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PREDICTION OF A SMALL BUSINESS' FINANCIAL LIQUIDITY AGAINST IN THE BACKGROUND OF THE EFFECTIVENESS OF DEBT RECOVERY

Summary: Financial liquidity is one of the major categories of a small business economy. Financial liquidity in small enterprises is based almost entirely on its own sources of financing. Therefore, a special role has to be played in the successful recovery of the claim. The paper presents a simple method for the dynamic analysis of small business liquidity, and the tools that enable to assess the effectiveness of debt recovery. The study uses an econometric system of equations describing the mechanisms of interdependent relationships between liquidity and efficiency of debt recovery. The feedbacks between these variables are taken into account. In this article the technology for estimating forecasts of liquidity and efficiency of small business debt recovery is also discussed. This technology takes into account the existing feedback.

Key words: liquidity, debt collection, small enterprise.

1. Introduction

Having cash needed for timely payment of obligations, is one of the most important problems of small business. Shortage of statistical information in a small company means that liquidity plays a special role in it. Financing a small business entity is usually carried out from its own resources. Most financial surpluses are a complement of the owner's own resources, including the amounts previously accumulated, due to having so-called transition. Small enterprises use bank credits very rarely. Throughout the period after 1990, small enterprises suffered from the reluctance of banks to grant them credit, which could be an instrument of "buffering" liquidity.

Hence, the liquidity of the small business depends on its ability to implement the sale, and to receive payments for goods and services sold. The effectiveness of debt recovery[1] plays a cardinal role in shaping liquidity in small enterprises. In this paper,

[1] "Recovery (Latin: ***vindicatio***) − an investigation in the manner specified in the laws of their rights to things or payment" [*Słownik*… 1980, p. 806]. Debt in business practice is often confused with the execution, implemented *inter alia* by resulting recovery in the nineties of the twentieth century. On the other hand: "Execution (Latin: ***exsecutio***) − forced debt collection bills or creditors debts creditor" [Słownik… 1980, p. 174].

we take the case of monthly, or short-term liquidity of a small company and debt collection mechanisms. We assume that in a small company in a short period, there is feedback between liquidity and efficiency of debt recovery. Verification of this hypothesis will be performed by a system of two interdependent stochastic equations. This will have a significant impact on the estimation of such forecasts as liquidity, as well as the effectiveness of debt recovery.

2. Measurement of dynamic financial liquidity in a small enterprise

Multiple measures of financial liquidity[2] do not mean that it is always possible to use them, especially in a small enterprise. In a study of a company's financial liquidity, many different tools such as indicators are used. Financial liquidity is usually measured over a specified period, or − for comparison − in two periods. The obtained information is therefore essentially static in nature, so it is extremely poor. A key difficulty of financial liquidity measurement is the lack of adequate statistical information. Book – keeping in small companies is very simplified. The price paid, however, behind this ease is the unavailability of critical information providing an accurate diagnosis of the situation and a rational assessment of past and future.

Collecting information about cash receipts and the value of finished goods and services[3] can bring many benefits to the owner. It allows, *inter alia*, an approximate account of liquidity. The comparison of sums of money, as the realization of receivables from customers and the value of finished goods and services[4], enables to achieve an accurate picture of the extent of liquidity. Denote as $\mathbf{pien}_t$ the value of cash inflows, while as $\mathbf{prod}_t$ − the value of ready production (in the sale prices). The comparison of the amounts of these variables in a given period allows the assessment of current financial liquidity. There should only be considered the way of comparison variable and $\mathbf{prod}_t$ variable.

The first possibility is to compare the value of simultaneous cash receipts to the value of ready production. If $\mathbf{pien}_t \geq \mathbf{prod}_t$ (t = 1, ..., n), this company has the necessary cash to cover liabilities in **t** period. A situation where $\mathbf{pien}_t < \mathbf{prod}_t$ the company suffers from the lack of funds. It should be noted that the trader who must rely primarily on their own thrift, is able to collect cash from the surplus over the

[2] The records of a small company very rarely regularly maintain commitments broken down by maturities. Much more attention is paid to register a claim. However, commitments play a decisive role in the collection of funds necessary to do business in the enterprise [Wiśniewska, Wiśniewski 2007; Wiśniewski 2008a; Wiśniewski 2008b].

