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MONETARY POLICY IN A LOW INFLATION ENVIRONMENT AND THE EXPECTATIONS OF MARKET PARTICIPANTS*

I. INTRODUCTION

Before the financial crisis which originated in the US market in 2007, the monetary policy of most central banks seemed to comply with the postulate put forward in 2000 by Sir Mervyn King, then Governor of the Bank of England. It was to be predictable, and even boring.[1] Such a monetary policy was in line with the theoretical consensus referred to as a new neoclassical synthesis (NNS), which as of the 1990s started to determine the manner of perception of the cause-effect relationship in economics. It has eventually become widely accepted by central bankers and the academic world. This approach brought about the harmonisation of the activities undertaken by the monetary authorities in the strategic, and even operational area. Because of the special importance of inflation expectations, monetary policy has been increasingly often realised as a part of the inflation targeting strategy (IT). Institutional arrangements implemented under this strategy supported the anchoring of market participants' expectations, while interest rate-based instruments made it possible to steer several transmission channels, including the expectations channel.

The outbreak of the crisis and its subsequent persisting repercussions forced a change in the manner in which banks conducted their monetary policies. Alongside the enlivening of the economic discussion about how the economy functions and about the shortcomings of the NNS models, a practical problem emerged—the ineffectiveness of interest rates channel. Moreover, in many monetary areas, very low and even negative changes in the general price level were registered. The experiences already encountered by Japan as of the 1990s, started to be felt in other economies as well. The problem of deflation and zero lower bound (ZLB) interest rates became the everyday life of central banks. The search for a remedy in new instruments such as quantitative easing (QE) or forward guidance (FG) had substantially reduced the opportunities of carrying out a boring monetary policy.

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[1] M. King, *Monetary Policy: Theory in Practice*, address of 7 January 2000, <http://www.bankofengland.co.uk/archive/Documents/historicpubs/speeches/2000/speech67.pdf> [accessed 15 July 2016].

These new circumstances raised a question of whether inflation (or deflation) expectations could be effectively managed. Both central bankers and scholars found themselves in a situation of having to cope with it. The aim of this paper is to present the management of expectations in an environment of low inflation and deflation. This issue seems particularly important as in such a situation expectations become the main channel of monetary transmission while, at the same time expectations management in the deflationary environment have been less understood than, for instance, the monetary policy conducted under standard conditions. The first step towards the achievement of the goal set in this paper is the analysis of the literature on inflation expectations in a zero bound level environment. Under such circumstances, difficulties appear already at the stage of data collection. As the measurement of expectations is one of the key elements necessary for their management, in this paper special focus will be put on the ways in which expectations can be measured under the conditions of a non-positive price change rate. In the empirical part of the paper the results of the quantification of the expectations done with two versions of the probabilistic method are presented. The data regarding expectations will be presented for Poland (July 2014–2015) and Sweden (November 2012–2015). The beginning of the time span depends on the moment at which deflation is registered in the official statistics. The countries chosen for this study are European Union Member States but not members of the eurozone, and their monetary policies are conducted in it frameworks

The structure of this paper has been subjected to the realisation of the research objectives. Thus in its second part the literature on expectations management in a low inflation environment will be reviewed. In the third part, the difficulties encountered in measuring expectations will be presented and in the fourth part consumer expectations quantified using different methods will be compared. The summing up of the whole paper will then follow.

II. EXPECTATIONS MANAGEMENT IN A LOW INFLATION ENVIRONMENT

As many central banks in modern economies succeed in maintaining price stability, deliberations on monetary policy in an environment of low inflation started to appear in the literature. This strand of the literature emerged even before deflation and ZLB became a fact. Why did this discussion erupt? First of all, monetary policy strategies were reoriented to maintaining price stability after a successful disinflation process. Under the new circumstances, central banks had to estimate the natural interest rate.[2] Secondly, at the moment when the increasing slow-down in the general price level change became a threat, a number of publications appeared, which offered suggestions on how to avoid the deflation trap or overcome it when the ZLB occurs. The discussion was generated by the Japanese experiences and was directly related to inflation expectations management in a low inflation or deflation environment.

[2] M. Brzoza-Brzezina, *Polska polityka pieniężna. Badania teoretyczne i empiryczne*, Warsaw: C.H. Beck, 2011, 46–47.

Table 1 presents an outline of these concepts. It should be emphasised that some of the solutions proposed have never been implemented. They generate costs, such as for example, the loss of credibility, lead to increased uncertainty, while others, implemented in the past, had not generated expected results.

