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Prerequisites of credit rationing in a bank-company relationship in empirical approach

Abstract

The paper investigates main aspects of a bank's loan activity related to the core strains of the credit rationing theory. The focus is set on the study of the empirical significance of credit rationing on the basis of dataset extracted from internal loan statistics of a commercial bank operating in Poland and belonging to the group of the ten largest banks in term of assets. The dataset covers loan applications of small and medium companies, confronted with corresponding decisions of the bank. This approach has allowed to determine two main regimes of bank credit activity distinguished on the basis of actual amount of granted loans compared to initial demand of potential borrowers (i.e. rationed and non-rationed companies.)

The analysis of the dataset has proved two hypotheses assuming that the scope and intensity of a bank-company relationship has a direct impact on the actual degree of credit rationing. The empirical results have also revealed that credit rationed companies are significantly less transparent to the Bank, which stems from their financial standing, operational activity and loan characteristics, together entailing the amplified credit risk in the bank. Moreover, it is concluded that rising the demand for credit in time has an actual beneficial impact on diminishing the risk of being a credit constrained borrower.

1. Conceptual framework of credit rationing

Credit rationing phenomenon in the theory of finance is considered as a fixed disequilibrium on the loan market perceived by the scope of price distortion. Generally the theory defines credit rationing as a situation in which the demand

[1] The paper is part of the research undertaken in Collegium of Management and Finance, Warsaw School of Economics. I would like to express my gratitude to employees of the Bank which provided me with the dataset for research purposes.

for loans exceeds the supply of these loans at the loan rate quoted by banks. Models of credit rationing tend to rationalize why banks are likely to set an interest rate below the market-clearing rate and thus limit the supply of credit instead of increasing interest rates in line with the growing demand for credit, especially in loan boom periods. It is assumed that adjusting the interest rates is likely to put the demand and the loan supply in balance, but in given circumstances this process is congested by inelastic loan interest rate set by banks.

Baltenspringer (1978) was the first to distinguish two main types of credit rationing. The first type is described as a situation where borrowers receive a loan and other segments of potential borrowers do not receive it, in spite of their inclination to pay higher interest rates. The second type of credit rationing defines the situation where potential borrowers from one segment are unable to get a loan when approaching the bank under one credit policy at any interest rate, but others, which are a homogenous form of the banks' standpoint, actually get such a loan. The research in this paper focuses on the first form of the credit rationing, as the main goal is to illustrate clusters of companies with the highest evident probability of being credit-rationed.

The first explanatory models of credit rationing attempted to explain this phenomenon by means of a full information framework and various market imperfections (e.g. Hodgman 1960, Jaffee and Modigliani 1969, Jaffee 1971, Smith 1972, Azzi and Cox 1976). The problem is that these theories tend to overlook the inherent complexity of the borrower-bank relationship, in particular the problem of less than perfect information or information asymmetry. However, this strain of credit rationing was commenced by Jaffee and Russell (1976) and Stiglitz and Weiss (1981) were the first to introduce asymmetrical information in the analysis of the credit decision

In the cornerstone concept of the traditional model of the credit rationing (i.e. 'Stiglitz-Weiss-model'), it is demonstrated that it occurs because the borrowers, with respect to their default risks, are in fact heterogeneous to the bank. Consequently, banks face the challenge to overcome the information asymmetry in relationships with individual borrowers in order to identify different possibilities of defaults. In such a situation, increasing interest rates serves banks as screening devices with increasing default risk premium, but at the same time it deteriorates the quality of the loan demand. The rise of the interest rate makes potential investments of the least risky borrowers drop out of the market. Moreover, the information asymmetry is getting more evident as the average risk of the borrower pool increases the adverse selection. The borrowers still present on the credit market are forced to undertake riskier projects to cover higher costs of funding, but this also favors moral hazard behavior. Both the effects negatively influence banking losses from a wider credit risk exposure and therefore induce banks to constrain the loan supply.

