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Confidence in future monetary policy as a way to overcome the liquidity trap

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Abstract

The global financial crisis of 2007–2009 has changed the landscape for monetary policy. Many central banks in developed economies had to employ various unconventional policy tools to overcome a liquidity trap. These included large-scale asset purchase programs, forward guidance and negative interest rate policies. While recently, some central banks were able to return to conventional monetary policy, for many countries the effectiveness of unconventional policies remains an issue. In this paper we assess diverse practices of unconventional monetary policy with a particular focus on expectations and time consistency. The principal aspect of successful policy in terms of overcoming a liquidity trap is the confidence that interest rates will remain low for a prolonged period. However, forming such expectations faces the problem of time inconsistency of optimal policy. We discuss some directions to solve this problem.

Keywords: liquidity trap, unconventional monetary policy, time inconsistency.
JEL classification: E43, E52, E58.

1. Introduction

The global financial crisis and the ensuing across-the-board decline in aggregate demand forced central banks in leading economies to pursue active policies to prevent the compounding of the crisis and to overcome the aftermath. Reducing interest rates was a natural monetary policy reaction to the crisis. Fig. 1 below shows the basic interest rates for the U.S. Federal Reserve (Fed), European Central Bank (ECB), Bank of Japan, and Bank of England.

As shown in Fig. 1, by the end of 2012, the interest rates set by central banks in developed countries hit all-time lows, approaching zero. This made it impossible for any further significant reduction in interest rates to stimulate the economy, and

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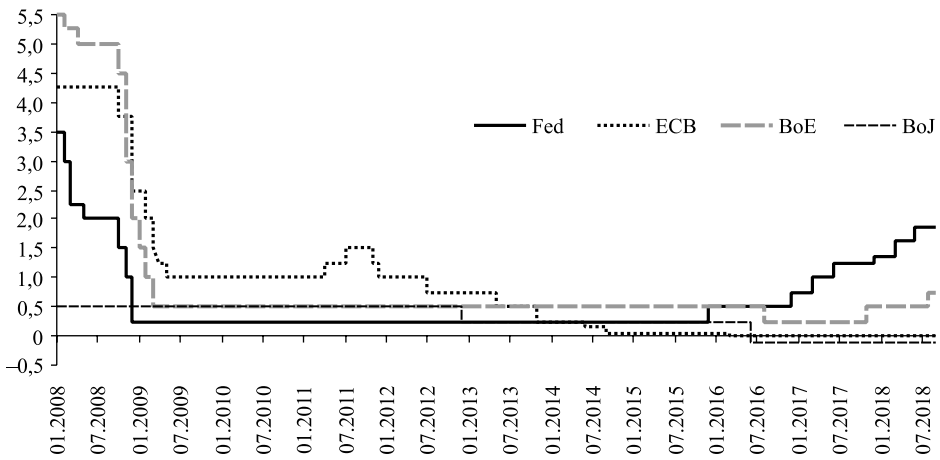

Fig. 1. Interest rates in the USA (Fed), eurozone (ECB), UK (BoE), and Japan (BoJ).

Note: Fed is the federal funds rate; *ECB* is the interest rate on the main refinancing operations; *BoE* is the Bank of England base rate; *BoJ* is the overnight call rate target.

Sources: official websites of the U.S. Federal Reserve (https://www.federalreserve.gov/), ECB (https://www.ecb.europa.eu/), Bank of England (https://www.bankofengland.co.uk/), and Bank of Japan (https://www.boj.or.jp/en/).

central banks found themselves unable to use their main monetary policy tool. This issue is known in literature as the *zero-lower bound* and is closely associated with the concept of a *liquidity trap* (see, e.g., Eggertsson and Woodford, 2003; Gambacorta et al., 2014; Hamilton and Wu, 2012; Jung et al., 2005; Svensson, 2000, etc.). In a liquidity trap, traditional monetary policy measures no longer actually work, and special macroeconomic policy measures are needed to overcome the aftermath of the crisis.

The issue of developing a macroeconomic policy under near-zero or even negative interest rates is a hot topic in modern literature (see, e.g., Rogoff, 2017). A number of aspects of this issue have been identified. *First*: low interest rates may be seen as a short-term phenomenon caused by central bank reaction to the financial crises (the 1990 crisis in Japan or the 2007–2009 global financial crisis). However, in recent years, interest rate reductions have more often been interpreted in literature as a long-term trend of the past three decades.

The structural character of interest rate reductions is consistent with the trend towards a declining natural interest rate balancing savings and investments under full-employment conditions. There are several explanations for this phenomenon. The most popular are *secular stagnation*, caused by structural shifts in aggregate demand and aggregate supply (see, e.g., Summers, 2015, 2016; Gordon, 2015; Eichengreen, 2015), and *excessive savings* in developing countries and their growing demand for risk-free assets, i.e. government bonds issued by developed countries (Bernanke, 2005; Bernanke et al., 2011; Hall, 2017; Caballero and Farhi, 2018). A growing number of empirical studies explain a downward trend in the *natural interest rate* by various global factors of increasing saving and declining investment (Del Negro et al., 2017; Rachel and Smith, 2017; Lunsford and West, 2018).