[3] There is no legal obligation to collect information about the value of production carried out and the influence of money in the accounts of companies engaged in book form of revenues and expenditures.

[4] Production value in itself embodies all the obligations performed by the company: to suppliers of raw materials and energy, to employees, public law and others. It presents the full weight of the obligations in conclusion. It is not creating obligations, such as depreciation and profit.

period of their commitments to use them during the periods of cash shortage. Therefore, a better analytical solution may be to consider the accumulated cash value in subsequent periods of the year and compare it with the cumulative value of finished goods.

As a result, we use three measures of micro liquidity[5] in this paper. The first measure will be the difference between the cumulative monthly cash inflows and cumulative value of finished goods, i.e.:

$$plyn_t = cum.pien_t - cum.prod_t, \tag{1}$$

where: $cum.pien_t = cum.pien_{t-1} + pien_t$, in t* year,
$cum.prod_t = cum.prod_{t-1} + prod_t$, in t* year,
(t* = 1, ..., 11; t = 2,...,12) and
$cum.pien_1 = pien_1$, $cum.prod_1 = prod_1$.

An alternative measure of the cumulative monthly financial liquidity is a relative measure of that liquidity for the current production, calculated as follows:

$$plproct = 100 \bullet (płynt / prodt). \tag{2}$$

Plproct variable is expressed in percentage points. It shows what per cent of the ready production in the month t assesses the value of cumulative monthly financial liquidity in the enterprise.

Another variant of the liquidity measure can be the quotient of the cumulative cash flows and the value of accumulated ready production, or in other words, the indicator of the relative liquidity of the accumulated ready production:

$$plwzgl_t = \left[\frac{cum.pien_t}{cum.prod_t} - 1 \right] 100. \tag{3}$$

Meter (3) contains a similar value of information to meter (2). It is also expressed as a percentage and shows whether and what per cent the cumulative cash inflows were higher than cumulative ready production in a given month. A positive value of *plwzglt* observation indicates what per cent the cumulative cash inflows were higher in a given month of the year than the value of ready production. This means, that the enterprise has the ability to discharge liabilities in the given month. *Plwzglt* negative value indicates the lack of financial liquidity. It is worth mentioning that it does not have to be necessary so[6].

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[5] We use the accumulated values based on the assumption of adequate precautions taken by the small business owner. The business collects funds in the periods of financial surpluses and reduces the time proceeds. An owner, who has no ability to accumulate, usually is not able to keep the company in a highly competitive market. The symbol t* determines number of years, but t is determined by the number of months in year t*.

[6] A small observation value plwzglt (when it is negative) of a few per cent can mean having cash flow by a company. Only if *plwzglt* ‘‘–10%, the company can be expected to risk the ability to pay current debts.

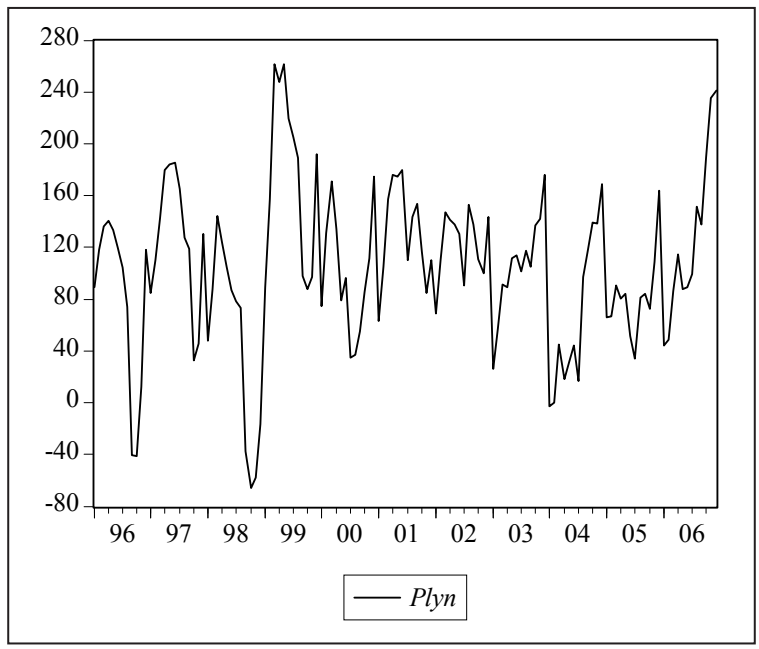

Figure 1. The cumulative monthly cash flow of the GR company in the period January 1996 − December 2006 GR (in thousands PLN)

Source: own calculations on the basis of GR enterprise data.

