Information Sharing in the Ukrainian Credit Market: the Impact on Bank Performance and Credit Expansion

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ABSTRACT

The paper conducts an empirical analysis whether the information sharing affects bank performance and credit volume using a panel of Ukrainian banks from 2002 to 2008. To capture gradual effects of information sharing, finite lag distributed models with fixed effects specification are introduced for both effects estimation. As a measure of information sharing between lenders, I use a dummy variable indicating the presence of a bank's partnership agreement with a credit history bureau. The empirical results confirm theoretical predictions on the insignificant bank performance effect and the substantial credit expansion effect of information sharing in both short- and long-run periods. The findings support importance of information sharing that mitigates the adverse selection and the moral hazard problems in the transition credit market under asymmetric information.

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CONTENTS

INTRODUCTION

Well-functioning banking systems, by providing external finance, strengthen the performance of an economy as well as reduce income inequality under easier lending funds access. Unfortunately, banks do not always operate efficiently in transition and developing countries from the point of their primary function of allocating scarce capital. The main reason is asymmetric information inherent in the lender-borrower relationship under weak institutional environment. Information sharing is considered to be a mechanism that can mitigate adverse selection problem in financial markets. The credit history bureaus, which provide the exchange of borrowers' information among lenders, are the practical realizations of the information sharing idea.

Nowadays, there is a worldwide expansion in the credit reporting industry that is particular intensive for developing countries. In Ukraine, the introduction of credit bureaus started in 2005 with a bureau jointly established by the group of banks. Up to the moment there are five private credit bureaus introduced. The number of Ukrainian banks engaged in sharing information increases every year. The type of information provided by bureaus varies, but in most cases it is a history of a borrower's credit line and how this credit has been utilized.

Due to the novelty of the information sharing phenomenon in the Ukrainian credit market, the question concerning its efficiency arises. Although there is a substantial body of the literature dealing with information sharing effects, the impact of communication among lenders on bank performance remains without empirical estimation, whereas the credit expansion effect is considered to be ambiguous. Another gap is the estimation of the effects at the micro level data. Thus, using a panel of Ukrainian banks from 2002 to 2008, I answer two particular questions within the scope of this empirical research:

- What is the effect of information sharing on bank performance in Ukraine?

- Does information sharing affect credit expansion in the lending market of Ukraine?

This paper develops econometric models for bank performance and bank lending based on theoretical predictions regarding the mechanism of information sharing effects. To capture the gradual effects of information sharing, I introduce finite lag distributed models with fixed-effects specification. The estimation results provide empirical evidence for the low economic effect of information sharing on bank performance and the substantial credit expansion effect in both short- and long-run period experienced by Ukraine.

The rest of the thesis is organized as follows. Chapter 1 discusses the literature on the information sharing effects and definitions of bank performance. In Chapter 2, I specify empirical models of bank performance and credit volume as well as the methodology of their estimation. Chapter 3 describes the retrieved data and variables definition. Chapter 4 presents the empirical results. In Chapter 5, I provide discussion of the results with the conclusion of their policy implication and possible questions for further research.

1. INFORMATION SHARING EFFECTS

1.1 THE THEORY

For about three decades, incentives and market equilibrium under asymmetric information have been studied in the economic literature. On financial credit markets, the fact that a borrower typically knows more than the lender about his creditworthiness leads to adverse selection. As a result, the price of a credit does not balance demand and supply (Akerlof, cited in Lofgren et al. 2002) and a problem of credit rationing arises (Stiglitz and Weiss 1981). Due to the latter, imperfectly informed banks ration the volume of loans instead of raising the interest rate to reduce losses from bad loans. Finally, Stiglitz and Grossman (cited in Lofgren et al. 2002) introduce the Grossman-Stiglitz paradox: if a market were efficient from the informational point of view (notably all relevant information is reflected in market prices), no agent would have an incentive to purchase the information on which prices are based. Therefore, the efficient allocation of lending funds is prevented in the credit market. Though information asymmetries are taken to be exogenous, lenders can improve their knowledge about new customers through information sharing institutions generally known as "credit bureaus".

Up to the moment there are the following theoretical predictions on how the information sharing affects credit market activities.

- Pagano and Jappelli (1993): information sharing smoothes the problem of adverse selection. The incentive to share information depends on borrowers' mobility, heterogeneity of the population, and degree of competition among financial intermediaries.

- Padilla and Pagano (1997): information sharing reduces moral hazard that occurs when a lender cannot observe certain efforts of a borrower and operates as a borrower discipline device. A bank's decision to share information affects credit market competition, interest rates, and lending volume.
- McIntosh and Wydick (2005): information sharing has credit expansion effect in which safe borrowers receive larger equilibrium loan contracts.

The literature on information sharing models implied effects on bank performance and credit volume in several ways. Pagano and Jappelli (1993) present the adverse selection model suggesting that increase in mobility of borrowers (i.e. their heterogeneity due to migration) and the large credit markets lead to higher degree of information sharing what secures the decrease of the default rate. The influence of information sharing on the credit volume remains equivocal because the increasing lending to safe borrowers may not compensate for the decreasing lending to risky ones. On the other hand, increased supply of banks' information makes the competition in financial markets fiercer. As a result, monopoly profits are reduced and so is the expected gain from information sharing.

Padilla and Pagano (1997) show that private information about borrowers gives to banks the monopoly about their clients that generates an incentives problem: since banks are expected to charge predatory high rates in the future, borrowers put low efforts to perform. Sharing information with other lenders stimulates competition between banks, reducing their future informational rents and interest rates, and thereby corrects the incentive problem. The reduced probability of default of each client causes the increase in total credit volume. Another authors' main result is that under information sharing, equilibrium profits are no lower than under the regime without information sharing. It is caused by two opposite effects: the borrowers' high effort levels raise current profits, but the tight competition triggered by information sharing lowers future profits.

The later study by Padilla and Pagano (2000) show that when banks, instead of exchanging information about borrowers' quality, share information about past defaults, the disciplinary effect is created. Default information becomes a signal of bad borrower's quality for other banks and carries the penalty in a way of higher interest rates. To avoid this penalty, debtors put more effort which leads to lower default and interest rates and to higher volume of lending. In this model, disclosing information about borrowers' quality, instead, has no effect on default and interest rates, unlike the result of Padilla and Pagano (1997).