The differences in the interpretation of the low interest rate phenomenon, i.e. short-term or long-term, are important for macroeconomic policy. A temporary

reduction in interest rates may be viewed as a cyclical phenomenon. Here, the liquidity trap represents a temporary challenge for monetary policy, which is unable to stimulate the economy through traditional measures (further interest rate reduction) and needs alternative/unconventional mechanisms to increase aggregate demand. Declining interest rates as a structural phenomenon can be seen as an even graver problem for monetary policy. Indeed, it is a common opinion that central banks influence economic activity in the short-run but are incapable of countering structural changes. For example, according to the popular Taylor rule, central banks seek to shift the interest rate (upwards or downwards) from its natural level as a response to inflation and output trends. A drop in interest rates below zero not only aggravates the liquidity trap problem, but even brings into question the central bank's ability to counter this trend in the long run.

This gives rise to the *second aspect* of the problem: should monetary policy actually counter the trend towards declining and negative interest rates? There seems to be no definitive answer to this question. First of all, economic theory cannot predict the duration of low or negative natural interest rates. Second, considering alternative, potentially more effective measures to counter low interest rates (primarily fiscal policies and structural reforms) does not make the issue of implementing monetary policy secondary (see, e.g., Bernanke et al., 2019).

Going forward from here, this paper discusses the *prospects and limitations of monetary policy in escaping the liquidity trap.* We do not attempt to review all of the above aspects of macroeconomic policy in a low interest rates environment, but emphasize the two interrelated issues. Comparing the measures taken by central banks in major economies following the global financial crisis of 2007–2009 (i.e. the policy of large-scale purchases of various assets and *forward guidance* on future monetary policy), we discuss the reasons for their varying degrees of success in influencing the *expectations* of economic agents. Further, we offer a qualitative analysis of those measures from the point of view of the policy's time consistency.

Given the experience of the U.S. Federal Reserve, ECB, and other central banks, the key macroeconomic policy tools in a liquidity trap were reducing basic interest rates to negative values, large-scale asset purchases by central banks (quantitative and qualitative easing), and forward guidance on future changes in monetary policy. The effectiveness of those measures varied between developed countries. For example, as the national economy was growing, the U.S. Fed had, as early as December 2015, the opportunity to switch to a policy of increasing the basic interest rate, which might be an indication that the U.S. economy had successfully escaped the liquidity trap. The Bank of England was able to start raising the basic interest rate in November 2017, meaning that in the UK, as in the U.S., the zero-lower bound has ceased to be a significant problem. Meanwhile, basic interest rates in the eurozone and in Japan are still at their all-time lows. Effective informational policies pursued by national regulators made a considerable contribution to successfully escaping the liquidity trap in the U.S. and UK. Shaping proper expectations regarding future changes in monetary policy is a top priority task for the central bank in a liquidity trap, and can only be achieved through a well-developed information policy.

Relying on a study that showed how successfully overcoming the Great Depression was made possible by a positive shift in expectations achieved by

F. Roosevelt's policy (Eggertsson, 2008), we discuss the possible link between the varying rates at which countries escaped the liquidity trap and the different expectations of economic agents. As shown below, this may explain why similar macroeconomic policy tools were quite successful in some countries, but failed to produce the desired effect in others. To this end, we should first of all discuss the expected effects of both the traditional and unconventional monetary and fiscal policy tools used during liquidity trap episodes. The effectiveness of these tools directly depends on the expectations of economic agents. If the agents believe that a policy for overcoming the liquidity trap will be successful, and that the economy will grow and inflation will rise, the economy can be expected to recover during the current period. The reason is that in this situation, expected long-term interest rates decrease, stimulating investment and aggregate demand. If agents' expectations are negative (i.e. inflation is expected to remain low in the medium term), agents are not inclined to increase their spending, the economy remains in the liquidity trap, and macroeconomic policy fails.

The literature reviewed below demonstrates a certain consensus with respect to the parameters for an optimal monetary policy during and after overcoming a liquidity trap. This policy keeps interest rates low for a longer period than that in which the economy remains in the liquidity trap. In this case, the agents can expect long-term interest rates to decline, stimulating economic activity and aggregate demand. The main problem with this policy is that it is difficult to implement due to its *time inconsistency*: central banks have incentives to deviate from the policy and raise interest rates as soon the economy overcomes the crisis and inflation starts to rise. For this reason, we devoted part of this paper to review mechanisms that could solve the problem of an optimal time-inconsistent policy in a liquidity trap. After that, we return to discussion of the results of policies aimed at overcoming the liquidity trap in various countries and the role of economic agents' expectations, to develop an effective macroeconomic policy to undertake under a zero-interest-rate environment.

2. Monetary policy in a liquidity trap

In a liquidity trap, macroeconomic regulators may use a number of measures to stimulate the economy. Nevertheless, the effectiveness of those measures may be heavily limited due to prevailing pessimistic expectations within the economy.