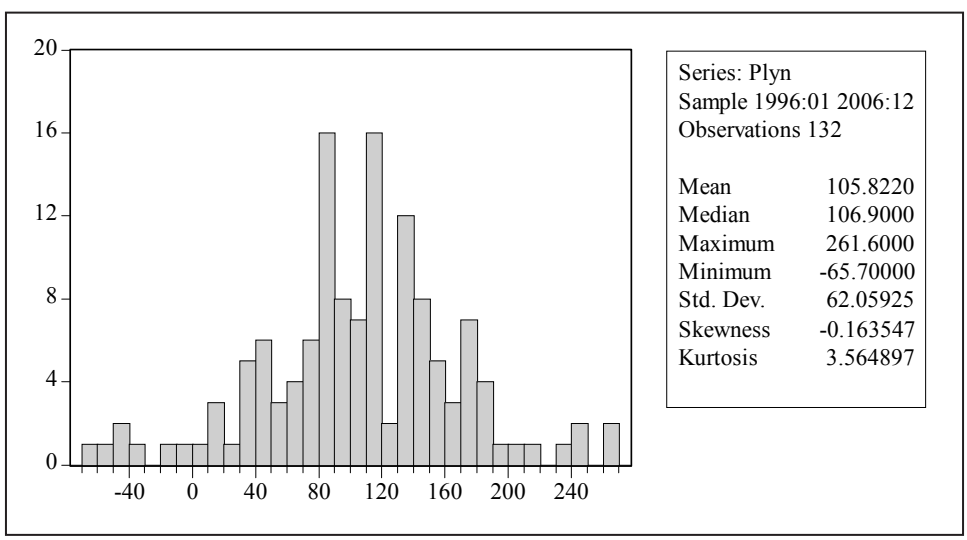

Figure 2. The structure of the monthly variables $plyn_t$ in GR company from 1996 to 2006 (in thousands PLN)

Source: own calculations.

Figure 1 shows the monthly fluctuations in cash flow in a small production company. The statistical data of this company is the basis for the calculation in this article. Figure 2 shows the distribution, which characterizes the structure of monthly observations of the GR plynt variable in the company from 1996 to 2006. It can be seen that in seven (out of 132) months, the negative value of this variable appeared. The minimum variable was –65.7 thousand PLN. However, during 125 months the requested $plyn_t$ value> 0, by which the maximum volume was reached, was 261.6 thousand PLN. On average, the $plyn_t$ variable amounted to 105.8 thousand PLN.

3. Measuring the effectiveness of debt recovery in a small company

Production cycle in an enterprise, including a batch of products, finishes at the time when the payment for sold goods and services is received. The common practice of granting trade credit means that after the delivery and invoicing there is a period to wait for payment, which takes, depending on the industry, from several days to several months. The law forces the operators to use non-cash payments, which helps to control the market in the banking system.

The manufacturer awards customers of trade credit agreement for about one month period between the date of invoicing, delivery and payment. The expiry of the agreed time should result in the payment for sold goods and services. In the GR company there were determined terms of payment for goods and services ranging from 21 to 30 days. This means that part of the invoiced delivery took place in the current month, the other part in the next month and in the event of minor delays some invoices were paid after an interval of 2 months[7].

These facts make it necessary to find differences between the cash inflows for sold goods and services ($pien_t$) and the value of the gross income from the sale of simultaneous (pbrutt), as well as delayed for 1 month (pbrutt-1) and by two months (pbrutt-2). Thus it is necessary to consider the following differences:

$$wind0_t = pien_t - pbrut_t, \tag{4}$$

$$wind1_t = pien_t - pbrut_{t-1}, \tag{5}$$

$$wind2_t = pien_t - pbrut_{t-2}. \tag{6}$$

A fully effective recovery should be close to zero values of the wind0t meter in each period t (t = 1, ..., n). The sum of the meter $\sum_{t=1}^{12} wind_t$ in year t^* (t^*= 1, ..., n^*)[8] should be close to 0. This means that charges for the goods and services have been

[7] For example, when billing delivery is on January 30 – payment in early March – it is considered to be frequently paid at the agreed time. However, in a statistical sense to pay in March for a delivery in January means a delay of two months.