Table 1

Deflation trap—avoidance and escape by managing expectations

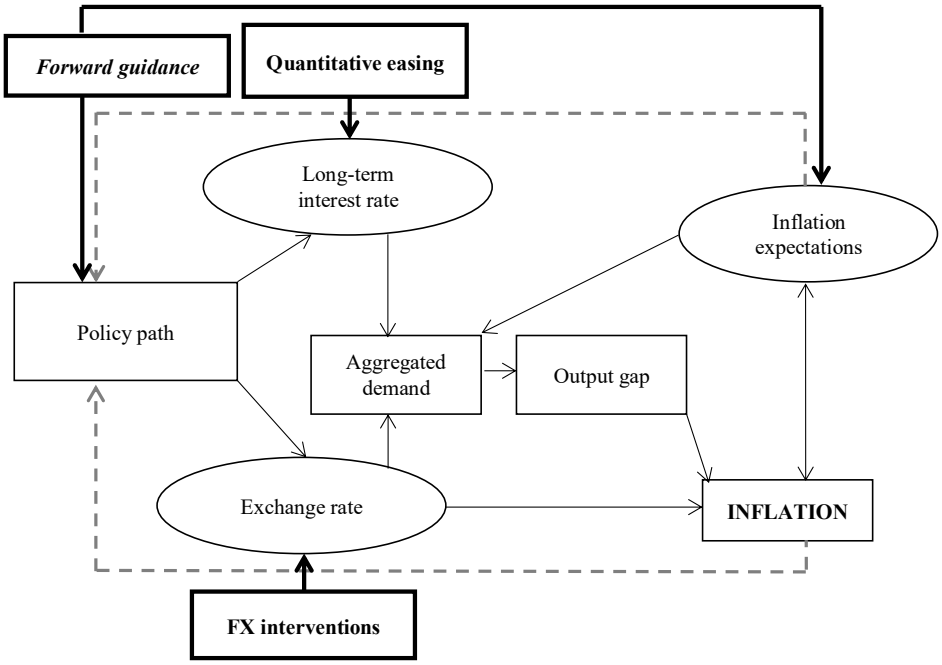
Solution	Impact on the expectations
Inflation target should be set at an adequately high level when the IT framework is designed. It reduces the necessity of functioning under ZLB This solution can be applied after the ZLB occurrence: the central bank should temporarily adopt a higher inflation target	In the case of a credible bank, the inflation expectations are anchored at the target level. Even temporary falls of inflation below the target level should not generate expectations falling to a low level. A higher inflation target should generate a rise in expectations to a new, higher level
Immediately on noticing the deflation threat, the interest rates should be reduced to zero. It should be a pre-emptive strike in response to a possible deflation Measures consisting in the reduction down to zero of interest rates upon noticing the deflation threat	An increase in inflation expectations formulated at the moment of a deflationary threat will restrict the decrease in the general price level
Declaration (promise) to maintain zero or near zero interest rates for a longer time, even at the cost of a subsequent increase in inflation above the inflation target	Such a promise should generate an increase in inflation expectations, which will reduce real interest rates and accelerate escaping the deflation trap
Conducting a price level target strategy (PLT) instead of the inflation targeting strategy	When a negative price shock occurs, the central bank operating in the PLT framework has to raise inflation to get prices back to the pre-announced path In IT frameworks inflation should simply reach the target level. A credible price target for the PLT triggers off a rise in expectations after the deflation shock. PLT is a more expansive strategy in comparison to IT in this case
Depreciation of the exchange rate in small open economies Alternatively, some exchange rate rule can be incorporated in the manner monetary policy is conducted. Foreign exchange intervention or at least a declaration of such an intervention	The effect achieved through the channel of the balanced portfolio changed (the) expectations regarding the national and foreign structure of the money supply. Changes in relative export and import prices occur. It will also influence expectations when depreciation is announced. Owing to the exchange rate pass-through, the inflation of import prices will grow. Then the real exchange rate is affected. It changes the relative structure of import and export prices
Additional transmission channels—implementation of instruments other than the interest rate.	It generates the signalling effects that extraordinary policy measures should be launched, which will then result in increased inflation expectations. Such a declaration suggests an increased money supply. The actual effect is connected with an increased money supply which may not occur

Source: prepared by the author based on M. Brzoza-Brzezina, *Polska polityka pieniężna*, 65-71, and A. Wojtyna, *Szkice o polityce pieniężnej*, Warsaw: PWE, 2004, 135–138.

A simplified mechanism of monetary transmission presented in Scheme 1 shows a solution that has actually been implemented by selected central banks operating under ZLB conditions. Three standard solutions are presented: enhanced communication of intentions (forward guidance), additional policy measures and interventions on the foreign exchange market.

Scheme 1

Monetary transmission under the zero lower bound environment



In oval frames—transmission channels
In bold frames—additional measures to support the monetary policy at ZLB