2.1. Negative interest rate policy

To understand why the zero-lower bound (ZLB) may pose a serious problem for central banks, we will discuss the operating principle of the respective tool. A reduction in the interest rate by the central bank has a two-pronged effect on returns on securities. First of all, reducing the central bank's base rate means cheaper borrowing in the short-run. In addition, the current interest rate reduction affects the expectations of market participants regarding future trends in basic macroeconomic indicators and future monetary policy. If they perceive current interest rate reduction as a guidance on the central bank's intent to pursue a looser policy in the future, both short-term and long-term interest rates will decline. Decreasing long-term borrowing costs stimulate investment and aggregate de-

mand. Thus, a key component for an effective policy is *strong correlation between short-term and long-term interest rates.*

This correlation is threatened when the interest rate approaches zero (Ruge-Murcia, 2006). The problem here is that when zero is reached, the central bank's ability to stimulate the economy through an interest rate policy becomes quite limited. Market participants realize that any further massive reduction in interest rates is impossible, and the central bank loses its ability to lower expected long-term rates. Two aspects must be taken into consideration in this situation: (1) the asymmetric nature of the effect of reducing and increasing short-term rates on the long-term end of the yield curve, and (2) the weak effect of short-term rates on long-term rates near the ZLB. Both aspects are attributable to the fact that market participants consider an interest rate policy to be ineffective near the ZLB, especially if this is a stimulating policy. These aspects of the policy effects were demonstrated based on Japanese data (Ruge-Murcia, 2006), while data on the U.S. stock market showed a reduction in the average impact of short-term rates on long-term rates (Grisse, 2015).

These aspects of the interest rate policy near the ZLB called for a revision in the role of interest rates as the main tool used by central banks in a liquidity trap. However, recent years have shown that the ZLB is often not rigid: in response to the crisis, the Riksbank, the National Bank of Denmark, the National Bank of Switzerland, the ECB, and the Bank of Japan have initiated negative interest rate policy (NIRP) by reducing rates on their basic deposit instruments to negative values. Thus, commercial banks keeping excessive reserves at the central bank were forced to put up with negative returns on these assets. The point of such rates is to make excessive reserves unprofitable for commercial banks. Theoretically, this may create incentives for massive lending or large-scale purchases of other financial assets by commercial banks which, in turn, should result in a growing aggregate demand and economic recovery.

The first experience with negative interest rates was by the Riksbank (the central bank of Sweden) which set a –0.25% interest rate on one-day deposit transactions in July 2009. At the same time, the rate on the basic instrument — one-week deposit and lending transactions (repurchase rate) — remained positive. The rate on deposit transactions remained negative for one year, after which monetary policy leveled out. Beginning in July 2014, the Riksbank was again forced to switch to negative rates (–0.5%) on deposit transactions. Moreover, within the two subsequent years, the bank made further rate reductions, which have been at –1.25% on one-day deposit transactions and –0.5% on repurchase transactions since February 2016.

The experience of the National Bank of Denmark is similar to the Riksbank in that the rate on one-week deposit certificates dropped below zero twice. The first bout of negative interest rates lasted from August 2012 to April 2014, followed by a short period of normal monetary policy and positive interest rates. However, the bank was again forced to switch to negative rates on deposit transactions in September 2014. Unlike Sweden, Denmark saw the beginning of a slight trend towards normal interest rates in January 2016: the interest rate on certificates of deposit was increased from –0.75% to –0.65%. Nevertheless, this process did not progress and Denmark still keeps these interest rates negative.

The ECB set the rate on deposit transactions at –0.1% in June 2014, which was followed by three reductions, and has remained at –0.4% since March 2016. At

the same time, the lending interest rate was set at zero. The Bank of Japan was relatively late to emulate the ECB practices, setting a negative target rate on one-day deposit transactions (–0.1%) in June 2016.

The experience of the National Bank of Switzerland is largely similar to that of other central banks that established NIRP: in December 2014, the lower level of the target range for short-term deposit rates was set below zero, while beginning in January 2015, the entire target range for interest rates became negative. A distinctive feature of the interest rate policy in Switzerland was the sharp reduction in the target rate (from –0.25% to –0.75%) in January 2015, by contrast with the gradual reduction in rates by other central banks.

Thus, rather sufficient observations have been made by this time to estimate the effects of NIRP. Certain tentative estimates challenge the notion that interest rates reduce their effectiveness as the main monetary policy tool when the zero level is reached. For example, an analysis of the experience of the central banks in Europe has shown that the transmission mechanism of moderately negative interest rates does not differ from the case of positive rates (Bech and Malkhozov, 2016). Based on data from Switzerland (Grisse, Schumacher, 2017) and 14 developed countries (Grisse et al., 2017), a detailed analysis has been performed on the correlation between short-term and long-term rates when approaching and then crossing the zero level. An asymmetric effect from reducing and increasing rates (predicted in Ruge-Murcia, 2006) was actually observed when rates approached zero. However, when central banks lowered the lower level of the target corridor of interest rates to a negative value, the effect of interest rate changes on the long-term end of the yield curve persisted. Moreover, after the zero level was crossed, the average effect of short-term rates on long-term rates not only failed to decrease, but even became stronger than when short-term rates were far from zero.

