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An Analysis of the Dynamics of Deposits and Loans in Polish Banking Sector.

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Abstract

This paper presents an approach to the analysis and modeling of the banking sector, which relies on the concept that the traditional analysis in banking in general and in the commercial banks in particular, ignores a significant part of the information on the dynamics of the analyzed sector. In the conventional analysis the net changes of the balance sheet items are used to represent the money flows through the stocks of deposits, loans as well as the stock of the government securities. However, at the central bank level the data concerning the money flows are not available. This paper presents a method of determining these flows and indicates the benefits of such an approach.

1. Introduction

As it was indicated in earlier papers, Gadomski [2002, 2003], economics of money is the only part of the economics where categories of supply and demand are represented by the magnitudes representing stocks and not the potential flows. The supply of money is measured by one of the money aggregates. This convention has many advantages; it is simple and harmonized with macroeconomic theory (where savings, for example, are in essence the net savings equal the change in the stock of deposits). However, for somebody who analyzes the impact of the bank loans on the investment, the conventional approach can be unsatisfactory, because a given change of the loans outstanding does not reveal the rate of flow of loans. The average term of the granted loans matters: the short-term and the long-term loans have different economic consequences; the change of the average term is a result of the change in the amount and the structure of demand for loans.

The same reasoning can be applied to the changes in deposits. The changes of that category do not reveal the rates of flow of savings through the banking system. Moreover, the average term of the deposits has also a significant impact on the supply of loans - banks' ability to provide loans.

The loans and deposits have some common features. Those who draw loans or save make, to a certain extent, similar decisions: on the term and the amount of money. These decisions are the primary factors shaping the amounts and structure of the loans outstanding and deposits respectively.

In Part 2 a method is applied in analyzing the dynamics of loans and deposits in Polish banking system. This method is based on the concept of the average term of the loans granted and money deposited respectively. In Part 3 methods of evaluation of the flows of savings and loans are presented. Part 4 includes the discussion of results and final remarks.

2. Analysis of loans and deposits

2.1. Loans

This research started before NBP (Polish central bank) adopted statistical classification used in EU. This is why performed analysis has been restricted to the period Dec1996 - Nov 2002.

The amount of the total outstanding loans is depicted in Fig.1. Another available data for that period are the shares of the loans belonging to the particular term ranges. These term ranges are the following: (1) up to 1 month, (2) from 1 month to 3 months, (3) from 3 months to 6 months, (4) from 6 months to 12 months, (5) from 12 months to 36 months, (6) from 36 months to 60 months, (7) more than 60 months. These shares are shown in Fig.2, where each line connects the points representing shares in the same month.

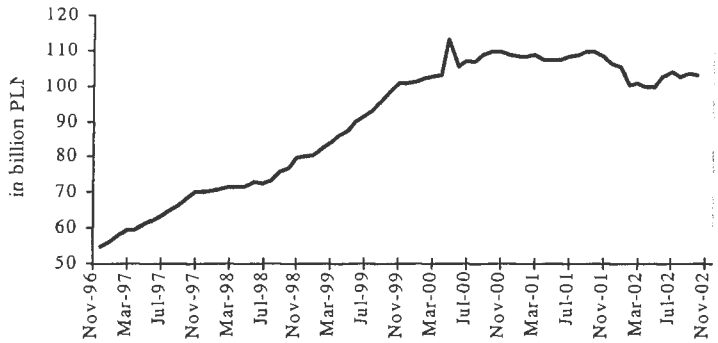

Fig.1. Total loans outstanding denominated in zloty (PLN).

A disturbance which occurred in June 2000, see Fig.1, is a result of the short-term loans involved in one of the big privatization projects. At the first glance one can say that nothing particularly dramatic happens in the analyzed period: after the period of steady growth the loans outstanding start slightly declining, while the shares seem to be stable. This still life picture revealed by Fig.1 and Fig.2 conceals vast changes in the behavior of the involved economic agents.

