Journal of Co-operative Organization and Management xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

Journal of Co-operative Organization and Management

journal homepage: www.elsevier.com/locate/jcom

Cooperative banks, the internet and market discipline

Łukasz Kozłowski

Kozminski University, Banking and Insurance Department, ul. Jagiellońska 57/59, 03-301 Warsaw, Poland

ARTICLE INFO

Article history:
Received 28 August 2015
Received in revised form 16 August 2016
Accepted 17 August 2016

JEL classification:
G21
G28

Keywords:
Cooperative banks
Market discipline
the internet

ABSTRACT

This paper analyses market discipline mechanisms at Polish cooperative banks within the special context of their internet activity. I argue that cooperative banks' depositors punish more risky banks for their bad behavior by withdrawing deposits. The findings demonstrate that a greater emphasis could be placed on stimulating market discipline at cooperative banks because a large number of these institutions hampers their regulatory discipline. To strengthen the market discipline mechanisms, regulators should promote internet activity at cooperative banks and among their depositors, as well as require banks to present financial information on their websites and to adopt online banking systems.

1. Introduction

Cooperative banks constitute a significant part of the European banking sector. For example, in such countries as Italy, France, Germany and the Netherlands, between 25% and 45% of all loans are granted by cooperative banks, with SMEs representing between 20% and 50% of their clients (European Association of Co-operative Banks, 2015). In terms of deposits, cooperative banks' market share is of a comparable magnitude. In Poland, cooperative banks make up the largest group of entities from the banking sector, with nearly 600 of them. Their market share is smaller than the EU average, but it is still significant because they possess 9% of banking sector assets, 8% of loans, and 10% of deposits from the non-financial sector. In addition, cooperative banks employ more than 20% of the banking sector's personnel (Polish Financial Supervision Authority, 2014). Polish cooperative banks serve mostly small local communities, whereas their areas of operation are usually restricted only to several counties. It should be noted that the banks are associated in two unions, but they are only loosely linked organizationally and financially.[1] In contrast to cooperative banks in certain other EU countries, including the Netherlands, France and Austria, Poland's distinct cooperative banks from the same association do not consolidate financial statements and even do not guarantee their obligations. As a result, institutions from the same or neighboring counties compete for depositors and debtors.

The financial standing of cooperative banks is vital for households, farmers and micro companies because these banks are significant and often major providers of financial services in rural areas and small cities. The stability of cooperative banks, as with other institutions in the banking sector, is under the monitoring auspices of the Polish Financial Supervision Authority. Nevertheless, the large number of cooperative banks in relation to the limited resources of supervisors reduces the possibility of performing onsite inspections within appropriately short time intervals. Because onsite inspections at individual cooperative banks take place once every 5 or 6 years, more resources are delegated to offsite activities, including analyses of cooperative banks' financial statements and other financial documents. Even if officials are able to increase supervisory efforts, it should be recalled that assessments become outdated quickly, which is especially evident in the case of banks with weak financial standing and during systemic crises (Cole & Gunther, 1998; Hirtle & Lopez, 1999; Berger, Davies, Flannery, 2000).

The limited resources held by authorities who exercise regulatory discipline at cooperative banks require a discussion of the role of private entities in ensuring the sector's stability. It is in line with the general opinion that regulatory discipline needs support from market participants to ensure financial stability. In other words, it naturally leads to questions about market discipline, that is, a process in which market participants monitor and evaluate the financial standing of a bank and provide informative signals that affect how bank managers run their companies and how they man-

E-mail address: lkozlowski@kozminski.edu.pl

[1] The situation changed at the end of 2015 when the introduction of the capital requirements regulation and Directive CRR/CRD IV pushed cooperative banks to build stronger ties within an association.

http://dx.doi.org/10.1016/j.jcom.2016.08.002
2213-297X/

age bank risks (Bliss & Flannery, 2002). Different groups of market participants can discipline a bank, including its depositors, bond holders, outside equity holders or even borrowers (Berger & Udell, 1995; Slovin, Sushka, Polonchek, 1993). The major and the most numerous risk bearers are nevertheless depositors, which is especially true in the case of cooperative banks in Poland because they rarely issue bonds,[2] and their legal form (a cooperative) eliminates the possibility of market discipline from stock market participants. Strengthened market discipline from depositors, that is, depositor discipline, could thus effectively complement regulatory discipline efforts aimed at cooperative banks to promote their financial stability (Flannery, 2001).

The literature presents a short list of market discipline prerequisites, including depositors' reasons for monitoring a bank, their financial competences to perform these tasks, as well as easy access to information about a bank, and the availability of tools to punish risky banks (Bliss & Flannery, 2000; Crockett, 2002; Llewellyn & Mayes, 2003; Caprio & Honohan, 2004; Hamalainen, Hall, Howcroft, 2005; Moe, 2006; Nier & Baumann, 2006). Depositors, a bank's major capital providers, usually track a bank's financial standing even in economies with partial or full deposit insurance schemes because many of them are not aware of the deposit insurance scheme or its details (Bowyer, Thompson, Srinivasan, 1986; Goedde-Menke, Langer, Pfingsten, 2014; Inakura, Shimizutani, Paprzycki, 2005; Steiger, Simon, Montgomery, 2001) or fear indirect costs of a bank's insolvency, such as waiting for deposit redemption (Park & Peristiani, 1998). In raising the issue of depositors' competences to monitor their banks, we face the uniqueness of cooperative banks. Their depositors are mostly private individuals and farmers and, to some extent, small and medium enterprises (SMEs) from outside the agriculture sector. At first glance, these groups have little or no expertise in evaluating the risk of bank failures, but other studies show that such circumstances do not necessarily preclude market discipline (Karas, Pyle, Schoors, 2013; Murata & Hori, 2006; Shimizu, 2009; Tsuru, 2003; Yan, Skully, Avram, Vu, 2014). Regardless depositors' motivation and financial competences, cooperative banks' depositors naturally possess tools to stimulate banks towards more safety because they are able to withdraw their savings from a bank or demand higher interest rates and, as a result, to influence a bank's access to cheap financing sources.