These results may be an indication that market players' expectations have changed (Grisse and Schumacher, 2017). Before negative interest rate corridor boundary values had been introduced, market participants had considered the ZLB to be a serious problem for monetary policy. That is why regulators had failed to duly influence the expectations of market participants by reducing rates. Crossing the zero level demonstrated that the ZLB is, in effect, insignificant and that regulators can reduce interest rates further. Thus, the success of the interest rate policy at rates approaching zero is largely dependent on the expectations of market participants regarding the effective lower bound (EFB) on interest rates.

This conclusion is consistent with estimates of the EFB perceived by stock market participants' interest in Europe (Lemke and Vladu, 2017). As actual rates in the eurozone approached zero, market participants perceived the EFB to be positive, albeit very low. In September 2014, EFB dropped sharply to –0.11%. The authors of the study attributed this to crossing of the zero level by the actual rates, which showed market participants the potential for the NIRP. Thus, the effectiveness of the interest rate policy is largely dependent on the regulator's ability to convince market participants that the EFB lies lower.

One should hardly expect further interest rate reductions to have significant potential for stimulating the economy. The current negative interest rates can be considered moderate on the whole. However, their further reduction may cause rates for private non-bank agents to hit negative values. This, in turn, would force agents to forgo cashless payments and prefer cash, which earns no income but

is not exposed to negative interest rates. Currently, certain costs associated with using cash (e.g. storage, transportation costs) prevent the massive abandonment of bank instruments. Nevertheless, concerns are being raised that further interest rate reductions or remaining below zero for a protracted period would lead to attempts by economic agents to cut the costs by using cash, which may ultimately take control over the money market from central banks (Bech and Malkhozov, 2016). Moreover, the NIRP has an adverse effect on the profitability of banks, which do not want to lose their clients by passing on costs of negative rates to them (Michail, 2019), which creates additional threats for the banking sector and further stimulation of the economy.

Central banks that have followed the NIRP are fewer in number than those that applied alternative unconventional policy measures, i.e. quantitative and qualitative easing, as described below. This is why one should not overestimate the effectiveness of the NIRP in countries still facing a need to stimulate the economy due to a liquidity trap.

2.2. Large-scale asset purchases by central banks

Large-scale asset purchases by central banks, to influence commercial bank reserves and, through them, the macroeconomic equilibrium, are not a recent invention. As far back as 2001, the Bank of Japan launched the first official quantitative easing campaign, in an attempt to stimulate the economy. However, only after the global crisis did such programs achieve an unprecedented scale. As compared with pre-crisis levels, the value of central bank assets increased roughly two-fold in the eurozone and four-fold in the UK and the U.S. by 2013 (Joyce et al., 2012). The asset balance for the Bank of Japan increased comparatively moderately over the same period (Gambacorta et al., 2014).

Differences in timing between these programs are one of the important reasons for the differences in central bank balances during the first half of the post-crisis period. For example, the first quantitative easing program in the U.S., QE1, was announced in November 2008, whereas the Bank of England announced large-scale asset purchases in March 2009. The Bank of Japan and ECB's first steps to buy assets were taken as early as summer 2008, but the main stages of the program were launched much later: in 2011 and 2012 by the ECB under pressure from the banking sector, and in 2013 by the Bank of Japan, forced by the need to fight the recession and due to the ineffectiveness of previous measures. The expansion of asset purchase programs led to a sharp increase in the central bank's assets. By 2016, the Bank of Japan's balance increased four-fold, while the ECB's increased three-fold compared with pre-crisis levels (Borio and Zabai, 2016). Thus, the total scale of asset purchases was approximately the same for the central banks under review, although, as we see below, it had different economic effects.[1]

The different results of asset purchases could be partly attributed to the specific tasks facing the central banks which led to differences in the designs of these programs. Both the Bank of England and the U.S. Fed aimed mostly at reducing long-term interest rates to stimulate the economy (Joyce et al., 2012). The main

[1] For more on large-scale asset purchase programs in a liquidity trap, please see, for example, IMF (2013), Kavitskaya (2015, 2019), etc.

asset purchase targets for the Bank of England were government bonds, while the Fed combined purchases of government securities and mortgage instruments. At the same time, the ECB's main task became preventing a banking crisis within the eurozone, which is why repurchases formed the basis for its unconventional transactions. The Bank of Japan faced the challenge of overcoming a protracted liquidity trap; therefore its programs combined lending to commercial banks and purchases of government and corporate securities.

The great variety of asset purchase programs pursued by major central banks led to a certain difficulty in their classification and some confusion around definitions. The literature most often cites quantitative, qualitative, and credit easing programs. *Quantitative* easing programs include those that significantly increase the money base, including asset purchases and credit transactions by the central bank (Fawley and Neely, 2013). *Credit* easing programs include those aimed at improving particular lending terms by reducing particular rates or by restoring a particular segment of the financial market. Thus, credit easing programs, which increase the central bank's asset balance, are also considered to be quantitative easing measures. According to another classification (Joyce et al., 2012), quantitative easing programs include government security purchases, while credit easing involves the purchase of commercial securities. According to this classification, the sets of credit and quantitative easing measures do not overlap, while the repurchase transactions actively pursued by the ECB do not fit any of these definitions.