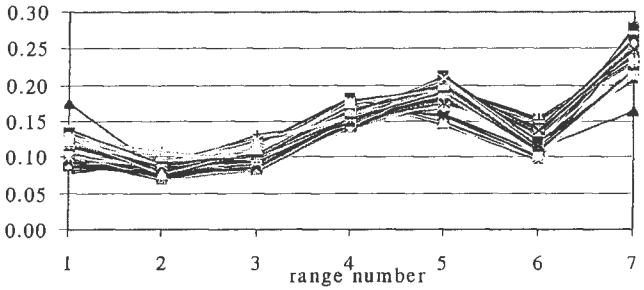

Fig.2 Structure of the outstanding loans in the Polish banking sector

What changes are so dramatic and worth an analysis? In order to capture them the following function is being introduced:

$$T_{Zt} = \sum_{l=1}^{7} i_l u_t^{(l)}, \tag{1}$$

where:

i_l – average length of the terms belonging to the l-th aggregated terms range (mid-range term),

$u^{(l)}_t$ – share of the loans outstanding $z_t^{(l)}$ from the l-th aggregated range in the total outstanding loans z_t at period t:

$$u^{(l)}_t = \frac{z_t^{(l)}}{z_t}$$

The variable T_{Zt}, defined in equation (1), is interpreted as the mean term of the loans in the total amount of the outstanding loans at period t. It's trajectory in the analyzed period is presented in Fig.3.

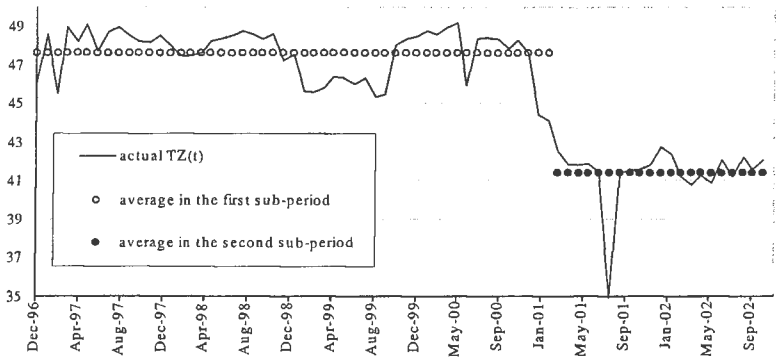

Fig. 3. Values of T_{Zt} (in months) in the period December 1996 – November 2002.

The values of the variable T_{Zt} (Fig.3) signal a significant change in the average term of the loans outstanding during the transition between the two sub-periods. In the first sub-period, the average value of T_{Zt} was about 48 months; in the second sub-period, this value decreased

by 6 months. This change coincided with a sharp decrease of the investment outlays in the Polish economy in that period. Whatever the reason of the decreased investment, the demand for loans changed, and that change was not just of the quantitative but substantially of the qualitative nature.

2.2 Deposits

In the analysis of deposits a similar approach has been applied as in the case of loans.

The total deposits are presented in Fig.4, while the shares of the deposits belonging to the particular term range are presented in Fig.5. Also in the case of deposits these figures do not show signs of big changes.

Now we define a variable T_{Dt} interpreted as the average term of the deposits:

$$T_{Dt} = \sum_{l=1}^{7} i_l v_t^{(l)}, \tag{2}$$

where:

i_l – average length of the deposit terms belonging to the l-th aggregated terms range,

$v^{(l)}_t$ – share of the deposits $d_t^{(l)}$ from the l-th range in the total deposits d_t at period t:

$$v^{(l)}_t = \frac{d_t^{(l)}}{d_t}$$

The time-path of T_{Dt} is presented in Fig.6.

It can be noticed in Fig. 4 that deposits grow during almost whole period with the exception of last few months, where they stabilize at the level of 230 billion PLN. Also shares of the deposits belonging to the particular term ranges seem to be steady, Fig.5.

