

Part 3. Influence of Interest Rates on Credits and Deposits of Non-Financial Sector in Poland

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3.1. Introduction

The purpose of this paper is to analyse the effects of real interest rates on the magnitude of credits and deposits held by households and non-financial sector enterprises in Poland during the period 1994–1998. Other exogenous variables explaining behaviour of credits and deposits include such macroeconomic variables as: real GDP, monetary aggregate M_2 to monetary base ratio (approximating the development of banking sector in Poland), real exchange rate of USD to PLN (defined as a relation of nominal exchange rate to CPI or PPI) and real interest rates on currency deposits.

The paper is divided into four sections. The dynamics of real interest rates, as well as dynamics of deposits and credits, during the 1993–1998 period is analysed first. The results of statistical analyses of macroeconomic variables' influence on deposits of households and enterprises are shown in the next section. The following section examines determinants of credits, and the last section contains conclusions.

3.2. Deposits, Credits and Interest Rates

This paper tries to determine factors that affect the amount of deposits and credits held by agents of non-financial sector in Polish economy. The research focuses on households and enterprises during the 1993–1997 period. The source of data used in analyses are monthly Information Bulletins of National Bank of Poland (NBP).

Household deposits (DG) amounted to over 70% of total deposits of non-financial sector agents (both in zlotys and foreign currency) during the analysed period. The share of enterprises deposits (DP) shows a noticeable trend to decrease and there is an increase of absolute value of household deposits (see: Figure 1). The amount of deposits of economic agents tends to be seasonal: there is a decline in enterprise deposits in the first quarter and increases in following quarters. A rise of household deposits is observed together with a decrease in enterprise deposits at the beginning of the year. That phenomenon may be a result of dividing gains accumulated by enterprises during previous year.

3.2.1. Deposits of Households and Enterprises

Real [1] total household deposits (sum of deposits in domestic and foreign currency) were increasing by approximately 2–6% a quarter. Substantial changes are observed among different kinds of deposits (see: Figure 2). The share of foreign currency deposits in total deposits during the years 1993–1994 amounted to approximately 50%. Later this share started to decline sharply to reach 18.5% at the end of 1998.

Growth rate of total household deposits implies that the increase in growth rate of real zloty deposits is associated with a change in the deposits structure (foreign currency deposits were converted into zloty deposits). A comparison of the dynamics of real foreign currency deposits with zloty deposits of households confirms the hypothesis of substitution between these two kinds of deposits (see: Figure 3).

Enterprise deposits are characterised by a small share of foreign currency deposits (see: Figure 4). Till the end of 1995 this share was stable and did not exceed 6% of total enterprise deposits. This was due to restrictions concerning foreign currency accounts kept by enterprises. After these restrictions were abolished, at the beginning of 1996, the share of foreign currency deposits increased on average by 2.73 percentage points annually, to stabilise at the level of 13.4% of total enterprise deposits in 1998. There is a cyclical decline in the real value of zloty deposits in every first quarter.

3.2.2. Credits Granted to Households and Enterprises

Practically, during the whole analysed period the real value of credits granted to households has shown a tendency to increase (see: Figure 5). It was the growth rate of credits that was significantly changing. After rapid increase in the years 1995–1997 the rate of growth decelerated to about 21% annually. It may be connected with the policy of curbing the increase of consumer credits' conducted by NBP. However, credits dynamics exceeded household deposits' dynamics (see: Figure 6).

The real value of credits given to enterprises decreased during the years 1993–1994. Only at the beginning of 1995 the amount of enterprise credits started to rise (see: Figure 7). Credits' dynamics exceeded dynamics of enterprise deposits in the middle of this year.

The growth rate of credits was (as in the case of households) restrained at the beginning of 1997.

[1] Variables describing households and enterprises were deflated with CPI and PPI, respectively.

Table 1. Dynamics of real credits and real deposits of enterprises, 1994–1998

	1994	1995	1996	1997	1998
Average annual dynamics of real enterprise credits	0.972	1.022	1.148	1.227	1.173
Average annual dynamics of real total enterprise deposits	1.058	1.039	1.118	1.095	1.144

3.2.3. Interest Rates

Interest rate on zloty deposits (RZ) was defined as an average rate on 6-month deposits in main commercial banks published by NBP. It was deflated according to a following formula:

$$r_t^z = \frac{1 + RDZ_t}{P_t / P_{t-4}}$$

where:

r^z – real annual interest rate on zloty deposits,

RDZ – nominal annual interest rate on zloty deposits,

P_t/P_{t-4} – annual rate of inflation calculated with CPI for households and with PPI for enterprises.

Real interest rate is highly positively correlated with real deposit dynamics (see: Figure 8). Interest rate on foreign currency deposits was based an average rate on 6-month deposits in main commercial banks published by NBP. However, the amount of money (in zlotys) that agents may withdraw when the term deposit matures, depends on the exchange rate as well. Exchange rate was defined as an exchange rate of PLN/USD published by NBP. Actual nominal interest rate on deposits of domestic agents (R^{Fw}) is a sum of interest rate on foreign currency deposits offered by banks (RDW) and on growth rate of the exchange rate.

$$R_t^{Fw} = RDW_t + \left(\frac{USD_t - USD_{t-4}}{USD_{t-4}} \right)$$

where:

R_t^{Fw} – actual nominal interest rate on foreign currency deposits in period t ,

RDW_t – interest rate on foreign currency deposits offered by banks in period t ,

USD_t – the amount of zlotys paid for USD in period t .

Real interest rate was calculated according to the formula:

$$r_t^w = \frac{I + R_t^{Fw}}{P_t / P_{t-4}}$$

where:

r^w – real interest rate on foreign currency deposits,
other symbols as above.

When comparing the actual real foreign currency deposits interest rate with the growth of real foreign currency deposits one may observe a strong positive correlation between these two series (see Figure 9).

Lending rate (RKZ) was defined as an average interest rate on the-lowest-risk credits offered by main commercial banks. The rate is published by NBP. It was deflated in the same way as interest rate on zloty deposits. The volatility of lending rate is similar to that of zloty deposits, although interest rate on credits declines a bit faster. It means that spread diminished, i.e. the difference between interest rates on credits and deposits. It may be caused by an increasing competitiveness in the Polish banking sector.

