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INTEREST RATES AND CHANGES IN ZLOTY DEPOSITS OF HOUSEHOLDS IN POLAND

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Abstract

The article presents the results of analyses on the impact of interest rates on changes in zloty deposits of households. In the article a comparison was made of the effects of using the two chosen methods of extracting the cyclical component in time series and the impact on performance of interest rates as predictors of cyclical turning points of deposits. The obtained results indicate that the choice of the method influences the identification of turning points. Irrespectively of the method used to extract a cyclical component, the interest rate on new deposits performs better than the interest rate on outstanding amounts of deposits in predicting turning points of zloty deposits of households.

Keywords: deposits of households, interest rates, cyclical fluctuations.

JEL classification: D14, E43, E32.

Introduction

Interest rate is a principal monetary policy tool. Managing the level of interest rates the National Bank of Poland on the one hand influences the shaping of loans demand, on the other – affects the supply of deposits[1]. The final level of interest rates on zloty deposits of each group of clients depends also to some extent on the decision of banking managers who take into consideration such factors as: how much additional deposits bank needs to gather to finance the rise in lending activity, what is the level of competition from other banks in gathering deposits and, finally, what is the expected level of interest rates in the near future. It is worth emphasizing that empirical analyses confirm that interbank loans interest rates are completely or almost completely transmitted to households deposits interest rates[2].

The increase in interest rates on deposits enhances the propensity of households to save money. The response of households to changes in interest rates on deposits can be weakened or strengthened by the expected rate of return on other forms of investing the available funds such as mutual funds, the stock market and Treasury bonds. The willingness to save money on deposits is also influenced by macroeconomic situation of the country and the level of income obtained by the household[3].

The aim of the article is to evaluate the relationship between the level of interest rates and changes in zloty deposits of households. The performance of interest rates as leading indicators in relation to the zloty-denominated deposits will be considered under this study. The analyses will be conducted on the basis of cyclical component of the time series of the above variables. The additional aim of the article is to make a comparison of the effects of using the two chosen methods to extract a cyclical component – the growth rate cycle approach (based on the rate of growth) and the deviation-from-trend approach (by means of the Hodrick-Prescott filter)[4]. The effect of using these two methods on establishing the turning points in time series and the length of leads of interest rates in relation to the reference variable will be evaluated under this study as well.

The analyses will be conducted on the basis of data from the National Bank of Poland, concerning the average interest rate on new deposits and the average interest rate on outstanding amounts of deposits of households. These data are available on a monthly basis and cover the period from January 2004 to April 2013[5]. In addition to interest rates in the analyses the author will use statistical data concerning the value of zloty deposits of households (according to the balance sheet of banks at the end of the month)[6].

1. Methodology of analyses

The data concerning interest rates and the value of deposits were transformed into a comparable form for the purpose of analyses. The two methods were used to extract the cyclical component of variables. In the case of the first method (deviation-from-trend approach) seasonal and irregular fluctuations were removed from the time series of variables with the use of ARIMA-X12 procedure available in Gretl. After removing irregular and seasonal fluctuations the time series (y_t) consists of a growth component called also a stochastic trend (g_t) and a cyclical component (c_t). One of the most popular method in deviation-from-trend approach is the Hodrick-Prescott filter[7]. Application of this filter to seasonally adjusted data allows to get a nonstationary trend component and a stationary cyclical component. To obtain the values of the stochastic trend (g_t) with the use of the Hodrick-Prescott filter we must solved the following programming problem[8]:

$$\underset{\{g_t\}_{t=-1}^{T}}{Min}\left\{\sum_{t=1}^{T}c_t^2+\lambda\sum_{t=1}^{T}[(g_t-g_{t-1})-(g_{t-1}-g_{t-2})]^2\right\} \tag{1}$$

where:

$c_t = y_t - g_t$,

λ – smoothing parameter.

The smoothing parameter penalizes the acceleration in the growth component relative to the cycle component. The higher is the value of λ the smoother trend is obtained with the use of the Hodrick-Prescott filter. If λ is equal to 0, the trend component will be just the observed series. In turn, if λ goes to infinity, the trend component will approach the linear trend. The value of λ recommended in the business cycle analysis depends on the frequency of data. In the case of monthly data it is usually set to 14,400[9]. A cyclical component used in the analyses in this article has been obtained by subtracting the trend (g_t) from the actual value (y_t)[10]. The resulted variables of the cyclical component are marked with letters _hpc.

