currency's valuation and generates the risk of its uncontrolled depreciation.

The unconventionality of negative interest rate policy (its scope and scale) also determines – at least temporarily – the risk of modification of financial markets functioning rules. Too long lasting period of negative interest rates can interfere with the classic reaction mechanisms and market participants' activities. This, in turn, can lead to an increase of the risk of speculative bubbles on financial assets and real estate markets. As a result, the functioning of financial institutions is impaired, in particular banking institutions, and more broadly the whole banking system, due to the mismatch in such extreme and long-term levels of interest rates (Klepacki, 2016: 727). There is also a need to work out changes in valuation models, for example for currency markets, or to transform assumptions concerning correlation between different asset classes.

A negative interest rate in a long term may also generate the risk related to the reduction or total loss of the central bank's policy effectiveness in stimulating eco-

conomic growth. The consequences of its materialization may be seen based on the example of the European economy, which after the collapse in 2009, cannot enter the path of sustainable growth, despite parallel low interest rate policy and liquidity support programs for the banking sector. Lack of effectiveness in stimulating economic growth is due to market participants' conviction that it is impossible to lower the level of interest rates any further.

Finally, one of the main types of the negative interest rates risk is the risk of strong main interest rates increase in the following period (NBP, 2015: 67). Both in theory and in banking practice, it is indicated that this increase inhibits banks' lending activity and may effectively reduce profitability of banking institutions. The reasons are mainly due to growing financing cost of all economic entities – companies, but also banks themselves. The risk of banks' profitability falling is undoubtedly dependent on availability of bank capital. In the face of its shortage, the risk of collateral level of bank investment to a level recommended by prudential regulations increases. However, when there is a high level of savings on the financial markets, and the total amount of capital shortfall is low, this risk will not be significant for banking sector functioning (Pyka, Nocoń, 2017c: 23–24).

5. Channels and effects of the negative interest rate risk

Considering the central banks' declarations regarding monetary policy normalization, as well as specificity of the low interest rates risk, it should be assumed that its effects require an assessment both from the perspective of their decrease and increase in the world economy and are inherently multidimensional (see Diagram 3).

For the most part, the effects of the negative interest rate risk relate to a banking sector and credit institutions. But, this risk may also arise among individuals – essentially, households, which are connected to banks' main lending activity. However, it is discussed whether and to what extent negative interest rates should be transferred to household savings (Masiukiewicz, 2017). Maintaining interest rates in the long term at a negative level may ultimately affect a wider range of business entities. The effects of this risk can also appear in financial and public institutions. The negative interest rate risk can occur among them separately, but it can also manifest in the whole financial system (banking, insurance, investment funds system, etc.) and the economy.

Effects of the negative interest rate risk in the economy, arising as a consequence of unconventional monetary policy, materialize both through the classic channels of monetary impulses in the economy, as well as through new transmission channels, defined in the study as modern channels (see Diagram 4).

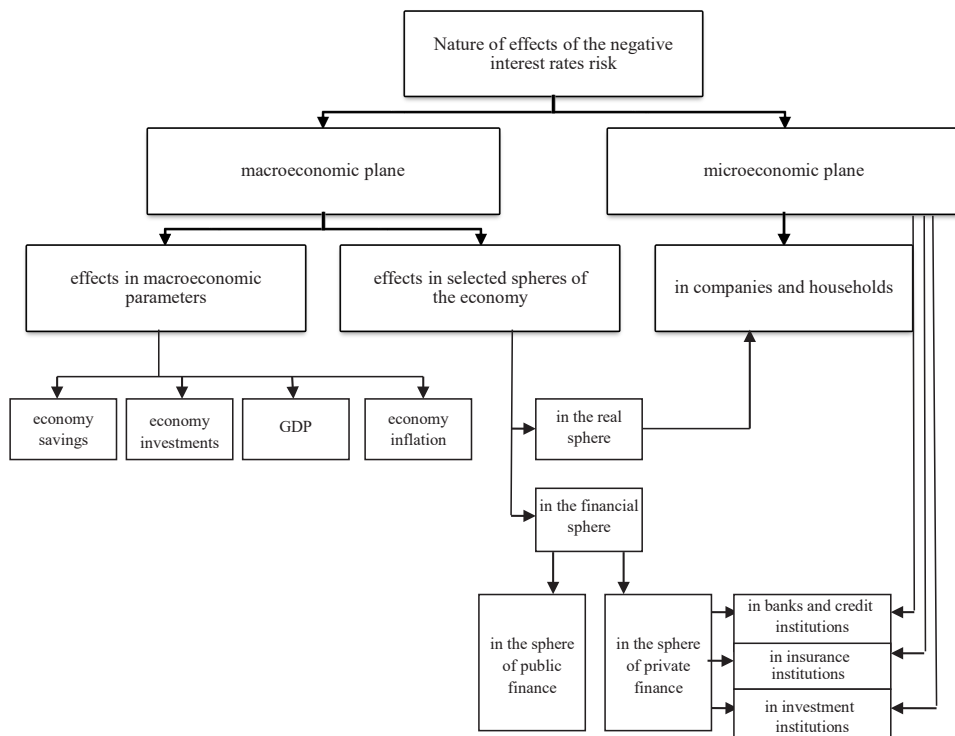


Diagram 3. Multidimensional nature of the effects of the negative interest rate risk