Qualitative easing covers programs aimed at reducing the risks associated with assets owned by private agents in the market (Farmer, 2012). For example, such a program may include the purchases of private high-risk securities by the central bank with the simultaneous sale of risk-free government bonds. Such transactions effectively transfer risk from private agent balance sheets to the central bank. Notably, the official policy pursued by the Bank of Japan since 2013 is called "quantitative and qualitative easing" (QQE). The word "qualitative" was included in the title to distance it from Japan's failed quantitative easing between 2001 and 2006, and from the policy pursued by the Fed (Ryuzo and Tatsuyoshi, 2017). In fact, the purpose of QQE was to double the money base, to which end the central bank conducted large-scale purchases of government bonds. As we can see, there is no single classification for these various asset purchase methods at this point. However, most of the programs actually carried out by central banks successfully combine various easing options, making the discussion on the definitions of various measures sound somewhat spurious.

All asset purchase programs are ultimately aimed at reducing long-term interest rates which, if successful, would stimulate investment and aggregate demand. Moreover, asset purchases from commercial banks improve their liquidity, resolve possible balance issues, and produce funds for investment. The literature on the effects of such unconventional monetary policy measures examines whether long-term interest rates are reduced by large-scale asset purchases. There is a consensus at present that asset purchases reduce long-term rates, but estimates of the absolute values of those reductions vary (see, e.g., Gagnon et al., 2011; Joyce et al., 2011; Krishnamurthy and Vissing-Jorgensen, 2011; Hamilton and Wu, 2012; D'Amico and King, 2013; Borio and Zabai, 2016; Altavilla and Giannone, 2017). Most often these estimates are based on an

event analysis methodology which uses high-frequency financial data to determine the instantaneous effect of new asset purchase announcements, free from all other factors. Unfortunately, high-frequency data cannot be used to estimate the macroeconomic effects of unconventional policies as inflation, output, and unemployment statistics are published quite rarely. This is why researchers trying to estimate the effect of asset purchases on output and inflation are forced to tackle the complicated task of purging data from other influencing factors. The resulting estimates diverge so greatly that it makes any definite conclusions regarding the effectiveness of these programs quite complicated.[2] Moreover, inflation and economic growth rates are still considerably lower than before the crisis, leaving open the question whether asset purchase programs are effective (Borio and Zabai, 2016).

Moreover, the effectiveness of an unconventional policy depends on the stage of the crisis: the maximum effectiveness can be achieved if the central bank has managed to take measures during the acute stage (Bech et al., 2014; Jannsen et al., 2015). The effectiveness of programs declines during the recovery stage of a financial crisis. This might be an explanation for the effect discovered in an analysis of the impact of asset purchase programs by the Fed and the Bank of England (Hesse et al., 2018): the initial programs yielded quite strong effects, whereas those of latter programs had virtually no effect. A comparison of macroeconomic trends between the United States and the eurozone shows that the obvious differences between the results of asset purchase programs are at least partly attributable to the fact that the measures were taken during different periods. In the U.S., the first QE programs were launched practically at the peak of the crisis, whereas in the eurozone the active implementation of programs was protracted, which is already one reason why their impact was weaker.

Making asset purchases over a long period of time as the main method to counter the aftermath of a crisis poses threats for the economy. For example, as such programs lose their effectiveness, the scale of asset purchases must increasingly be expanded (Jannsen et al., 2015). This increases the chance of bubbles in financial markets and financial crises due to increasing risk-taking. In addition, asset purchase opportunities are limited by the market size, which hardly makes asset purchases a panacea against crises. Consequently, to increase the effectiveness of the above programs, they should be augmented with measures that influence the expectations of market participants.

2.3. Using forward guidance on policy changes

Attempts by regulators to influence the expectations of private agents produced a system of forward guidance on future monetary policy changes, which is a vital component of any central bank's information policy. The key role of such guidance is that, in a liquidity trap, possibly the only opportunity for macroeconomic policy to stimulate the economy is the central bank's promise that even after overcoming the crisis, interest rates will remain low for a long time (see, e.g.,

[2] Examples of the most recent estimates can be found in Baumeister and Benati (2012), Kapetanios et al. (2012), Boeckx et al. (2014), Meinusch and Tillmann (2016), Weale and Wieladek (2016), Wu and Xia (2016), Hesse et al. (2018).

Jung et al., 2005). If private agents trust these promises by the authorities, this will motivate them to increase spending and will stimulate business activity even during the current period of zero interest rates. In fact, all leading central banks have used this tool to varying extents, promising that rates would remain low over a lengthy period. Notably, the effect of such guidance on long-term interest rates was, on the whole, positive in the U.S. and Japan, although some authors doubt the effectiveness of this tool in the eurozone and in the UK.[3]

In order to boost confidence, the central bank needs to develop an effective guidance system that would be seen by the population and key macroeconomic agents as a binding commitment by the central bank (Eggertsson, Woodford, 2003). The way to build a successful forward guidance system is for the central bank to take consistent and timely measures. A key role in this strategy is given to forward guidance on future changes in the monetary policy, which would be perceived by private agents as the central bank's binding commitment (Bodenstein et al., 2012). However, they will only trust guidance on interest rate changes (increasing inflation expectations in a liquidity trap) if the central bank has a solid reputation (Nakata, 2015).