[8] The symbol t^* determines the number of years, and n^* is determined by the number of years under consideration.

transformed into cash. It cannot be expected the $\sum_{t=1}^{12} wind_t$ to be positive. If, however, the $\sum_{t=1}^{12} wind_t$ is significantly less than zero, it indicates the total lack of effective debt recovery in the enterprise, which can even threaten its existence.

A measure of the effectiveness of debt recovery (ewindt) will be the arithmetic mean of the separate measures of the effectiveness of recovery:

$$\text{ewind}_t = (\text{wind0}_t + \text{wind1}_t + \text{wind2}_t)/3. \quad (7)$$

Variable ewindt, having the nature of the moving average, will be characterized by a much smaller dispersion as compared with the detailed measurements of the effectiveness of recovery.

Having a time series of the effectiveness of recovery measures enables the possible analysis of the visual assessment of size variation. This gives the orientation of the size of the periodicity changes. Table 1 shows the variations in performance indicators debt recovery in a small production company ZET. Appropriate scaling of each plot of variation of any of the meters, allows a precise assessment of the effectiveness of the effort to convert receivables into cash.

Another possible analysis form the basic characteristics of statistical measures of the effectiveness of debt recovery. Table 1 shows the average measure, dispersion, skewness, and the concentration of variables wind0_t, wind1_t, wind2_t and ewind_t. Each of these variables has an oscillatory nature. By its nature, they should hover around 0 value. Hence, their arithmetic mean should be close to zero, although in practice it is negative, while slightly less than zero.

Mean values of recovery efficiency indicators are slightly smaller than zero. They range from 1.111 to 1.742 PLN respectively. This allows to conclude that the

Table 1. Statistical characteristics of performance indicators in the debt recovery in the GR company from 1996 to 2006

Measure	ewind	wind0	wind1	wind2
Average	–1.669	–1.111	–1.673	–1.742
Median	1.900	2.650	2.900	1.950
Maximum	42.63	84.00	97.90	94.60
Minimum	–85.27	–110.8	–118.1	–144.2
Standard deviation	25.33	40.14	37.62	39.24
Skewness	–0.899	–0.345	–0.534	–0.916
Kurtosis	3.925	2.851	3.409	4.741
Total	–216.93	–146.6	–219.1	–226.4
Number of obs.(n)	130	132	131	130

Source: own calculations.

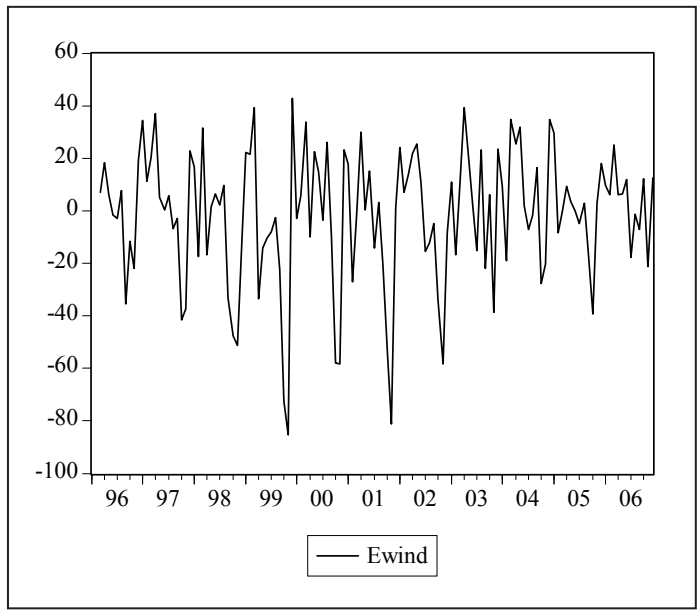

Figure 3. The monthly effectiveness of debt recovery in GR company from 1996-2006 (thousand PLN)

Source: own calculations.