McIntosh and Wydick (2007) develop a model of screening, incentive and credit expansion effects of credit information systems. The first two effects are set in line with the previous researches, whereas credit expansion effect causes higher default rates from larger and more favorable equilibrium loan contracts. With a simulation model the authors conclude that credit expansion does not overwhelm the reduction in portfolio default from screening and incentive effects. Another case is the presence of competition among banks that leads to elimination banks' informational rents anyway, so that the interest rate cannot be reduced further. As a result, under information sharing, borrowers have no incentives to change their effort level, therefore default and interest rates stay unchanged that makes no change in banks profits.

Thus, given the variety of the models and their informational specifications, predicted effect of information sharing on bank performance is mostly defined as insignificant due to tight competition, reduction of information rents, and unchanged or decreased equilibrium interest rates. Concerning the impact of information sharing on lending, the above models offer different predictions. In the adverse selection model of Pagano and Jappelli (1993) reduction of adverse selection raises efficiency, but has ambiguous effect on lending. Padilla and Pagano (1997) show increase in lending under sharpened borrowers' incentives, lowered default and interest rates. The model by Padilla and Pagano (2000), accounting for type of information being shared, also shows the increased lending level. Therefore, the way

information sharing impacts credit expansion as well as bank profitability is left to be explained by the empirical literature.

1.2 Empirical Evidence

A substantial body of empirical literature supports the hypothesis that information sharing enhances credit market performance. The impact of information sharing on aggregate market performance has been tested by two main cross-country studies. Jappelli and Pagano (2002) provide their own investigation of the existence and impacts of credit bureaus in 43 countries around the world. They show that credit volume to the private sector is larger and default rates are lower for countries with broader credit markets, lower credit risk and solidly established information sharing institutions. Djankov et al. (2005) find that information sharing institutions are associated with highest ratios of private credit to GDP. They use panel data on private and public credit registries in 129 countries for the period 1978-2003.

The study by Brown et al. (2007) investigates whether the communication among lenders affects credit market performance in the transition countries of Eastern Europe and the former Soviet Union, using a firm-level panel data. The authors find that the information sharing is associated with higher availability and lower costs of loans to businesses.

In addition, Luoto et al. (2007) measure the effect of a newly implemented credit information system in Guatemala. Their estimates show that improved screening causes decline of portfolio arrears and reduction of late payments that occur during the loan cycle. Experimental evidence by Brown and Zehnder (2007) suggests that under substantial endogenous competition for good borrowers, lenders lose market power by sharing information with competitors that in turn affects banks' earnings.

Given that the above studies rely either on aggregate credit information or firm-level data, the value of this paper is in measuring the information sharing effects using a uniquely-

assembled bank-level panel data that let to use tests controlling for unobserved banks' heterogeneity.

1.3 The Literature on Bank Performance

To examine empirically the effects of information sharing on bank performance the question concerning a measure of bank performance arises. There are several approaches in the literature trying to explain it in the most accurate way.

The most common one is the banking assessment achieved on a set of financial performance indicators, such as the return on equity (ROE), the return on assets (ROA), leverage multiplier, the profit rate, the margin of assets utilization, and margin profit. If one considers bank performance from the point of earnings, then ROE and ROA are the profitability ratios the most suggested by banking literature (Rose 1995).

But there is an additional concern with evaluating bank performance on the bank account basis, particularly in regard to banking in transition countries, such as Ukraine. Fries at al. (2002) suggest that the standard financial performance indicators are often over evaluated in the environments with low reforms and less developed regulatory procedures. Moreover, these measures are highly sensitive to the strategy of writing off bad loans that leads to inaccurate reflection of economic profits by accounting profits under overstatement of both bank equity and total assets. To evaluate bank performance in transition economies, the authors consider a bank as a multi-product firm. They estimate an econometric model of banks' revenues and costs.

Fraser et al. (1974) emphasize the necessity to account for a multidimensional concept of bank performance, including both quantitative and qualitative measures. The authors rely on the multivariate specification of the model with a canonical correlation analysis. They define bank performance as a linear combination of several performance indices that allows them to

measure bank performance not with one isolated variable but with several "jointly interacting" factors.

Due to the limitation of data, in spite of the fact that the bank literature suggests to estimate bank performance with a multivariate specification, I turn to a univariate one. The lack of data on management costs, inter-bank rates, and interests obtained on loans and paid on deposits, does not allow me to implement the multivariate approach following Fraser et. al. (1974). Therefore, to analyze bank performance in Ukraine, I have to choose a credible, available from the dataset indicator of bank performance among the following ones: the net income, ROA, or ROE. First I considered defining bank performance using a basic measure of bank profitability either ROA or ROE. Both of the indicators are adjust for the bank's size, making it easier to compare performance across banks. But each of the foregoing ratios looks at a slightly different aspect of bank performance. ROA is primarily an indicator of managerial efficiency (the quality of using a bank's assets to generate profits). On the other hand, ROE measures the rate of return flowing to the bank's shareholders (a bank's earnings on the equity investment). That is why I use net income as a general financial measure of bank performance.