3.2.4. Development of Banking System

The development of banking sector is one of the factors that influence the amounts of credits and deposits in the economy. The degree of development was approximated by a ratio of monetary aggregate M_2 to monetary base (money multiplier). The higher the multiplier, the more developed the banking sector is. The rate of money flowing out of the banking sector negatively influences the multiplier (with reserve requirements independent of commercial banks). It means that activities of banks on making their offer more attractive (for example by introducing credit and debit cards, opening new offices, and simplifying banking procedures) should lead to a smaller outflow of money from the banking system and to a bigger multiplier.

3.3. Deposits and Interest Rates

To analyse the influence of real interest rates on deposits held by households and enterprises authors use a simple microeconomic model of intertemporal choice. Following assumptions are made:

1. A typical economic agent has the following utility function:

$$u(c_0, c_1) = c_0^\theta c_1^{1-\theta} \quad \theta \in (0;1) \quad (1)$$

where c_0 (c_1) is current consumption (expected future consumption) and θ ($1-\theta$) stands for elasticity of utility with respect to current consumption (expected future consumption).

2. A typical agent earns real current income $y_0 > 0$. He may use it either for current consumption c_0 or for current saving s . It means that:

$$y_0 = c_0 + s \quad (2)$$

3. Future consumption c_1 is paid for with future income $y_1 > 0$ and savings s (taking into consideration discount rate – real interest rate r):

$$c_1 = y_1 + (1+r)s \quad (3)$$

Combining equations (2–3) gives intertemporal budget constraint:

$$(1+r)c_0 + c_1 - (1+r)y_0 - y_1 = 0 \quad (4)$$

Finding an optimal consumption structure ($c_0; c_1$) and an amount of current saving is synonymous with the maximization of the utility function (1) with budget constraint (4).

J.L. Lagrange polynomial for this problem is given by a formula:

$$L(c_0, c_1, \lambda) = c_0^\theta c_1^{1-\theta} + \lambda[(1+r)c_0 + c_1 - (1+r)y_0 - y_1]$$

where $\lambda \in \mathfrak{R}$ is indefinite Lagrange multiplier.

Maximum of function (1) with budget constraint (4) exists only if following necessary conditions are satisfied:

$$\left. \begin{aligned} \frac{\partial L}{\partial c_0} &= \theta c_0^{\theta-1} c_1^{1-\theta} + \lambda(1+r) = 0 \\ \frac{\partial L}{\partial c_1} &= (1-\theta)c_0^\theta c_1^{-\theta} + \lambda = 0 \\ \frac{\partial L}{\partial \lambda} &= (1+r)c_0 + c_1 - (1+r)y_0 - y_1 = 0 \end{aligned} \right\} \quad (5)$$

It may be proved that optimal consumption structure (satisfying necessary conditions for the existence of mentioned above Lagrange's conditional extreme) is given by a formula:

$$\left. \begin{aligned} c_0 &= \theta \left(y_0 + \frac{y_1}{1+r} \right) \\ c_1 &= (1-\theta) [(1+r)y_0 + y_1] \end{aligned} \right\} \quad (6)$$

A current saving function of typical agent can be obtained from the first simultaneous equation (6) and equation (2):

$$s = (1 - \theta)y_0 - \theta \frac{y_1}{1+r} \quad (7)$$

Basing on equation (7) one can conclude that there exist following relations [2]:

$$s = s \left(y_0^+, r^+, \theta^-, y_1^- \right)$$

It means that the higher real current income and real interest rate, the higher should be current saving. The higher the elasticity of utility with respect to current consumption and expected future income, the lower is current saving. θ and y_1 cannot be measured directly, therefore authors concentrate mainly on the effect y_0 and r on s .

It should be mentioned that deposits of households were divided into foreign currency and zloty denominated deposits (changes in structure of these deposits are presented in the second section of this paper). It was assumed that the first difference of the logarithm of real zloty deposits (deflated with CPI) is a function of the logarithm of real interest rate (deflated with CPI) on these deposits, real exchange rate (defined as a ratio of the amount of zlotys paid for USD to CPI), real GDP (as a proxy for personal incomes), M_2 to monetary base H ratio (measuring the degree of Polish banking sector development) and logarithm of real zloty deposits in previous period. In order to avoid seasonality (resulting from seasonality of GDP) seasonal differencing (4-differencing) was used.

The equation describing first differences of deposits may be written in the following form:

$$\begin{aligned} \Delta_4 \ln \left(\frac{DZG_t}{CPI_t} \right) &= \alpha_0 + \alpha_1 \ln \left(\frac{1 + RDZ_t}{CPI_t / CPI_{t-4}} \right) - \alpha_2 \ln \left(\frac{USD_t}{CPI_t} \right) + \alpha_3 \ln(PKB_t) + \\ &+ \alpha_4 \ln \left(\frac{M2_t}{H_t} \right) - \alpha_5 \ln \left(\frac{DZG_{t-4}}{CPI_{t-4}} \right) + \xi_t^{DZG} \quad \alpha_0 \in \mathfrak{R}; \quad \alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5 > 0 \end{aligned} \quad (8)$$

where:

$$\Delta_4 \ln \left(\frac{DZG_t}{CPI_t} \right) \equiv \ln \left(\frac{DZG_t}{CPI_t} \right) - \ln \left(\frac{DZG_{t-4}}{CPI_{t-4}} \right)$$

[2] Formula of $y = y \left(x_1^+, x_2^-, \dots \right)$ means that y is an increasing (decreasing) function of variable x_1 (x_2).

DZG_t – nominal zloty deposits held by households (in million of zlotys) in period t ; source as in the second section,

CPI_t – CPI in period t (1995:1 equals 1); source as in the second section,

RDZ_t – nominal interest rate on zloty deposits offered by main commercial banks in period t ; source as in the second section,

USD_t – the amount of zlotys paid for USD in period t ; source as in the second section,

PKB_t – real GDP in period t (1995:1 prices) [3],

$M2_t$ – monetary aggregate $M2$ in period t ; source as in the second section,

H_t – monetary base in period t ; source as in the second section,

$\alpha_0, \alpha_1, \alpha_2, \alpha_3, \alpha_4$ and α_5 – structural parameters of equation (8),

$\xi_t DZG$ – random error term.

$\Delta_4 \ln \left(\frac{DZG_t}{CPI_t} \right)$ in equation (9) is an approximation of current savings s in equation (7).