3. The problem of time-inconsistency of optimal policy

Ever since the classical paper by F. Kydland and E. Prescott (Kydland and Prescott, 1977), the issues of optimal macroeconomic policy have been related to the problem of time consistency. In most aspects, developing a macroeconomic policy is associated with creating certain expectations among private agents, while the actual implementation of a policy may be based on expectations that have already been created. Taking those expectations for granted, a policymaker may have an incentive to deviate from the previously announced optimal plan, since the parameters for an optimal policy differ before and after creating the expectations. In other words, an optimal policy may be time-inconsistent. The awareness that policymakers may have such an incentive may cause economic agents to shape their respective expectations in another way, creating an important feedback effect.

With regards to the inflation problem, the time inconsistency of an optimal policy consists of the following points. Monetary policy may stimulate aggregate demand and raise output to a higher-than-natural level if actual inflation rates exceed anticipated rates. Realizing that the central bank would benefit by deviating from its announced goal to hold back inflation, rational private agents will not form their inflation expectations according to the central bank's announced targets. This restricts the central bank's ability to achieve a low inflation rate.[4]

In view of the prospects and limitations of monetary policy discussed in the previous sections, a logical question arises regarding the design of an optimal and time-consistent policy in a liquidity trap. On the whole, we could state that

[3] A review of central bank practices and the most recent empirical studies is provided in Borio and Zabai (2016).

[4] The two ways to resolve the time inconsistency problem that are most often discussed in the literature are the approach by Barro and Gordon (1983) to building a reputation for policymakers and the delegation of monetary policy to a conservative central bank which is more inclined to hold back inflation than to stimulate output (see the classical paper by Rogoff, 1985).

there is a consensus in theoretical literature with respect to the problem. An optimal policy requires keeping interest rates low for a period exceeding the period during which the economy is in a liquidity trap (Eggertsson, 2006). This kind of policy can generate positive expectations among private agents, as it promises a looser policy in the future. In this situation, even if interest rates cannot be lowered at the present time, private agents expect them to be "lower for longer", which may stimulate investment and the recovery of economic activity.

In developing an effective macroeconomic policy for a modern economy, the expectations of the population are important regardless of the chosen monetary policy or the specific conditions of a given economy. However, in a liquidity trap, the level of confidence in the macroeconomic policy being implemented is of prime importance. In this situation, creating expectations with respect to that policy becomes the government's and the central bank's key challenge. If the regulators fail to effectively create expectations among the population and increase confidence in the policy being implemented, any attempts to stimulate the economy in a liquidity trap will be seen as the implementation of a time-inconsistent policy. The main reason for this is that the key macroeconomic agents realized that, if the economy grows and inflation rates rise, the central bank's optimal policy will be to raise interest rates to combat rising inflation, rather than to keep rates low. In this situation, the reputation of a conservative central bank that sets as its main goal the fight against inflation would prevent the shaping of the population's expectations needed to escape the liquidity trap and, as a consequence, the monetary policy would demonstrate a tendency towards deflation.[5]

As a result, the attempts to stimulate the economy in the liquidity trap fail to achieve their goals. This problem demonstrates that near-zero interest rates considerably hinder the development of a macroeconomic policy in the medium- and long-term as well as in the short-run. Under modern conditions, many countries have found themselves in a liquidity trap, facing the need to implement an effective macroeconomic policy capable of stimulating the economy at near-zero interest rates. To this end, the government and the central bank need to solve the problem of time inconsistency for an optimal policy by influencing the expectations of private agents with respect to the future policy and by improving the population's confidence. In other words, the central bank needs to develop a plan that would provide it with a "commitment to be irresponsible," meaning the refusal to fight inflation in the future (Eggertsson, 2006).

Below, we review various ways to influence expectations by means of fiscal and monetary policy, and discuss the prospects for using this to improve the effectiveness of macroeconomic policies in a liquidity trap. This will allow us to offer recommendations on designing a macroeconomic policy that would be perceived by the country as a binding commitment on the authorities and would enable an effective resolution to the problem of escaping the liquidity trap.

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[5] The extensive literature on the time inconsistency of monetary policy dates back to the period during the 1980s when developed and developing countries pursued disinflationary policies and discovered the so-called "inflation bias" problem, where the central bank may face the population's distrust towards its inflation control policy. However, following the 2007–2009 crisis, central bank efforts to overcome the liquidity trap have run into the completely opposite problem of "deflation bias," where by expectations of a temporary refusal to maintain low inflation rates need to be created.

3.1. Changing the central bank's targets

There is a discussion on changing the official targets established by central banks to overcome the deflation bias and build a reputation as a less conservative agent. Two policy modification options are usually considered: adding alternative goals to the inflation goal and changing the inflation target rate. For example, concerns have been raised that the target inflation rate of 2% that is accepted in many developed countries may turn out to be an insufficient buffer to prevent future liquidity traps if the reduction in real interest rates takes on a more permanent nature (Williams, 2009). Central banks have been recommended to prefer a 4% target inflation rate instead of 2%, as this would not lead to considerable adverse effects for the economy and would keep the economy from falling into a liquidity trap (Ball, 2013). At the same time, increasing the target inflation rate means a commitment to pursue a more stimulative policy in the future as compared to the current target inflation rate.