Because cooperative banks' depositors supposedly have reasons and tools to engage in the disciplinary activity, the issue of fostering the market discipline mechanism is mostly a matter of increasing depositor's financial competences and improving the availability of information about the banks. Strengthening people's financial competences is a desirable investment but one with a relatively long-term return. On the other hand, increasing the availability of information about individual cooperative banks, fostering their transparency in the eyes of their clients and thus reducing their opaqueness (Flannery, 1998) are manageable in a straightforward manner. Promoting cooperative banks' activity on the internet and placing this activity in a predefined framework could play a pivotal role in boosting market discipline because the internet is a fast and easy-to-access source of information. In other words, if cooperative banks were obliged to run websites, Facebook profiles, and Twitter accounts to consistently disclose information in the social media, doing so could increase their transparency and thus improve market discipline. Such improved transparency would additionally work in favor of depositors because it reduces the risk they bear. Online banking, that is, a special case of a bank's internet presence, could additionally strengthen the tools with which depositors influence cooperative banks. Online banking systems do not only decrease depositors' risk by offering convenience and speed. Because they increase deposit mobility and encourage banks to think about a threat of faster deposit outflow, they are independent factors that can improve market discipline.

This article contributes to the literature on cooperative banking and, especially, on mechanisms that can be used in order to increase the stability of this banking sector. I empirically analyze market discipline at Polish cooperative banks with panel data comprising more than 2.5 thousand observations covering the period 2007–2013. The results confirm the findings from other countries that cooperative banks' depositors punish more risky institutions for their bad behavior by withdrawing deposits. Thus, I argue that, in spite of the unique group of served clients, their organizational form, and the role of profit (Tuominen, Tuominen, Jussila, 2013), cooperative banks can be disciplined by their depositors similarly to large commercial banks. Moreover, the study extends the existing literature on cooperative banking and market discipline by pointing out that the internet activity of a bank significantly alters depositors' sensitivity to a bank's fundamentals. To be more precise, more internet-active cooperative banks face stronger market discipline, and their depositors pay special attention to banks' equity levels. The research results lead to policy conclusions and demonstrate that steps aimed at promoting cooperative banks' financial stability do not have to be restricted to purely regulatory measures.

2. Literature review and hypotheses

The market discipline mechanism is discussed extensively in the literature. A bulk of authors study the behavior of commercial banks' and bank-holding companies' depositors, and provide evidence of a relation between a bank's fundamentals and access to deposits or their cost. Within this strand of literature, works by Martinez Peria and Schmukler (2001), Demirgüç-Kunt and Huizinga (2004), Ungan and Caner (2004), Nier and Baumann (2006), Levy-Yeyati, Martinez Peria, Schmukler (2010), Bertay, Demirgüç-Kunt, Huizinga (2013) and Karas et al. (2013) constitute several notable and seminal examples. In addition, several authors study depositor discipline at thrift institutions (Brewer & Mondschean, 1994; Cook & Spellman, 1991, 1994, 1996; Goldberg & Hudgins, 1996, 2002; Kane, 1987; Park & Peristiani, 1998), but only a few examines small savings banks (Choi & Sohn, 2014), non-banking financial institutions (Hess & Feng, 2007), and small cooperative banks (Chipalkatti, Ramesha, Rishi, 2007; Murata & Hori, 2006; Shimizu, 2009; Tsuru, 2003). Taking into account the scope of my research, I concentrate on the latter group of studies, which is nevertheless relatively limited. It should be noted that within this strand, the literature provides evidence that is restricted almost entirely to Japanese *shinkin* banks. Tsuru (2003), using information on more than 300 Japanese cooperative banks, finds that *shinkin* banks with higher asset risk proxied by a non-performing loan ratio generated significantly lower deposit growths. Murata and Hori (2006), in their extensive study of *shinkin* banks and credit cooperatives, provide additional observations. First, they argue that deposit growth and interest rates are correlated negatively and positively, respectively, with the risk of financial institutions, supporting the existence of depositor discipline. Second, the relative importance of depositor discipline is stimulated by the failures of Hyogo Bank and the two large credit cooperatives, that is, during periods in which depositors became more aware of risk of bank failure. Third, depositors strengthen their monitoring activities of banks when they anticipate the relaxation of deposit insurance scheme. On the other hand, Shimizu (2009) addresses the issue of limited availability of information about Japanese cooperative banks in the context of

[2] Between 2010 and 2014, only 21 out of nearly 600 Polish cooperative banks issued bonds, and the bond market was illiquid.

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depositor discipline. Because much information is not produced for these institutions, their depositors withdraw funds after observing a fall in the stock process of neighboring Regional banks, which means the depositors presumably look for a proxy for their cooperative banks' performance. In summary, the three abovementioned Japanese studies generally suggest that cooperative banks' depositors are risk-sensitive and react to banks' worsening fundamentals.

Although market discipline has the potential to play a vital role in promoting financial stability in different economies, it has attracted little attention by authors analyzing small cooperative banks in emerging countries. To the best of my knowledge, the study by Chipalkatti et al. (2007) is the only example. Unlike many other studies on commercial banks in emerging countries, the authors are not able to provide evidence on the existence of market discipline in the case of urban cooperative banks (UCB) in India. The authors nevertheless suggest that their results can be driven by the specificity of their sample. Given UCB's significance in extending credit to the under-serviced Indian socio-economic strata, these banks cannot simply be shut down, despite poor performance. Thus, the possibility of depositors' losses is reduced, and as a result, depositors are not motivated to monitor UCBs' financial standing. Taking into account the abovementioned findings on depositor discipline at cooperative banks, I formulate my first hypothesis:

H1: *Depositors of cooperative banks in Poland react to their banks' fundamentals.*