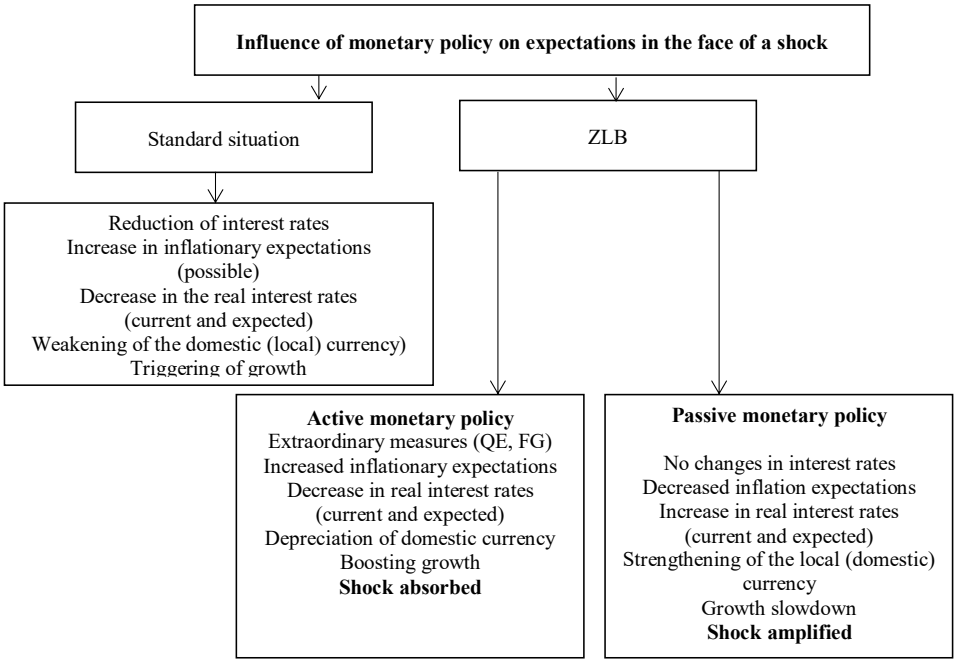
Source: D. Laxton, *Discussion of* '*Evaluating a Structural Model Forecast: Decomposition Approach*', Presentation given at the Czech National Bank Research Open Day, 18 May, 2016, Prague, <http://www.cnb.cz/miranda2/export/sites/www.cnb.cz/en/research/seminars_workshops/2016/rod_2016_Laxton.pdf> [accessed 20 May 2016].

Management of the expectations under ZLB involves not only the problem of the choice of instruments to shape them, but also the cost of the use of these instruments in the long run, or their not yet fully recognised impact on the short-time and long-time expectations. The effective management of expectations depends obviously on the response of the economic agents to the hock in ZLB. Scheme 2 presents three variants of possible reactions (on the part of the expectations—to the shock, and on the part of the expectations to the bank's reaction to the shock) of which two are for the ZLB environment. Expecta-

tions may, in these cases, constitute an absorbing as well as an amplifying factor of the shock. The variant that will occur will depend on the credibility of the monetary policy as well as the possibility of implementing extraordinary measures by the central bank. Even a very active monetary policy when faced with a shock may not lead to an increase in inflation expectations, when, for example, an increase in the reserves of financial institutions generated by these extraordinary instruments does not translate into an increase in the money supply. Market participants may estimate the effects of similar measures taken by the central bank earlier and decide, on the basis of them, upon their actual impact on inflation.

Scheme 2

Absorption or amplification of shocks through the expectations channel



Source: K. Clinton et al., *Inflation Forecast Targeting. Applying the Principle of Transparency*, IMF Working Paper 132/2015, 26.

When the interest rate is reduced to zero, the central bank is left with two channels with which it can influence the aggregated demand and inflation: (i) a promise to maintain interest rates at a low level for a time adequately prolonged to achieve a situation in which the total demand exceeds the potential one, and (ii) to generate expectations for a boom, which will increase inflation expectations, reduce the real interest rate and stimulate total demand.[3]

[3] A. Rzońca, *Kryzys banków centralnych. Skutki stopy procentowej bliskiej zera*, Warsaw: C.H. Beck, 2014, 83.

Using both channels is connected with undertaking non-standard measures such as the implementation of extraordinary instruments and a change in communication regarding the intentions of the central bank. To ensure that the extraordinary policy measures are effective, it is crucial to adjust them to the expectations of the economic agents. Under ZLB it is not only the effectiveness of expectations management which is disputable. Their measurement, which should allow the assessment of the impact of the measures taken by the central bank—is also questionable. The expectations are not directly observable and their measurement under the ZLB cannot be made with the use of standard procedures.

The practical dimension of the analysis of expectations will be presented in the following section of this paper.

III. CHALLENGES CONNECTED WITH THE MEASUREMENT OF EXPECTATIONS UNDER ZLB

Several methods of measuring inflation expectations can be found in the economic literature. Three groups of methods[4] leading to the estimation of expectations may be distinguished: (i) indirect methods consisting in extracting inflation expectations from the theoretical model of the economy (ii) direct methods which are basically quantitative or qualitative surveys conducted among different groups of economic agents to assess their expectations, and (iii) methods based on gathering market data from—among other things—yields curves or inflation-linked swaps. Central banks analyse the results of expectations obtained from several different groups of market participants using different measurement methods.[5]

The measurement of expectations is crucial not only because of their importance in the monetary transmission mechanism but also because the expectations constitute an unbiased estimator of future price dynamics. Inflation expectations also express the credibility of the central banker[6]. Because of them banks can estimate the inflation pressure and the level of assessment of this pressure by private agents.[7] The quantitative approxima-

[4] Apart from the methods for estimating expectations presented here—most frequently used by central banks—the literature points to other methods, outside of the main trend, such as for example the use of contingency tables or an experiment to proxy the expectations and to analyse their proprieties.