2. SPECIFICATION AND METHODOLOGY

2.1 AN EMPIRICAL MODEL OF BANK PERFORMANCE

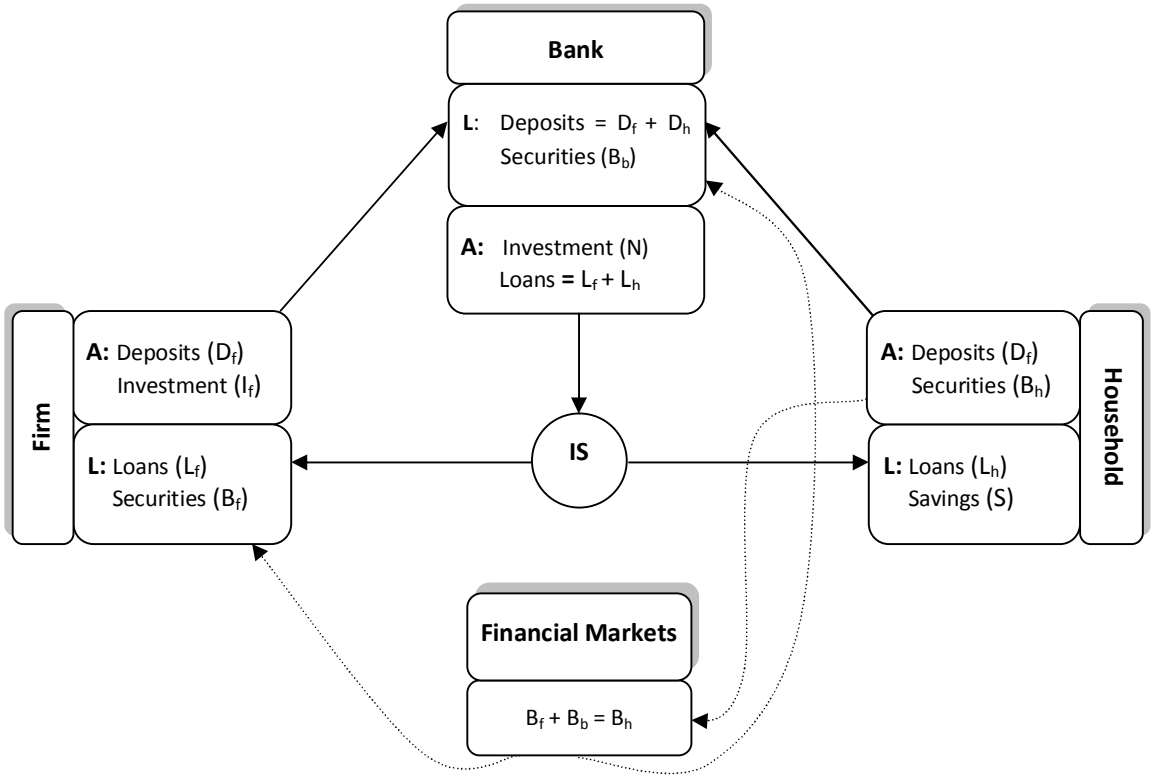
The analysis is focused on the key relationship about the impact of information sharing on bank performance. Here, as a proxy for the information sharing factor, I use an indicator of presence of a partnership agreement between a bank and an information sharing institution, namely a credit history bureau. Net income, presenting bank performance, is the bank's income from routine and recurring sources of revenue, including revenues generated by loans, investments, operations and fees from selling other financial services (long-term assets). Bank expenses, such as management and employee costs, dividends paid, profits tax and others, are excluded from this bank profitability measure.

Given discussed effects of information sharing, this study intents to test the theoretical predictions regarding influence of information sharing on bank profitability. The main concern is that the regime of information exchange sharpens bank competition for borrowers what causes the reduction of bank informational rents. Therefore, following Padilla and Pagano (1997) who claim that under information sharing, equilibrium profits are no lower than under the regime without information sharing, as well as McIntosh and Wydick (2007), the stated hypothesis for empirical estimation is:

H1: Information sharing does not impact equilibrium profits.

To make right specification for testing the hypothesis, the issue of the bank conceptual framework should be discussed first. On the basis of the simplified general equilibrium model by Freixas and Rochet (1998), I present the banking model adjusted for the information sharing component (Figure 1).

Figure 1. The conceptual banking model adjusted for the information sharing component



The model embodies the asset approach for constitution of banking output. Under this approach banks are considered only as financial intermediaries between liability holders and debtors (fund beneficiaries). In this context loans and other assets are taken as a bank output, whereas deposits and other liabilities are inputs to the intermediation process (Sealey and Lindley 1977). The other participants of the loan market (firms and households) are presented with the same assets-liabilities (A, L) structure that reflects their activities on investing, lending, and borrowing funds. Information sharing (IS) does matter when a bank plays the role of a delegated monitor on behalf of their debtors, who often do not have the time and the skill to evaluate the credentials of a borrower. In addition, information sharing mechanism provides banks with tools for evaluation and choice of financial instruments with the most desirable risk-return features.

The above model shows that banks manage both their liabilities by attracting deposits and issuing bank securities, and their assets by providing loans and investments. The main constraint for this multi-product banking activity is equality of total assets to total liabilities (A=L). If the volume of deposits obtained from non-financial institutions does not match the total volume of loans, the banks also have opportunity of borrowing in the inter-bank market.

Then the profit function of a representative bank *i*, adopted from a model by Fries et. al. (2002) includes the returns obtained from lending activities and investments, the interest paid on deposits, the interest cost of a bank's net position on the interbank loan market, management cost of undertaking activities, as well as costs of sharing information:

$$\pi_i = (r_i^l - R)\cdot L(IS_i) - (r_i^d - R)\cdot D_i + (r_i^n - R)\cdot N_i + R\cdot E_i - C(L_i, D_i, N_i, IS_i). \qquad (2.1)$$

Here $L(IS_i)$ denotes loans, defined now as a function of information sharing, D_i, N_i, E_i are deposits, securities investments, and the equity capital of a bank; R is the inter-bank rate, r^l and r^n are the interests obtained on loans and investments respectively, r^d is the interest paid on deposits. $C(L_i, D_i, N_i, IS_i)$ refer to costs of management and information sharing. The latter ones are considered to be fixed costs of partnership with an information sharing institution spending on monitoring and consulting services.

From equation 2.1, the main observed sources of banks revenue – in particular the loans, deposits, non-loan assets (i.e. investment securities), and equity capital – are credible determinants of bank performance that could be directly estimated. The estimated parameters present the average margins earned by a bank on its lent, borrowed and invested funds, as well as an estimate of the inter-bank rate.