$\frac{1 + RDZ_t}{CPI_t / CPI_{t-4}}$ and PKB_t stand for r and y_0 , respectively. Negative influence of real exchange rate USD_t / CPI_t on $\Delta_4 \ln \left(\frac{DZG_t}{CPI_t} \right)$ may result from the policy of real appreciation of zloty, when economic agents convert their foreign currency deposits into zloty deposits. Therefore, the lower the USD_t to CPI_t ratio, the higher the growth rate of zloty deposits and the higher $\Delta_4 \ln \left(\frac{DZG_t}{CPI_t} \right)$ will be. Ratio of $M2_t$ to H_t describes the effect of development of banking sector on the amount of zloty denominated deposits. The effect of $\ln \left(\frac{DZG_{t-4}}{CPI_{t-4}} \right)$ on $\Delta_4 \ln \left(\frac{DZG_t}{CPI_t} \right)$ may come as a result of the assumption that the higher the level of deposits, the lower the first difference of this variable (it is therefore assumed that growth rates of household zloty deposits decline if levels of these deposits rise).

To analyse the structure of household deposits (defined as a ratio of foreign currency deposits to total deposits), authors estimated the following regression:

[3] Source: J. Brzezczczyński, R. Kelm, A. Welfe, "Banki danych wysokiej częstotliwości modeli serii WK", Prace Instytutu Ekonometrii i Statystyki UŁ, Łódź, 1996 and Statistical Bulletin published by Central Statistical Office (GUS).

$$\ln\left(\frac{DWG_t}{DWG_t + DZG_t}\right) = \beta_0 - \beta_1 \ln\left(\frac{1 + RDZ_t}{CPI_t / CPI_{t-4}}\right) + \beta_2 \ln\left(\frac{RDZ_t + USD_t / USD_{t-4}}{CPI_t / CPI_{t-4}}\right) + \beta_3 \ln\left(\frac{M2_t}{H_t}\right) + \beta_4 d_{95} + \xi_t^S \quad \beta_0 \in \mathfrak{R}; \beta_1, \beta_2, \beta_3, \beta_4 > 0 \quad (9)$$

where:

$$\frac{DWG_t}{DWG_t + DZG_t}$$

is a share of foreign currency deposits held by households in total household deposits; source as in the second section,

$$\frac{1 + RDZ_t}{CPI_t / CPI_{t-4}}$$

is real interest rate on zloty deposits in main commercial banks; source as in the second section,

$$\frac{RDZ_t + USD_t / USD_{t-4}}{CPI_t / CPI_{t-4}}$$

is real interest rate on foreign currency deposits; source as in the second section,

d_{95} – dummy variable that equals 1 in 1995, and 0 otherwise,

$\beta_0, \beta_1, \beta_2, \beta_3, \beta_4$ – structural parameters of equation (9),

ξ_t^S – random error term.

Specification of equation (9) implies that authors make following assumptions:

– The higher real interest rate on foreign currency (zloty) deposits, the lower (higher) the share of foreign currency deposits of households in total household deposits. Zloty appreciated in real terms and real interest rate on foreign currency deposits was most of the time lower than on zloty deposits. As a result, households converted their foreign currency savings into zloty savings. The higher the real interest rate on zloty deposits to foreign currency deposits, the higher was the confidence in domestic currency and the lower share of foreign currency deposit.

– $M2/H$ variable describes development of Polish banking sector. Its influence on the share of foreign currency deposits in total household deposits may be explained in a following way: it is possible that at the beginning of the transition period a big part of savings was kept in US dollars outside the banking system because agents did not trust in domestic currency and because the banking system was underdeveloped. As the banking system developed, households were more and more eager to keep their savings in banks. Part of dollar savings was placed on banking accounts. Savings in foreign currencies were converted into Polish zloty and put in banks as zloty deposits because real interest rate on zloty deposits were higher than on foreign currency deposits. Provided that the above

arguments are valid and relations between the above-mentioned variables are correctly specified, the higher the M_2 to H ratio, the lower should be the share of foreign currency deposits in total household deposits.

– Dummy variable d_{95} describes the results of liberalising the exchange rate (with respect to convertible currencies) on the structure of households deposits in 1995.

Equations (8–9) were estimated using Two-Stage Least Squares method (TSLS). TSLS estimations of the above mentioned equations during the years 1994–1998 yielded following results [4]:

$$\Delta_4 \ln \left(\frac{DZG_t}{CPI_t} \right) = 4.841 + 4.108 \ln \left(\frac{1 + RDZ_t}{CPI_t / CPI_{t-4}} \right) - 1.003 \ln \left(\frac{USD_t}{CPI_t} \right) +$$

$$+ 0.182 \ln(PKB_t) + 0.890 \ln \left(\frac{M_2_t}{H_t} \right) - 0.681 \ln \left(\frac{DZG_{t-4}}{CPI_{t-4}} \right)$$

$R^2 = 0.963 \quad \text{adj. } R^2 = 0.950 \quad DW = 1.700$

$$\ln \left(\frac{DWG_t}{DWG_t + DZG_t} \right) = 2.870 - 4.945 \ln \left(\frac{1 + RDZ_t}{CPI_t / CPI_{t-4}} \right) +$$

$$+ 0.546 \ln \left(\frac{RDZ_t + USD_t / USD_{t-4}}{CPI_t / CPI_{t-4}} \right) + -3.088 \ln \left(\frac{M_2_t}{H_t} \right) + 0.119 d_{95}$$

$R^2 = 0.968 \quad \text{adj. } R^2 = 0.956 \quad DW = 1.909$

One can draw following statistical conclusions from presented estimations of functions (8–9):

– Right hand side variables specified in equations (8–9) explain approximately 95% and 96% of variation in endogenous variables (see adjusted R^2).

– All explanatory variables significantly influenced endogenous variables at 8% significance level.

– An increase of real interest rate on zloty deposits by 1% raised the growth rate of these deposits by approximately 4.1% [5]. The same increase in real exchange rate of USD led to about 1% decline in the growth rate. One percent rise of real GDP raised the growth rate of zloty denominated deposits of households by 0.18%. Moreover, every

[4] Values of t statistics are given in parenthesis below the estimated coefficients. R^2 (adj. R^2) stands for coefficient of determination (adjusted coefficient of determination), DW is J. Durbin-G.S. Watson statistic.