[5] The ways in which central banks gather and use information on inflation expectations are presented in: T. Łyziak, *Measurement of Perceived and Expected Inflation on the Basis of Consumers Survey Data*, Irving Fisher Committee on Central Bank Statistic Working Papers No. 5, Basel: Bank for International Settlements, 2010.

[6] T. Łyziak, Oczekiwania inflacyjne, in: A. Sławiński (ed.), *Polityka pieniężna*, Warsaw: C.H. Beck, 2011, 114–115.

[7] B. Bernanke, *Inflation Expectations and Inflation Forecasting. Technical Report*, Speech at the National Bureau of Economic Research Summer Institute, Cambridge, MA, 2007.

tion of the expectations of price-setters may be taken into account when the inflation gap is estimated formally—by including them in the models—or informally—during the deliberations of the monetary committee. There are even proposals in the literature to treat inflation expectations as a certain intermediary target.[8]

While the necessity of measuring expectations is unquestionable, the quality of the measuring techniques already poses a problem, since each has certain advantages as well as disadvantages.[9] This is the reason why banks analyse various data indicating inflation expectations obtained in different ways.

The difficulties with expectations measurements are even greater when the central bank operates under specific circumstances, such as close-to-zero inflation, or deflation, disturbances in financial markets, or when it is necessary to resort to non-standard instruments, as well as in a situation in which the policy framework changes.

The central banks' engagement in financial stability issues that has evolved recently illustrates this last case. Prior to the eruption of the latest crisis, the Jackson Hole consensus expressed the central banks' attitude toward pressures on financial markets: the monetary policy remained passive to any tensions. Financial stability was to be ensured by the realisation of the inflation target, and—at the micro scale—by supporting banks' liquidity. After the crisis, financial stability was incorporated in the system of central banks' goals. However, none of the central bankers has ever announced a formal inclusion of financial stability to the loss function. There is no declaration either how central banks will conduct their policies in the event of an occurrence of a conflict of goals.

Table 2 presents other problems connected with inflation expectations measurement under such specific circumstances. It must also be remembered that the model in which expectations are formulated may be changed by economic agents as a result of the changing circumstances in which they operate, for example, the rules of learning in the adaptive learning concept, the percentage of persons who fall under the monetary illusion in the near-rationality concept, or the increase in the cost of acquiring and processing information in the bounded rationality concept. When the economic agents modify the pattern of expectations formation, the declarations they expressed in surveys differ to a greater degree from their actual expectations.

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[8] D. Pfajfar, E. Santoro, Heterogeneity, learning and information stickiness in inflation expectations, *Journal of Economic Behavior & Organization* 75, 2010, 426–427.

[9] A discussion about expectations measurement methods is also contained in the following: A. Ang, G. Bekaert, M. Wei, Do macro variables, asset markets or surveys forecasts inflation better?, *Journal of Monetary Economics* 54(4), 2007; P. Sinclar, Inflation Expectations. An Introduction, in: P. Sinclar (ed.), *Inflation Expectations*, London: Routledge, 2010; B. Desroches, E. Santor, Inflation expectations and the conduct of monetary policy: a review of recent evidence and experience, *Bank of Canada Review* 2010, Spring.

Table 2

Difficulties with measuring expectations under specific conditions

Measurement method	Difficulties
Indirect methods	In order to use these methods it is necessary to know the model of the economy and of the patterns of how expectations are formed (usually they are assumed to be rational). It is then verified to what extent the model of expectations formation reflects the relations at the macro scale described in this model. At a time of market disturbances an adequate model which will assess the shock and potential structural changes properly is much more difficult to identify
Direct methods	The increasing risk and uncertainty as well as the manner in which public authorities respond to specific circumstances hinder the assessment of the economic situation by specialists and non-specialists. It results in a higher dispersion of answers to the survey questions The difficulties with the quantification of expectations based on qualitative surveys arise from the fact that the method must be adapted to the situation when the scaling factor is negative. Questions in the questionnaires are basically relevant for expectations in the circumstances of inflation
Reference to market data	Increased variability. The fluctuations in prices reflect the volatility of the risk premium. Illiquid markets. Increased influence of one-off factors. These disadvantages of determining inflation expectations based on market data are not characteristic of the time of market disturbances but they nevertheless do accelerate at this time. At a time of crises, market liquidity may also be distorted. At a time of deflation—a negative inflation risk premium will occur (which is connected with inflation growing up to a level exceeding the expected, basic level of inflation, it is normally positive)

Source: own assessment.

Consumer expectations measurement is particularly difficult owing to the lowest level of economic knowledge among this group of economic agents and the specific method used for measuring expectations. At the same time central banks themeselves analyse consumer expectations because their economic decisions drive consumption and demand and their expectations are in some way representative of the expectations of businesses,[10] when the latter are not surveyed. In most monetary areas the measurement of consumer expectations is based on qualitative surveys on the perceived and expected inflation. Quantitative surveys which consist in asking direct questions about expected changes in prices are not used or play an ancillary role only, complementing the qualitative surveys. The relatively low economic awareness of individuals generates very dissimilar and erroneous results of quantitative surveys.[11]

[10] O. Coibion, Y. Gorodnichenko, Is the Phillips curve alive after all? Inflation expectations and the missing disinflation, *American Economic Journal: Macroeconomics* 7(1), 2015, 204.