The above mechanisms are based on the assumption that the information asymmetries prevent the bank from distinguishing between borrowers in terms of

the reliable value of their future projects. As a result, from the bank's perspective, all projects have the same expected value. Once the bank has information on the disadvantaged position of the pooled borrowers, the loan contracts take a standard debt form**.** Consequently, the interest rate does not bring the demand and the loan supply to balance and the reduced credit availability causes long-lasting distortions on the loan market.

However, the main scope of analyses in this paper does not focus on the interest rate adjustment. This approach of simple correlation of higher returns on the investment project with its lower chance of its prospective accomplishment seems to be too narrow. In terms of investment projects, higher expected returns stimulate companies to make additional efforts in order to bring the investment successfully to its end. This is especially true when the own financial contribution of the borrower tends to rise and the risk of the project is shared between two partners of the loan contract. Consequently, the hypothesis of a general negative correlation between projected investment return and its chance of success is not universally viable (Sobreira 2002). This paper takes more functional approach of asymmetric information to assess the scale of credit rationing based on factual demand and credit supply.

On this basis it should be emphasized that in spite of differences in specific proposed mechanisms, credit rationing theories share a general theme i.e. asymmetric information (e.g. Blinder and Stiglitz 1983; Gale and Hellwig 1984; Besanko and Thakor 1987a, 1987b; Williamson 1987; De Meza and Webb 1987). Main strands in the literature focus on preventing the adverse selection risk, moral hazard risk and contract enforcement problems. This paper provides a sample of the first approach, as the focus is given to individual characteristic of potential borrowers, stressing the main prerequisites for being credit-rationed. Moreover, it can be argued that other strands of credit rationing are fundamentally similar in terms of their underlying logic and bank credit policy implications.

Credit rationing is the most striking manifestation of adverse selection in the banking activity as it is closely connected with the possibility of default. In case of adverse selection, credit rationing ought to be reduced in line with the scope of interactions between the bank and the same borrower. Such tight ties have a beneficial influence on the information position of the bank, which has more opportunities to learn about the debtor activity. Furthermore, untruthful borrowers reveal themselves to the bank over time, entailing more credit constraints in the further loan. Over the extended period of a bank-company relationship borrowers tend to become more transparent and owners of such companies are likely to increase their contributions to the company's activity so that they can bear a larger share of the asymmetric information risk.

Nevertheless, while banks do accumulate private information about their borrowers, informational asymmetries remain, e.g. concerning the borrower's heterogeneity in particular segments of companies. Companies that are financially

strong and creditworthy at the moment of a credit contract cannot assure that they will remain creditworthy in the future. Consequently, a repeated company-bank relationship has substantial influence on the reduction of this risk (Cole 1998).

Before the model is estimated, main hypotheses concerning the demand and supply of the bank credit activity evoking economic theory in this field need to be formulated. Early models of disequilibrium on credit markets are based on price, i.e. interest rates. Numerous studies have examined the significance of the dynamics of a market disequilibrium as well as the methodology of estimating the supply and the demand function for those markets in disequilibrium (Fair and Jaffee 1976; Maddala 1980; Goldfeld and Quandt 1981). However, more recent models, as it was stated above, set aside the traditional hypotheses of the price's impact on restoration of equilibrium on the market (Sobreira 2002). These studies aim at separating the demand and supply effects on credit availability by using information from both loan applications and further loan contracts. Cheng and Degryse (2010) observe requested and granted loan amounts and also studied credit rationing on the Chinese credit card market. Furthermore, studies on correlations of the companies' characteristics and credit rationing degree are examined by Kirschenmann (2010)

As stated above, the scale of demand for a bank loan is determined by a wide scope of factors influencing the level of asymmetric information, which influences the amount of the requested and obtained loan contract. This is especially true for the sector of small and medium companies, which are covered in this paper[2]. Consequently, two main hypotheses are formulated in this paper:

H1: Credit rationing tends to increase as the companies applying for a bank loan are characterized by less loan transparency to the bank.

H2: Credit rationing tends to be lower as the intensity of the loan activity of the companies increases over the period of the relationship with the bank.