But, the main focus of this study is the effect of information sharing on bank performance. Therefore, to test the hypothesis *H1*, the following linear regression model is estimated:

$$\log NetIncome_{i,t} = Controls_{i,t}\beta + \sum_{j=0}^{3} IS_{i,t-j}\delta_{j+1} + a_i + y_t + \varepsilon_{i,t}, \quad (2.2)$$

where $NetIncome_{i,t}$ is the net income of a bank i in period t; $Controls_{i,t}$ is a vector of financial indicators of the main lines of bank activity discussed above; $IS_{i,t-j}$ are dummy variables indicating whether a bank has an agreement on information sharing with a credit bureau at the moment $t - j$; a_i is the bank fixed effects (ownership, location, reputation); and y_t is the year dummy capturing period fixed effect.

The choice of controls is based on the above conceptual banking model and the fact that, in the context of asymmetric information, the communication between lenders could be a way to improve efficiency through all the types of banking activities. There are continuing debates about whether deposits are inputs to the production of loans or vice versa. Subject to a balance sheet constraint linking the quantity of assets to the quantity of liabilities, it can be concluded that information sharing mechanism impacts deposits through loans, investments through loans and deposits, whereas the main condition for this is well performed loans with the low probability of default.

Therefore, as controls the following indicators are included:

- *Loans = {Business Loans, Household Loans}* are the main source of revenues that supports the normal life-line banking function.
- *Deposits = {Business Deposits, Household Deposits}*. The acquisition of deposits is a principal condition for lending and investment activity as well as for accumulating profits to support long-term growth.
- *Investment Securities* the income-generating investments made by a bank for their expected rate of return.

There are also dummies describing the status of bank's partnership with a credit bureau in the previous years. The reason for including lagged variables is to examine how the effect of

information sharing evolves over time. As for most banks loans account is for about two-thirds of their revenues, then it can be concluded that information sharing impacts bank performance primarily through the high repayment probability. The results of this cannot be observed immediately due to the loan cycles. To capture the average effect of information sharing on bank performance in all years after bank introduction to a bureau, I first estimate the model without the lagged *IS* effects. When the lagged effects are introduced, it shows whether the possible changes in bank performance occur instantly or after some adjustment period.

I estimate the bank performance equations given the assumption about bank specific effects. To test whether fixed or random effects are present in the model, I use the Hausman test on a statistically significant difference between these types of estimators. As a result, the random-effects model is overwhelmingly rejected in favour of fixed effects. In turn, the fixed effects model implies inconsistence of pooled OLS estimators.

In the absence of selection bias and measurement error, a possible source of endogeneity is the omitted variables. In order to avoid misspecification, I include the variables of deposits and loans diversified for individual and business groups as well as alternative degrees of control. Fixed effects method also lets control for endogeneity owing to a time-invariant omitted variable.

2.2 A Credit Model for Estimation

The second empirical question asked by this study concerns the impact of information sharing on credit volume lending by Ukrainian banks. The literature suggests (Padilla and Pagano 1997, 2000) that banks' sharing private information with other lenders reduces the probability of default of each client and creates incentives for borrowers to put more effort for loan

repayment. This leads to lower default and interest rates and to higher volume of lending. Therefore, the second tested hypothesis is the following:

H2: Under information sharing there is the credit expansion effect.

To estimate the credit expansion effect of information sharing, I take the total individual loans as a measure of credit volume to be explained despite the fact that there is observed data on business and interbank credits. This is because up to now, except for one of the Ukrainian credit history bureaus, the rest share and exchange information about bank lending activity to private borrowers only.

Bank performance on a loan market depends significantly on the institutional and competitive environment. In the banking literature, the market power of a bank is measured with its share on a deposit market. The higher the market share of a bank, the high the credit volume provided by banks. Therefore, basically, deposit market share is used as a proxy for the size of bank networking.

On the other hand, in segmented credit markets, if lenders commit to exchange information about borrowers' types, borrowers who value their future access to loans have greater incentives to reduce defaults. Thus information sharing fosters competition for creditworthy borrowers while allowing for reduction of bank information rents. The higher market power allows bank to capture greater credit effect of information sharing that, as predicted by theory, may result in lending volume increase. Therefore, the indicators of bank market power measured with its share on household and business deposit markets are included into the credit specification.

The other important determinant of bank lending activity is the capital adequacy ratio examining whether a bank's loan growth is associated with the capital base of banks. This allows controlling for the emergence of excessive risk taking, typical for banking systems in

transition. If the total volume of loans grows with a shift towards more speculative assets, the proportion of bad loans will increase and the capital base will shrink. Fries et al. (2002) suggest that high rates of loan growth are associated with high capital adequacy ratio in the high-reform state. This implies that low levels of bank capital tend to constrain the real expansion of lending volume if banking and related institutions are more developed.

Thus the regression model estimating the effect of information sharing on credit expansion can be describe as following:

$$\log IndividualLoans_{i,t} = Controls_{i,t}\beta + \sum_{j=0}^{2} IS_{i,t-j}\delta_{j+1} + a_i + y_t + \varepsilon_{i,t}, \qquad (2.3)$$

where controls are *i*'s bank capital adequacy ratio, and the bank shares of business deposits and individual deposits in the financial market. $IS_{i,t-j}$ are dummy variables indicating whether a bank has an agreement on information sharing with a credit bureau at the moment $t-j$; a_i and y_t are bank and period fixed effects respectively. The credit equation is estimated again while allowing for bank and period specific effects as well as for possible adjustment period due to the lag effects of information sharing. And a large value of the Hausman test statistic leads to the conclusion about presence of fixed effects that grounds a choice of fixed-effects estimation model.

2.3 THE ENDOGENEITY PROBLEM

The main concern arises due to the lack of consistent information on nonperforming loans across banks. The nonperforming loans are credits that no longer accrue interest income for the bank due to a borrower's default. As a consequence, banks are forbidden to record any accrued interests that are not actually received and must deduct them from loan revenues.

There is a variation in practices regarding the writing off nonperforming loans. This misreporting, especially common for transition countries, distorts the measured loan volume as well as overstates both bank equity and total assets, which construct the capital adequacy ratio of the individual loans specification. In addition, there are results by Berger and DeYoung (1997) who examine the causality among loan quality, cost efficiency, and bank capital. The authors provide support for the 'bad luck hypothesis' according to which high volume of problem loans makes banks increase spending on monitoring. Therefore, the regression result on the credit expansion effect of information sharing might be biased upward due to overestimated credit volume and higher bank incentives to enter a credit bureau under large portion of 'bad' loans.