Before formulating my second hypothesis, I refer to two different strands in the literature on banking. The first one is devoted to the causes and consequences of internet adoption by banks, including its impact on a bank's effectiveness and profitability (e.g., DeYoung, Lang, Nolle, 2007; DeYoung, 2005; Delgado, Hernando, Nieto, 2007; Hernando & Nieto, 2007). Within this strand, Hernández-Murillo, Llobet, Fuentes (2010) claim that banks with a large share of non-performing loans are less eager to adopt online banking systems. This finding could suggest that those banks fear that internet banking would increase deposit mobility and expose them to faster deposit outflows, in line with Arnold and Ewijk's (2011) observations that internet banks have a less stable deposit base compared with that of traditional or hybrid banks. In summary, analyses by Hernández-Murillo et al. (2010) and Arnold and Ewijk (2011) suggest that online banking systems constitute a powerful tool of depositor discipline given that they remove physical barriers associated with creating or withdrawing deposits. Thus, a worsening of a bank's fundamentals should generate higher deposit outflows in the case of banks that have adopted online banking. Furthermore, a bank's internet activity can stimulate depositor mobility in a less direct way. It can be argued that the intensity of a cooperative bank's internet marketing campaigns as well as the accessibility of a deposit offer through different channels, including a bank's website, can increase depositors' positive response to a cooperative bank's sound fundamentals.[3]

The second strand of literature that is relevant from the perspective of my second hypothesis is related to the role of a bank's informational transparency. Within this strand, it has been claimed that banks that publish in-depth qualitative and quantitative information about their financial standing or risk management practices are more exposed to market discipline (Fonseca & González, 2010; Nier & Baumann, 2006; Spiegel & Yamori, 2007; Wu & Bowe, 2010, 2012). A bank's internet activity is a special case in which a bank's transparency can manifest. A well-developed website, Facebook or Twitter profile and the publication of financial statements and risk management-related documents in particular, are indicators of a bank's willingness to present information about itself, i.e., to be transparent to its depositors and other capital providers. Thus, a bank's internet activity can positively influence the relation between a bank's fundamentals and access to capital or its cost. Hou, Gao, Wang (2016) argue that internet banking may contribute to the function strengthening of information and disclosure as one of the market discipline building blocks. Unsophisticated depositors can thus obtain true information on the risk exposures of banks in a timelier manner because of the availability of internet banking, which enables searching for and analyzing relevant information at lower costs.

The arguments presented above lead to general hypothesis H2, which concerns the potential impact of a bank's internet activity on market discipline:

H2: *Market discipline is stronger at cooperative banks that are active on the internet.*

3. Empirical strategy, dataset and model construction

3.1. Empirical strategy

My empirical strategy is based on an analysis of determinants of cooperative banks' deposit growth. This choice is justified by theoretical considerations presented by Stiglitz and Weiss (1981), who showed that under asymmetric information a debtor is rationed by quantity rather than by price. The information asymmetry is most evident in the case of relations between bank managers and less financially sophisticated depositors, especially households and micro-companies, who are major customers of cooperative banks. Due to limited access to banks' financial information and a lack of comprehensive financial knowledge, such depositors are less likely to accurately quantify the default risk. Therefore, in such circumstances, they are expected to react to increased bank risk by withdrawing deposits instead of demanding higher interest rates. The choice of strategy is additionally supported by empirical evidence provided in the literature on market discipline in developing countries. For example, in the case of CEE countries, Hasan, Jackowicz, Kowalewski, Kozłowski (2013) found that bank risk significantly influences commercial banks' deposit growth but does not affect implicit interest rates on deposits. Nevertheless, in my research I do not neglect the role of interest rates in shaping the equilibrium in deposit markets. I introduce an interest cost variable to the set of regressors in my panel models, which is in line with an approach adopted by Maechler and McDill (2006), Kraft and Galac (2007), Ungan, Caner, Özyildirim (2008), Wu and Bowe (2012), and Choi and Sohn (2014), among others.

3.2. Control variables and variables testing the existence of market discipline

I use the annual financial statements of 364 Polish cooperative banks from the largest association, i.e., BPS (Bank Polskiej Spółdzielczości S.A.), covering the period 2007–2013. The analyzed institutions constitute nearly two-thirds of the Polish cooperative banking sector. The panel data consist of 2548 observations, but the final number of observations used in regressions is lower because some variables represent increases in financial measures, and some of them are additionally introduced into the models with a one period lag. Table 1 presents the list of all financial variables. Their selection requires some explanation. DEPO.GR reflects the yearly inflation-adjusted growth rate of deposits and will constitute an explanatory variable in all regressions. EQUITY and PROFIT are introduced into the models to test the market discipline hypothesis. Banks with better capitalization and higher profits are expected

[3] Naturally only a survey-based research of depositors and their responses could ultimately confirm this potential phenomenon.

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Table 1
Definitions of financial variables.

Variable	Definition
DEPO.GR	yearly inflation-adjusted growth rate of deposits
EQUITY	equity to total assets
PROFIT	operating profit to average equity
LOANS	loans to total assets
SIZE	natural logarithm of total assets in constant prices
INVEST	yearly inflation-adjusted growth rate of tangible fixed assets
OVERHEADS	overheads to net interest and non-interest income
INT.COST	inflation-adjusted ratio of interest costs and average total deposits

to draw more deposits. The remaining variables from Table 1 control for a bank's asset structure (LOANS), size (SIZE), investment into new branches (INVEST), management efficiency (OVERHEADS) and implicit deposit interest rates (INT.COST). It should be noted that some researchers use the loans-to-assets ratio as a proxy for a bank's credit risk (Clair, 1992; Fernández de Lis, Martínez, Saurina, 2000; Huybens, Jordan, Pratap, 2005; Tsuru, 2003; Ungan et al., 2008; among others), which could thus be negatively related to deposit growth in line with the market discipline hypothesis. On the other hand, Karas, Pyle, Schoors (2006) claim that a higher loans-to-asset ratio is a reflection of a more traditional and less risky business model, and as such should be positively correlated with deposit growth. Following suggestions by Karas et al. (2006), I treat that variable as a control one instead of using it for testing the market discipline hypothesis. As far as the SIZE variable is concerned, I expect it to be positively related to the deposit growth due to the too-big-to-fail paradigm, and especially a conjecture that higher banks are more reliable in the eyes of their depositors (Karas et al., 2006). INVEST is a proxy for development of a branch network and is expected to positively impact deposit growth. Furthermore, OVERHEADS might reflect management efficiency, but on the other hand it can be argued that higher non-interest operating costs are born by banks that generate higher personnel costs and offer better customer service. In such circumstances, the OVERHEADS variable should positively impact deposit growth (Cubillas, Fonseca, Gonzalez, 2012; Demirgüç-Kunt & Huizinga, 2004; Karas et al., 2006). Finally, higher INT.COST should increase the deposit base unless customers treat it as a reflection of higher bank risk (Kraft & Galac, 2007). Table 2 presents descriptive statistics for the abovementioned variables. As previously stated, the number of observations is lower than 2548 due to missing values, the dynamic character of some variables, and outlier elimination.[4]

[4] I exclude outliers in order to eliminate the effects of increased deposit growth due to mergers and acquisitions.