[11] M. Szyszko, *Oczekiwania inflacyjne w polityce pieniężnej. Zarządzanie z wykorzystaniem prognoz inflacji*, Warsaw: Difin, 2016, 50.

Table 3 presents a standard structure of questions asked in a qualitative survey with polychotomous questions. When qualitative questions are asked, respondents tend to indicate a more or less precise direction of change.[12] Questions about the perception of inflation have been added to the Table because the result of the quantification of the distribution of answers may constitute a scaling factor in the quantification of the expected inflation.

Table 3

Survey questions about the perception of inflation and inflation expectations

Study	Question	Multiple-choice answers
Perception of inflation	Do you think that in the last 12 months, prices have:	a – increased significantly, b – increased moderately, c – increased insignificantly, d – remained at the same level, e – fallen f – don't know
Expected inflation	Do you think that, when compared with the situation today, in the coming 12 months the prices will:	a – increase much more quickly, b – increase at a similar rate, c – increase much more slowly than today, d – stay more or less the same, e – fall f – don't know

Source: own arrangement based on the European Commission, *The Joint Harmonised EU Programme of Business and Consumer Surveys*, User Guide, Brussels 2007, 48.

The question and answers structure is not time dependent, neither do they depend on the actual rate of the general price level change. Knowing the distribution of the answers to the survey's questions, it is then possible to quantify inflation expectations. The quantification may be done using several different methods, among which the most frequently used one is the probabilistic method.[13] It can be done under the assumptions regarding the distribu-

[12] E. Tomczyk, Analysis of expectations on the meso scale: use of contingency tables, in: E. Tomczyk, E. Stanisławska (eds.), *Inflation Expectations. Views from Different Perspective*, Warsaw: Oficyna Wydawnicza SGH, 2010, 22–25.

[13] They appeared for the first time in the work by H. Theil, On the time shape of economic microvariables and the Munich business test, *Revue de l'Institut International de Statistique* 20(2), 1952, 105–120, although this method is also referred to as the Carlson and Parkin method: J.A. Carlson, J.M. Parkin, Inflation expectations, *Economica* 1975, no. 42, 123–138. The other group of methods relatively frequently used in empirical studies consists of regression methods. It was introduced to the literature by Pesaran: M.H. Pesaran, Expectations formation and macroeconomic modeling, in: P. Malgrange, P.-A. Muet (eds.), *Contemporary Macroeconomic Modeling*, Oxford: Basil Blackwell, 1984, 27–55. Sometimes the results obtained using regression and probabilistic methods are confronted with each other: J.M. Berk, Measuring inflation expectations, *Applied Economics* 31(11), 1999. The regression method also requires a reference to the scaling factor, hence—it is not analysed here but later on.

tion of answers to the survey questions.[14] When the probabilistic method is used, references must be made to the current inflation which is the standard scaling factor for this method. The actual inflation indicator (the latest that can possibly be known to the consumer) as well as perceived inflation can constitute the scaling factor (in such a case the scaling factor used for the quantification of the perception of inflation is the inflation level noted 12 months earlier).

The use of the probabilistic method at the moment when the scaling factor is zero or negative, results in interpretation difficulties. Three of the survey questions concern the price increase rate (faster, slower or comparable to the current) at the moment when the survey is held. These questions are in principle adjusted for the analysis of inflation expectations in a situation where respondents perceive the inflation tendency as positive.[15] At a time of deflation, the question about a faster price increase rate cannot be properly interpreted. In the standard version of the probabilistic method, an assumption is made that the scaling factor (understood as the average rate of price change rate over a length of time) is positive and the same for the whole population. For periods with deflation or zero inflation, it is postulated to abandon this assumption. It is then assumed that respondents who choose the first three responses in the polychotomous survey are not referring to the scaling factor but to another reference value which is positive. Whereas those who declare a fall in prices relate to another scaling factor, obtained from the answers to survey questions asked at times when the scaling factor was positive.[16]

An alternative method of obtaining a scaling factor is the development of a consumer perceived price index (CPPI). The expression 'inflation perception' is used here in a slightly different context than in the consumer survey questions when respondents are asked about how they perceive the current general price level change rate. The CPPI constitutes an attempt to estimate the index which will most accurately reflect the level of perception perceived by consumers. Results of earlier studies also indicate that when assessing the current inflation, consumers first of all take into account the prices of products which weigh more in their everyday consumption basket (or are higher in their hierarchy of consumption). Moreover, they tend to overestimate the price increase and underestimate the decrease in prices. In order to obtain the CPPI, the indices obtained with the use of different baskets of goods and services must be compared with the answers to survey questions about the perceived inflation. The index showing the highest correlation with the balance statistics may be considered the representative for the CPPI.[17] In the survey carried out for Poland this index exceeded the current inflation rate for

[14] It is most often assumed that they are normally distributed.