Source: own work

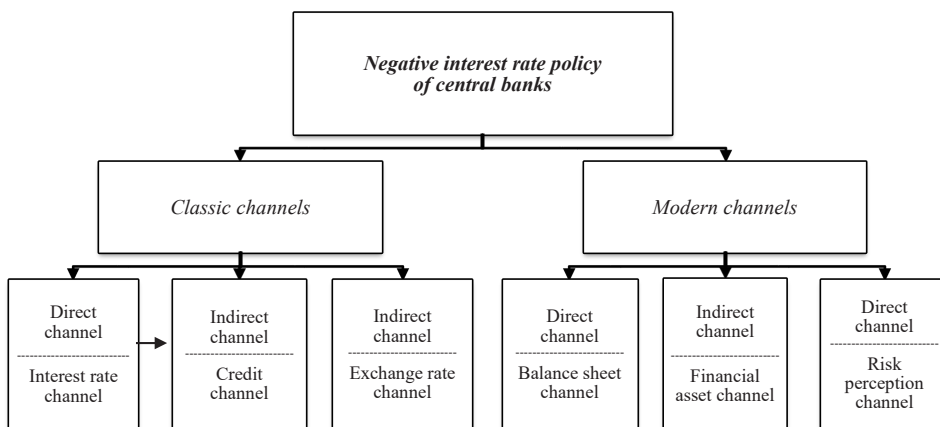


Diagram 4. Transmission channels of negative interest rates in the economy

Source: own work

These channels are very closely related to each other, although they differ in instruments and methods in which monetary impulses are transmitted to the economy. During the global financial crisis, central banks implemented significant interest rate cuts. First, they used the classic interest rate channel. They directly influenced the level and structure of nominal interest rates in banks, changed the term structure of interest rates, at the same time determining rates of return on equity financial assets, decided about the level of real interest rate and they determined profitability of domestic financial instruments compared to foreign instruments (an effect of changes in the exchange rate). However, the interest rate channel proved to be inefficient under the conditions of the global financial crisis. A significant reduction of interest rates to close to zero level did not manage to activate the credit channel and its consequences in the global economy scale. In these circumstances, majority of central banks adopted an assumption that the stimulus effect of close to zero interest rates can be achieved through combination of Treasury bonds purchases and recommendations about the future path of interest rates (Rogoff, 2016). The main justification for non-standard activities, undertaken by central banks, was firstly the classic fear of liquidity trap, and subsequently the vision of economic deflation.

However, *quantitative easing* is a specific central banks' instrument of expansionary monetary policy, focused on asset purchase from the secondary market (Nocoń, 2016: 97–99). Central banks – in diversity of transactions carried out within QE, have activated hitherto “dormant” channels of monetary policy influence on the economy. The first one can be defined as the balance sheet channel. The banks used this channel to adjust demand and supply of financial resources in the banking sector, mainly between central banks and commercial banks. Central banks, through the purchase of qualified securities from credit institutions, provided liquidity, frozen by the confidence crisis between interbank market participants. The main aim of such activity, often referred to as *credit easing*, was to facilitate the access to financing for business entities. The effect of *credit easing* should have been a reduction of risk premium that is paid by entities of the real economy.

A threat from the negative interest rate risk in the balance sheet channel is constantly accumulating. Commercial banks do not use negative interest rates for quick stimulation of lending. In the long term, disruption of an interbank market mechanism persists. The amount of money in circulation does not grow in line with central banks' expectations, and implemented negative deposit rates do not discourage commercial banks to lower the volume of reserve money (see Table 2).