3.3. Variables describing a bank's activity on the internet

To verify hypothesis H2, I gathered data on the cooperative banks' activity on the internet. The data are static and reflect the situation from the middle of 2014. Despite their static character, I treat them as reflection of a bank's relatively invariable approach to shaping its image among clients, and of a bank's transparency. While the data were collected I checked whether each analyzed bank: (a) had its own website, (b) had a Facebook profile, (c) had a Twitter profile, (d) made it possible for its clients to use an online banking system, (e) published its financial statements on its own website, and (f) presented a deposit offer on the website. In addition, I checked how long a bank had run its Facebook profile, and how much time had passed since the first piece of information on the bank's website was entered. I did not analyze detailed specificity of a bank's Twitter activity, as only a few of them had used Twitter. Based on the collected information I constructed five variables that describe in a condensed way a bank's: (a) presence on the internet (PRESEN), (b) experience in this area (EXPER), (c) transparency on the internet (TRANSP), (d) potential deposit mobility (DEP.MOB), and (e) general activity on the internet (INTERN). The selection of the variables is driven by three criteria. First, I am restricted by the real activity of cooperative banks on the internet; thus, I choose measures that refer to fields in which the activity of institutions is relatively significant and quite differentiated. Second, I construct measures that require easy-to-collect data. Third, I try to cover different aspects of internet activity; thus, the variables differ significantly among one another. Table 3 presents definitions of the variables while Table 4 shows descriptive statistics of the dataset after the static variables were assigned to bank-year observations. Supplementing the data from Table 4 it should be noted that 91% of cooperative banks had websites, while 12% had Facebook profiles. Moreover, 18% of the banks presented their financial statements on the internet, but a majority of them restricted the information to the last one or two years only.

3.4. Construction of panel models

I verify both empirical hypotheses on the basis of panel model estimation results. The dependent variable, i.e., DEPO.GR, additionally enters the set of explanatory variables with a one-year lag due to potential persistence or reversibility in deposit growth. Dynamic linear panel models are finally given by the following equation:

$$\mathrm{DEPO.GR}_{t,i} = a_0 + a_1 \cdot \mathrm{DEPO.GR}_{t-1,i} + \mathbf{a}_2 \times \mathbf{ZD}_{t-1,i} + \mathbf{a}_3 \times \mathbf{ZK}_{(t,t-1),i} + \mathbf{a}_4 \times \mathbf{YEAR.D}_t + \mathbf{a}_5 \times (\mathbf{ZD}_{t-1,i} \cdot \mathrm{INT}_i) + v_{t,i} \quad (1)$$

where $\mathbf{ZD}_{t-1,i}$ is a vector of variables used for testing the market discipline hypothesis (i.e., EQUITY and PROFIT), measured for bank *i* at the moment of *t−1*; $\mathbf{ZK}_{(t,t-1),i}$ is a vector of control variables (i.e., LOANS, INVEST, SIZE, OVERHEADS and INT.COST) describing bank *i* at the moment of *t* or *t−1*; $\mathbf{YEAR.D}_t$ is a set of year dummies; INT_i represents a variable that describes bank's *i* activity on the internet (PRESEN, EXPER, TRANSP, DEP.MOB or INTERN); and finally $v_{t,i}$ is a

Table 2
Financial characteristics of the analyzed cooperative banks – descriptive statistics.

Variable	Observations	Mean	Standard deviation	Percentiles				
				5th	25th	50th	75th	95th
DEPO.GR	2040	7.2%	9.1%	−7.7%	1.5%	7.3%	13.1%	22.4%
EQUITY	2502	13.5%	5.0%	7.6%	9.8%	12.4%	15.7%	23.7%
PROFIT	2120	13.0%	5.2%	5.7%	9.7%	12.4%	16.1%	21.9%
LOANS	2502	87.6%	12.4%	59.1%	87.2%	92.1%	94.3%	96.0%
INVEST	2053	15.4%	17.5%	0.6%	4.0%	9.7%	21.1%	51.5%
SIZE	2502	18.01	0.84	16.78	17.39	17.93	18.50	19.55
OVERHEADS	2502	65.0%	9.7%	48.4%	58.7%	65.7%	71.5%	79.9%
INT.COST	2081	−0.4%	1.3%	−2.4%	−1.4%	−0.6%	0.6%	1.9%

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Table 3
Definitions of internet-related variables.

Variable	Definition
PRESEN	an index describing a bank's presence on the internet, calculated as a sum of binary variables A + B, where A and B obtain values of 1 if a bank has a website and a Facebook profile, respectively
EXPER	an index describing a bank's experience on the internet, calculated as min(A,6)/6 + min(B,3)/3, where A is a number of years starting from the first entry on the banks' website (A = 0 for banks without a website), and B is a number of years since the bank's Facebook profile was created (B = 0 for banks without a Facebook profile)
TRANSP	an index of a bank's transparency on the internet, calculated as min(A,6)/6, where A is a number of years for which a bank's financial statements were presented on the bank's website (A = 0 for banks without a website)
DEP.MOB	an index of a bank's deposit mobility, calculated as a sum of binary variables A + B, where A equals 1 if a bank made it possible for its clients to use an online banking system, and B equals 1 if a bank presented a deposit offer on its website (B = 0 for banks without a website)
INTERN	a general index of a bank's web use, calculated as a sum of the four distinct indices, i.e.: PRESEN, EXPER, TRANSP, and DEP.MOB.

Table 4
Internet-related variables – descriptive statistics.