[15] T. Łyziak, *Oczekiwania inflacyjne konsumentów: pomiar i testowanie*, Warsaw: Wyd. UW, 2014, 98–99.

[16] A proposal to adapt the probabilistic method to the zero inflation period can be found in an article by: T. Łyziak, Non-positive scaling factor in probability quantification methods: deriving consumer inflation perceptions and expectations in the whole euro area and Ireland, *Comparative Economic Studies* 55(March), 2013, 77–98.

[17] The essence of the balance sheet statistics is presented later in this article.

all periods and could serve as a scaling factor in the quantification of inflation expectations at deflation periods.[18]

The rearrangement of survey questions offers an alternative to the search of the scaling factors that are adequate for low inflation and deflation periods. An example here is the way in which expectation measurements have been implemented by the Bank of Japan. The respondents participating in a qualitative survey were asked whether in their opinion, in the following year (and over a 5-year horizon), prices would increase significantly, increase slightly, would remain the same, would fall slightly, or fall significantly.[19] Such an arrangement of answers is more symmetrical. A change in the methodology of the survey would, however, frustrate the possibility of making direct comparisons of results. Neither is it known for how long the fall in the general price level will be continued in world economies. Nor do all countries where the standard surveys are conducted—at least not all of those included in the Business and Consumer Surveys—experience deflation. Hence it seems that what should be continued is research that would lead to the adjustment of standard quantification methods to new economic circumstances.

The accuracy of expectations measurements is also significant in the context of the accuracy of such measurements when the central bank operates under the circumstances of low inflation or even deflation. Even very slight absolute changes in expectations are a proof of significant relative changes and translate into the real rate—then also very low. The accuracy of measurement also determines the possibility of assessing the influence which the additional measures undertaken by the central bank exercise on the expectations, and indirectly, on the economy.

The expectations analysis may also take a simplified form, without the quantification of the answers provided to the qualitative survey questions. This can be done with the use of balance statistics that are based entirely on the structure of the survey questions; otherwise they are the function of the fraction of the respondents who expect different changes in the price level or no changes at all in comparison to the general price level. Such statistics are much less frequently used in research or other studies and analyses because their interpretation is not straightforward. Nevertheless, some central banks present balance statistics in their official documents and reports[20] in place of

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[18] A. Hałka, T. Łyziak, *How to Define the Consumer Perceived Price Index? The Case of Poland*, National Bank of Poland Working Paper no. 160, Warsaw, 2013, 7–11.

[19] Bank of Japan, *Results of the 66th Opinion Survey on the General Public's Views and Behavior (June 2016 Survey),* <https://www.boj.or.jp/en/research/o_survey/ishiki1607.pdf> [accessed 1 July 2016].

[20] Since the qualitative surveys were abandoned in 2007, the publication of the balance statistics has been taken over by the National Bank of the Czech Republic. The National Bank of Poland practised for many years the publication of its own quantification of consumer expectations made with the use of the Carlson and Parkin method. However, in June 2016 it stopped using it and decided to announce the balance of the answers to the survey questions. This decision was on the one hand related to the problems encountered when the qualitative method was to be used in (the) circumstances of prolonged deflation, and on the other hand it resulted from the intention to present data in a manner that would be the least dependent on the quantification methods assumed.

quantified inflation expectations. Other central banks refrain from making direct references to the expectations levels, but comment on their anchoring.

No matter which solution a central bank adopts regarding the publication of the inflation expectations of different economic agents, the information published may be less creditworthy at a time of deflation, when it would indeed have been of particular use or importance.

IV. MEASURING EXPECTATIONS USING A METHOD ADJUSTED TO PERIODS OF DEFLATION

The adjustment of the qualitative method in the near zero inflation or deflation environments is particularly important vis-à-vis the results of the leading world economies, including the Eurozone, which give this issue a practical dimension. This part of the paper presents the results of the quantification of inflation expectations for two countries: Poland and Sweden, performed with the use of the standard probabilistic method[21] and another version of the same method with an additional scaling factor.[22] The quantification with the scaling factor was performed at times when the general price level change was non-positive.[23] The standard probabilistic method that constitutes the basis of quantification expectations considered in this paper is based on the following assumptions:

— Each of the respondents adheres to his or her own function of the probability of the expected price change: it may be different for different respondents and may also change over time; this function constitutes the basis for the answers provided under the survey.

— If the expected change in prices develops within a certain interval, the respondents will declare that the expected price level will stay the same; such an interval is termed the sensitivity interval; the sensitivity interval is also determined for answers predicting the same rate of price increase as the current one.

— The scaling factor (understood as the mean level of inflation over a longer time) is positive and the same for the whole population.

As the assumptions of this method show, when the number of the respondents under the survey is sufficiently large, the expected price change rate shows a normal distribution of an unknown mean and standard deviation. Once a set of equations is derived, the expected inflation rate with its standard deviation and sensitivity intervals can be calculated. Additionally, in the

[21] The quantification method used was based on the work by: T. Łyziak, *Measurement*, 8–11.

[22] The quantification of expectations with the use of the scaling factor for the periods of non-positive inflation. See: T. Łyziak, *Non-positive scaling factor*, 80–85.