2. The model settings

The model comprises dataset from loan applications as well as loan decisions of the leading commercial bank operating in Poland (called "the Bank.") The Bank was qualified into a group of ten largest commercial banks operating in Poland on the basis of the total assets value at the end of 2010.

[2] Berger, A.N. and G.F. Udell, 1995, Relationship lending and lines of credit in small company finance, *Journal of Business* 68, 351–382. Petersen, M.A. and R.G. Rajan, 1994, The benefits of company-creditor relationships: Evidence from small business data, *Journal of Finance* 49, 3–37. Elsas, R., and J.P. Krahnen, 1998, Is relationship lending special? Evidence from credit-file data in Germany, *Journal of Banking and Finance* 22, p. 1283–1316. Hancock, D., Wilcox, J.A., 1998, The 'credit crunch' and the availability of credit to small business, *Journal of Banking and Finance* 22, 983–1014.

The time of the data sample has been set for 2006–2010, which covers a period of abnormally high exposure of the banking sector towards credit risk. This period has reinforced the symptoms of credit rationings in both the Polish and the worldwide financial sector. Moreover, the process of the bank's deleveraging is commonly regarded as one of the main roots of unprecedented distress on the financial markets and economic slowdown.

On the basis of borrowers' loan applications and requested loans, the dataset of the actually granted loan terms was extracted from the Bank's register. Moreover, the borrowers' characteristics as well as the scope of loan relationships before the time of the loan origination have been analyzed. The data sample embraces 16,317 loans granted to 8,796 small and medium companies, among which there are 3,359 companies servicing loans for at least four years. This segment of companies has been taken on purpose for studying credit rationing because informational asymmetries are presumably most severe among small and medium companies. It is worth stressing that small and medium companies have especially limited loan relationships with banks. The Bank's largely standardized loan contracts for these companies entail dealing with credit risks arising from informational asymmetries. Finally, since the loan granting process is the same for all the observed loans, possible heterogeneity is reduced at this level.

The empirical study aims at assessing the scope of credit rationing and has been split up into two phases. Firstly, credit rationing analyzed as a disequilibrium of demand and the supply of bank loan are estimated by means of the Ordinary Least Squares regression taking *Actual loan (AL)* as a depended variable. Secondly, the outcome equation was estimated to be a panel model with main characteristics of companies to control any unnoticed time-invariant borrower heterogeneity that may influence the AL. In reference to the first part of the empirical study, the credit rationing formula prepared for the need of the empirical study takes the form of:

$$AL_{c,l,t} = \alpha + \beta_1 BR_{c,t} + \beta_2 LC_l + \beta_3 CP_{c,t} + e_{c,l,t}$$

where:

$AL_{c,l,t}$ – *actual loan* as a ratio of the granted loan amount to the requested loan amount for loan l to the company c in month t;
$BR_{c,t}$ – vector of *bank relationship* variables;
LC_l – vector of *loan contract* variables;
$CP_{c,t}$ – vector of *company profile* variables.

The vector of the intensity of *bank relationship* ($BR_{c,t}$) includes following variables:

- *Relationship intensity* – indicates the number of credit products of the company taken from the Bank in the analyzed period with an assumption that this varia-

ble measures the intensity of the bank-borrower relationship. Consequently, this variable serves as the basis for interactions analysis between borrowers and the Bank, as the more interaction, the better information position of the Bank about the company's overall activity. The analysis includes nonlinear effects with the dummy variables:

- *Product n* where $n = 2, ..., 5$ which pools interactions number from two to five because of the fewer observations in companies with more than five credit products. Moreover, the descriptive analysis has shown that most of the credit action happens at the beginning of the relationship with the Bank.
- *Product 1* as the reference category.