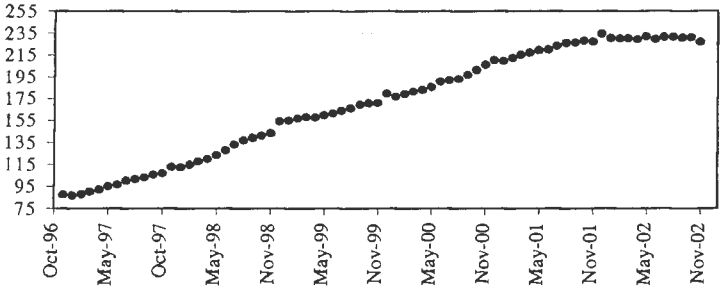

Fig. 4. Zloty denominated deposits in Polish banking system, in billion PLN.

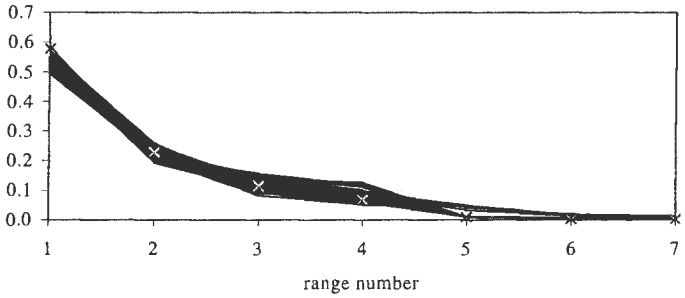

Fig. 5. Shares of deposits of particular term range in total.

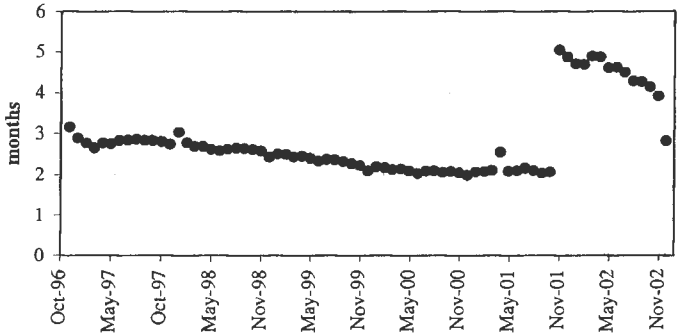

Fig. 6. Value of the average term of deposits T_{Dt}.

It can be noticed in Fig. 6 that there is a long-run tendency of slowly decreasing average term of deposits. This process has been disturbed in November 2001 when depositors sharply reacted to the introduction of the tax on the interest on deposits; in order to benefit on the vacatio legis they restructured their deposits by increasing the average term. Further development allows the assumption that the above mentioned long-run process was continued in later months. The discussed change is not apparent in Fig. 4 and Fig. 5, although it had a significant impact on the money supply and the liquidity of Polish banking system.

The conclusion from the above considerations is the following. Although the changes of amounts of the loans outstanding and deposits are relatively slow and changes of the respective term structures are small, the essential qualitative changes important in the monetary policy decision-making can occur. The average term (of loans outstanding or deposits) can serve as an indicator of such changes.

3. Evaluation of flows

The model applied for the description of the relationship between the flows of savings (the inflow) and dissaving (the outflow) as well as the flows of the loans granted (the inflow) and the loans repaid (the outflow) is based on the assumptions that the system is tight. This means that no losses occur in the deposits (what is obvious) and loans (what is far from obvious). In the latter case it is usual that some loans deteriorate. However, it can be assumed that in certain periods the share of the deteriorated loans in total loans outstanding is constant so that the written-off loans constitute constant part of the outflow.

The above mentioned relationship can be described by the following equation:

$$y_{it} = \sum_{j=0}^{\infty} w_{ij} x_{it-j} \,. \tag{3}$$

where y_{it} denotes an outflow (dissaving or capital repaid) in period t of the savings / loans granted for the period of i months while x_{it} denotes an inflow (savings / the loans granted). We assume that parameters w_{ij} are all non-negative and satisfy the equality:

$$\sum_{j=0}^{\infty} w_{ij} = 1;\ i = 0, 1, 2,...$$

The distributed lag relationship (3) is based on the set of the parameters w_{ij}, which - in the cases of the loans and the deposits - are generated in different manner. In the case of loans these sets (forming the lag distributions for each i) can be assumed to reflect commonly used scheme of constant installments, what justifies the use of the uniform distribution. It can happen that loans are being restructured so that the time distribution is deformed. Moreover, the cases when the loans are being repaid before the agreed upon term occur hardly ever.