[5] All statistical conclusions are based on the *ceteris paribus* assumption.

increase in M_2/H ratio (describing the development of Polish banking sector) by 1% caused a 0.89% rise in the growth rate of deposits. If the level of these deposits increased by 1%, their growth rate would rise by approximately 0.69%.

– When analysing estimated parameters of the deposits structure equation one may state that: i) increase in real interest rate (deflated with CPI) on zloty deposits by 1% diminished the share of foreign currency deposits in total deposits by approximately 9.95%. ii) The same rise in real interest rate on USD deposits increased its share by about 0.55%. iii). Increase in M_2/H ratio by 1% led to approximately 3.09% decline in the share of USD deposits in total deposits. iv) the share of foreign currency deposits in total deposits in 1995 was by 0.12% higher than in any other period suggesting the existence of factors not specified in the model.

Deposits of enterprises were not disaggregated into zloty and foreign currency deposits because the share of foreign currency deposits in total deposits was very small relative to the share of zloty deposits in total household deposits. A following first difference equation of total enterprise deposits was estimated:

$$\begin{aligned} \Delta_4 \ln \left(\frac{DP_t}{PPI_t} \right) &= \gamma_0 + \gamma_1 \ln \left(\frac{1 + RDZ_t}{PPI_t / PPI_{t-4}} \right) - \gamma_2 \ln \left(\frac{USD_t}{PPI_t} \right) + \\ &+ \gamma_3 \ln(PKB_t) + \gamma_4 \ln \left(\frac{M2_t}{H_t} \right) - \gamma_5 \ln \left(\frac{DP_{t-4}}{PPI_{t-4}} \right) + \gamma_6 d_{98.4} + \xi_t^{DP} \\ \gamma_0, \gamma_6 &\in \mathfrak{R}; \quad \gamma_1, \gamma_2, \gamma_3, \gamma_4, \gamma_5 > 0 \quad (10) \end{aligned}$$

where:

DP_t – nominal level of enterprises deposits in period t , in million PLN; source as in the second section,

PPI_t – PPI in period t (1995:1 equals 1); source as in the second section,

$d_{98.4}$ – dummy variable that equals 1 in the fourth quarter of 1998, and 0 otherwise,

$RDZ_t, USD_t, PKB_t, M2_t, H_t$ – as in equation (8),

$\gamma_0, \gamma_1, \gamma_2, \gamma_3, \gamma_4, \gamma_5$ and γ_6 – structural parameters of equation (10),

ξ_t^{DP} – random error term.

The influence of real zloty deposits interest rate, real exchange rate, real GDP, M_2/H ratio and level of enterprise deposits (in real terms) on the growth rate of these deposits may be explained in the same way as the effect of analogous variables on the growth rate of household zloty deposits. Dummy variable $d_{98.4}$ describes a rapid increase in growth rate of these deposits during the fourth quarter of 1998, caused by factors not specified in the model. OLS regression of equation (10) gave the following results:

$$\Delta_4 \ln \left(\frac{DP_t}{PPI_t} \right) = 2.418 + 1.337 \ln \left(\frac{I + RDZ_t}{PPI_t / PPI_{t-4}} \right) + 0.0722 \ln \left(\frac{USD_t}{PPI_t} \right) +$$

$$+ 0.205 \ln(PKB_t) + 0.134 \ln \left(\frac{M_2_t}{H_t} \right) - 0.493 \ln \left(\frac{DP_{t-4}}{PPI_{t-4}} \right) + 0.0867 d_{98.4}$$

$R^2 = 0.866 \quad adj. R^2 = 0.806 \quad DW = 2.342$

From the above estimations of equation 10 one may conclude that the influence of logarithms of real exchange rate and M_2/H ratio on the logarithm of real enterprise deposits growth rate is not significant (as may be seen from the low t statistics). Firstly, it may be caused by enterprises maintaining mainly zloty denominated deposits in Polish banks (because of institutional regulations) and therefore being indifferent to fluctuations of exchange rate. Secondly, there may be a history of keeping deposits in banks. This can explain the lack of influence of banking sector development (measured with M_2/H ratio) on the growth rate of enterprise deposits. This is why $\ln(USD_t/PPI_t)$ and $\ln(M_2_t/H_t)$ were removed from equation 10, which resulted in the following estimates:

$$\Delta_4 \ln \left(\frac{DP_t}{PPI_t} \right) = 2.260 + 1.376 \ln \left(\frac{I + RDZ_t}{PPI_t / PPI_{t-4}} \right) + 0.180 \ln(PKB_t) -$$

$$- 0.425 \ln \left(\frac{DP_{t-4}}{PPI_{t-4}} \right) + 0.0805 d_{98.4}$$

$R^2 = 0.864 \quad adj. R^2 = 0.827 \quad DW = 2.418$

From the above estimations of enterprise deposits growth rate one may conclude that:

- Independent variables specified in this equation explained approximately 83% of variation in the dependent variable.
- All exogenous variables significantly affected the endogenous variable.
- Increase in interest rate on zloty deposits by additional 1% led to about 1.38% rise of growth rate of enterprise deposits. The same change in real GDP increased analysed growth rate by approximately 0.18%, and 1% rise in the level of these deposits diminished their growth rate by about 0.43%. In the fourth quarter of 1998 growth rate of enterprise deposits was by 8% higher than in other periods.

Interest rate that determines total deposits of households and enterprises in the economy was defined as zloty deposit interest rate. This was done due to a big share of zloty deposits in total deposits (approximately 75%). Thus, the equation of total deposits is written in a following form:

$$\begin{aligned} \Delta_4 \ln \left(\frac{DOg_t}{Defl_t} \right) &= \tau_0 + \tau_1 \ln \left(\frac{1 + RDZ_t}{Defl_t / Defl_{t-4}} \right) + \tau_2 \ln PKB + \tau_3 \ln \left(\frac{M_2}{H} \right) - \\ &- \tau_4 \ln \left(\frac{USD}{Defl} \right) - \tau_5 \ln \left(\frac{DOg_{t-4}}{Defl_{t-4}} \right) + \tau_6 d_{97.3} + \xi_t^{Og} \\ \tau_0, \tau_6 &\in \mathfrak{R} \quad \tau_1, \tau_2, \tau_3, \tau_4, \tau_5 > 0 \end{aligned} \quad (11)$$

where:

DOg_t – nominal level of total deposits of households and enterprises in period t , in million PLN,

$Defl_t$ – indicator of inflation rate in period t ; weighted average of CPI (83%) and PPI (17%) [6], 1995.1 equals 1,

$d_{97.3}$ – dummy variable that equals 1 in the third quarter of 1997, and 0 otherwise,

$\tau_0, \tau_1, \tau_2, \tau_3, \tau_4, \tau_5, \tau_6$ – structural parameters of equation (11),

ξ_t^{Og} – random error term,

other symbols as above.