Variable	Observations	Mean	Standard deviation	Percentiles				
				5th	25th	50th	75th	95th
PRESEN	2548	1.01	0.44	0.00	1.00	1.00	1.00	2.00
EXPER	2548	0.54	0.42	0.00	0.17	0.50	0.83	1.33
TRANSP	2548	0.08	0.23	0.00	0.00	0.00	0.00	0.67
DEP.MOB	2548	1.61	0.67	0.00	1.00	2.00	2.00	2.00
INTERN	2548	3.25	1.37	0.00	2.83	3.33	3.83	5.50

bank-year specific error component. I estimate the model parameters using the Generalized Method of Moments (GMM-SYS), that is, method proposed by Blundell and Bond (1998). The method and its predecessor by Arellano and Bond (1991) are extensively used in market discipline tests such as those of Maechler and McDill (2006), Karas et al. (2006), Kraft and Galac (2007), Hadad, Agusman, Monroe, Gasbarro, Zumwalt (2011), Fonseca and González (2010), Berger and Turk-Ariss (2010), Cubillas et al. (2012), Hasan et al. (2013), and Oliveira, Schiozer, Barros (2014). The GMM methods, in contrast to static panel model estimators (such as the fixed effects or random effects estimators), allow for removal of the strict exogeneity assumption for regressors and thereby include among them the lagged dependent variable. In my calculations I treat the lagged dependent variable as sequentially exogenous, while the other regressors (most of which are lagged by one period) enter calculations as exogenous ones. I base my statistical inferences regarding the significance of parameters on the one-step estimator, as simulations performed by Arellano and Bond (1991) and Blundell and Bond (1998) suggest that the asymptotic standard errors for the two step-estimator can be a poor guide to hypothesis testing, especially when there are heteroscedastic error components. The appropriateness of the instrument choice is formally evaluated by the Hansen test and the Arellano-Bond test for error term autocorrelation.

4. Empirical results

Table 5 presents the results of panel model estimations. The Hansen and Arellano-Bond tests confirm the appropriate selection of instruments. It should be noted that *p*-values resulting from the Hansen statistics are lower than 1, which suggests that the models do not suffer from too many instruments that could weaken the Hansen test (Roodman, 2009). As far as the model coefficients and their standard errors are concerned, they lead to a conclusion that the lagged deposit growth negatively influences the current deposit growth in a statistically significant way. This means that deposits grow cyclically, i.e., rapid increases are not followed by similarly fast growth in a consecutive year. Furthermore, in all specifications interest costs (INT.COST) and a bank's size (SIZE) are positively correlated with the dependent variable. The positive coefficient for the latter variable suggests that larger cooperative banks are more reliable in the eyes of their depositors, although it might not be directly related to the too-big-to-fail paradigm, as any one of the Polish cooperative banks is systemically important. Coefficients for INVEST and OVERHEADS are statistically insignificant, but their signs are in line with a conjecture that branch expansion and better customer service (Demirgüç-Kunt i Huizinga, 2004; Karas et al., 2006) positively influence deposit growth. Finally, the coefficients for the LOAN variable are consistently statistically significant and positive, which leads us to conclude that from the perspective of a cooperative banks' depositors the ratio of loans to assets is not a reflection of the banks' riskiness. The results prove that cooperative banks with higher loan-dependent asset structure require more deposits to finance it and, thus, generate faster deposit increases in following periods.

Through the analysis of coefficients for EQUITY and PROFIT I investigate the question whether the fundamentals of cooperative banks affect deposit growth (hypothesis H1), i.e., whether market discipline at cooperative banks works. Coefficients for both variables are positive and statistically significant in all specifications, at least at the 5% level (in the case of EQUITY at levels below 1%). Taking into account the value of the coefficients one can assume that a 1 p.p. increase in equity-to-asset ratio stimulates the deposit growth by 1 p.p., which is economically significant. On the other hand, a similar increase in deposits can be achieved by a jump in the profitability ratio by 5 p.p. (specification 1) or even 3.3 p.p. (specification 6). In summary, the coefficients for both variables prove that depositors of Polish cooperative banks are risk-sensitive and react to their banks' fundamentals in a direction that is in line with the market discipline hypothesis. The results support the observations of other authors who claim that less financially sophisticated depositors of cooperative banks (see Murata & Hori, 2006; Shimizu, 2009; Tsuru, 2003) or small savings banks (Choi & Sohn, 2014) constitute a significant power in imposing market discipline. In a less direct manner, the estimated coefficients also confirm the results by Karas et al. (2006, 2013), as well as Yan et al. (2014), who argue that households do monitor the financial situation of a bank in which they placed their deposits.

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Table 5
A bank's activity on the internet and market discipline.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	DEPO.GR	DEPO.GR	DEPO.GR	DEPO.GR	DEPO.GR	DEPO.GR
Experimental variable:	–	PRESEN	EXPER	TRANSP	DEP.MOB	INTERN
L.DEPO.GR	−0.0940**	−0.0883**	−0.0915**	−0.0950**	−0.0890**	−0.0885**
	(0.0386)	(0.0394)	(0.0391)	(0.0385)	(0.0393)	(0.0394)
L.EQUITY	1.089***	0.999***	1.034***	1.082***	1.007***	0.989***
	(0.128)	(0.133)	(0.129)	(0.127)	(0.137)	(0.134)
L.PROFIT	0.199**	0.301**	0.269***	0.221**	0.288**	0.307**
	(0.0836)	(0.121)	(0.101)	(0.0871)	(0.130)	(0.127)
L.LOANS	0.0753**	0.0739***	0.0755***	0.0736**	0.0743***	0.0743***
	(0.0301)	(0.0283)	(0.0291)	(0.0305)	(0.0286)	(0.0281)
L.INVEST	0.0164	0.0161	0.0165	0.0159	0.0159	0.0159
	(0.0118)	(0.0118)	(0.0118)	(0.0118)	(0.0118)	(0.0118)
SIZE	0.0591***	0.0596***	0.0590***	0.0582***	0.0586***	0.0586***
	(0.00727)	(0.00743)	(0.00745)	(0.00728)	(0.00737)	(0.00749)
OVERHEADS	0.0564	0.0681	0.0676	0.0667	0.0665	0.0669
	(0.0461)	(0.0454)	(0.0468)	(0.0476)	(0.0451)	(0.0451)
INT.COST	2.022***	1.833***	1.877***	2.051***	1.959***	1.865***
	(0.557)	(0.560)	(0.547)	(0.555)	(0.556)	(0.554)
L.EQUITY x experimental var.	–	0.197**	0.243**	0.459**	0.115**	0.0707***
	–	(0.0822)	(0.102)	(0.200)	(0.0582)	(0.0274)
L.PROFIT x experimental var.	–	−0.0907	−0.123	−0.239*	−0.0498	−0.0301
	–	(0.0839)	(0.0911)	(0.139)	(0.0641)	(0.0289)
Constant	−1.262***	−1.297***	−1.282***	−1.263***	−1.279***	−1.281***
	(0.159)	(0.161)	(0.162)	(0.158)	(0.160)	(0.162)
Observations	1582	1576	1576	1576	1576	1576
Banks	364	363	363	363	363	363
Wald	478.7***	492.8***	490.2***	497.4***	494.2***	500.7***
AR(1)	−10.07***	−10.07***	−10.04***	−10.09***	−10.03***	−10.04***
AR(2)	−0.546	−0.378	−0.408	−0.482	−0.408	−0.394
Hansen	8.579	8.228	8.521	8.332	8.428	8.319
p-value (Hansen)	0.804	0.828	0.808	0.821	0.815	0.822