The other concern is about reverse causality. That is, does the expectations of future information sharing lead to greater credit volume providing by bank? Or, does increasing lending activity induce the communication among lenders? This source of endogeneity can also bias the estimation results upward.

3. DATA

3.1 SAMPLE SELECTION

To analyze the impact of information sharing on bank performance and offered loans the data on the banks' balance sheets and income statements is used. Raw data is publicly available from the Association of Ukrainian Banks' (AUB) website[1] and presented as a set of tables corresponding to six groups of financial indicators that banks are required to disclose, i.e. Assets and Liabilities, Structure of Credit-Investment Portfolio (CIP), Capital Structure, Individual Deposits, Firm Deposits, and Financial Results. The data in each table is updated monthly, but for this research the dataset at the beginning of a calendar year is taken. A detailed list of indicators and their descriptive statistics is tabulated in Appendix A.1.

There are five private credit bureaus established in Ukraine between 2002 and 2008. The information on banking partnership with four of them[2] (Ukrainian Credit History Bureau, First Ukrainian Credit History Bureau, International Credit History Bureau, and Data Mining Group) was collected manually from the bureaus' web sites in compliance with available data on banks from the AUB dataset. In addition to the sources mentioned above, I relied on officially published banks' and bureaus' press releases to obtain the information regarding the number and the order of banks introduced to credit bureaus (Appendix A.2).

The Law of Ukraine *On Organization of Forming and Circulating Credit Histories* was issued in 2005 from when the introduction of credit bureaus in Ukraine started. This year was treated as a time point of information sharing policy implication. Therefore, to create a time window including the key 2005 year, the period from 2002 to 2008 was chosen for construction of the Ukrainian banks' panel.

[1] http://www.aub.com.ua

[2] First three bureaus are available online respectively at http://www.ibch.info, http://pvbki.com, and http://www.ibch.info; Data Mining Group is founded by ALFA bank that is included into the sample.

Although there are 185 banks in Ukraine, only 102 of them are chosen due to the capability to track their performance within seven years. To collect a sample of banks acting in the Ukrainian financial market since 2002 within the chosen period, the information regarding their mergers, changing ownership, and renaming was drawn from the Ukrainian Financial Server website[3].

Thus, I investigate the effect of information sharing on bank performance and loan volume for the Ukrainian credit market using a balanced bank-level panel consisting of 102 banks and 714 observations.

3.2 VARIABLES

According to the hypotheses stated above, the key explanatory variable in the analysis is an information sharing dummy indicating whether a bank made a partnership agreement with a private credit bureau. A private credit bureau is defined by Djankov et al. (2007) as a private commercial firm that maintains a database on the standing of borrowers in the financial system, and its primary role is to facilitate exchange of information among banks and financial institutions. Taking into account that there are some banks partnering with several credit bureaus in Ukraine, I set the variable equal to one if a bank is a partner with at least one of the Ukrainian credit bureaus by the end of a year, and zero otherwise.

To define the performance and credit volume of banks the variables specified on the basis of financial indicators from the AUB dataset are taken. Though all the dataset indicators are presented in the national currency of Ukraine (UAH), as regression variables, they appear in the logarithmic form. One of the reasons for log transformation is that taking logs narrows the range of the variable by which estimates are made less sensitive to outlying observations. Due to the fact that some observations have zero value (for instance net income), following the

[3] http://www.ufs.com.ua

applied econometric literature, I add one unit of the national currency to a variable so to take logarithms of all bank observations.

Thus, the set of bank activity determinants that I control for includes the following:

- Net income;
- Individual (household) loans;
- Business (firms) loans;
- Total individual deposits;
- Total business deposits;
- Investment securities;
- Equity capital;
- Capital adequacy ratio constructed as the equity-to-total-assets ratio;
- Share of individual deposits in the market;
- Share of business deposits in the market.

The descriptive statistics on the above variables are highlighted in the Appendix A.1. The evolution of average mean values of key variables (net income and individual loans) over time is presented in Appendix A.3.

4. RESULTS

Table 4.1 presents estimation results from the different specifications of the basic bank performance regression model (equation 2.2). Columns 1 is the regression results for the whole sample, while the second, third, and fourth ones show the estimates for the sample excluding outlying observation.

Table 4.1.: Estimation of the information sharing effect on bank performance

	Baseline	Robust		
log Net Income	(1)	(2)	(3)	(4)
IS	0.161	0.174	0.041	0.125
	(0.489)	(0.234)	(0.209)	(0.149)
IS_{t-1}	0.554	0.150	0.062	
	(0.392)	(0.154)	(0.154)	
IS_{t-2}	-0.602	0.164	0.101	
	(0.482)	(0.165)	(0.164)	
IS_{t-3}	0.678	-0.071	-0.171	
	(0.566)	(0.291)	(0.297)	
log Individual Loans			-0.051	-0.031
			(0.061)	(0.037)
log Business Loans			0.095	0.051
			(0.076)	(0.032)
log Individual Deposits			0.250**	0.031
			(0.112)	(0.089)
log Business Deposits			0.135	0.166**
			(0.121)	(0.078)
log Investment Securities			0.018	0.014
			(0.034)	(0.018)
log Equity Capital			0.220	0.367***
			(0.171)	(0.130)
Constant	15.526***	15.754***	6.139**	9.331***
	(0.260)	(0.119)	(2.707)	(1.077)
Time effects	Yes	Yes	Yes	Yes
Bank effects	Yes	Yes	Yes	Yes
Observations	408	403	403	701
R-squared adjusted	0.422	0.780	0.804	0.795

Note: IS is a dummy variable which indicates whether the bank has a partnership on sharing information in the current year. IS_{t-1}, IS_{t-2}, and IS_{t-3} are dummy variables indicating whether the bank was introduced to a credit bureau one, two, and three periods before respectively.