- *Newcomer* – the dummy variable to identify young companies that might face especially high difficulties in credit accessibility, which equals tighter credit rationing. It takes 1 if the company has been operating for less or equally two years and 0 otherwise.
- Relationship length – the dummy variable that stipulates the length of the credit application procedure in months between when the loan claim was placed with the Bank and when the loan decision was taken.
- *Size* – the dummy variable to identify borrowers belonging to small or medium companies according to the 2003/361/EC Recommendation regarding the SME definition i.e. companies that fulfill the criteria stipulated as either the turnover ceiling or the balance sheet ceiling and staff headcount ceiling in both cases. This variable takes 1 if the total assets are below the median company size when applying for a loan, and 0 otherwise.

The set of interaction effects is analyzed in this study. It is examined whether credit rationing evolves differently over bank relationships for opaque vs. transparent companies:

- *Product n* Newcomer,* where $n = 2, ..., 5$
- *Product n * Size* where $n = 2, ..., 5$

The vector of *loan contract (*LC_l*)* consists of the following variables:

- *Granted loan amount* – this variable specifies the loan amount in PLN as stipulated in the Bank's register.
- *Requested loan amount* – this variable specifies the loan amount in PLN that the company initially demanded in its loan claim.
- *Granted loan maturity* – this variable stipulates the loan maturity as stated in the Bank's register after the loan decision.
- *Requested loan maturity* – this variable stipulates the loan maturity as the company demanded in its loan claim.
- *Collateral* – this variable indicates whether the loan has the specified collateral in fixed assets or it is intended to finance working capital otherwise. The underlying asset may be sold in case of default so from the bank's perspective the associated credit risk is much lower than in the case of financing the working capital.

- *Loan type* – the dummy variable which stands on 1 if the loan is a long-term loan (at least one year payment) and 0 if it is a loan to sustain liquidity. The regular repayment schedule is set for long-term loans so the Bank has a greater potential to monitor the debtor and it influences the quality of the Bank's loan monitoring process positively.
- *Loan status* – this dummy variable the current status of the borrower takes into account to analyze whether a new loan is to be granted before the previous loan is fully repaid; if this is the case of a company applying for a new loan, the variable stands on 1 and 0 otherwise.

The vector of *company profile* ($CP_{c,t}$) consists of the following variables:

- *Financial Leverage* – highly indebted companies have larger exposure to financial risk in their strategy, which entails higher risk of default in case of external shocks to their income. This variable is calculated as the ratio of total debt against its total sum of equity and liabilities at the disbursement date of the loan.
- *EBIT* – this variable (in PLN) measures the extent to which a company is prone to react negatively to unforeseen changes in its operational income as a consequence of external shocks to its current activity. The smaller EBIT is, the more endangered the repayment of the loan might be.
- *Multiply loans* – borrowing from multiple sources may reduce the company's need for funds in the Bank, which is likely to reduce credit rationing due to a lower demand. Loan relationships with various banks indicate a positive financial standing of the company in view of the banking sector and therefore the company is less credit rationed. This variable takes 1 if the total liabilities are larger than the outstanding debt in this Bank, and 0 otherwise.
- *Past overdue* – the dummy variable showing the degree of rationing on the basis of previous repayment problems in the bank relationship. Negative loan history is much likely to adversely influence the next loan procedure, so this variable amounts to 1 if the borrower was past-due on interest or principal payments for more than 30 days with their previous loan, and 0 otherwise.

3. Credit rationing – empirical analysis

3.1. Main determinants of credit rationing

The analysis of empirical loan data has been divided into two subdivisions, i.e. non-rationed and rationed bank loans. Non-rationed loans have been granted by the Bank in line with the requested amounts. On the contrary, the credit rationed loans have been granted with an actual amount lower than initially requested by the company.

Summary statistics for subsequent variables of the bank relationship, a loan contract and the company profile create subsamples, which allows to concompany

the differences between companies that faced credit rationing and these that have received financing from the Bank in line with their requests (table 1).

Non-rationed companies exhibit significantly smaller requested and larger granted loan amounts than the rationed loans. Credit rationed companies are less inclined to finance fixed capital and therefore to offer the collateral to the Bank, as in case of companies from the second subdivision.