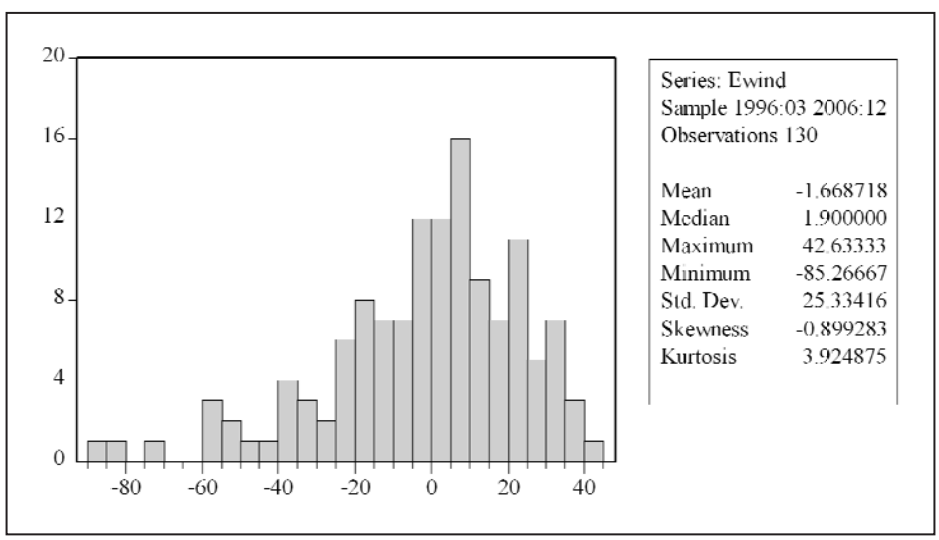

Figure 4. The structure of the monthly measure of the effectiveness of debt recovery $ewind_t$ in GR company from 1996 to 2006

Source: own calculation.

conversion of receivables into cash was characterized by a sufficient efficiency. These figures should be compared with the average monthly gross sales values and cash inflows, which amounted to 109.814 thousand PLN and 108.703 thousand PLN respectively. The average value of $wind0_t$ variable observation, amounting to 111 PLN, determines the size of gross sales, which have not been converted into cash. This also determines the scale of the losses caused by dishonest debtors. In a statistical sense, this figure is insignificant while the sum of observations $wind_{0t}$ variable, which is –146.6 thousand. PLN, informs about the full amount lost by the claims in the years 1996-2006. Figure 3 shows the variation of $ewind_t$ variable in GR company. Figure 4 shows the structure of the meter. An interesting characteristic of that distribution is the left-handed bias[9].

4. Econometric system of equations describing the interaction of liquidity and efficiency of debt collection

The practice of short-term financial management in a small enterprise necessitates the simultaneous monitoring of its liquidity and efficiency of debt recovery. Low levels of liquidity may be the result of the small activity in debt collection. Improving the efficiency of debt recovery results in the improved liquidity of the company. Decisions in this regard are taken in the company on an ongoing basis. Therefore, we assume that the variables $plyn_t$ and $ewind_t$ direct feedback form[10], namely:

$$plyn_t \overset{\Rightarrow}{\underset{\Leftarrow}{}} ewind_t. \tag{7}$$

The hypothetical system of two interdependent equations will be identifiable as ambiguity. The equation describing financial liquidity equation includes among others the explanatory variables autoregression for the twelfth raw and interdependent variable $ewind_t$. In addition, there are the following predetermined variables: $ewind_{t-1}$, $ewind_{t-2}$, ..., $ewind_{t-12}$ − delayed of 1, 2, ..., 12 months of size measure of the effectiveness of recovery; dummy variables used to extract the monthly periodic fluctuations, taking value 1 for a month, highlighted, and 0 at other times, however: st denotes January, lu February, mar − March, kw − April, mj − May, cze − June, lp − July, się − August, wrz − September, pa − October, ls − November. In addition, variable time t was taken into account in order of any linear trend or the square trend.

[9] A left skewness measure of the effectiveness of debt recovery seems to be the logical correctness of the company to correct the effective implementation of receivables from debtors. Few cases should be significant negative ewindt. The vast majority of ewindt size should be close to zero.

[10] Equations forming the structural parameters of the model must be estimated with a dual method of least squares (2MNK). Under the parameter estimates of structural equations they will serve as the empirical value of Student t-statistics. In addition, they will serve as a coefficient of determination (R2), standard error of residuals (Su) and the value of statistics and Durbin Watson (DW).