Following coefficients were obtained during the estimation:

$$\begin{aligned} \Delta_4 \ln \left(\frac{DOg_t}{Defl_t} \right) &= \underset{(3.626)}{1.962} + \underset{(7.651)}{1.526} \ln \left(\frac{1 + RDZ_t}{Defl_t / Defl_{t-4}} \right) + \underset{(2.106)}{0.061} \ln PKB + \\ &+ \underset{(1.714)}{0.190} \ln \left(\frac{M_2}{H} \right) - \underset{(-2.653)}{0.139} \ln \left(\frac{USD}{Defl} \right) - \underset{(-3.945)}{0.240} \ln \left(\frac{DOg_{t-4}}{Defl_{t-4}} \right) + \underset{(1.620)}{0.019} d_{97.3} \\ R^2 &= 0.973 \quad adj.R^2 = 0.960 \quad DW = 1.596 \end{aligned}$$

Independent variables used in the equation describe the behaviour of the dependent variable in 96%. All exogenous variables significantly influenced the left-hand side variable. Only the estimates of the degree of banking sector development and dummy variable t statistics were not conclusive. Obtained parameters should be understood in the following way: 1% increase in independent variables (other things being equal) raised the growth rate of total deposits by about 1.53% – in the case of interest rate on zloty deposits; by 0.06% – in the case of GDP growth; by approximately 0.19% – in the case of the growth of banking system development indicator. A 1% rise of real exchange rate and the level of total deposits diminished the growth rate of these deposits by about 0.14% and 0.24%, respectively. In

[6] Such weights were implied by IMF data: government and private consumption expenditures in Poland in the years 1990–1995 amounted to 83% of GDP.

addition, in the third quarter of 1997 the growth rate of analysed deposits was by approximately 2% higher than in other periods.

3.4. Determinants of Credits

Analysis of domestic currency credits given to households and enterprises has been already laid out in this paper. In both cases the first difference of the logarithm of credits was chosen as a dependent variable. It describes the actual behaviour of agents reacting to market situation. In other words, the volume of credits is less sensitive to economic conditions than its first difference.

Credits given to households were set to depend on the following factors:

- lending rate deflated with CPI. The working hypothesis was that the lending rate should negatively affect the first differences of households' indebtedness;
- GDP as an approximation of household incomes. Bigger incomes should encourage households to apply for credits [7];
- degree of banking sector development. The more developed the banking sector, the bigger should be availability of credits (for example through higher number of banking offices and intermediaries offering possibilities of buying on credit in shops, bigger competitiveness between banks and lower lending rates), and bigger credit availability should raise the amount of obtained credits.

Relations between real increase in the volume of credits and explanatory variables can be written in the following way:

$$\begin{aligned} \Delta_4 \ln \left(\frac{KG_t}{CPI_t} \right) &= \delta_0 + \delta_1 \ln PKB_t + \delta_2 \ln \left(\frac{M2_t}{H_t} \right) + \delta_3 \ln \frac{I + RKZ_t}{CPI_t / CPI_{t-4}} + \\ &+ \delta_4 d_{95} \ln \left(\frac{M2_t}{H_t} \right) + \delta_5 d_{97.3} - \delta_6 \ln \left(\frac{KG_{t-4}}{CPI_{t-4}} \right) + \xi_t^{KG} \\ \delta_0, \delta_4, \delta_5 &\in \mathfrak{R}; \quad \delta_1, \delta_2, \delta_3, \delta_6 > 0 \quad (12) \end{aligned}$$

where:

KG_t – nominal level of credits given to households,

$d_{97.3}$, d_{95} – dummy variables for the third quarter of 1997 and for the whole year 1995, respectively,

[7] It seems that the expected growth rate of GDP can serve as a better independent variable than GDP in levels. But the problem is that expected growth rate of GDP is difficult to measure, because it is difficult to assess whether expectations of economic agents are rather adaptive or rational.

$\delta_0, \delta_1, \dots, \delta_6$ – structural parameters of the equation (12),

ξ_t^{KG} – random error term,

other symbols as above.

Estimated coefficients of equation (12) are presented below:

$$\begin{aligned} \Delta_t \ln \left(\frac{KG_t}{CPI_t} \right) = & -3.7443 + 0.3330 \ln(PKB_t) + 3.7161 \ln \left(\frac{M_2}{H_t} \right) + \\ & + 1.3631 \ln \frac{1 + RKZ_t}{CPI_t / CPI_{t-4}} - 0.1664 d_{95} \ln \left(\frac{M_2}{H_t} \right) + 0.2083 d_{97} d_3 + \\ & - 0.5394 \ln \left(\frac{KG_{t-4}}{CPI_{t-4}} \right) \\ R^2 = & 0.8359 \quad adj.R^2 = 0.7602 \quad DW = 2.4592 \end{aligned}$$

From the estimation of equation (12) one may conclude that:

- 76% of the dependent variable was explained by the right-hand side variables.
- Real GDP and real interest rate did not significantly (even at 10% significance level) influence the growth rate of real credits given to households.

– Increase in M_2/H ratio by 1% led to approximately 3.72% rise of the growth rate (excluding observations for 1995, when the elasticity of analysed growth rate with respect to M_2/H amounted to ca. 3.54%). During the third quarter of 1997 the credit growth rate rose by 0.21%. The rise might have been caused by floods in southern and western Poland in July. In spite of this, every additional 1% of credits obtained by households increased the growth rate by about 0.54%.

The growth of credits given to enterprises was affected by the following factors:

- Lending rate deflated with PPI. The interest rate should be negatively correlated with the dependent variable.
- Output (GDP).
- The growth rate of real exchange rate of USD. The inclusion of this variable was intended to pinpoint one of the factors determining foreign currency debt of enterprises. Higher and higher value of foreign currency should discourage enterprises from applying for foreign currency credits.
- Inflation rate. Growing uncertainty about economic situation and frequently changing cost of foreign capital should negatively influence readiness to get new credits and should encourage enterprises to use their own resources.