Table 1
Main empirical determinants of credit rationing

Variables	Credit rationed	Non-credit rationed	Difference
Bank relationship – BR			
Relationship intensity	1,62	2,89	–1,27***
Relationship length	4,58	6,12	–1,54***
Newcomer	0,28	0,12	0,16***
Size	0,64	0,42	0,22***
Loan contract LC			
Share granted	0,60	1,02	–0,28***
Requested loan amount	94 774	70 614	24 160***
Granted loan amount	56 809	72 344	–15 535***
Requested maturity	42,23	33,86	8,37***
Granted maturity	28,48	30,05	–1,57***
Collateral	0,43	0,46	–0,03***
Loan type	0,74	0,68	0,06***
Loan status	0,79	0,56	0,23***
Company profile – CP			
Financial leverage	0,17	0,12	0,05***
EBIT	165	244	–79***
Past overdue	0,09	0,04	0,05***
Multiply loans	0,43	0,56	–0,13***
	n = 4 243	n = 12 074	

***, **, * denote that variables are significantly different from each other at the 0.01-, 0.05- and 0.1-level using a two-sided T-test.

More precisely, credit rationed companies approach the Bank to finance day to day activity before full repayment of the previous loan more frequently. Furthermore, credit rationed companies requested longer loan maturity, as compared to non-rationed counterparts, and are more likely to be younger and smaller with their first loans. Moreover, credit rationed companies exhibit shorter bank relationships than the non-rationed ones. They have been operating in the market shorter than the non-rationed companies. It is worth stressing that credit rationed loans are over twice as likely to be overdue for over 30 days as the non-rationed loans, which is in line with the assumptions of the credit rationing theory.

Furthermore, credit rationed companies display lower EBIT but a higher financial leverage, which has a negative impact on their credit worthiness. Non-

credit rationed companies maintain relationships with more than one bank more frequently than their rationed counterparts.

The T-test concompanies that these differences in company characteristics are statistically significant at the 0.01-level when comparing the subdivision of the credit rationed and non-rationed loans.

3.3. Cross-determinants of credit rationing

The regression analysis with the aim to determine the most crucial determinants *actual loan* $AL_{c,l,t}$ have been conducted in two parallel estimations, i.e. for the full sample and the panel of companies that have already benefited from at least two loans from the Bank over the analyzed period (*Regular borrowers*) arranged in clusters set according to the number of their credit products (*Product number* n).

The dependent variable *Actual loan* indicates the ratio of the granted loan amount to the requested loan amount for subsequent companies. The first row includes results for the full sample from an OLS regression and the second row displays the results from fixed results regressions for the panel of these companies whose credit rationing phenomena ought to be lower due to inferior information asymmetry (see table 2).

In case of the latter companies the Bank was able to gather data about financial standing while assessing their credit worthiness during the previous credit procedure. The assumption is in line with the second hypothesis that the more credit products company has been benefiting from, the more transparent its credit status to the Bank is.

The results from the analysis of the panel of Regular borrowers in the second row show that individual borrower relationships with the Bank have vital influence on credit rationing intensity. It is worth emphasizing that the result of regression demonstrate that the impact of the Product number dummies on the panel of regular borrowers is stronger than in the full sample analysis.

Table 2

Overall intensity of the borrower and the Bank relationship

Variables	Product 2	Product 3	Product 4	Product 5
Full sample	0,023***	0,030***	0,029***	0,038***
	(0,002)	(0,003)	(0,003)	(0,004)
Regular borrowers	0,037***	0,051***	0,055***	0,078***
	(0,003)	(0,005)	(0,007)	(0,009)

Standard errors are reported in parentheses and account for clustering at the company level.

***, **, * denote significance at the 0.01-, 0.05- and 0.1-level using a two-sided T test. The number of observation and adjusted R2 are displayed in table 6.

The repeated interactions with the Bank imply the substantial decrease in the degree of credit rationing. As a result, the observed company credit activity has a favorable influence on the access to the Bank loan and the borrowers encounter fewer obstacles in the later stages of their bank relationships. These results concompany that companies with more intense bank relationships are more transparent as well as less risky to the Bank. On the whole, it leads to less frequent credit rationing symptoms.