The second method which is used to extract the cyclical component is based on the growth rate cycle and involves estimating the year-over-year growth rate for each month[11]. Because of further operation on the time series "1" is added to growth rates in order to avoid problems with values below zero (2). This transformation allows to get variables without a long term trend and with seasonal fluctuations reduced to some extent. Because of this reason the growth rates in the business cycle analyses are treated as a trend filter[12].

$$z_t = \frac{y_t - y_{t-12}}{y_{t-12}} + 1 \tag{2}$$

As a result of the above transformation also the time series are shortened by as many as twelve observations. At the final stage the seasonal and irregular fluctuations are removed from the above time series with the use of ARIMA-X12 procedure[13]. The cyclical component time series obtained with the use of the method II are marked with letter _c.

In order to evaluate the usefulness of variables representing interest rates as leading indicators in relation to the changes of zloty deposits of households, the analysis of turning points was conducted. The Bry-Boschan procedure developed at The National Bureau of Economic Research was applied to identify the turning points. According to this method the upper and lower turning points must follow each other alternately. Applying this method means that the first six and the last six observations in the time series of monthly data should be omitted. The phase of a cycle should last at least five months and the minimum length of the whole cycle can not be less than fifteen months[14].

The applicability of a given variable as a potential component of composite leading indicator can be evaluated taking into consideration the signaling in advance all the turning points of the reference variable. It is very important, that such component has the length of average lead in relation to the reference variable turning points similar to the length of lead obtained on the basis of cross correlogram analysis. In order to get confirmation of good leading properties the correlation analysis will be conducted between the variables, assuming the maximum length of leads and lags in time amounting to twelve months[15].

2. The impact of cyclical fluctuations of interest rates on zloty deposits of households

2.1. Analysis on the basis of the cyclical component extracted with the use of the method I

When analyzing the shaping of the cyclical component of households' deposits which has been extracted with the use of the Hodrick-Prescott filter (dep_hpc) in the period from January 2004 to April 2013, one can indicate the total of five turning points (Table 1). The first is the upper turning point which appeared in May 2005. It is followed by the lower turning point which occurred just over two years later – in November 2007. The expansion phase that started at that time ended in April 2009 with another upper turning point. After the expiry of further twenty two months – in February 2011 the second lower turning point appeared in the time

series of the cyclical component of zloty deposits of households. The last upper turning point was identified in September 2012.

Table 1. Turning points in the analyzed variables in the period from January 2004 to April 2013

Turning points	dep_hpc	opr_n_hpc	opr_s_hpc
Peak	2005M05	2004M12	2005M03
Trough	2007M11	2007M01	2007M03
Peak	2009M04	2008M11	2009M03
Trough	2011M02	2010M11	2011M02
Peak	2012M09	2012M07	2012M09

Source: own calculations.

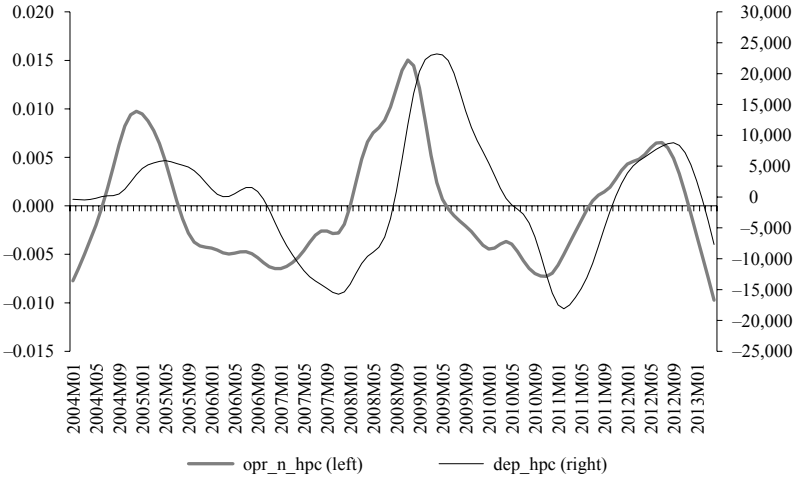

Fig. 1. Cyclical components of zloty deposits of households (dep_hpc) and the interest rate on new deposits (opr_n_hpc) in the period from January 2004 to April 2013

Source: own calculations.

