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Econometric Modeling of Monthly Liquidity of Small Enterprise

1. Introduction

The central problem of small enterprise is to gain the money supply required to meet obligations on time. The lack of sufficient information in a firm causes that the financial liquidity plays a particular role in small enterprise. The economic activity in small enterprise is usually self-founded; a bank credit is rarely taken out. During the whole transformation period a small enterpise was facing with the prospect of refusing the credit by a bank. These credits were meant as a liquidity bufor (or counterbalancing). Therefore, the financial liquidity of small enterprise[1] depends on its ability to sale and collect payment for sold commodities and services. The cash deficit is rarly filled with credit. Usually it is filled with own resources of firm's owner amongst others the money surpluses cumulated as an effect of periodic overliquidity. In this paper the attention is concentrated on monthly short-run liquidity of small enterprise.

2. Simple Method of Measurement the Financial Liquidity of Small Enterprise

The variety of financial liquidity measures of enterprise does not mean that there are always possibilities to apply them, especially in micro-enterprise. The main difficulty is the lack of appropriate statistical information. To keep the accounts (so called simplified accounting) is not complicated. However, it is paid

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[1] The registers of obligations taking into account the maturity dates are very rarely kept in small enterprise. The more important role play the registers of liabilities, especially in gathering financial resources required to lead economic activity. See Wiśniewska, Wiśniewski (2007).

with the lack of important information which could enable the precise diagnosis of financial standing and rationally evaluate the future.

The collected information about an income and final production gives the many benefits to the owner. This enables to compose the very general evaluation of financial liquidity. The comparison of cash (collected payment) with the value of final production[2] gives the approximation of financial liquidity.

Let *pien* denote the value of cash inflow and *prod* – the value of final production. The comparison of these variables enables the evaluation of the financial liquidity of enterprise. The way of comparison between *pien* variable and *prod* variable should be considered.

First possibility is to compare the current values of cash inflow to the values of final production[3]. If $pien_t \geq prod_t$ ($t = 1,...,n$), then the enterprise will own sufficient cash resources to meet its obligations in period t. If $pien_t < prod_t$, then it may indicate the lack of sufficient cash resources. It is worth mentioning, that the owner is usually able to gather sufficient resources coming from the periods when cash surpluses occurred. These surpluses are usually used to meet current obligations. Therefore it is seemed that the comparison of cash resources cumulated in given subperiods of each year to cumulated final production is better solution.

As a result two measures of the financial liquidity of micro-firm will be applied. First one is the difference between the cumulated monthly cash inflow and cumulated final production[4]:

$$plyn_t = cum.pien_t - cum.prod_t \qquad (1)$$

where:

$$cum.pien_t = cum.pien_{t-1} + pien_t, \ in \ year \ t^*,$$

$$cum.prod_t = cum.prod_{t-1} + prod_t, \ in \ year \ t^*,$$

($t^* = 1, ..., 11; t = 2,...,12$) and $cum.pien_1 = pien_1, cum.prod_1 = prod_1$

The alternative measure of financial liquidity is the relative measure of liquidity calculated as follows:

$$plproc_t = 100 * (plyn_t / prod_t). \qquad (2)$$

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[2] Values of final production captures all liabilities of the enterprise and elements not creating liabilities, such as depreciation costs and profit.

[3] See Wiśniewska , Wiśniewski (2007).

[4] The use of cumulated values results from the assumption that the owner of small enterprise is cautious. He gathers resources in periods of financial surpluses to cover the deficit in periods of decreased cash inflow. The owner who does not accumulate financial resources is usually not able to keep a company in conditions of strong competition. Symbol t^* denotes the number of a year, symbol t – the number of month in year t^*.

The *plproc$_t$* variable is expressed in percentages. It informs how many percentages of final production in month *t* determine the cumulated quarterly financial liquidity of enterprise.

3. Empirical Description of the Financial Liquidity of Small Enterprise

The monthly financial liquidity of production enterprise was carried out from January 1996 to December 2006. The figures 1 and 2 depict the time series of *plyn$_t$* and *plproc$_t$*. The substantial seasonal fluctuations of cumulated liquidity and relative liquidity can be observed. However, the amplitude of seasonal fluctuations is decreasing. This indicates the growing stabilization of the liquidity. Moreover, both measures of liquidity are positive in most of periods and considerably greater than zero in many periods. This suggests the good or very good financial standing of enterprise.
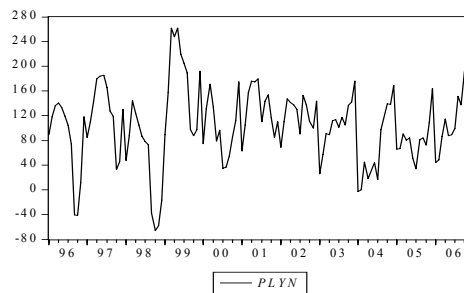