The cross-comparison of the *Product number n* and *Newcomer* variables capture the effect of credit rationing for companies operating on the market for a short period of time (see table 3). The results show that the more often young companies borrow from the Bank, the less credit rationed they are.

Consequently, companies that have been operating for less or equally two years but display very intensive credit activity, commonly experience a significant drop in the degree of credit rationing on the background of the full sample companies. Such results are in line with the second hypothesis of this paper. On the basis of credit interactions the Bank is able to gather most of the valuable private information about a company at the beginning of a bank-borrower relationship.

Table 3

***Newcomers* – intensity of the borrower and the Bank relationship**

Variables	Product 2	Product 3	Product 4	Product 5
Full sample	0,024***	0,033***	0,029***	0,041***
	(0,004)	(0,005)	(0,006)	(0,009)
Regular borrowers	0,018***	0,015***	0,019***	0,029***
	(0,005)	(0,007)	(0,009)	(0,012)

Standard errors are reported in parentheses and account for clustering at the company level.

***, **, * denote significance at the 0.01-, 0.05- and 0.1-level using a two-sided T test. The number of observation and adjusted R2 are displayed in table 6.

The results of another analysis demonstrate that the companies that are included in clusters of small companies (variable *Size*) can offset odd consequences of credit constraints by tighter loan relationships with the Bank (table 4).

The significantly positive coefficients for the interaction effects of *Product number n* and *Size* indicate that the reduction of credit rationing over a loan sequence is noticeable for smallest companies on the background of the full sample.

The further variables of company and loan profiles show that credit rationing also depends on the observable credit risk of the company. The companies with higher *EBIT* and requesting loans for fixed capital financing (*Collateral* variable) are less credit constrained. This finding is also in line with credit rationing assumptions because companies with higher operational income are less vulnerable to external shocks to their business and since fixed assets are claimed to be an appropriate collateral in case of default. Consequently these loans may be considered less risky to the Bank.

Table 4

***Size* – intensity of borrower and Bank relationship**

Variables	Product 2	Product 3	Product 4	Product 5
Full sample	0,029***	0,033***	0,051***	0,045***
	(0,002)	(0,003)	(0,005)	(0,006)
Regular borrowers	0,028***	0,031***	0,049***	0,037***
	(0,003)	(0,005)	(0,006)	(0,007)

Standard errors are reported in parentheses and account for clustering at the company level.

***, **, * denote significance at the 0.01-, 0.05- and 0.1-level using a two-sided T test. The number of observations and result of adjusted R2 are displayed in table 6.

Table 5

Regular borrowers – loan and company characteristics

Variables	**Financial leverage**	**Ln (EBIT)**	**Multiply loans**	**Collateral**	**Loan type**
Full sample	–0,0534***	0,0098***	0,0062***	0,0142***	–0,001***
	(0,004)	(0,001)	(0,002)	(0,001)	(0,004)
Regular borrowers	–0,0427***	0,0107***	0,0134***	0,0071***	–0,002***
	(0,008)	(0,002)	(0,002)	(0,002)	(0,007)

Standard errors are reported in parentheses and account for clustering at the company level.

***, **, * denote significance at the 0.01-, 0.05- and 0.1-level using a two-sided T test. The number of observations and result of adjusted R2 are displayed in table 6.

Bank loans used in companies to finance investments (*loan type*) may be more difficult to be split, which leaves more scope for loan constraints. At the same time, companies that show a higher *Financial Leverage* are more risky to the Bank and thus they are more frequently credit rationed.

Multiply loans with different banks lead to a decrease in the degree of credit rationing. This may either stem from lower demand due to other available funds or from increased supply because companies with several bank relationships are the most profitable and vital ones. These results concompany hypotheses that credit rationing is higher for the group of opaque companies.