[23] During the researched period, Sweden experienced a fall in the general prices level. However, there occurred periods when the scaling factor was positive, meaning that there were times when quantification should have been done using a standard method. The mean rate of the price change was negative and, consequently, a long-term price fall tendency could have been assumed, however, the deflation period was too short to draw such conclusions.

quantification method adjusted to the deflation period, the assumption of the same scaling factor in the population is dropped.

The use of both versions of the probabilistic method allows the comparison of results. Table 4 describes the sample. A relatively long time horizon is necessary to achieve a scaling factor for the period of non-positive inflation based on the regression equation. The quantification results obtained using both methods will be presented entirely for the deflation periods occurring in Poland and Sweden. What is worth noting is that while in Poland the official CPI index was constantly negative from July 2014 till the end of 2015, in Sweden, from November 2012 deflation periods were accompanied by a low but positive value of the CPI index. Since December 2013 Sverige Riksbank reference rate has been kept below 1.00%. As of October 2014 it had been 0.00%, and dropped below the zero level in February the next year. The Bank of Sweden operated in the ZLB environment and even below the technical boundaries established for inflation rates, but the National Bank of Poland still has a chance to manoeuvre and resort to the reduction of the main reference rate, which anyway has been at an unprecedentedly low level since March 2015.

Table 4

Data and a research sample

Feature	Poland	Sweden
Time span	2005–2015	2005–2015
Deflation period	July 2014–December 2015	November 2012–December 2015
Number of observations	60 (18 for deflation)	60 (38 for low inflation or deflation)
Data source	Expectations—survey of the European Commission (*Business and Consumer Surveys*) Inflation—national statistical offices	

Source: own material.

Graphs 1 and 2 below illustrate inflation expectations quantified using two methods selected respectively for Poland and Sweden. Different horizons are the consequence of different deflation periods[24] presented in Table 4.

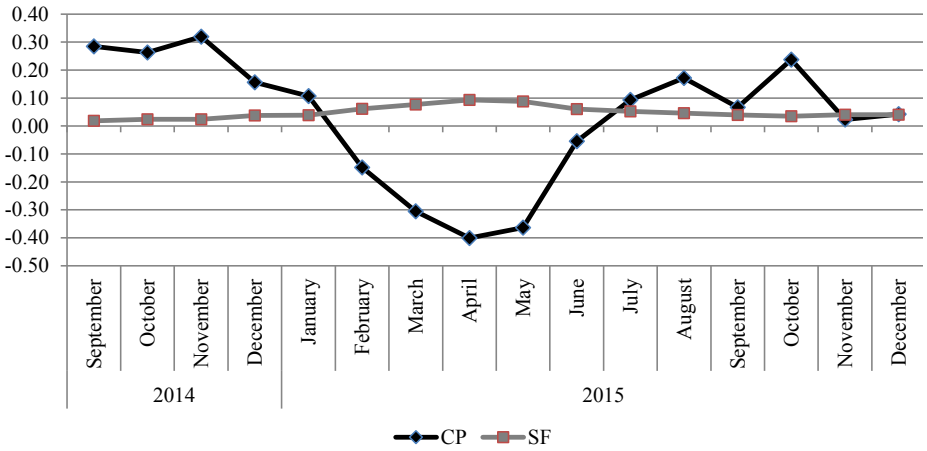
The empirical data are merely illustrations. The differences in expectations measured using two quantification methods are relatively high, both for Poland and Sweden. In a situation where the main interest rate is close to zero or very low, small differences in expectations generate much greater relative differences in the real interest rate. At the same time their management con-

[24] The period in which the method with a scaling factor is shortened by two months in relation to the deflation period. It is taken that at the moment of the survey the respondents are familiar with the consumer price index from two months earlier.

stitutes the main transmission channel. Hence the importance of the manner in which measurements are made because, as the empirical data show, the result of the measurement depends on the method used.

Graph 1

Comparison of expectations quantified using two methods—Poland

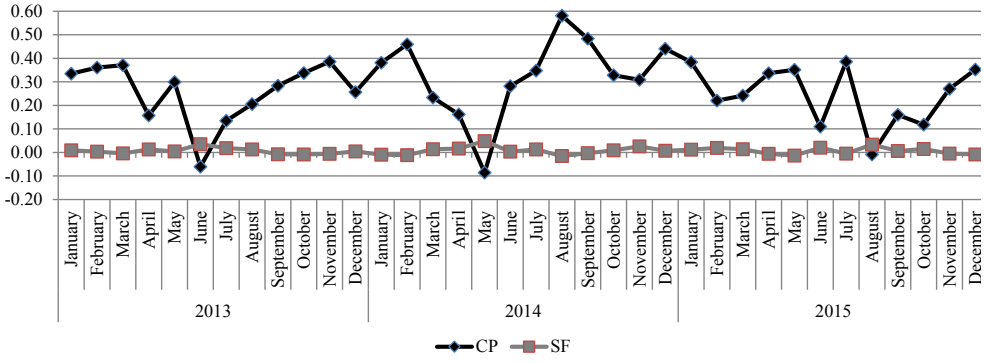


CP—the standard Carlson and Parkin method
SF—the probabilistic method with an additional scaling factor

Source: prepared by the author.