The cyclical component of the interest rate on new deposits (opr_n_hpc) is very similar to the cyclical component of zloty deposits of households (dep_hpc) (Figure 1). The cyclical fluctuations of the interest rate on new deposits are leading those of zloty deposits of households. Figure 1 shows that in both series we can identify two cycles measured between the upper turning points. In the case of both variables the maximum value is reached in the second upper turning point and the minimum value in the second lower turning point. It is worth emphasizing

that all the turning points in the variable opr_n_hpc appear in advance to the turning points in the reference variable dep_hpc. The leads in the upper turning points range from two to five months. Also, the lower turning points appear from three to ten months earlier than in the reference variable. As a result the average lead of the turning points in the variable opr_n_hpc in relation to the turning points in the variable dep_hpc amounts to five months.

The leading features of the cyclical component of the interest rate on new deposits are confirmed by the cross correlogram analysis. The highest value of the correlation coefficient (0.80) is obtained for the lead of six months.

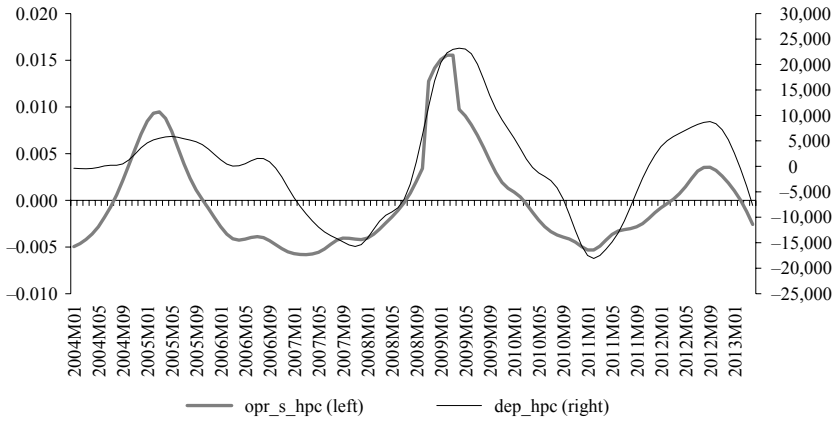

Fig. 2. Cyclical components of zloty deposits of households (dep_hpc) and the interest rate on outstanding amounts of deposits of households (opr_s_hpc) in the period from January 2004 to April 2013

Source: own calculations.

The cyclical fluctuations of the interest rate on the outstanding amounts of deposits of households (opr_s_hpc) are shaping in a similar way to the zloty deposits of households (dep_hpc) (Figure 2). Some differences can be found in the years 2004–2007 due to various rates of increase before the first peak and various rates of decrease after that. Figure 2 confirms the same number of phases and cycles in both series. Both variables reach the maximum value in the second upper turning point. The minimum value of the cyclical component of interest rate on the outstanding amounts of deposits of households is reached in the first lower turning point. The variable opr_s_hpc is leading in three turning points of the reference variable and the other two turning points appear in the same periods as in the case of the zloty deposits of households. The lead in the first upper turning point of the reference variable amounts to two months, in the

second one it is shorter and equals to one month and the last upper turning point in the interest rate appears in the same month as in the deposits of households. The difference in the length of lead in the lower turning points is very large. The first lower turning point is signaled by the variable opr_s_hpc with the lead of eight months, and another one appears at the same time as the second lower turning point in the reference variable. The average lead of the cyclical component of the interest rate on outstanding amounts of deposits of households in relation to the cyclical component of zloty deposits of households in the identified turning points amounts to 2.2 months.

The cross correlogram analysis allows to consider the cyclical component of the interest rate on outstanding amounts of deposits as a leading indicator in relation to the zloty deposits of households. The lead in relation to the reference variable, which has been established on the basis of the correlation analysis, is similar to the one obtained on the basis of turning points analysis and amounts to two months. The highest value of the correlation coefficient between the variables dep_hpc and opr_s_hpc that has been obtained for the lead of two months equals to 0.84.

2.2. Analysis on the basis of the cyclical component extracted with the use of the method II

In the second method used to extract the cyclical component the time series are shortened by twelve observations because of the transformation of data to year-over-year growth rates. As a result the analysis is carried out for the period from January 2005 to April 2013. In the above time period four turning points are identified in the time series of the cyclical component of zloty deposits of households (dep_c). All the turning points in the variable dep_c appear in the range from three to nine months earlier than in the case of the dep_hpc variable. This result confirms therefore that the method used to extract cyclical component is not indifferent to identifying a peak and a trough.

On the basis of the time series of the dep_c variable it can be found that the first lower turning point occured in July 2007 (Table 2). After one and half a year – in January 2009 the first upper turning point appeared. The contraction phase which began at that time lasted until May 2010 and ended with the second lower turning point. The last upper turning point can be found almost two years later – in March 2012.

