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IES Working Paper: 18/2015

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Bibliographic information:
Kuc M., Teply P. (2015). " A Comparison of Financial Performance of Czech Credit Unions and European Cooperative Banks " IES Working Paper 18/2015. IES FSV. Charles University.

This paper can be downloaded at: http://ies.fsv.cuni.cz

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June 2015

Abstract:
Czech credit unions have been yet criticized by both academics and regulatory representatives for its business based on moral hazard and excessive risk taking. This paper empirically assesses financial performance of Czech credit unions in relation with other European cooperative banks in terms of profitability and stability. To do that, we created a unique dataset of 283 cooperative banks from 15 European countries in the 2006–2013 period. System GMM method is employed as a main instrument of our empirical analysis and alternative panel data methods are used as supplementary techniques. Results revealed poor performance of Czech credit unions in terms of both profitability and stability. Moreover, adverse trends in stability measures of Czech credit unions are in sharp contrast to the tendencies in the rest of cooperative banks in our sample. To conclude, we argue that bigger Czech credit unions will face serious financial problems in coming years.

Keywords: credit union, cooperative banking, financial statements, moral hazard, credit risk, system GMM, Z-score
JEL: C23, G21, L25

Acknowledgements:
This research was supported by the Grant Agency of Charles University in Prague (project No. 105815) and by the Czech Science Foundation (projects No. GACR 14-02108S and GACR 15-00036S).

1 Introduction

Credit unions in Czech Republic were traditional financial institutions that made financial services accessible to broad masses of population before the Second World War. They were consequently abolished by political regime of that time and they lost track to the mainstream development of Western Europe. Credit unions founded after the fall of communism suffered from poor legislative framework that did not reflected recent trends in cooperative banking of the second half of the twentieth century. Boom of credit unions turned into severe crisis of the sector in 1999. Czech credit unions regained lost customer confidence after few years of stagnation but some of the leading credit unions got into problems again recently, as their licenses were revoked.

The aim of this paper is to compare financial performance of Czech credit unions with cooperative banks in other European countries. We are interested in discovering the differences in profitability and risk between Czech and European financial cooperatives. We will focus specifically on return on average assets (ROAA), return on average equity (ROAE), net interest margin (NIM) as profitability measures and stability will be tested using Z-Score. Empirical analysis will be carried out by dynamic panel data method (system GMM) where applicable. Alternative panel data methods serve as supplementary techniques.

The structure of the paper is following: we start with literature review regarding financial performance of cooperative banks with focus on Europe. Next, we describe empirical methodology, variables selection and data description in section 3. We test hypotheses of low profitability and high riskiness of Czech credit unions in section 4. This section also summarizes key results and findings of this study. We conclude the work and state the final remarks in section 5.

2 Literature review

There is lack of empirical studies assessing financial performance of credit unions from new EU member states. There are two main reasons to which we can attribute this gap: insufficient data availability and smaller relative share of cooperative banking business in these countries. Since we are not able to find intercept, we split this literature review into two separate streams: the first one describes general condition of Czech credit unions sector and the second one is focused on drivers of cooperative banks' performance in Europe.

IMF (2012), MFČR (2014) and Tomšík (2015) claim that there is a structural difference between Czech credit unions and cooperative banks elsewhere in Europe. Their analyses show

that Czech credit cooperatives behave like small and risky commercial banks denying baseline cooperative principles but these studies are lacking econometrical justification of their conclusions.

Although some of the most striking problems of legislative framework that lead to credit unions sector crisis in 1999 such as lack of proper supervision, limitation of scope of business were resolved by new regulation, some issues remained. Dvořák (2004) showed high dependency of Czech credit unions on interest rate sensitive deposits – credit unions needed to attract members' deposits on savings products bearing significantly higher interest rates than commercial banks. Full deposit insurance of deposits and common Deposit Insurance Fund with less risky commercial banks further promoted moral hazard of depositors who do not have to distinguish riskiness of individual deposit taking institutions. As IMF (2012) and Tomšík (2015) showed, trend of high interest rates on deposits is still present in Czech credit union sector.

Although there is no single universal model of cooperative banking in Europe (for further details see Ayadi et al., 2010), there are basic principles shared by cooperative banking models across Europe. Interestingly, Czech credit unions do not follow some of them. Typical example is that Czech credit unions do not follow basic cooperative principle of "one member – on vote" as members are allowed to buy additional membership shares and consequently have higher voting power on general meetings. Members of Czech credit unions also do not seem to share some common bond as is typical for cooperates according to the World Council of Credit Unions (WOCCU)[1]. Despite their small size, Czech credit unions typically offer whole range of products having branches all around the country – from this point of view we can see no clear focus of individual institutions. Not sharing some of the cooperative best practices advised by the WOCCU, Czech credit unions are not members of this organization.