*, **, *** Statistically significant at the 10%, 5%, 1% level. White period standard errors in parentheses

The estimated regression model has the fixed effects specification. Therefore, all the results are from the estimation which eliminates bank specific effects. For this purpose, the time-demeaning method rather than differencing the data is employed due to serially uncorrelated unobservables tested with the Durbin-Watson statistic. Since I am hoping to capture the lagged effects of information sharing on bank performance, I estimate the finite distributed lag model. A large sample lets me use the highest possible number of lags that is equal to three without concerning the degrees of freedom problem.

The initial data analysis shows the presence of outliers in the sample (Appendix A.1). Though log transformation is considered to be sufficient for taking individual (bank) heterogeneity into account, the outlying bank observations still remain. As it might drive the estimation results, for the reason of comparison the first two columns from Table 4.1 report the estimates for both the whole sample and the sample without influencing observations. The last one is formed by eliminated bank observations characterized by low profitability results for which log (*Net Income*) equal to zero. Given the difference in magnitudes of coefficients and standard errors from both specifications, it can be concluded that outlying data points substantially change the results that is why I take the reduced sample for the further analysis.

The results from the second specification show that the information sharing does not have statistically significant effect on bank profitability. In this context, the fact that the third lagged value of the information sharing dummy has a negative sign, which is difficult to interpret economically, does not make a concern. To control for possible sources of endogeneity due to omitted variables, the column 3 explores the impact of information sharing in the presence of additional bank activities controls. Estimation of the full specified model does not show a significant impact of a bank's introduction to a credit bureau on its performance either. As far as net income is concerned, the only significant result of the third model is increase in a bank's margin by 25% with 1% increase in the bank individual deposit

funds. To capture the average effect of information sharing in all subsequent years after bank entering a credit reporting system, I estimate the model without the lagged sharing effects (column 4). The reported results does not show significant impact of information sharing on bank profitability, but both the large return on equity (36.7%) and the margin in the business deposit market (16.6%). Thus, the regression results support the hypothesis H1 about insignificant information sharing effect on bank performance. The analysis shows neither the significant long-term impact nor the immediate (or short-run) effect of communication between lenders.

Table 4.2 presents the estimation results for the effect of information sharing on individual credit volume in Ukraine. The specifications are based on equation 2.3 for the credit model.

Table 4.2.: Estimation of the information sharing effect on credit expansion

	Baseline	Robust		
Δlog Individual Loans	(1)	(2)	(3)	(4)
ΔIS	0.321***	0.278***	0.274***	0.238**
	(0.122)	(0.099)	(0.104)	(0.096)
ΔIS_{t-1}	0.426***	0.339***	0.328***	
	(0.159)	(0.105)	(0.102)	
ΔIS_{t-2}	0.334**	0.214**	0.239***	
	(0.155)	(0.086)	(0.082)	
ΔCapital Adequacy Ratio			-1.023*	-1.106*
			(0.583)	(0.627)
ΔMarket Share of Individual Deposits			0.294**	-0.243
			(0.125)	(0.303)
ΔMarket Share of Business Deposits			0.055**	0.009
			(0.026)	(0.087)
Constant	0.539***	0.605***	0.593***	3.261***
	(0.103)	(0.054)	(0.053)	(0.041)
Year dummies	Yes	Yes	Yes	Yes
Observations	408	406	406	609
R-squared adjusted	0.035	0.049	0.069	0.971

Note: IS is a dummy variable which indicates whether the bank has a partnership on sharing information in the current year. IS_{t-1} and IS_{t-2} are dummy variables indicating whether the bank was introduced to a credit bureau one and two periods before respectively.

*, **, *** Statistically significant at the 10%, 5%, 1% level. White period standard errors in parentheses

The framework for the analysis of the credit expansion effect has the same stages as for bank performance. As the Durbin-Watson test gives the evidence of substantial AR(1) serial correlation, differencing the data as a method for eliminating unobserved effects is employed (Cameron and Trivedi 2005). To check the idea of the credit volume gradual adjustment to the introduction credit bureaus in Ukraine, I estimate the finite distributed lag model with only two lags. The reason for this is that the coefficient on the third lag is insignificant that makes its introduction to the model unnecessary.

Columns 1 and 2 contain regression estimates for the whole sample and the sample reduced by outlying observations on banks with low lending activity respectively. The histogram for naturally logarithm of individual loans is presented in Appendix A.1. Though the significance of baseline estimation results are supported on the basis of the reduced sample estimation, driven magnitudes of coefficients and standard errors show substantial impact of outliers. Therefore the reduced sample is used for further estimation and interpretation of the credit expansion effect.

The dependent variable - the change in log*(Individual Loans)* - can be interpreted as the approximate annual growth rate in the volume of individual loans from year *t-1* to *t*. The results from estimation of the second specification show economically large and statistically significant impact of the bank presence in the information sharing coalition: the immediate impact of introduction to a credit bureau is about 32% increase (calculated by [exp(0.278)-1]·100) in bank lending, whereas the overall long-term effect for the banks that have cooperated with a credit bureau for at least three years is about 96% increase. Considering the third specification, the inclusion of additional control variables still implies a positive and significant credit expansion effect of information sharing. The other interesting results are positive and statistically significant coefficients on bank market shares. These findings show that profits derived from the bank market power are used to fund loan growth.

A significant negative association between loan growth and capital adequacy ratio support the evidence of bank excessive risk taking in transition economies. This suggests that low levels of bank capital do not constraint lending that implies the presence of "gambling for resurrection" (Fries et. al. 2002) by banks with low capital base and high real loan growth. The estimation results from fourth specification capture the average effect of information sharing on lending volume as about 27% increase in all subsequent years after bank introduction to a credit bureau. Thus, the results obtained from the estimated credit model align with the second hypothesis concerning the credit expansion effect of information sharing.

It also should be mentioned that due to the sources of endogeneity stated above, the results might be overestimated and therefore their interpretation requires some care. The problem of accounting for unobserved nonperforming loans still remains. In addition, IV estimation method cannot be implemented to solve the problem of inverse causality due to practical difficulty of finding the valid instrument for the information sharing variable. The task of finding a good instrument having zero correlation with equation errors (for consistency) and high correlated with the variable of lenders communication (for efficiency) could be the further research question.