The growth of real domestic currency indebtedness of enterprises is given below:

$$\begin{aligned} \Delta_4 \ln \left(\frac{KP_t}{PPI_t} \right) &= \phi_0 + \phi_1 \ln(PKB_t) + \phi_2 \Delta_4 \ln \left(\frac{USD_t}{PPI_t} \right) - \phi_3 \ln \left(\frac{I + RKZ_t}{PPI_t / PPI_{t-4}} \right) + \\ &- \phi_4 \ln \left(\frac{PPI_t}{PPI_{t-4}} \right) + \phi_5 d_{95} \ln \left(\frac{I + RKZ_t}{PPI_t / PPI_{t-4}} \right) + \xi_t^{KP} \\ \phi_0, \phi_5 &\in \mathfrak{R}; \quad \phi_1, \phi_2, \phi_3, \phi_4 > 0 \quad (13) \end{aligned}$$

where:

$$\Delta_4 \ln \left(\frac{USD_t}{PPI_t} \right) \quad \text{acts as a logarithm of growth rate of real exchange rate,}$$

$\phi_0, \phi_1, \dots, \phi_5$ – structural parameters from the above described equation,

ξ_t^{KP} – random error term,

other symbols as above.

Estimation yielded following coefficients of function (13):

$$\begin{aligned} \Delta_4 \ln \left(\frac{KP_t}{PPI_t} \right) &= \underset{(1.3491)}{0.8512} - \underset{(-0.6773)}{0.0384} \ln(PKB_t) + \underset{(5.2525)}{0.4657} \Delta_4 \ln \left(\frac{USD_t}{PPI_t} \right) + \\ &- \underset{(-3.0745)}{1.0941} \ln \left(\frac{I + RKZ_t}{PPI_t / PPI_{t-4}} \right) - \underset{(-9.6413)}{1.3158} \ln \left(\frac{PPI_t}{PPI_{t-4}} \right) + \\ &+ \underset{(3.6767)}{0.7984} d_{95} \ln \left(\frac{I + RKZ_t}{PPI_t / PPI_{t-4}} \right) \end{aligned}$$

$$R^2 = 0.953 \quad adj.R^2 = 0.945 \quad DW = 1.685$$

Following conclusions can be drawn from the above equation:

- 94% of the dependent variable was explained by independent variables.
- Real GDP level did not significantly affect the growth rate of real credits given to enterprises.
 - Increase in the growth rate of USD exchange rate by 1% led to approximately 0.47% rise of growth rate of credits obtained by enterprises. Elasticity of the endogenous variable with respect to real interest rate amounted to –1.09, except for 1995 when it had the value of –0.29.
 - Inflation rate significantly influenced the growth rate of credits given to enterprises. Its 1% rise diminished credits growth rate by 1.32%.

Following relations were assumed to hold in the equation describing total credits granted to enterprises and households (KOG) [8]:

$$\begin{aligned} \Delta_4 \ln \left(\frac{KOG_t}{Defl_t} \right) = & \psi_0 + \psi_1 \ln(PKB_t) + \psi_2 \Delta_4 \ln \left(\frac{USD_t}{Defl_t} \right) + \\ & - \psi_3 \ln \left(\frac{I + RKZ_t}{Defl_t / Defl_{t-4}} \right) + \psi_4 d_{95} \ln \left(\frac{I + RKZ_t}{Defl_t / Defl_{t-4}} \right) + \\ & - \psi_5 \ln \left(\frac{Defl_t}{Defl_{t-4}} \right) + \xi_t^{KOG} \quad \psi_0, \psi_5 \in \mathfrak{R}; \quad \psi_1, \psi_2, \psi_3, \psi_4 > 0 \quad (14) \end{aligned}$$

where:

KOG_t – level of nominal total credits given to enterprises and households in period t , in million PLN,

$\psi_0, \psi_1, \dots, \psi_5$ – structural parameters of the above equation,

ξ_t^{KOG} – random error term,

other symbols as above.

The results of estimation are presented below:

$$\begin{aligned} \Delta_4 \ln \left(\frac{KOG_t}{Defl_t} \right) = & 1.369 - 0.079 \ln(PKB_t) + 0.624 \Delta_4 \ln \left(\frac{USD_t}{Defl_t} \right) + \\ & - 1.410 \ln \left(\frac{I + RKZ_t}{Defl_t / Defl_{t-4}} \right) + 1.271 d_{95} \ln \left(\frac{I + RKZ_t}{Defl_t / Defl_{t-4}} \right) + \\ & - 1.435 \ln \left(\frac{Defl_t}{Defl_{t-4}} \right) \\ R^2 = 0.957 \quad adj.R^2 = 0.942 \quad DW = 2.013 \end{aligned}$$

Following conclusions are drawn from these results:

– The estimated equation determined the behaviour of growth rate of real total credits in 94%.

– The level of real GDP did not significantly affect endogenous variable. Other independent variables influenced it in a significant way.

– 1% increase in the growth rate of USD exchange rate raised the growth rate of total zloty credits by approximately 0.62%; the elasticity between dependent variable and real interest rate amounted to –1.41, except for the year 1995 when it was –0.14.

[8] Nominal variables were deflated with the same index, which was used in the equation of total deposits.

– The rate of inflation significantly influenced the growth rate of total credits. Increase in inflation by 1% led to 1.44% decline in the growth rate of credits.

3.5. Conclusions

Following conclusions may be drawn from conducted research:

– Analysis of household deposits in Poland in the years 1994–1998 shows that the structure of these deposits has changed. The share of foreign currency deposits declined and the share of zloty deposits rose. It seems to be to some extent caused by the real appreciation of zloty. The policy, which made the zloty to appreciate in real terms, led to higher real interest rate on zloty deposits in comparison with the rate on foreign currency deposits. The development of Polish banking sector appears to be important for changes in the structure of deposits. This development leads to converting dollar savings kept in home into zloty deposits.

– The growth rate of household zloty deposits is sensitive to changes in real interest rate and exchange rate. GDP growth and banking sector development significantly affect the growth of deposits as well.