Small capital levels and possible problems of larger Czech credit unions connected to needs of capital increases arising from new regulation were criticized by Matejašák and Teplý (2013). Problem of low equity level is further intensified by strategy of low price for membership shares in order to attract new clients more easily. Low membership claims of members harm cooperative spirit of institutions as members are not motivated to follow performance of credit union which is once again denying basic cooperative principle.

[1] See eg. WOCCU (2011).

Moreover, significant concentration of ownership rights is suspected because additional membership shares formed more than 85% of total equity from membership shares in every Czech credit union in 2013[2].

Let us focus now on studies revealing performance drivers of cooperative banks profitability and stability in Europe. Papers in our review cover time periods from 1979 to 2009. Data samples were created solely by banks from Western Europe.

Iannotta et al. (2006) showed that bigger cooperative banks and banks with higher share of loans to total assets are more profitable. Banks with more diversified income sources yield higher profits according to Goddard et al. (2010). Capital to asset ratio's effect on profitability is ambiguous - Goddard et al. (2004) and Iannotta et al. (2006) found positive relation, whereas Goddard et al. (2010) negative and Beckmann (2007) no statistically significant dependence. Liquidity's effect is insignificant according to Iannotta et al. (2006) and Goddard et al. (2004) found negative effect of cost to income ratio on profitability. Market concentration has either no (Beckmann, 2007) or negative effect (Goddard et al., 2010) and GDP growth seems to support banks' profitability (Iannotta et al., 2006; Beckmann, 2007). Low interest rate environment affects profitability negatively according to Beckmann (2007).

The studies interested in risk factors of cooperative banks used distinct measures to proxy for banking stability such as Z-Score, ratio of non-performing loans or distinct capital ratios. Effects of most of the variables on stability of cooperative banks differ from paper to paper. Consensus was reached on negative effect of growth rate of the bank (Beck et al., 2009; Köhler, 2012) and cost to income ratio on bank stability (Hesse and Čihák, 2006; Beck et al., 2009; Ayadi et al., 2010). Liquidity (Iannotta et al., 2006; and Köhler, 2012) and GDP growth (Iannotta et al., 2006; Hesse and Čihák, 2006; Köhler, 2012) seem to have no effect on bank soundness. This is probably also the case for market concentration (Hesse and Čihák, 2006; Ayadi et al., 2010; Köhler, 2012), capital to asset ratio (Iannotta et al., 2006), loans to deposit ratio (Köhler, 2012) and inflation (Hesse and Čihák, 2006) where most of the studies found no significant effect. Positive or no effect on stability was found for share of loans on total assets (Iannotta et al., 2006; Hesse and Čihák, 2007; Köhler, 2012) and also for income diversity (Hesse and Čihák, 2007; Beck et al., 2009; Köhler, 2012). Effect of size on stability was

[2] Authors computations based on annual reports of individual credit unions.

found positive by Beck et al. (2009), statistically insignificant (Iannotta et al., 2006; Köhler, 2012) as well as negative (Hesse and Čihák, 2007; Ayadi et al. 2010).

3 Data and methodology description

Following section of this paper consists of three parts. We explain usage of system GMM model in our analysis in the first part. Consequently, we describe variable selection process in the second one and finally, we present the data used in the final part of section 3.

3.1 Econometric model

Shehzad et al. (2009) found significant persistence in bank profitability. Similar were results of Goddard et al. (2004) or Athanasoglou et al. (2008). Delis and Kouretas (2011) and Köhler (2012) found persistence in banking risk measures and therefore suggested using dynamic panel models. Delis and Kouretas (2011) argued that the risk is persistent due to intertemporal risk smoothing, regulation, and relationship with risky customers. Because of this evidence of persistency, we will use dynamic panel data model which we prefer over simple panel data methods for it can deal with so called dynamic panel data bias.

System GMM can deal with endogeneity and leads to robust estimates when dealing with persistent variables. This method is becoming increasingly popular in empirical studies researching banking profitability or stability (see e.g. García-Herrero et al., 2009; Liu et al., 2013). Dynamic panel data models are characterized by including lagged dependent variable ($y_{i,t-1}$) among independent variables:

$$y_{i,t} = \alpha y_{i,t-1} + x'_{i,t}\beta + \varepsilon_{i,t}\,, i = 1, \dots, N;\ t = 1, \dots, T \tag{1}$$

$$\varepsilon_{i,t} = \mu_i + v_{i,t}$$

$$E[\mu_i] = E\left[v_{i,t}\right] = E\left[\mu_i v_{i,t}\right] = 0$$

where $x'_{i,t}$is vector of independent variables, I = 1,…,N is individual's index and t = 1,…,T stands for time. Error term $\varepsilon_{i,t}$ is composed of two terms: μ_i is fixed effect and $v_{i,t}$ is idiosyncratic shock. OLS estimator is in this case inconsistent because lagged dependent variable is correlated with fixed error term (dynamic panel data bias). Nickell (1981) shows that the problem with fixed effects cannot be solved by within groups transformation. Bond (2002) suggests using both OLS and within groups estimators as a robustness check for GMM since both methods are likely to be biased in opposite directions.