Table 2. Turning points in the analyzed variables in the period from January 2005 to April 2013

Turning points	dep_c	opr_n_c	opr_s_c
Trough	2007M07	2005M12	2006M03
Peak	2009M01	2008M11	2009M01
Trough	2010M05	2009M12	2010M02
Peak	2012M03	2011M12	2012M08

Source: own calculations.

The variable opr_n_c which shows cyclical fluctuations of the interest rate on new deposits signals all the turning points of the reference variable dep_c ahead (Figure 3). In both series there is one cycle between the upper turning points. Three phases can be identified here. Figure 3 shows that in case of both variables the amplitudes of the first phase of increase and the first phase of decrease are higher than in the case of the second phase of increase. Both variables reach the maximum value in the first upper turning point. The minimum value is reached in the first lower turning point by the variable dep_c and in the second lower turning point by the variable opr_n_c. The length of the lead in the upper turning points is relatively short and ranges from two to three months. Much longer is the lead in the first lower turning point which amounts to nineteen months. In the case of another lower turning point the length of the lead amounts to only five months. The average lead of the turning points of the cyclical component

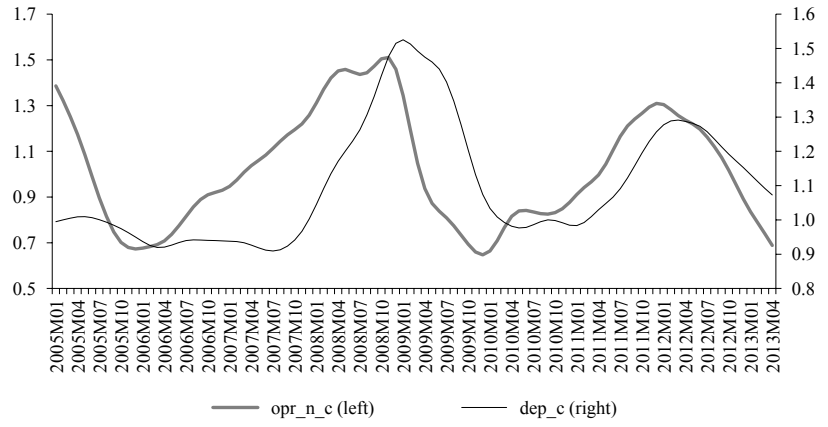

Fig. 3. Cyclical components of the zloty deposits of households (dep_c) and the interest rate on new deposits (opr_n_c) in the period from January 2005 to April 2013

Source: own calculations.

of the interest rate on new deposits in relation to the reference variable is therefore equal to 7.25 months. The similar evaluation of leading properties of the variable opr_n_c can be made on the basis of the cross correlogram analysis. It can be concluded that the cyclical component of the interest rate on new deposits gives signals of turns in the zloty deposits of households seven months ahead. The peak correlation coefficient equals to 0.79.

Figure 4 shows that from 2008 till 2013 the cyclical component of the interest rate on outstanding amounts of deposits of households and the cyclical component of the zloty deposits of households are shaped in similar way. The differences in the shape of both variables are visible in the period from 2005 till 2007. Despite that the Figure 4 confirms the same number of phases and cycles in these two series. The maximum value of both variables is reached in the first upper turning point and the minimum value in the first lower turning point.

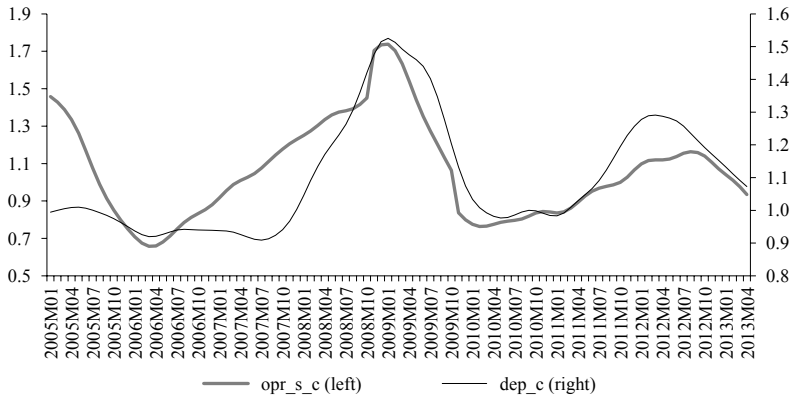

Fig. 4. Cyclical component of the zloty deposits of households (dep_c) and the interest rate on outstanding amounts of deposits of households (opr_s_c) in the period from January 2005 to April 2013

Source: own calculations.