– The growth rate of enterprise deposits is indifferent to banking sector development and fluctuations in the exchange rate. It may be caused by the fact that enterprises (contrary to households) are obliged to have banking accounts, and their financial surpluses are placed in banks no matter what is the degree of banking sector development. The lack of real exchange rate's influence on analysed variable may be explained by enterprises' unwillingness to undertake risk associated with foreign currency trading.

– Moreover, non-financial sector enterprises are less sensitive than households to changes in real interest rate and (to some extent) to different levels of GDP. It may be caused by the fact that the primary purpose of firms' activity is to use their financial surpluses for production, and do not engage in speculation on interest rate changes.

– Analysis of factors determining credits given to households shows that households react neither to changes in real interest rate, nor to fluctuations of real GDP. The most important factor affecting growth of credits is banking sector development and availability of credits. It is worth underlining that equation of growth rate of credits granted to households estimated by authors explains only about 75% of the variation of the above mentioned variable. It means that there can exist other significant factors influencing the amount of credits, such as, difficult to measure, expected growth rate of future incomes.

– The growth rate of zloty credits given to enterprises is not affected by current levels of GDP, but it is highly correlated with growth rate of real exchange rate, inflation rate, and real lending rate. Growth rate of real exchange rate positively influences the growth rate of zloty credits obtained by enterprises. This relation indicates that economic agents treat these two kinds of credits as substitutes. A rise in price of foreign currency credit (measured among others by changes in real exchange rate) leads to increased demand for zloty credits. Curbing high inflation relieves uncertainty concerning economic activity, raises demand for investment and credits obtained by enterprises. Negative influence of real lending rate on growth rate of credits is obvious.

Figure 1. The share of household deposits in total deposits

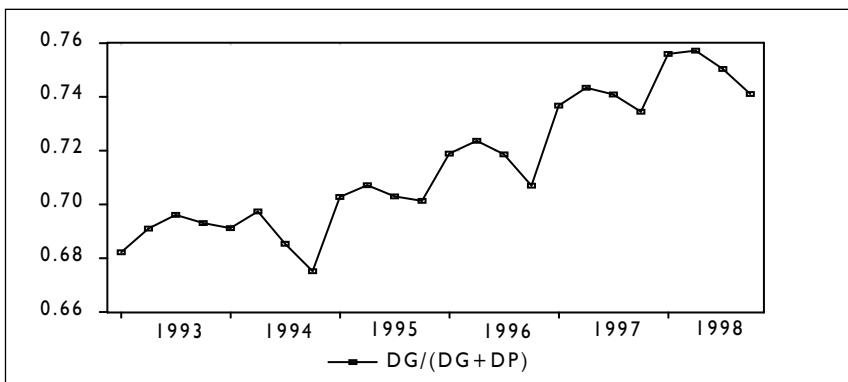


Figure 2. Real zloty deposits (DZG/CPI) and foreign currency deposits (DWG/CPI) held by households

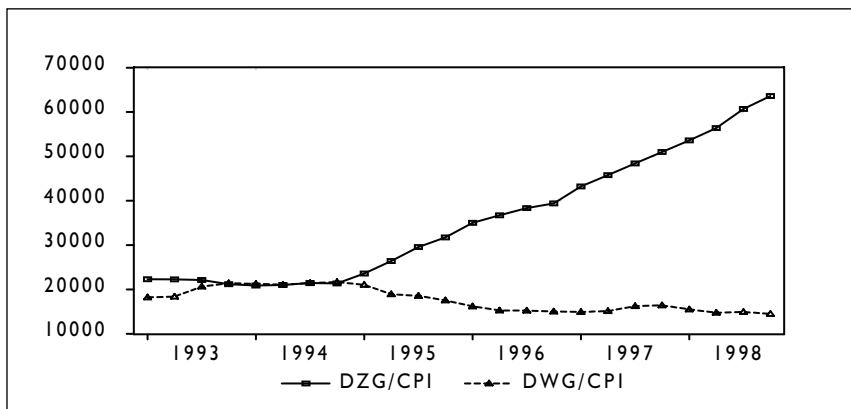


Figure 3. Growth rates of real foreign currency and zloty deposits held by households

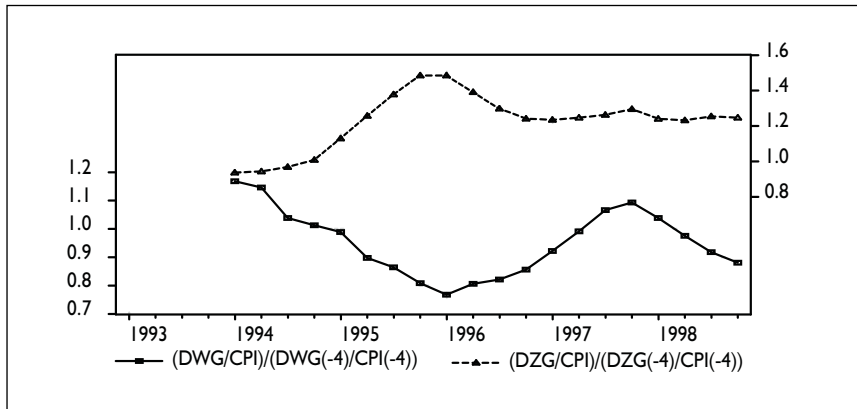


Figure 4. Real zloty (DZP/PPI) and foreign currency (DWP/PPI) deposits held by enterprises