Note: The table presents GMM-SYS estimates. "L." in front of a variable name denotes a one-year lag. Year dummies are included in all specifications. ***, ** and * denote statistical significance at 1%, 5% and 10%, respectively. Robust standard errors are included in parentheses.

Table 6
Robustness checks.

	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Dependent variable:	DEPO.GR	DEPO.GR	DEPO.GR	DEPO.GR	DEPO.GR	DEPO.GR	DEPO.GR	DEPO.GR	DEPO.GR	DEPO.GR
Experimental variable:	PRESEN	PRESEN	EXPER	EXPER	TRANSP	TRANSP	DEP.MOB	DEP.MOB	INTERN	INTERN
L.DEPO.GR	−0.0908**	−0.0950**	−0.0935**	−0.0948**	−0.0947**	−0.0941**	−0.0909**	−0.0948**	−0.0909**	−0.0954**
	(0.0389)	(0.0386)	(0.0388)	(0.0386)	(0.0385)	(0.0386)	(0.0388)	(0.0386)	(0.0389)	(0.0386)
L.EQUITY	1.032***	1.093***	1.058***	1.088***	1.085***	1.089***	1.040***	1.107***	1.025***	1.099***
	(0.128)	(0.128)	(0.128)	(0.128)	(0.128)	(0.128)	(0.127)	(0.129)	(0.127)	(0.128)
L.PROFIT	0.203**	0.118	0.201**	0.170**	0.202**	0.197**	0.202**	0.0917	0.204**	0.0939
	(0.0834)	(0.0946)	(0.0834)	(0.0867)	(0.0840)	(0.0837)	(0.0829)	(0.0950)	(0.0830)	(0.0967)
L.LOANS	0.0748**	0.0756**	0.0757**	0.0752**	0.0744**	0.0748**	0.0758***	0.0771**	0.0757***	0.0765**
	(0.0291)	(0.0305)	(0.0298)	(0.0306)	(0.0306)	(0.0305)	(0.0293)	(0.0304)	(0.0290)	(0.0305)
L.INVEST	0.0161	0.0162	0.0166	0.0165	0.0161	0.0163	0.0156	0.0157	0.0158	0.0160
	(0.0118)	(0.0118)	(0.0118)	(0.0118)	(0.0118)	(0.0118)	(0.0119)	(0.0118)	(0.0118)	(0.0118)
SIZE	0.0580***	0.0571***	0.0572***	0.0575***	0.0575***	0.0584***	0.0576***	0.0570***	0.0568***	0.0561***
	(0.00732)	(0.00735)	(0.00731)	(0.00739)	(0.00734)	(0.00729)	(0.00723)	(0.00729)	(0.00729)	(0.00737)
OVERHEADS	0.0650	0.0639	0.0679	0.0678	0.0681	0.0680	0.0632	0.0613	0.0642	0.0634
	(0.0464)	(0.0477)	(0.0472)	(0.0478)	(0.0478)	(0.0479)	(0.0465)	(0.0477)	(0.0462)	(0.0477)
INT.COST	1.820***	1.934***	1.895***	1.992***	2.017***	2.023***	1.961***	1.998***	1.853***	1.944***
	(0.560)	(0.557)	(0.547)	(0.553)	(0.554)	(0.558)	(0.555)	(0.552)	(0.553)	(0.553)
L.EQUITY x experimental var.	0.133***		0.134**		0.161		0.0830***		0.0505***	
	(0.0455)		(0.0550)		(0.117)		(0.0294)		(0.0154)	
L.PROFIT x experimental var.		0.0755*		0.0515		0.0264		0.0636**		0.0313**
		(0.0441)		(0.0472)		(0.0763)		(0.0300)		(0.0155)
Constant	−1.261***	−1.238***	−1.247***	−1.248***	−1.249***	−1.265***	−1.258***	−1.239***	−1.244***	−1.220***
	(0.159)	(0.160)	(0.159)	(0.160)	(0.159)	(0.159)	(0.157)	(0.158)	(0.158)	(0.160)
Observations	1576	1576	1576	1576	1576	1576	1576	1576	1576	1576
Banks	363	363	363	363	363	363	363	363	363	363
Wald	493.2***	485.5***	494.3***	485.8***	488.9***	482.1***	494.5***	485.6***	501.9***	489.2***
AR(1)	−10.05***	−10.05***	−10.04***	−10.05***	−10.09***	−10.07***	−10.03***	−10.05***	−10.03***	−10.05***
AR(2)	−0.399	−0.448	−0.428	−0.448	−0.457	−0.442	−0.402	−0.416	−0.400	−0.435
Hansen	8.221	8.370	8.309	8.346	8.617	8.539	8.397	8.422	8.272	8.362
p-value (Hansen)	0.829	0.819	0.823	0.820	0.801	0.807	0.817	0.815	0.825	0.819

Note: The table presents GMM-SYS estimates. "L." in front of a variable name denotes a one-year lag. Year dummies are included in all specifications. ***, ** and * denote statistical significance at 1%, 5% and 10%, respectively. Robust standard errors are included in parentheses.