Table 2. Reserve money of central banks during negative interest rate policy²

Central bank	Structure of reserve money	2012	2013	2014	2015	2016
Danmarks Nationalbank (in thous. DKK)	1) Banknotes in circulation	65804840	66491023	67337375	70166151	70923552
	2) Monetary-policy deposits: a) Net current accounts and settlement accounts b) Certificates of deposit	286671334 102.570.334 184.101.000	227357723 59.325.723 168.032.000	155078317 30.306.317 124.772.000	201795744 28.918.744 172.877.000	145128229 51.018.229 94.110.000
Swiss National Bank (in mln CHF)	1) Banknotes in circulation	61801,4	65766,4	67595,8	72881,9	78084,4
	2) Sight deposits of domestic banks	281814,1	317131,7	328006,2	402316,5	468199,2
Sveriges Riksbank (in mln SEK)	1) Banknotes in circulation	96441	85700	83224	73451	62393
	2) Liabilities to credit institutions in Sweden related to monetary policy operations denominated in Swedish kronor: a) Deposit facility b) Fine-tuning operations	26154 339 25815	21665 580 21085	14803 130 14673	70922 96 70826	144341 198 144143
Bank of Japan (in mln JPY)*	1) Banknotes in circulation	83378274,9	86630810,2	89673254,6	95594792,7	99800187,5
	2) Deposits (excluding those of the government)	58320053,3	132347720,2	206071829,0	282939643,3	356378851,3
European Central Bank (in EUR)	1) Banknotes in circulation**	73007429075	76495146585	81322848550	86674472505	90097085330
	2) Other liabilities to euro area credit institutions denominated in euro	0	1054000000	1020000000	0	1851610500

National Bank of Hungary (in mln HUF)												
1) Liabilities denominated in forint:	7 747 150	9 470 835	10 290 278	9 527 734	7 833 804							
a) Central government deposits	442 829	242 019	524 838	403 624	785 648							
b) Deposits by credit institutions	1 009 194	864 490	5 997 814	4 772 252	2 408 122							
c) Banknotes and coins in circulation	2 721 674	3 188 994	3 735 554	4 304 879	4 580 614							
d) Other deposits and liabilities	3 573 453	5 175 332	32 072	46 979	59 420							
2) Liabilities denominated in foreign currency:	2 342 660	1 455 590	1 650 694	1 407 934	1 798 115							
a) Central government deposits	935 756	509 886	550 771	416 115	544 616							
b) Deposits by credit institutions	0	571	59 096	58 378	75 866							
c) Other deposits and liabilities	1 406 904	945 133	1 040 827	933 441	1 177 633							

* As at the balance sheet date – 31 March of the following year

** This item consists of the ECB's share (8%) of the total euro banknotes in circulation

Source: own work

2 Reserve money consists of banks' cash reserves, including both reserve requirement as well as optional reserves.

Therefore an interbank market, despite drastic drop in the cost of loan capital, is constantly imbalanced. Central banks' financial risk is growing, and its effects still remain unrecognized (Pyka, Nocoń, 2017b). On the other hand financial institutions, mainly credit ones, have adjusted to the declining profitability and low interest margins. Banks did not transfer negative interest rates into deposits of business entities. However, they benefited from low costs of short-term financing of their lending activities, thus improving their own profitability. They also changed their behavior in terms of risky investment strategies (*broad-based risk-taking*) or previous existing business models. The role of financial markets in providing external financing for enterprises has also increased, and financial and economic stabilization has occurred. Therefore, the cost of returning to monetary policy normalization may be high.

During *quantitative easing*, central banks also used the financial asset channel. Through the asset purchases of various issuers, they tried to influence the reduction of market interest rates. Considering the end result that accompanies these transactions, it can be defined as the modified channel of interest rate effects.

Furthermore, the risk perception channel has also appeared among new channels of the low interest rates risk. Bringing interest rates close to zero or even below zero was a non-standard central banks' activity and it is expected that interest rates will be normalized in the process of *exit strategies* from the unconventional monetary policy. Normalization requires raising the level of the interest rates. The interest rate increase risk will materialize in the form of an increased cost of debt services for the new as well as the existing borrowers. It can also cause an increase of credit risk and a decrease of bank profits. Moreover, the risk of interest rate increase will raise market cost of business entities funding, which at the same time may cause an increase of banks' funding cost. It can also significantly increase the cost of public debt financing, thus destabilizing the financial system and the economy again. Therefore, the effects of the interest rate increase risk will be more numerous in the banking sectors, on financial markets and in the economy in the countries which have implemented the negative interest rate policy.

6. Summary. Monitoring areas and methods for assessing the negative interest rate risk

The conclusions drawn on the basis of the conducted analysis of the negative interest rate risk seem to be ambiguous, as a result of:

- 1) lack of theoretical premises for acceptance of the negative interest rates in the economy and hitherto unacknowledged deflationary effects of maintaining long-term interest rates close to zero level,

- 2) unclosed cycle of the low interest rates application in practice, and as a consequence, a significant inability to verify their effects,
- 3) neutrality of the negative interest rate risk which determines assessment of its impact on a banking system, financial markets and the economy, as well as impedes its quantification and monitoring,
- 4) modification of the channels of impact of negative and close to zero interest rates environment as well as their multifaceted nature, strongly fostering diversity of effects within the banking, financial and economic systems.