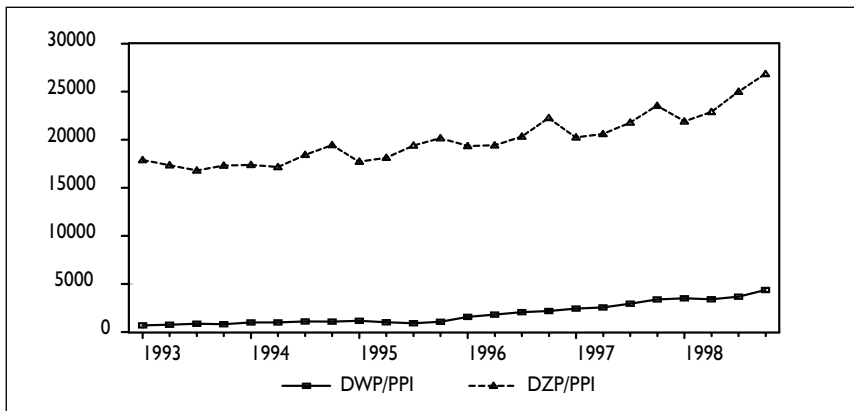


Figure 5. Real zloty credits given to households

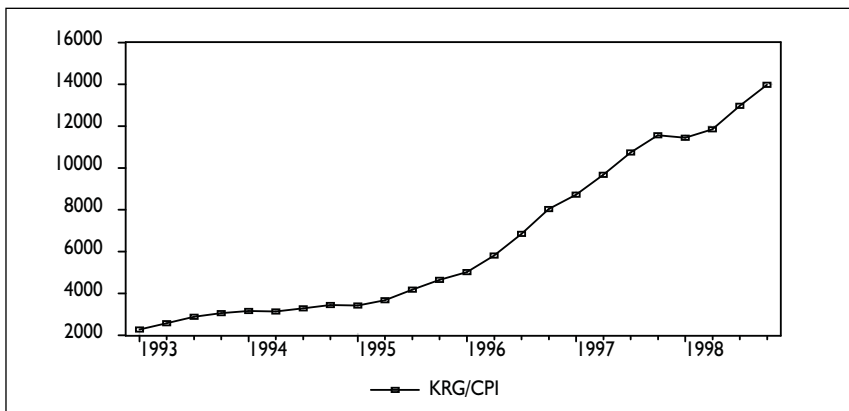


Figure 6. Comparing dynamics of real credits and real deposits held by households

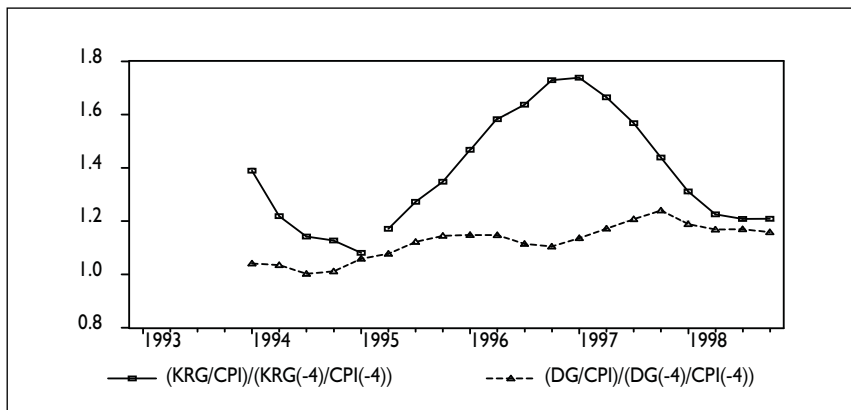


Figure 7. Real zloty credits given to enterprises (KRP/PPI)

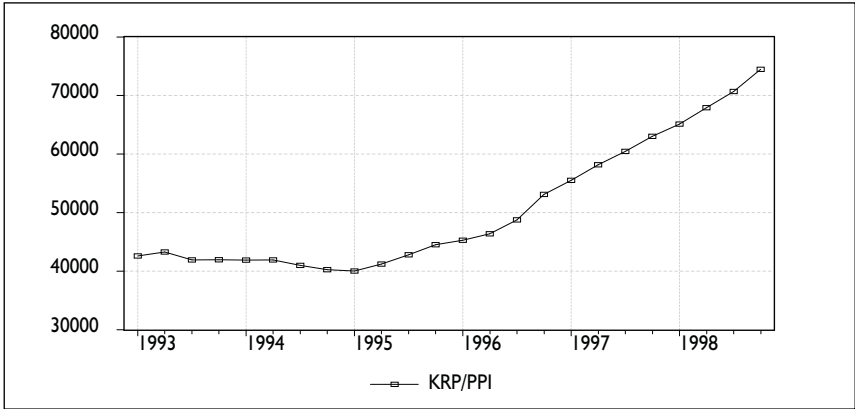


Figure 8: Comparing interest rate on deposits deflated with CPI and dynamics of real zloty deposits held by households

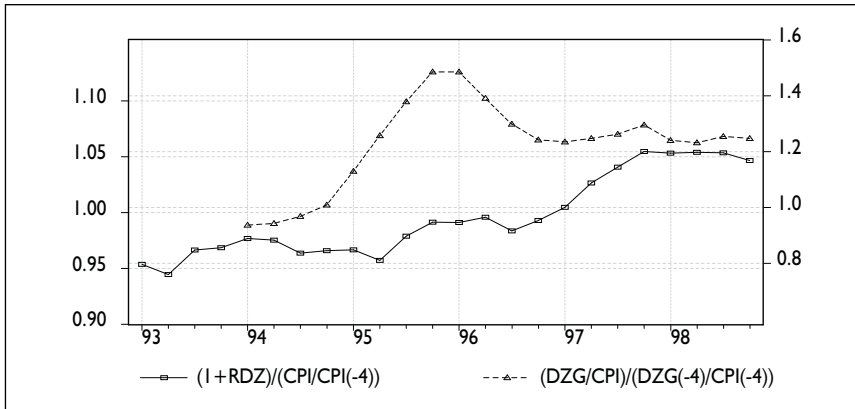
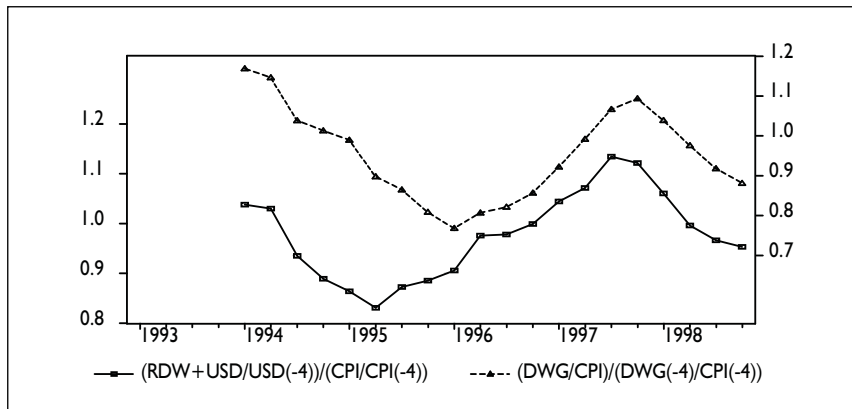


Figure 9. Comparing actual interest rate on foreign currency deposits deflated with CPI and dynamics of real foreign currency deposits held by households



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