According to some estimates, the optimal inflation rate is positively correlated with the probability of falling into a liquidity trap and its average duration (Carreras et al., 2016). Therefore, the calibrations of the New Keynesian model, consistent with data from the most recent liquidity trap episodes, admit an optimal inflation rate exceeding 2%. Moreover, in a model that takes menu costs into account, and consistent with micro data on the price behavior of firms, the optimal inflation rate was placed at 5% (Blanco, 2016). Still there is an evidence that the optimal long-term inflation rate depends on the discretion of monetary policy (Billi, 2011). If the central bank has access to the binding commitment technology, the optimal inflation rate in the model does not exceed 1% in the U.S.; if the technology is unavailable and the central bank implements a discretionary policy, the optimal inflation rate exceeds 10%.[6] The Japanese experience demonstrates that increasing the target inflation rate may encourage economic recovery (Michelis and Iacoviello, 2016).

However, there are concerns that this kind of policy shift may strongly affect the population's confidence in the central bank (Walsh, 2011; Blinder et al., 2017). It is noted that any modification of the target inflation rate should be gradual and accompanied by informational support from the central bank, so that market participants understand the reasons for the policy changes (Blanchard et al., 2010). This would enable them to adjust their contracts to the new conditions and to avoid a redistribution of wealth from lenders to debtors. In addition, a full explanation of the reforms being undertaken would help to maintain the confidence of the economic agents in the central bank which would pave the way for a successful future policy.

Adding new target indicators to the central bank's loss function, or changing their relative weights, can also help in fighting the liquidity trap. For example, increasing the weight of output in the standard Taylor rule will reduce the adverse impact of negative shocks on output when the target inflation rate is reached (Williams, 2009). However, the events of recent years bring the question to light regarding the potential transition from inflation targeting to price level target-

[6] The conclusions obtained in Billi (2011) are indeed of interest, but can hardly be extrapolated to other countries due the specific characteristics of the U.S. economy.

ing (Walsh, 2011). This policy presumes that the economic recession increases the gap between the real price level and the target trajectory of their level. As a consequence, in the future the central bank would be forced to pursue a more stimulative policy to narrow this gap. Thus, this policy entails a higher inflation rate in the future (exceeding the target in the case of inflation targeting), lower long-term interest rates, and higher recovery rates for aggregate demand. Consequently, targeting the price trajectory may solve the time inconsistency problem for an optimal policy. It has been demonstrated that switching to price level targeting may improve the effectiveness of guidance on future changes in monetary policy (Cole, 2018). Nevertheless, switching to this policy during a crisis may considerably undermine confidence in the central bank, thus calling for further discussion (Walsh, 2011).

3.2. Shaping expectations through accumulating non-indexed debt

Another way to solve the deflation bias in a liquidity trap may be an issuance of non-indexed public debt in order to influence future macroeconomic policy and shape inflation expectations. A deflation bias could be regarded as a problem with the population's lack of confidence under liquidity trap (Eggertsson, 2006). In this situation, increasing public debt, whose real value depends upon inflation, creates future incentives to keep the interest rate low to reduce debt service cost on the national debt and to raise the inflation to devalue the nominal public debt. These measures may have a positive effect on the population's confidence level and assist in developing an effective macroeconomic policy in a liquidity trap.

This idea was developed further in a review of quantitative easing policy (Bhattarai et al., 2015) As part of effective quantitative easing, the population receives guidance that by purchasing private securities, and thereby increasing the nominal debt, the state shows interest in maintaining low interest rates not only at the present time but also in the future, when near-zero rates cease to be a limitation for implementing effective macroeconomic policy.

However, accumulating nominal public debt should not be regarded as an obvious solution for improving the effectiveness of macroeconomic policy in a liquidity trap. Increasing nominal debt will inevitably affect output, exchange rates, financial stability, and, accordingly, the economic situation in general. Therefore, certain caution is required in using nominal public debt as a tool to influence the expectations of private agents in a liquidity trap.

3.3. Shaping expectations through devaluing the domestic currency

Admitting that promises to keep the interest rate lower for longer are themselves associated with the significant difficulties in improving the population's confidence, there are suggestions to shape expectations for a lower national currency value in the future. The logic of this idea is as follows: expectations for a lower national currency value mean expectations that the competitive power of domestic products in the global market and aggregate demand will grow. Also, a cheaper national currency requires maintaining lower real interest rates in the future. Thus, promises to devalue the currency in the future are, in a large

part, a substitute for a policy of guidance on future rate reductions, but may cause the problem of a time-inconsistency of optimal policy.

For example, a scheme has been suggested for creating binding commitments for central banks (Svensson, 2000). First of all, an optimal policy should include a temporary transition to price level targeting, while the target price level should grow over time. At the same time, the central bank must devalue the national currency and switch to a *crawling peg*, so that the devaluation rate is pegged to the gap between the domestic inflation rate and the average global inflation rate. As soon as the ultimate price target is reached, the central bank can give up foreign exchange rate control and switch either to standard inflation targeting or to price level targeting.