Figure 1. Cumulated monthly financial liquidity of the GR enterprise in 1996–2006 (in thousands of PLN)
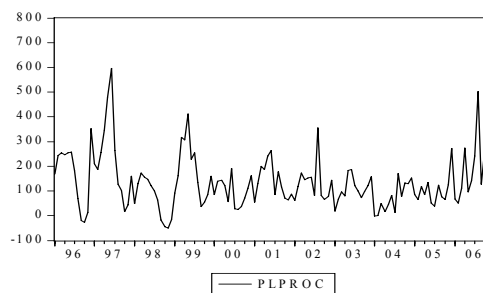

Figure 2. Cumulated relative monthly financial liquidity of the GR enterprise in 1996–2006 (in %)

Figures 3 and 4 present the structure of absolute and relative financial liquidity of enterprise in 1996-2006 period. The distribution of absolute liquidity is seemed to be normal. The distribution of relative liquidity is distinctly right-skewed. The average absolute liquidity equals to 106 thousands PLN, but aver-

age relative liquidity - more than 31%. The financial standing, on average very high, can not lead to the passive attitude of owners. It may happen that in several, each after another periods the lack of liquidity will be observed (negative values), which will result in considerable difficulties in management. As a result the threat of bankruptcy of enterprise may occur, if the liquidity values are lower than zero.
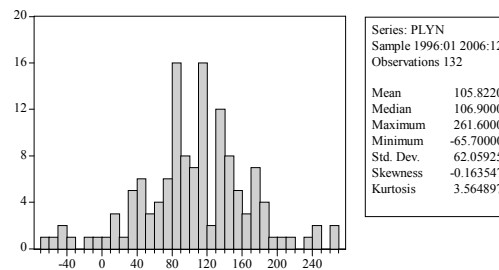

Series: PLYN		
Sample 1996:01 2006:12		
Observations 132		
Mean	105.8220	
Median	106.9000	
Maximum	261.6000	
Minimum	-65.70000	
Std. Dev.	62.05925	
Skewness	-0.163547	
Kurtosis	3.564897	

Figure 3. The structure of cumulated monthly financial liquidity of the GR enterprise in 1996–2006 (in thousands of PLN)

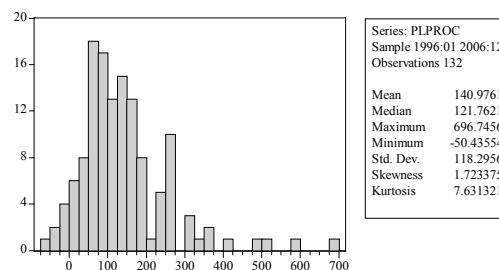|		
Series: PLPROC		
Sample 1996:01 2006:12		
Observations 132		
Mean	140.9761	
Median	121.7621	
Maximum	696.7456	
Minimum	-50.43554	
Std. Dev.	118.2956	
Skewness	1.723375	
Kurtosis	7.631321	

Figure 4. The structure of cumulated relative monthly financial liquidity of the GR enterprise in 1996-2006 (in %)

Detailed analysis of liquidity indicates that the measures of liquidity were negative in 7 out of 132 months. The worst situation took place in the period from September to December 1998, when the financial liquidity measures were negative. In the month with the worst financial standing the cumulated cash inflow was only about 6.37% lower than the executed final production[5]. In 1999-2006 period the measure of financial liquidity of enterprise was negative only in January 2004.

At the same time we can observe overliquidity in many periods. In 29 out of 132 months the surplus of cumulated cash inflow over cumulated final production was visible. This surplus exceeded 50%, but its maximal value was equal to

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[5] Such small deficiency of cash did not cause the threat to meet obligations, especially those the most urgent.

210%. This means that there were the possibilities of gathering the financial resources in months characterized by overliquidity, which could be used in months characterized by negative liquidity. It is worth to mention that the overliquidity usually occurred in the first 3 – 5 months of the year with the exception of two years: 2003 and 2004, when liquidity in the first months of the year was striking higher, especially in comparison with the second half of the year.

It is worth to mention that the dispersion of the financial liquidity measures was high, i.e. the standard deviations of both variables representing the liquidity were high. However, it was mainly the effect of differentiation between the normal liquidity and overliquidity.

4. Empirical Equations of Financial Liquidity

The mechanism of monthly financial liquidity of the enterprise, described by $plyn_t$ variable, is presented by the following dynamic econometric model:

$$plyn_t = 48.22 + 0.797 plyn_{t-1} - 0.162 plyn_{t-5} - 0.146 plyn_{t-12} + 0.209 pbrut_{t-2} +$$
$$(3.413) \quad (16.774) \quad\quad (3.385) \quad\quad (2.775) \quad\quad (2.857)$$

$$- 0.212 pbrut_{t-10} + 0.322 pbrut_{t-12} - 4.744 st - 110.4 wrz - 150.2 pa - 98.59 ls +$$
$$(2.861) \quad\quad (3.920) \quad\quad (2.784) \quad (4.502) \quad (6.095)) \quad (3.744)$$

$$- 1.211 t^* st - 0.344 t^* lu - 0.350 t^* lp + 0.565 t^* wrz + 1.117 t^* pa +$$
$$(4.621) \quad (2.556) \quad\quad (2.581) \quad\quad (2.174) \quad\quad (4.199)$$

$$+ 0.776 t^* ls + u_{1t}, \qquad\qquad\qquad\qquad (3)$$
$$(2.841)$$

$R_1^2 = 0.829$, $Su_1 = 27.278$, $DW_1 = 2.079$.