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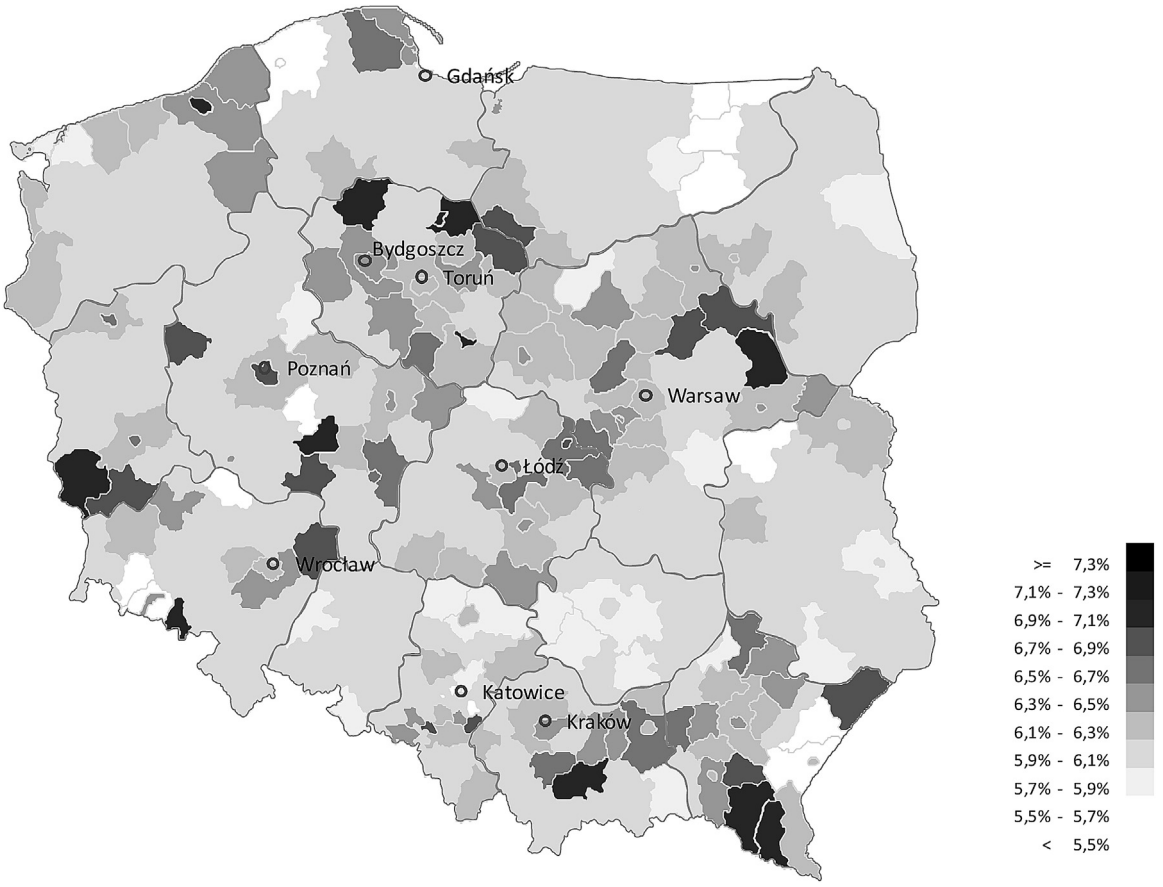

Graph 1. A bank's activity on the internet and market discipline. Expected percentage increase in deposits due to increase in equity-to-asset ratio by 5 percentage points. *Note*: A map is based on specification (2) estimates from Table 5.

Coefficients for interaction terms in specifications (2)–(6) show that cooperative banks that are generally more active on the internet (in different manners) are more strongly disciplined by their depositors, especially by those who monitor the bank's equity-to-asset ratio. This supports hypothesis H2. All coefficients for products of EQUITY and an experimental variable are positive and statistically significant at the 5% level or at levels below 1% (specification 6). Taking into account the obtained results, a few detailed conclusions can be drawn. First, the results suggest that a bank's activity on the internet, especially its experience in this field, accompanied by its willingness to publish financial statements on the website (especially for a longer period), increases the bank's transparency and its depositors' risk-awareness. This leads to a stronger relation between a bank's equity-to-asset ratio and deposit growth. Nier and Baumann (2006), Spiegel and Yamori (2007), Fonseca and González (2010), as well as Wu & Bowe (2010, 2012) draw comparable conclusions from different studies as they stress the importance of a bank's transparency in stimulating market discipline. It is also in line with observations by Hou et al. (2016) who provide evidence that market discipline for large Chinese banks is strengthened with the development of internet finance. Second, although a bank's transparency boosts depositors' sensitivity to its equity levels, the idea that the availability of financial statements on the internet for a longer period reduces depositors' reactions to a bank's profitability cannot be rejected (see specification 4). The result is rational. If depositors have access to a cooperative bank's profit and loss account for several recent years, they can easily observe that short-term decreases in profitability ratios are a normal part of a business cycle and do not have to increase a bank's default rate if they are not accompanied by a poor equity-to-asset ratio. Third, special attention should be paid to a positive and statistically significant coefficient for the interaction term of EQUITY and DEP.MOB (specification 5). The result is in line with a conjecture that banks face higher deposit mobility if they present a transparent deposit offer and make it possible for their clients to use an online banking system. The online banking system removes many physical obstacles connected with creating or withdrawing deposits, and as such stimulates a positive relation between a bank's fundamentals and deposit growth. In a less direct way the results also confirm observations by Arnold and Ewijk (2011) who stated that internet banks have a less stable deposit base in comparison to traditional or hybrid banks. Finally, the estimation outcomes supplement evidence by Hernández-Murillo et al. (2010) who claim that banks with more risky assets are less eager to adopt online banking, which can be interpreted as an effect of managers' concerns about deposit outflows.