The equation describing the effectiveness of debt recovery in a natural way will include the explanatory variable $ewind_t$ and delayed endogenous variables $ewind_{t-1}$, $ewind_{t-2}$, ..., $ewind_{t-12}$. In addition there will be included: autoregression of the twelfth raw, dummy variables describing the monthly variation (st − denotes January, lu − February, mar − March, kw − April, mj − May, cze − June, lp − July, się − August, wrz − September, pa − October, ls − November) and time variable t. In addition, there is a variable that represents the business activity in the sales network $pnet_t$ − net sale income (in thous and PLN) with its delays from 1 to 12 months ($pnet_t$, $pnet_{t-2}$, ..., $pnet_{t-12}$). $Pnet_t$ variable indicates the intensity of the sale, which is always combined with the recovery of debts.

As a result, the statistically insignificant variables are necessarily reduced. In the course of the next iteration of the model parameter estimation equations using 2MNK, the following empirical equations of structural forms were estimated:

a) the equation describing the mechanism of financial liquidity:

$$\begin{aligned} plyn = {} & \underset{(5,733)}{59,90} + \underset{(18,35)}{0,936}\,plyn_{-1} - \underset{(4,802)}{0,253}\,plyn_{-4} + \underset{(1,998)}{0,146}\,plyn_{-11} - \underset{(2,094)}{0,170}\,plyn_{-12} + \\ & + \underset{(3,469)}{0,642}\,ewind - \underset{(4,130)}{0,514}\,ewind_{-1} - \underset{(2,505)}{0,307}\,ewind_{-3} - \underset{(2,310)}{0,384}\,ewind_{-11} - \underset{(9,522)}{132,04}\,st + \\ & - \underset{(3,640)}{38,532}\,mj - \underset{(2,108)}{22,512}\,cze - \underset{(3,028)}{31,364}\,lp - \underset{(3,208)}{39,782}\,wrz - \underset{(2,399)}{32,929}\,pa + u_1, \end{aligned} \tag{8}$$

$$R_1^2 = 0,808, \quad S_{1u} = 28,72, \quad DW_1 = 1,999;$$

b) the equation describing the mechanism of the efficiency of debt collection:

$$\begin{aligned} ewind = {} & \underset{(4,104)}{22,593} - \underset{(3,112)}{0,279}\,ewind_{-10} - \underset{(3,426)}{0,086}\,plyn_{-3} - \underset{(4,386)}{0,202}\,pnet_{-1} - \underset{(4,519)}{0,290}\,pnet_{-2} + \\ & + \underset{(6,677)}{0,321}\,pnet_{-3} + \underset{(2,908)}{16,809}\,st + \underset{(5,870)}{37,209}\,mar - \underset{(2,131)}{12,126}\,kw - \underset{(2,106)}{11,228}\,lp - \underset{(3,808)}{23,367}\,ls + u_2, \end{aligned} \tag{9}$$

$$R_2^2 = 0,705, \quad S_{2u} = 14,663, \quad DW_2 = 2,039.$$

Estimating the parameters of the structural form equations using the dual least squares method and the elimination of successive iterations of statistically insignificant variables led to a system of two equations with a recursive nature. A measure of financial liquidity in month t (plyn) was not statistically significant in equation (9) describing the efficiency of debt recovery (ewind). However, the effectiveness of debt recovery (ewind) in equation (8) affected its liquidity. Feedback (7) has been "broken[11]". The next step was to abandon strict rules for the application and estimation of parameters 2MNK equation describing the effectiveness of debt recovery by using

[11] From a practical point of view this result is not very logical, it differs from the experience in the management of liquidity and debt recovery.

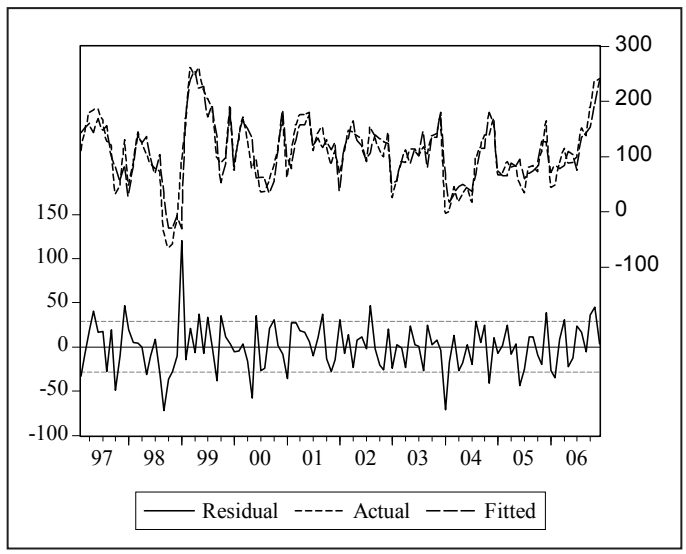

Figure 5. The actual and theoretical values of monthly financial liquidity in GR company calculated using equation (8) and the rest[1] (u1)

Source: own calculations.