In the model we can observe autoregressive dependences and following variables: t – time variable, indicating month's number ($t = 1,...,132$); $pbrut_{t-2}$, $pbrut_{t-10}$ and $pbrut_{t-12}$ – value of income from gross sale with lags respectively: 2, 10 and 12 months. The seasonal dummies are the separate group of exogenous variables. They take unit value in a given month and zero otherwise. The symbols denote respectively: st – January, lu – February, mar – March, kw – April, mj – May, cze – June, lp – July, sie – August, wrz – September, pa – October, ls – November[6].

From equation (3) results that the autoregression of first order for $plyn_t$ variable plays the most important role, and the autoregression of 5th and 12th order capture the periodicity of this variable. The dominant role for the financial li-

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[6] Residuals in each of empirical equations (3) and (4) are denoted respectively: u_1, u_2; other symbols denote respectively: coefficients of determination – R_1^2, R_2^2, standard deviation of residuals – Su_1, Su_2, the Durbin-Watson statistics – DW_1, DW_2. Below the estimates of structural parameters in brackets are t-Student statistics. Calculations and figures have been done using EViews 4 package. Both models describe the variability of financial liquidity with sufficient accuracy for the purpose of management. In both equations the autocorrelation of residuals is not observed.

quidity has the income from gross sale being the sum of gross invoices gross in a given month, which further is transformed into cash inflow. In the model the constant seasonality and changing seasonality (as a result of decreasing amplitude) occur. Actual and fitted values of monthly cumulated financial liquidity calculated from equation (3) and residuals are presented in Fig. 5.
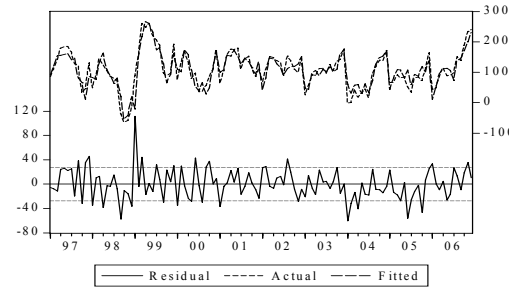

Figure 5. Actual and fitted values (calculated from equation (3)) of monthly cumulated financial liquidity of the GR enterprise and residuals in 1996–2006 (in thousands of PLN)[7]
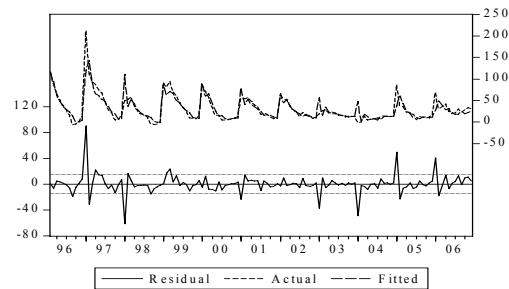

Figure 6. Actual and fitted values (calculated from equation (4)) values of monthly cumulated relative financial liquidity of the GR enterprise and residuals in 1996–2006 (in %)

The alternative dynamic empirical model describing $plproc_t$ variable has the following form[8]:

$$plproc_t = 3.749 + 0.661 plproc_{t-1} + 120.0 st + 13.71 mar - 0.881\, t^* st + u_{2t} \quad (4)$$
$$\qquad (1.967)\ (15.982)\qquad (11.448)\quad (2.819)\qquad (6.418)$$

$R_2^2 = 0.771$, $Su_2 = 14.96$, $DW_2 = 2.307$.

Model (4) describes the mechanism of variability of the relative financial liquidity in the enterprise. In this model. the autoregression of first order for

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[7] The right axis refers to actual and fitted values of monthly cumulated financial liquidity of the enterprise, the left axis – to residuals (in Fig. 5 and 6).

[8] Symbols here are identical as in model (3). Compare footnote 6.

plproc$_t$ variable occurs. which reflects the inertia in variable *plproc$_t$*. Moreover. very strong. positive seasonality in January and March can be observed. Constant seasonal effect of January is systematically decreased by introducing into the model the additional dummies to take into account the changing seasonality. Actual and fitted values of monthly cumulated relative financial liquidity of the GR enterprise (calculated from equation (4)) and residuals are presented in Fig. 6.

5. Summary

The simple method of calculation and modeling the financial liquidity of small enterprise shown the sufficient accuracy for the purpose of current management in the enterprise. The analysis of figures (liquidity measures) already enables to evaluate the size of liquidity and the scale of seasonal fluctuations. The application of appropriate. not complicated econometric models enables to predict the scale of future financial liquidity. This gives the owner the information about the expected levels of liquidity. which require proper accumulation of financial resources needed to maintain the safety of production process. This also indicates the periods. in which the relative easiness in financing the investment expenditure appears.

The presented in paper solutions should be recommended to the owners of small enterprises and it should be a task for well educated graduates of economic studies. The common application of these solutions may help to increase the safety of economic turnover in Poland.

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