The cyclical component of the interest rate on outstanding amounts of deposits of households (opr_s_c) extracted with the use of method II anticipates only two turning points of the reference variable (dep_c). At one turning point the opr_s_c is coincident and at another one it gives its signal behind. Both the lower turning points are signaled by the opr_s_c in advance, accordingly sixteen and three months before the occurrence of the corresponding turning points in the variable dep_c. The first upper turning point in the time series of the opr_s_c variable is identified in the same month as in the reference variable. Another upper turning point appears five months later than in the time series of the cyclical component of zloty

deposits of households. The average length of lead in turning points in relation to the reference variable amounts to 3.5 months.

The leading properties of the cyclical component of the interest rate on outstanding amounts of deposits of households (opr_s_c) are confirmed by the cross correlogram analysis. However, there is quite a difference in the length of lead comparing to the one established on the basis of turning points analysis. The highest value of the correlation coefficient which amounts to 0.77 has been obtained for the lead of the variable opr_s_c in relation to the variable dep_c that is two months. Because of the above discrepancy in the length of lead and taking into account signaling one turning point with a lag, it should be stated that the relevance of the variable opr_s_c as a leading indicator in relation do the zloty deposits of households can be evaluated much lower than the variable opr_n_c.

Conclusions

Interest rate is a very important determinant of changes in the market for zloty deposits of households. The cyclical movements (increase or decrease) in interest rates paid by banks for the deposits of households result mainly from changes in the monetary policy and cyclical fluctuations in the economic situation of a country. The level of interest rates is a very important criterion to households when making a decision about the way of saving money[16]. The effect of this impact on households decisions are cyclical fluctuations in the total amount of deposits of households gathered in banks. The above relationships are the reason why the increase (or decrease) in the interest rates on deposits entails similar changes in the zloty deposits of households.

The above analyses have confirmed that the variable which is especially valuable is the interest rate on new deposits which signals in advance the changes in the above deposits' segment. This implies that this variable should be a component of a composite leading indicator used for signaling the cyclical changes in the zloty deposits of households. This variable can also be included in an econometric model as one of the principal independent variables explaining the shaping of the above category of deposits.

The second variable discussed in the article – the interest rate on the outstanding amounts of deposits of households shows weaker leading properties because not all the turning points of this variable signal in advance the changes in the deposits of households. Moreover, the correlation analysis indicates considerably shorter lead of this variable in relation to the reference variable.

The choice of the method used to extract the cyclical component in the time series influences the identification of the turning points and also has impact on the length of lead of a variable representing the interest rate in relation to the reference variable, as well as the strength of the relationship between variables. In the case of the cyclical component of zloty deposits of households which has been extracted with the use of the method II (the growth rate cycle), the turning points appear from three to nine months earlier in comparison to the method I (the deviation-from-trend approach). The average lead of variables representing the interest rates in relation to the reference variable is shorter in the turning points in the case of the method I. Moreover, the relationship between the cyclical components of interest rates and the reference variable is a bit stronger in the case of the deviation-from-trend approach.

Notes

[1] Przybylska-Kapuścińska (2008).

[2] Demchuk et al. (2011).

[3] Schmidt-Hebbel et al. (1992); Masson et al. (1998).

[4] The differences in establishing turning points resulting from the method used to extract cyclical component were signaled e.g. in: Burzała (2011); Barczyk et al. (2010).

[5] More details: www.nbp.pl/home.aspx?f=/statystyka/pieniezna_i_bankowa/oprocentowanie_n.html.

[6] More details: www.nbp.pl/home.aspx?f=/statystyka/pieniezna_i_bankowa/nal_zobow.html.

[7] Nilsson, Gyomai (2008).

[8] Hodrick, Prescott (1997); Reeves et al. (2000).

[9] Jacobs (1998).

[10] Skikiewicz (2012).

[11] In the case of "growth rate cycle" approach there can be calculated alternatively 6-month smoothed annualized growth rate. Zarnowitz and Ozyildirim proved, that between 6-month smoothed annualized growth rate and year-over-year growth rate there is little difference. For more see: Zarnowitz, Ozyildirim (2002).

[12] Bovi (2005).

[13] Garczarczyk, Skikiewicz (2010).

[14] Bry, Boschan (1971); Drozdowicz-Bieć (2006).

[15] Garczarczyk, Skikiewicz (2009).

[16] Białowąs (2013).

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