5. CONCLUDING DISCUSSION

Overall, the results of the study support the claim that information sharing institutions contribute to the efficiency of financial markets by promoting transparency in lending. Both hypotheses H1 and H2, built on the existing approaches to the information sharing issue, are confirmed in the context of a transition economy.

The features inherent in the Ukrainian financial market as a transition one are the following: poor protection of creditor rights, weak enforcement mechanism, and low accounting transparency. Moreover, the market is considered highly contestable. Due to the constantly growing demand for individual loans, it can be also characterized by the high heterogeneity of credit applicants. All these factors lead banks to higher degree of information sharing in order to obtain benefits from information exchange, such as the improved portfolio quality with optimal diversification of credit and deposit accounts as well as decreased rates of arrears under screening and incentives effects. But there are also opposite effects of communication among lenders that impact the performance of banks. First of all, a lender engaged in tight competition, may lose its market power by sharing information with competitors. Then fostered competition reduces lenders' future informational rents. This decreases predatory rates fixed by banks and increases incentives of borrowers. As a result, default and interest rates are reduced in the equilibrium.

Thus, the answer to the question whether these opposite effects compensate each other defines the negative or positive effect of information sharing on lender performance. The insignificant impact of credit bureaus introduction on bank performance in the Ukrainian credit market suggests that banking activity in Ukraine is susceptible to both types of information sharing effects, canceling each other. The stated insignificance can also be explained by following McIntosh and Wydick (2007), who suggest that the competition

among banks under information sharing leads to reduction of lenders' informational rates anyway and the interest rate cannot be reduced further. This does not lead borrowers to change their effort level and then default rates do not change either. In the context of the unchangeable interest and default rates, information sharing cannot influence bank performance.

Concerning the effect of information sharing on lending, it is considered to be ambiguous due to the fact that increase in lending to creditworthy borrowers may not compensate for the lending reduction to risky ones. However, the findings of this paper support the credit expansion effect of information sharing in Ukraine. The main explanation is based on the issue of incentives for consumers who value their access to the individual loan market (Padilla and Pagano 1997). Committing to the information exchange among lenders about borrowers' types reduces the probability of default of each client, and therefore the interest rate charged by a bank. This implies improved credit access for a higher number of borrowers and increase in total credit volume.

Thus, this thesis has contributed to the growing empirical literature on information sharing by investigation of the information exchange effects on bank performance and credit volume in Ukraine. The analysis of the micro-level data supports theoretical predictions of the insignificant economic effect of information sharing on bank performance and the large credit expansion effect in both short- and long-run period.

5.1 Policy Implication and Extensions

The findings of this paper have important policy implications. In the presence of a weak legal and institutional environment, as well as high costs of credit contracts enforcement, information sharing mitigates adverse selection and moral hazard problems by providing timely information on potential borrowers. In this context, according to the above discussion,

insignificant effect of information sharing on bank performance may suggest the reduction of default and interest rates. On the other hand, increased volume of lending may imply the improvement of credit access for the poorest borrowers if one of the information sharing result is assumed to be the decreased interest rate. Therefore, the main conclusion that could be made is that in transition countries information sharing is strongly associated with lower credit costs and enhanced credit access.

Understanding the effects of information sharing also sheds light on some key issues in the design of a credit information system, such as the relationship between public and private mechanisms and the dosage between white and black information sharing. There is considerable difference between private credit bureaus and public credit registers (PCR) managed by central banks. Whereas the formers collect, file and distribute data supplied voluntarily by its members, the PCRs' data is compulsory reported by lenders. Thus, the presence of either private or public and private bureaus in the high competitive financial market may impact bank performance and efficiency in different ways. As up to the moment there are only private information sharing institutions presented in the Ukrainian credit market, the question regarding the necessity of PCR introduction could be the further research.

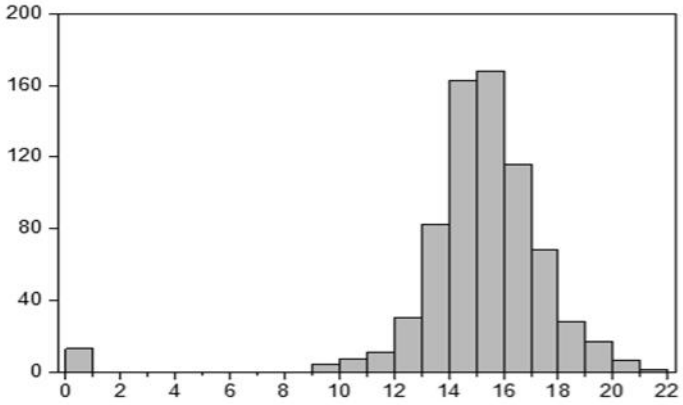
The choice between sharing information on borrowers' types relevant to a customer's ability to repay or negative information about her defaults is also important issue for the design of the credit information system. Following Padilla and Pagano (2000), different types of disclosing information have different effects on default and interest rates that could be another research question on the basis of micro-level data.