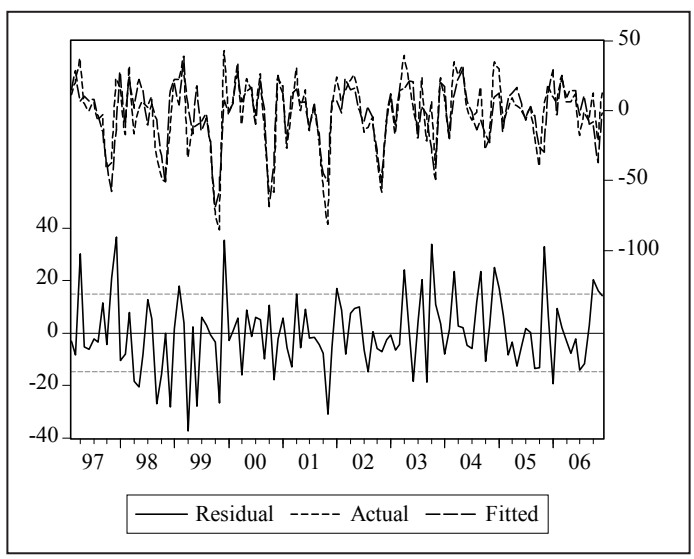

Figure 6. The actual value of monthly efficiency of debt recovery in GR company from 1996 to 2006 and its theoretical value (in thousand PLN) calculated on the basis of equation (9) and the rest of the (u2)

Source: own calculations.

[1] The right ordinate is indicated by empirical and theoretical value of the company's financial liquidity GR while the left axis is used to read the rest. Similar rules apply to Figures 6 and 7.

the classical method of least squares[12]. There was established the following empirical equation:

$$\begin{aligned} ewind = {} & \underset{(3,297)}{15,232} - \underset{(3,250)}{0,179}\, ewind_{-10} + \underset{(5,704)}{0,202}\, plyn - \underset{(6,094)}{0,210}\, plyn_{-1} - \underset{(4,475)}{0,189}\, pnet_{-1} + \\ & - \underset{(4,636)}{0,267}\, pnet_{-2} + \underset{(6,244)}{0,250}\, pnet_{-3} + \underset{(6,411)}{37,575}\, st + \underset{(4,499)}{25,874}\, mar - \underset{(4,531)}{24,720}\, ls + u_3, \end{aligned} \tag{10}$$

$$R_3^2 = 0,753, \quad S_{3u} = 13,409, \quad DW_3 = 1,944.$$

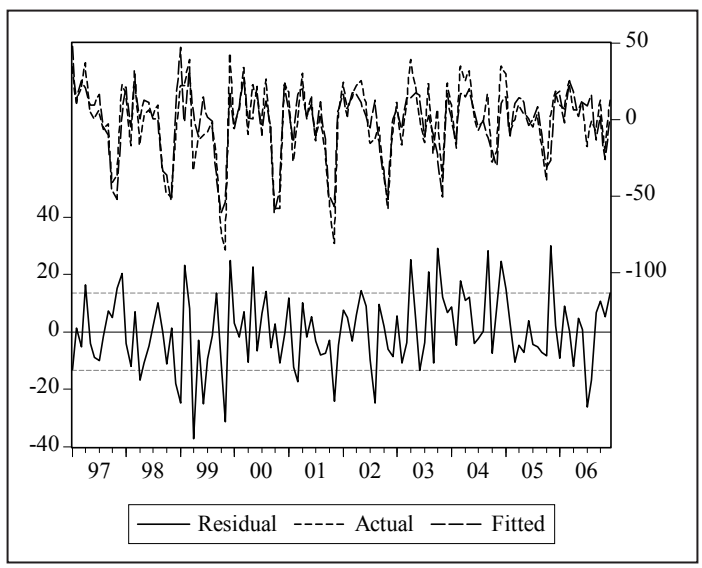

Figure 7. The actual value of the monthly efficiency of debt recovery in GR company from 1996 to 2006 and its theoretical values (in thousand PLN) calculated from equation (10) and the rest (u3)

Source: own calculations.