Table 6

Sample characteristics

	Observations	**Adjusted R^2**
Full sample	15 426	0,072
Regular borrowers	7 985	0,215

3.2 Credit rationing intensity changes in time

An interesting issue in credit rationing analysis it determination of the scale of changes in bank loan constraints over time, taking different models of bank-borrower relationships' development into consideration.

In customer-driven relationships banks tend to increase the granted loan amount to meet the borrowers' demands. Contrary to this approach, in bank-driven relationships borrowers decrease their loan requests to the level which banks are willing to provide. This issue has been addressed in the model of fixed effects regressions for the panel of these companies in the dataset that have taken more than one loan from the Bank during the observation period (*Regular borrowers*).

The dependent variable in the first row is *Ln(Granted amount),* which is a natural logarithm of the granted loan amount in PLN. The dependent variable in the second row is Ln(*Requested amount),* which is a natural logarithm of the requested loan amount in PLN (see table 7).

The regression results in the first row show that granted loan amounts actually increase over loan sequences. The variable Ln(*Requested amount*) in the second row reveals that requested amounts also increase significantly during multiple interactions with the Bank, but on a smaller level than the granted amounts.

Consequently, next credit products increase the probability of higher credit amount considerably both in terms of the granted amount and requested amount. It is worth stressing that the Bank tends to apply less credit restrained procedures if a company is more willing to broader its credit relationships with the Bank.

Table 7

Credit rationing intensity changes in time – number of products

Variables	Product 2	Product 3	Product 4	Product 5
Ln (granted amount)	0,205***	0,361***	0,490***	0,578***
	(0,008)	(0,014)	(0,019)	(0,028)
Ln (requested amount)	0,121***	0,258***	0,367***	0,431***
	(0,009)	(0,014)	(0,021)	(0,029)

Standard errors are reported in parentheses and account for clustering at the company level.

***, **, * denote significance at the 0.01-, 0.05- and 0.1-level using a two-sided T test. The number of observations and results of adjusted R2 are displayed in table 9.

If companies are more indebted (*Financial leverage*), they are granted smaller amounts. On the other hand, the loans that are secured by fixed assets (*Collateral*) which may be sold in case of default and loans with regular repayment schedules (*Loan type*) lower credit risk and thus show higher granted amounts.

Lending relationships with many banks (variable multiply loans) lead to higher granted loan amounts by the Bank, given the evidence that companies with several

lending relationships are less credit restrained on the basis of credit risk credibility in the banking sector. Facing such findings, it is not a surprise to see that better operational results Ln (EBIT) reduce the probability of credit rationing.

In case of the requested amount there is a significantly positive but again smaller coefficient for *multiply loans*. This provides clear evidence that the observed decrease in credit rationing over loan sequences does not stem from the borrowers' reduced demand from the Bank due to their access to debt capital from other sources. Consequently, in case of active debtors, the observed lessening credit rationing stems from the credit strategy of the Bank.

Table 8
Credit rationing intensity changes in time – loan and company characteristics

Variables	Financial levarage	Ln (EBIT)	Multiply loans	Collateral	Loan type
Ln (granted amount)	-0,558***	0,111***	0,159***	0,323***	0,511***
	(0,024)	(0,005)	(0,006)	(0,007)	(0,021)
Ln (requested amount)	-0,479***	0,096***	0,138***	0,312***	0,498***
	(0,025)	(0,006)	(0,007)	(0,007)	(0,022)

Standard errors are reported in parentheses and account for clustering at the company level. ***, **, * denote significance at the 0.01-, 0.05- and 0.1-level using a two-sided T test. The number of observations and results of adjusted R2 are displayed in table 9.

Table 9
Sample characteristics

	Observations	Adjusted R^2
Full sample	7 985	0,358
Regular borrowers	7 985	0,256

Conclusions

The analysis of the dataset in this paper evidences the existence of credit rationing on the basis of loan activity of one of the major commercial banks in the Polish banking system. Moreover, the paper provides the measures of its degree and evolution over repeated relationships between companies and the Bank. The study of the dynamics showing fluctuations of demand and credit supply using observed degree of credit rationing allows to positively assess two hypotheses stipulated for the need of this research.