A. DATA DESCRIPTION

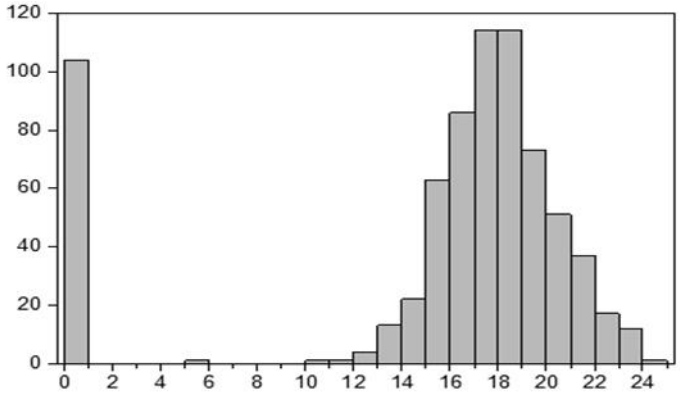
A.1 SUMMARY STATISTICS OF BANKS' FINANCIAL INDICATORS

Variable (mln.UAH)	Mean	Stand. Dev.	Min	Max
1. Assets and Liabilities				
Assets	**2784,512**	**7338,797**	**14,420**	**80165,460**
Share of assets in total market (%)	0,861	1,699	0,007	12,124
Liabilities	2472,148	6611,682	0,020	71969,780
2. Structure of the credit-investment portfolio (CIP)				
Total CIP	2225,442	6245,595	0,000	71653,560
Market share of CIP (%)	0,865	1,733	0,000	12,614
Interbank loans	173,728	494,659	-0,004	6257,173
Business loans	**1260,159**	**3341,077**	**-0,510**	**38634,660**
Individual loans	**692,483**	**2730,303**	**0,000**	**30504,680**
Investment securities	**99,072**	**242,445**	**0,000**	**2186,657**
3. Capital structure				
Total capital	40,469	826,688	5,510	8711,943
Capital growth to previous year (%)	143,021	88,427	0,000	1851,751
Capital (mln. EUR)	42,856	93,308	1,000	802,540
Share in total (market) capital (%)	0,821	1,349	0,033	9,480
Equity capital (mln. EUR)	24,829	52,297	0,990	523,689
Equity capital	**198,045**	**470,480**	**5,478**	**5684,903**
4. Individual deposits				
Total individual deposits	**736,661**	**2219,904**	**0,000**	**32750,090**
Share of individual deposits in the market (%)	**0,859**	**2,121**	**0,000**	**17,570**
Share of individual deposits in liabilities (%)	34,940	16,379	0,000	82,883
Individual demand deposits	130,729	494,930	0,000	5706,146
Individual time deposits	605,932	1761,418	0,000	27043,950
5. Business deposits				
Total business deposits	**748,253**	**2023,224**	**0,000**	**26018,540**
Share of business deposits in the market (%)	**0,877**	**1,696**	**0,000**	**14,908**
Share of business deposits in liabilities (%)	38,314	15,840	0,100	96,443
Business demand deposits	322,199	797,335	0,000	8992,487
Business time deposits	426,054	1415,917	0,000	23999,300
6. Financial results				
Net Income	**27,589**	**102,723**	**0,000**	**1534,162**
Share in total (market) result (%)	0,883	2,267	0,000	24,665
ROE (%)	13,271	20,915	0,000	239,687
ROA (%),	1,132	1,184	0,000	11,730
Number of observations: 714				

Histogram for naturally logarithm of Net Income



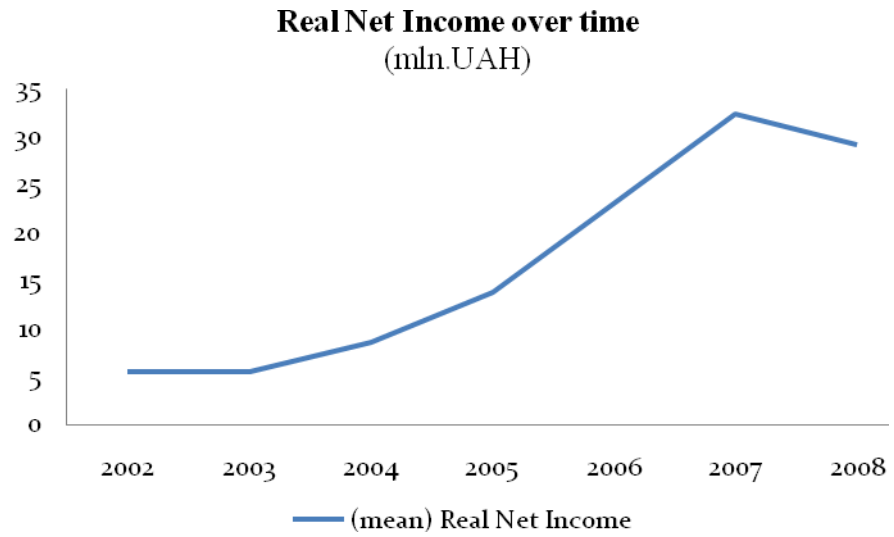
Histogram for naturally logarithm of Individual Loans

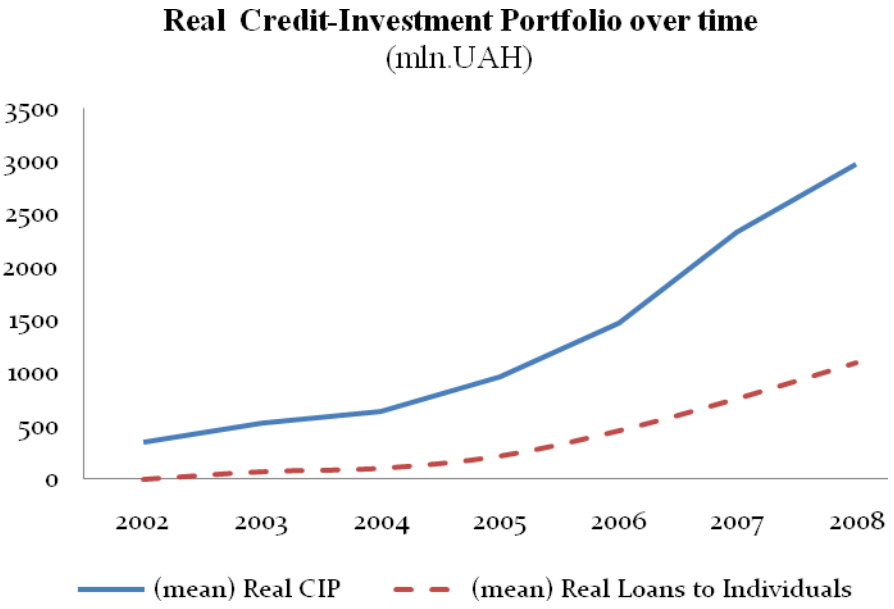


A.2 THE ORDER OF BANK INTRODUCTION TO CREDIT BUREAUS

Year of Introduction	2005	2006	2007	2008	Total
Number of Banks	27	20	8	2	57

A.3 AVERAGE NET INCOME AND CREDIT-INVESTMENT PORTFOLIO OVER TIME





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