Plyn variable was statistically significant in equation (10) while maintaining the same feedback. Equation (10) is characterized by a significantly better description of the variable accuracy *ewind* compared with equation (9). From the standpoint of management practices, equation (10) provides more information. This way an important dilemma comes into being: what, from an economic perspective uses empirical results better: proper, orthodox, consistent with the theory of econometrics method for estimating the parameters of the equation, or depart from the strict rules, while applying KMNK. Taking into account the requirements of business management practices is more important than the economic modelling and the accuracy of the

[12] Application KMNK results in the loss of compliance in comparison with 2MNK. KMNK benefit compared with 2MNK is a more efficient parameter estimate. Here we omit a detailed interpretation of empirical results, because they seem to be obvious.

content description of the economic variable. This criterion determines that in practice a better pair of empirical equations will be an interdependent system of equations (8) − (10) instead of a recursive set (8) − (9).

5. Forecasting the liquidity and efficiency of debt recovery

Consequent duality of empirical results in the form of recursive and interdependent equations can be effectively used in the prediction process of the financial liquidity and efficiency of debt recovery. It is possible to avoid the use of forecasts to estimate reduced form equations. Application procedures for the prediction of the chain (connected to the sequential procedure)[13] allow the estimation of the forecast variable $ewind_T^{(o)}$ (T is the forecast period) using equation (9). Possession of forecasts $ewind_T^{(o)}$ enables the estimation of the forecast cash flow, together with a measure of its accuracy, using equation (8). Estimating forecast $ewind_T^{(1)}$ by equation (10), using the previous forecast $plyn_T^{(o)}$, we will get better value of the relative and average prediction error. We consider forecast $ewind_T^{(1)}$, estimated from equation (10), as final. This allows to go back to the final estimation of forecast $plyn_T^{(1)}$ using equation (8)[14], used as an earlier forecast.

6. Conclusion

In this study the defined feedback between liquidity and the effectiveness of debt recovery in the company is proved. The paper indicates that the company should continuously keep operations in the area of its financial management, while focusing attention on liquidity and debt recovery. The constructed empirical econometric model has proved to be an effective instrument for estimating forecasts of both the company's financial liquidity, as well as the efficiency of recovery of its claims. The dilemma that arose during the construction of the model was resolved in favor of the economic logic of the mechanism. Using an instrument presented in this work for managing small business finances enables to better control the current liquidity through the prism of the effectiveness of debt recovery. Estimating the forecasts of these variables contributes to the creation of enterprise security against possible difficulties in financing its current and future economic activity.

[13] Detailed descriptions of the chain and the sequential procedure can be found for example in the work of [Wisniewski 2009b].

[14] In the case of significant differences between the forecasts $\mathbf{ewind}_T^{(1)}$ and $\mathbf{ewind}_T^{(0)}$ as well as projections $\mathbf{plyn}_T^{(1)}$ and $\mathbf{plyn}_T^{(0)}$ the procedure must be repeated.

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PROGNOZOWANIE PŁYNNOŚCI FINANSOWEJ MAŁEGO PRZEDSIĘBIORSTWA NA TLE SKUTECZNOŚCI WINDYKACJI WIERZYTELNOŚCI

Streszczenie: Płynność finansowa należy do najważniejszych kategorii ekonomicznych małego przedsiębiorstwa. Bazuje ono niemal wyłącznie na własnych źródłach finansowania działalności gospodarczej. Dlatego szczególną rolę odgrywa w nim skuteczna windykacja wierzytelności. Efektywna windykacja może gwarantować płynność finansową. W pracy przedstawiono prostą metodę dynamicznej analizy płynności finansowej małej firmy oraz narzędzie badania efektywności windykacji wierzytelności. Za pomocą ekonometrycznego układu równań współzależnych opisano mechanizmy powiązań płynności finansowej oraz efektywności windykacji wierzytelności, uwzględniające sprzężenie zwrotne pomiędzy tymi zmiennymi. Omówiono też technologię szacowania prognoz płynności finansowej małej firmy oraz efektywności windykacji wierzytelności, uwzględniającą istniejące sprzężenie zwrotne.