In the case of deposits such assumptions would be inadequate, because the time distributions of deposits of particular terms are more complex. The term of a deposit is on the one hand a result of the ex ante intention of the depositor to deposit money for the period longer than the agreed upon term. On the other hand some part of such deposits is removed before maturity, while another part resides in the deposit for the period longer than the one implied by the nominal term[1]. Hence, in the case of deposits it seems natural to assume that the time distribution of money deposited for certain term follows the Pascal distribution.

The inflow x_{it} is a part of the total inflow x_t , and :

$$x_t = \sum_{i=0}^{\infty} x_{it} \tag{4}$$

Consider the shares α_i of each x_{it} in x_t:

$$\alpha_i = x_{it} / x_t$$

[1] As a disincentive for not keeping to the deposit term banks punish such depositors with reduced interest.

Coefficients α_i, $i = 0, 1, 2,..$; form a distribution (all $\alpha_i \geq 0$, and $\sum_{i=0}^{\infty} \alpha_i = 1$), which can be called preference distribution because they reveal the term preferences of the economic agents (and to a certain extent banks) to save/ borrow.

If such a preference distribution is constant, the relationship between the total outflow and the inflow can be presented by the following equation:

$$y_t = \sum_{i=0}^{\infty} \alpha_i \sum_{j=0}^{\infty} w_{ij} x_{t-j} . \tag{5}$$

In order to make the notation simple it is useful to present the relationship (5) in the following form;

$$y_t = \sum_{i=0}^{\infty} w_i x_{t-i} , \tag{6}$$

where coefficients w_i , $i = 0, 1, 2,..$; denote coefficients:

$$w_i = \sum_{j=0}^{\infty} \alpha_j w_{ji} . \tag{7}$$

It is easy to prove, see Gadomski [2003], that coefficients w_i, $i = 0, 1, 2,..$; also form the lag distribution W, because for all i, $w_i \geq 0$, and $\sum_{i=0}^{\infty} w_i = 1$. It can be noticed from equation (7) that the distribution W is not a simple sum of distributions W_i; it is also influenced by the preference distribution. The latter property is particularly important when these preferences undergo changes.

For the purposes of further analysis a concept of the lagged stock will be introduced, which stands for that part of the inflow which has not flown out. The level of the lagged stock z_t is given by the following equation:

$$z_t = z_{t-1} + x_t - y_t. \tag{8}$$

The equation (8) can be transformed into the following form (Gadomski [2002]):

$$z_t = \sum_{i=0}^{\infty}\left(1 - \sum_{j=0}^{i} w_j\right)x_{t-i} = T_W \sum_{i=0}^{\infty} v_i x_{t-i}, \qquad (9)$$

where:

v_i – coefficients, $i = 0, 1, 2,..$; form the lag distribution V :

$$v_i = \left(1 - \sum_{j=0}^{i} w_j\right) / T_W,$$

T_W – mean of the distribution W - average time a unit of the outflow spent in the lagged stock in the steady state or at the static equilibrium[2].

The term in brackets in equation (9) denotes the part of the inflow at time t-i which resides in the lagged stock at time t. The mean T_V of the distribution V is interpreted as the average time a monetary unit spends in the lagged stock at the static equilibrium. Note that T_V does not necessarily equal the mean T_W.

The method used for the evaluation of the flows is based on the property of the distributed lag that in the dynamic steady state, e.g. when inflow x grows at the constant rate r, both the outflow and the lagged stock grow at the same constant rate r. In such a case we can rewrite equations (6) and (9), respectively as follows:

$$y_t = x_t \sum_{i=0}^{\infty} w_i (1+r)^i \qquad (10)$$

$$z_t = x_t T_W \sum_{i=0}^{\infty} v_i (1+r)^i . \qquad (11)$$

On the other hand, the lagged stock z_t is the sum of the lagged stocks z_{it} :

$$z_t = z_{1t} + z_{2t} + z_{3t} + ...; \quad i = 0, 1, 2,...; \qquad (11)$$

which stand for the lagged stocks of the flows associated with the term i, $i = 0, 1, 2,....$

[2] As interpreted by Solow [2000].