Graph 2

Comparison of expectations quantified using two methods—Sweden



CP—the standard Carlson and Parkin method
SF—the probabilistic method with an additional scaling factor

Source: prepared by the author.

However, there is no doubt that research aimed at determining the optimal method of measurement, also under specific circumstances, must be continued. Unless a reliable quantification method is found, whose acceptability compares with the Carlson and Parkin method, central banks must do with a multi-variant analysis of consumer expectations based on different ways of quantifying consumer expectations, and the analysis of balance statistics. It must also be added that it is not only consumers' expectations which are given special attention.

V. CONCLUSIONS

According to the cause-effect relationships derived in the framework of the new neoclassical synthesis, an optimal monetary policy from the point of view of households, business profits and market equilibrium would lead to a situation in which aggregated demand expectations were close to the output gap, while the inflation expectations oscillated around the inflation target. The compliance of long-term expectations with the inflation target is also one of the bank's credibility measures. This measure is the conviction of market participants of the central bank's ability to stabilise inflation at the declared level. At times of low or negative general price increase level, higher expectations are in the central bank's interest. When they increase, the central bank may, without resorting to manipulating interest rates (which could anyway be impossible once ZLB occurs) influence the real interest rate and its relationship to the natural interest rate.

There is no agreement as to the optimal way of steering expectations in ZLB circumstances. Central banks have implemented some measures that did not require any changes in the strategic framework of their monetary policy. The effects resulting from their implementation vary, and the most appropriate conclusion seems to be that the effects cannot yet be fully judged or estimated. Also the assessment using econometric tools is cumbersome owing to the interdependencies or mutual relationships between non-standard measures, the central bank's communication and the expectations of the public. It is also difficult to isolate the influence of other factors on the expectations and measures undertaken by these banks at the same time. It cannot be determined either, to what extent the monetary policy will abandon the implementation of quantitative easing once the trend in general price level has reversed. Neither can one be sure that the banks will not use if nothing else, at least forward guidance, which may simply mean that they will publish interest rates paths consistent with the inflation forecast they have made earlier.[25] Only a few central banks have done this so far.[26]

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[25] This is how *forward guidance* is understood by, among others, L.E.O. Svensson, Forward guidance, *International Journal of Central Banking* 11, 2015, Supp. 1. A substantial difference must be however indicated—FG ought to have the form of a commitment while central banks emphasise that the interest rates path is not such a commitment.

[26] Among others the Bank of Sweden, the Bank of Norway, The National Bank of the Czech Republic, the Federal Reserve System of New Zealand, the Bank of Israel.

The analysis of expectations management cannot neglect information on the levels of inflation expectations expressed by different groups of market participants, their volatility and the extent to which they are anchored at the inflation target. The periods of financial market disturbances and turbulences in the economy highlight the shortcomings of the standard methods of expectation measurements. Consequently the measurement error increases. In some cases standard methods of quantification are even modified. It seems that estimates made using the probabilistic method for non-positive scaling factor periods reflect consumer expectations better.

This paper is a review of expectations management in low inflation and deflation environments. The empirical material added covers a comparison of inflation expectations quantified using two methods. The subject matter has not been exhausted, hence no optimal solutions may be offered. On the one hand, the situation in many countries with developed economies is an impulse to continue research in this area. On the other hand, many economists believe that the conviction about the death of inflation is much exaggerated,[27] and central banks will return to the inflation path.

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MONETARY POLICY IN A LOW INFLATION ENVIRONMENT AND EXPECTATIONS OF MARKET PARTICIPANTS

Summary

The paper focuses on inflation expectations management in a low inflation or deflation environment. Firstly, it presents theoretical findings on avoiding and escaping the deflation trap. They are closely related to expectations management as expectations become the main transmission channel in the zero lower bound (ZLB) environment. In response to the recent economic crisis some of the following solutions have been applied by central banks: quantitative easing, forward guidance and depreciation. Their use is not detrimental to the framework of inflation targeting strategy. Secondly, some remarks about the difficulties of measuring expectations during the occurrence of ZLB and in a crisis situation are made. The information on expectations levels, their distribution, volatility and the degree to which they are anchored is crucial for central banks, especially when the expectations offer the most effective way to affect the economy. Finally, a comparison of the expectations quantified with the Carlson and Parkin probabilistic method and its version adjusted for non-positive scaling factor periods is made. The empirical part of the research covers Poland (July 2014–December 2015) and Sweden (November 2012–December 2015). Both countries experience deflation, and (additionally) Sweden operates under ZLB. An alternative method of quantification smoothes the expectations and reduces their volatility. The subject dealt with in this paper is still under theoretical and empirical examination. No conclusion as to the optimal solution for expectations management is made.

[27] K. Rogoff, *Informacje o śmierci inflacji są mocno przesadzone*, <https://www.obserwatorfinansowy.pl/tematyka/makroekonomia/informacje-o-smierci-inflacji-sa-mocno-przesadzone> [accessed 1 July 2016].