It is easier for the central bank to shape expectations with respect to its commitment to foreign exchange rate control than to reducing interest rates in the future, as currency devaluation for the central bank is associated with purchases of foreign reserves and increasing the money supply. Unlike a revaluation, this process may last infinitely, as the central bank is not limited in increasing money supply. Ideally, the recognition of this policy (unlike the disputable future interest rate reduction) by the population boosts their confidence. By demonstrating its commitment to its promises regarding the exchange rate, the central bank may ultimately convince the population that the current policy will be successful, which is just what is needed to solve the time inconsistency problem.

The central bank's concerns regarding the size of its net worth and the fear of losing independence also create a necessary binding commitment mechanism to maintain a low national currency value in the future (Jeanne and Svensson, 2007). Most central banks try to maintain a rather large net worth, since a considerable reduction in net worth may force the central bank to turn to the government for help, which would mean a lower degree of independence from the government. Thus, accumulating foreign reserves, combined with the current devaluation of the national currency, creates a binding commitment for the central bank to avoid currency appreciation, since a sharp appreciation in the currency would reduce the value of foreign reserves in the national currency, thereby reducing net worth. Thus, the central bank finds incentives to avoid currency appreciation in the future and, accordingly, to maintain lower interest rates to solve the time inconsistency problem.

3.4. Shaping expectations under recurring crises

Regardless of the central bank's choice of method to stimulate the economy in a liquidity trap, its effectiveness will be contingent upon whether the bank has a solid reputation, and whether the announcements by central bank representatives are perceived as the regulator's binding commitments. The policy of maintaining low interest rates following severe crises is most likely to enjoy confidence if the private agents expect periodic future shocks that hinder economic activity (Nakata, 2018). If such shocks threaten, the central bank will be reluctant to raise the nominal rate immediately after overcoming the crisis, as it may otherwise provoke a significant economic recession and thereby severely undermine the population's confidence in its policy. Thus, a potential loss of reputation given comparatively frequent shocks will force the central bank to honor its promises

and maintain a low nominal interest rate even during an economic recovery. In this case, due to the potential threat of shocks, the long-term motives for maintaining a low nominal rate will be more important for the central bank than short-term motives for fighting inflation. Private agents will recognize the motives behind the central bank's behavior in the current circumstances, making it possible to solve or at least mitigate the time inconsistency problem and resulting in an effective macroeconomic policy in a liquidity trap.

4. Conclusion

To counter the consequences of the global financial crisis, central banks in many countries took a number of unconventional measures: large-scale asset purchases by the central bank, forward guidance and NIRP. At the same time, similar measures taken by central banks led to different results in different countries, bringing into question the effectiveness of the unconventional monetary policies. For example, the U.S. Fed and the Bank of England managed to switch to raising basic interest rates, demonstrating that the liquidity trap ceased to be a pressing problem for them. The ECB, the Bank of Japan, the National Bank of Switzerland, and others are still forced to maintain low (or even negative) rates and increase the scale of financial asset purchases to stimulate aggregate demand. This indicates that the liquidity trap problem still persists and requires new solutions to be found.

Modern studies identify a number of potential sources of ineffectiveness for unconventional monetary policy measures. An essential factor determining the extent of their effect on the economy is the expectations of economic agents regarding future interest rate trends and central bank policy. Indeed, the path to success for a central bank's measures in a liquidity trap is its ability to undertake a binding commitment that in the future, after overcoming the trap, interest rates will remain low over a long period. Unfortunately, the central bank's ability to undertake such a binding commitment is very limited. The greatest obstacle here is the central bank's reputation as a conservative macroeconomic agent. However, if other macroeconomic agents perceive the central bank to be an excessively conservative agent, they will expect that when inflation rises in the future, it will have an incentive to raise interest rates. This may help in comparing the effectiveness of unconventional policies in the U.S. and in the eurozone. The ECB has a reputation as a very conservative central bank that sees its main goal in maintaining inflation at 2% or lower. The U.S. Fed, despite its current inflation target, also postulates maintaining a low unemployment rate as one of its tasks. Thus, the Fed is a less conservative agent that the ECB in terms of its objectives. This suggests to economic agents that, all other conditions being equal, the Fed is more likely to maintain low interest rates, which is why the unconventional measures in the U.S. have been more effective. Moreover, the U.S. Fed is potentially able to demonstrate greater concern with the issuance of public debt than the ECB. This is attributable to the fact that the ECB pursues a unified monetary policy in the eurozone, while fiscal policy is the responsibility of national governments. In this respect, a large public debt in individual European countries can hardly be expected to force the ECB to keep interest rates low in the future. In the U.S.,

where the public debt is larger, this problem may raise greater concerns for the central bank. This consideration is another argument in favor of the statement that the success of the unconventional policy in the U.S. is attributable to more favorable expectations by economic agents.

The ability to influence the expectations of economic agents is becoming the cornerstone of successful macroeconomic policy. There are a number of papers studying anchored expectations in the U.S. economy and in the eurozone (Tsenova, 2015; Lyziak and Paloviita, 2017). However, the issues of how differences in shaping expectations in the U.S. and in the eurozone can encourage binding commitments on central banks, and thereby solve the problem of time inconsistency during a liquidity trap, remain a part of the future research agenda.

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