The degree of credit rationing is considerable and most evident for companies that are comparatively young or small when they first borrow from the Bank. In spite of quite difficult access to credit at the beginning of bank relationships,

this obstacle is resolved with lessening informational asymmetries over bank relationships.

The analysis of the dynamics of the observed credit rationing patterns over bank-borrower relationships specifies that granted loan amounts increase significantly over time. Parallel findings concern the requested loan amounts but these increase slower. These results are in line with the hypothesis that longer and stronger relationships of companies with banks are recommended in order to decrease obstacles in credit access. Thus, banks are in a better position to collect and evaluate the quality of information in due course. Moreover, active borrowers are more likely to get better loan terms as their relationship with the Bank progresses.

References

Azzi, C.F. and J.C. Cox, 1976, A theory and test of credit rationing: comment, *American Economic Review* 66.

Baltensperger, E., 1978, Credit rationing: issues and questions, *Journal of Money, Credit and Banking* 10.

Besanko, D. and A. Thakor, 1987a, Collateral and rationing: sorting equilibria in monopolistic and competitive credit markets, *International Economic Review* 28 (3).

Besanko, D. and A. Thakor, 1987b, Competitive equilibrium in the credit market under asymmetric information, *Journal of Economic Theory* 42.

Berger, A.N. and G.F. Udell, 1995, Relationship lending and lines of credit in small company finance, *Journal of Business* 68.

Blinder, A. and J. Stiglitz, 1983, Money, credit constraints, and economic activity, *American Economic Review* 73.

Cheng, X., and H. Degryse, 2010, Information Sharing and Credit Rationing: Evidence from the Introduction of a Public Credit Registry, *European Banking Center Discussion Paper* No. 2010-07S.

Cole, R.A., 1998, The Importance of Relationships to the Availability of Credit. *Journal of Banking and Finance* 2.

De Meza, D. and D. Webb, 1987, Too much investment: a problem of asymmetric information, *Quarterly Journal of Economics* 102.

Fair, R.C. and D.M. Jaffee, 1972, Methods of estimation for markets in disequilibrium, *Econometrica* 40.

Gale, D. and M. Hellwig, 1984, Incentive-compatible contracts: the one-period problem, *Review of Economic Studies* 52(4).

Goldfeld, S.M. and R.E. Quandt, 1981, Single market disequilibrium models: estimation and testing, Journal of Econometrics 13.

Elsas, R., and J.P. Krahnen, 1998, Is relationship lending special? Evidence from credit-file data in Germany, *Journal of Banking and Finance* 22.

Hancock, D., Wilcox, J.A., 1998, The 'credit crunch' and the availability of credit to small business, *Journal of Banking and Finance* 22.

Hodgman, D.R.,1960, Credit risk and credit rationing, *Quarterly Journal of Economics* 74.

Jaffee, D. and F. Modigliani, 1969, A theory and test of credit rationing, *American Economic Review* 59(5).

Kirschenmann, K., Credit Rationing in Small Business Bank Relationships, *Job Market Paper,* November 2010.

Maddala, G.S., 1980, Disequilibrium, self-selection and switching models, *Social Science Working Paper* 303, California Institute of Technology.

Petersen, M.A. and R.G. Rajan, 1994, The benefits of company-creditor relationships: Evidence from small business data, *Journal of Finance* 49.

Smith, V., 1972, A theory and test of credit rationing: some generalizations, *American Economic Review* 62(3).

Stiglitz, J. and A. Weiss, 1981, Credit rationing in markets with imperfect information, *American Economic Review* 71(3).

Sobreira, R., 2002, Credit rationing and banking company behavior: a post Keynesian approach, paper at seminar at Brazilian Institute of Capital Markets (IBMEC).

Williamson, S., 1987, Costly monitoring, loan contracts, and equilibrium credit rationing, *Quarterly Journal of Economics* 102(1).

Key words: Credit rationing, market imperfections, asymmetric information, SME lending