In summary, if we take into account the positive coefficient for the product of EQUITY and INTERN, we can argue that in general a cooperative bank's activity on the internet increases its exposure to market discipline through its higher transparency and increased deposit mobility. The effect of market discipline tightening is strongly visible despite the fact that significant internet activity of a cooperative bank can also stimulate its credibility and marketing power, which could potentially reduce the linkage between fundamentals and deposit growth, especially in the case of banks with customers who are less financially sophisticated. It is worth stressing that the obtained results do not mean that all depositors read internet information but that the group of affected depositors is substantial, and as a result, the phenomenon is statistically identifiable.

The robustness of the results was tested through estimation of additional models in which interaction terms of experimental

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variables with EQUITY and PROFIT, respectively, were introduced separately to eliminate the effects of their potential correlation. Table 6 presents the results. Coefficients for the products of EQUITY and experimental variables remain positive and additionally they are statistically significant in four out of five cases, while in three specifications the corresponding *p*-values stay at levels below 1%. It should be noted that in three out of five specifications (8, 14 and 16) the interaction terms including PROFIT become statistically significant as well. Taking this into account, it cannot be fully rejected that an improvement in a cooperative bank's transparency on the internet stimulates depositors' sensitivity not only to the bank's equity-to-asset ratio but also to its profitability. More importantly, the additional results generally support the main conclusions from the baseline specifications presented in Table 5.

Using the estimation results from Table 5 and data on all Polish cooperative banks' activity on the internet I constructed a map (see Graph 1) that reflects the geographical distribution of expected county-specific market discipline incremental strength due to the cooperative banks' presence on the internet. In other words, it provides information about the expected percentage increase in the volume of a bank's deposits due to an increase in the equity-to-asset ratio by 5 p.p. A value for each county was obtained as an average of values for individual cooperative banks weighted by the number of branches these banks have in a given county. The map proves that the incremental strength of market discipline at cooperative banks due to their internet activity is not geographically driven in a visible way, i.e., areas with the highest expected increase in total deposits due to an improvement in a bank's fundamentals are dispersed throughout the entire country, and they are not equivalent to highly urbanized city-counties (marked with city names on the map). It additionally suggests that entering the internet and social media is also a common feature of smaller cooperative banks from dominantly rural areas.

5. Concluding remarks

Market discipline has the potential to increase financial stability in the banking sector. This potential is observed because depositors' risk aversion encourages banks to reduce risk, that is, to select safer asset portfolios and increase equity levels. The market discipline mechanism has been extensively studied in the literature but only to a minor extent in the case of cooperative banks. The article fills the gap by analyzing depositors' reactions to cooperative banks' risk in Poland in the context of the banks' internet activity. The results allow us to draw two major conclusions. First, although cooperative banks serve less financially sophisticated customers from mostly rural areas and small cities, their depositors are able to appropriately distinguish between less risky and more risky institutions. Second, more internet-active banks face stronger market discipline, and their depositors pay special attention to banks' equity levels. The reasons why this situation arises are twofold. A bank's extensive internet activity is a reflection of its eagerness to present information about itself, i.e., it increases transparency, especially if a bank publishes its financial statements for a longer period on its website. In addition, the adoption of online banking systems and presenting detailed information about the deposit offer on the bank's website boost deposit mobility. The availability of an online banking system can be thus treated as an additional tool with which depositors can effectively discipline a bank.

The results are useful for future research on cooperative banking and their internet activity, as well as on market discipline mechanisms. The findings demonstrate that despite cooperative banks adopt relational banking model and usually serve small local communities, the internet can be a significant factor contributing to their success or failure. Thus, greater emphasis should be placed on investigating the role of the internet in different aspects of cooperative banks' activity. Within this context one should generally take into account cooperative banks' social media presence, including their Facebook or Twitter activity as it becomes more popular among those institutions.

The results have also important policy implications. A large number of cooperative banks in Poland (nearly 600) hamper regulatory discipline. In fact, because of the limited resources of official supervisors, onsite inspections can take place only once every several years. Thus, effective market discipline mechanisms could be particularly beneficial to the sector's stability because they support regulatory discipline measures. The results demonstrate that cooperative banks' depositors are able to identify a bank's risk, and greater emphasis could thus be placed on stimulating market discipline at those institutions. To strengthen the mechanism, regulators should promote the internet activity of cooperative banks and their depositors, require the banks to present detailed financial information on their websites and adopt online banking systems.

One cannot forget about the managerial implications of the results. The literature proves that greater internet presence can positively impact a bank's effectiveness and profitability (DeYoung et al., 2007; DeYoung, 2005; Delgado et al., 2007; Hernando & Nieto, 2007). My study extends these observations and suggests that even managers of small cooperatives should approach social media and internet presence of their institutions with the utmost interest. What is additionally important, in adopting internet media, business managers of cooperative banks have to be aware that doing so will require from them better risk management and greater care about financial standing as depositors become more sensitive to a bank's risk.

This study, as with any work of research, has its limitations, which are mostly related to the available data (here, panel data on cooperative banks' financial profiles with static information on internet presence). The limitations nevertheless indicate the direction further studies should take in the respective area. First, panel data for a longer time horizon with dynamic information on internet activities would prove the robustness of the results. Second, a survey-based research of depositors and their responses to a bank's internet activity would allow for in-depth insight into the observed mechanisms and the role of depositors' traits in the observed phenomenon.

Acknowledgment

The author acknowledges the financial support of the National Science Center, Poland (NCN) under research project number 2014/15/D/HS4/00830.

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Łukasz Kozłowski is Assistant Professor at the Banking and Insurance Department, Kozminski University, Warsaw. He has published on market discipline, impact of political factors on banks and other companies, as well as lending behavior of commercial banks during the recent crisis. His current research explores different aspects of cooperative banks' performance, including market discipline and competition against credit unions and commercial banks.

Please cite this article in press as: Kozłowski, Ł. Cooperative banks, the internet and market discipline. *Journal of Co-operative Organization and Management* (2016), http://dx.doi.org/10.1016/j.jcom.2016.08.002