The multifaceted nature of the effects of the negative interest rate risk means that both micro- and macroeconomic sphere should be the specific areas of their assessment and quantification. Undoubtedly, in the microeconomic sphere, the most serious effects of the negative interest rate risk are related to banking sector functioning. Under negative interest rates, a strong barrier appears for market participants to accumulate deposits in banks, which directly creates a change of conditions of the banks' operating activities. Negative interest rates may also result in replacing stable sources of banks' funding by capital with higher risk. In turn, their increase related to central bank's *exit* from the negative interest rate policy will directly contribute to an increase of interest rates on loans, reduce market participants' willingness to take out new loans and change the attitude to running banking business. In these areas, assessment of the interest rate increase risk should focus at least on monitoring changes in the volume of banks' lending activities and their effectiveness. For this purpose, the methodology developed by the European Central Bank to assess banking sector stability can be used (ECB, 2009).

Negative interest rates in macroeconomic sphere may also have a significant impact on financial markets' stability. Both their decline and growth can cause high volatility of their price indicators. Therefore, Financial Stability Indicators (FSI) can be useful in the assessment of this area of the negative interest rate risk, illustrating the condition of the whole financial system, paying particular attention to financial markets (IMF, 2006). Negative interest rates on financial markets also have a significant distributional implications. Each change of main interest rates reduces propensity to save and the structure of economic savings, hence the effects of the negative interest rate risk in the macroeconomic sphere are an important area of its assessment and quantification. It should also be noted that a drastic drop in interest rates has caused an increase of intergenerational inequality, because retirement income of older people (cumulative savings accumulated during their working life) has decreased. However, an increase of interest rates does not have to mean elimination of this inequality.

The impact of the negative interest rate risk on volatility of domestic currency exchange rates in relation to major global currencies has a similar nature. Assessment of its effects is associated with their monitoring both on micro- and macroeconomic scale. Excessive fluctuation of domestic exchange rates may cause con-

sequences in cash and capital flows with foreign countries, but also in effects and changes of balance sheets of financial as well as non-financial business entities. However, exchange rate destabilization may also prove the ineffectiveness of the negative interest rate policy.

Furthermore, negative interest rates generate the risk of economic deflation in a macroeconomic scale. Therefore in the case of negative interest rates, it is necessary to monitor deviation of inflation rate from the adopted inflation target. The persistently low level of interest rates (below zero) may also limit effectiveness of monetary authorities in stimulation of the economic growth. If in theory, a reduction of interest rates favors stimulation of the economic growth, overcoming the lower bound of interest rates (below 0%) may cause the opposite effect. Indeed, when assessing the negative interest rate risk, it is important to analyze the correlation between the level of base interest rates and the economic growth rate.

In the macroeconomic plane, a high level of the negative interest rate risk is also strictly connected with public debt service. A decrease of interest rates below zero may increase the level of this debt, while, an increase of negative interest rates may cause an avalanche growth of this service's cost. Therefore, monitoring of this area of the negative interest rate risk seems to be particularly important, in order to maintain financial stability and economic growth. Undoubtedly, the conducted risk exploration, accompanying the negative interest rate policy, allowed for the confirmation of the adopted main research hypothesis. The negative interest rate risk is a consequence of low effectiveness of modern central banks' monetary policy normalization and may adopt a systemic nature.

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Ryzyko ujemnych stóp procentowych. Atawizm czy normalizacja polityki monetarnej banków centralnych

Streszczenie: Wobec globalnego kryzysu finansowego banki centralne sięgnęły po niekonwencjonalne instrumenty polityki monetarnej. W pierwszej kolejności zastosowały politykę stopy procentowej, sprowadzając bazowe stopy procentowe do bardzo niskiego (niemal zerowego) poziomu. W kolejnych latach nie podjęły jednak działań normalizujących. Sytuacja makroekonomiczna wymagała bowiem dalszych zdecydowanych inicjatyw. Po raz pierwszy w historii banki centralne przyjęły politykę ujemnych stóp procentowych (Negative Interest Rate Policy – NIRP).

Celem głównym artykułu jest eksploracja ryzyka towarzyszącego polityce ujemnych stóp procentowych, zmierzająca do analizy kanałów jego wpływu na gospodarkę i konsekwencji ich wzrostu wskutek normalizacji polityki monetarnej banków centralnych. W opracowaniu wskazuje się, że ryzyko ujemnych stóp procentowych, dotychczas nierozpoznawalne w teorii stopy procentowej, podobnie jak ryzyko stóp procentowych bliskich zeru, modyfikuje dotychczasowy paradygmat polityki monetarnej, a jego ocena – z uwagi na systemowy charakter ryzyka ujemnych stóp procentowych – wymaga monitorowania.

Słowa kluczowe: ryzyko ujemnych stóp procentowych, polityka ujemnych stóp procentowych, nie-standardowa polityki monetarna, współczesny bank centralny

JEL: E52, E58, G21

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