The share of the i-th lagged stock in the total lagged stock z_{it} / z_t depends on the preferences, distribution and the rate of growth r of the inflow x_t. The greater the rate r, the greater share of the shorter-term stocks in the amount of total stock.

It is obvious that during the steady growth of x at a constant rate r the sums in (10) and (11) represent some constant figure smaller than one. Hence, if we know the levels of lagged stock z_t and the distribution V in the period of steady growth, we can determine the value of x_t. However, the lag distribution is not known. We can only make an attempt to evaluate it on the basis of information on the structure of the lagged stock presented in Fig.2 and Fig. 5 respectively for the stock of the loans outstanding and the stock of deposits. Such information is aggregated into seven terms ranges, see Part 2.

We assume that all the distributions W_i belong to the same family of distribution. In the case of the loans it is assumed that the capital repayment follows the uniform distribution while in the Pascal distribution is used in the case of deposits.

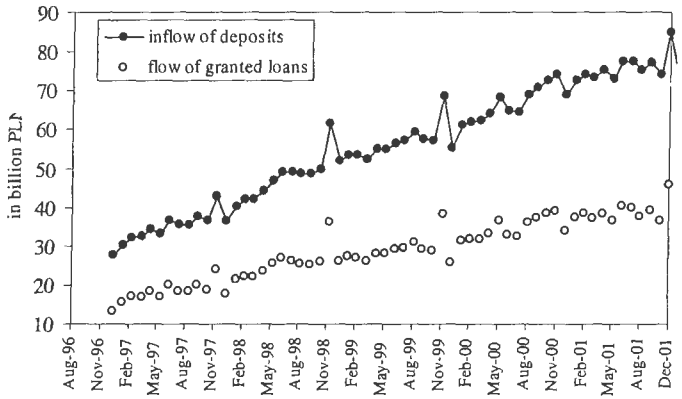

Fig. 7 The evaluated flows of the loans and the savings, respectively.

Under the above assumptions the missing element is the preference distribution A. It is determined by minimization of the expression;

$$\min_{\alpha_i} \sum_{t=1}^{7} \left(u_t'^{(t)} - u_t^{(t)} \right)^2 ,$$

where $u^{(t)}_t$ was defined in Part 2 and $u'^{(t)}_t$ denotes the value of i-th share of the lagged stocks (associated with the term i in total lagged stock) generated by the model.

The detailed description of the evaluation procedure is presented in Gadomski[2003].

4. Final remarks

In the case of loans the coefficients of the lag distribution W, equation (6), were estimated on the data from the period December 1996-December 2000, because there are convincing premises, see Fig. 3, that the preference distribution in that period was stable. In the case of the flow of savings, that stability is questionable, see Fig. 6, as there is a trend of shrinking mean term. The evaluation was made for the period preceding the "great leap" of the mean term which occurred in November 2001.

The rates of flows depicted in Fig. 7 show the well known fact that the savings flow much faster than the flow of loans, because the former provide the means not only for the loans but are also located government bonds, fixed assets, as well as the interest for the depositors.

It was shown that the above presented method of evaluation of the rates of money flowing into the banking system as the savings as well as the money in the form of the loans granted flowing out of the banking system can provide reasonable results.

This analysis leads to the conclusion that the dynamics matters: the amount of the loans outstanding can grow either with the growth or with the decrease of the loans granted. Hence, in the formulation of the monetary policy the dynamics of the loans granted and changes in the term preferences should be taken into account.

It was proven that the flows of the loans granted as well as the flow of savings could be evaluated on the basis of the available data. Two solutions could be considered. First, that the central bank becomes convinced to the idea of evaluating the rates of these flows and collects

the relevant data, and the second, that a method can be found to use the existing and available data for that purpose. This study, in the opinion of the author, presents such a method. Moreover, as these solutions should not be contradictory, it would be interesting to compare actual data with the results obtained using the proposed method.

Literature

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