There are two popular approaches how to deal with above mentioned endogeneity problem without the need for further correction. The first one is difference general method of moments (difference GMM). Difference GMM uses first-differencing to get rid of fixed effects and

therefore the problem with dynamic panel data bias (Arellano and Bond, 1991). Drawback of difference GMM method is that it does not allow for time-invariant variables and hence we cannot use dummy variables to distinguish between different institutional types of banks.

The second method is called system GMM. It uses additional assumption that first differences of instrument variables are not correlated with the fixed effect term. This method allows using of time-invariant variables. System GMM method was popularized by works of Arellano and Bover (1995) and Blundell and Bond (1998).

We use Windmeijer (2005) correction for standard errors because Arrelano and Bond (1991) warn that inclusion of too many instruments may create the downward bias of standard errors during two-step estimation and method by Windmeijer (2005) corrects it.

Our estimated model takes following form:

$$Y_{i,s,t} = \alpha + \beta Y_{i,s,t-1} + \gamma B_{i,s,t} + \delta C_{s,t} + \epsilon D_s + \theta E_s + \vartheta T_t + \varepsilon_{i,s,t} \quad (2)$$

where

$Y_{i,s,t}$ is bank performance measure for bank *i* in country *s* at time *t*,

$Y_{i,s,t-1}$ is first lag of bank performance measure,

$B_{i,s,t}$ is a vector of bank specific variables,

$C_{s,t}$ is a vector of country specific variables,

D_s and T_t are vectors of country and time dummies,

$\varepsilon_{i,s,t}$ stands for error term.

3.2 Variables selection

Selection of variables is based mainly upon empirical papers mentioned in the literature review section. Our goal is twofold: we want to assess profitability and stability and therefore, our variables selection differs according to objective of individual regression. Still, all the regression equations are derived from equation (2). We will use three common measures as dependent variables that capture banking profitability:

Return on average assets: $ROAA_{i,t} = \frac{NET\ INCOME_t}{\frac{As_t + As_{t-1}}{2}}$

Return on average equity: $ROAE_{i,t} = \frac{NET\ INCOME_t}{\frac{Eq_t + Eq_{t-1}}{2}}$

Net interest margin: $NIM_{i,t} = \frac{NET\ INTEREST\ INCOME_t}{\frac{EAR\_As_t + EAR\_As_{t-1}}{2}}$

The risk (or stability) of bank is measured by Z-Score. Z-Score is popular measure of banks' soundness. It is a quantity of standard deviations of net income that company has to loose, under the assumption of normal distribution of income, so that all its capital is depleted. We

can alternatively imagine Z-Score as a distance to upper bound of insolvency. The higher the Z-Score is, the lower is the probability of going insolvent. In this paper, we will use time-varying Z-Score approach of Hesse and Čihák (2007), i.e.:

$$ZSCORE_{i,t} = \frac{ROAA_{i,t} + CAR_{i,t}}{-\sigma(ROAA)_i}$$

where $CAR_{i,t}$ is capital to asset ratio and $\sigma(ROAA)_i$ is standard deviation of ROAA for bank i over the whole sample period, in our case 2006 – 2013. For further discussion about usage of Z-Score as a measure of bank soundness we refer to Lepetit and Strobel (2013).

Summary of all the explanatory variables used is provided in Table 1. Because of our focus on Czech credit unions, we put all the relevant banking figures in CZK currency.

Table 1: List of independent variables

Variable	Description	Source
ln_As	logarithm of assets	author based on BankScope and annual reports
gr_As	annual growth rate of assets	
CAR	capital to assets ratio	
Liquidity	liguid assets to total asset ratio	
LtD	ratio of loans to deposits	
LoansRatio	ratio of loans to assets	
CostIncome	cost to income ratio	
FeeRatio	net fee income to total income ratio	
HHI	Herfindahl-Hirschman index	European Central Bank
GDPgr	annual growth rate of real GDP	Eurostat
Unemployment	annual unemployment rate	
Inflation	annual inflation rate	
InterestRate	long term interest rate (gov. bond yield with 10Y maturity)	
CZ	dummy for Czech credit unions	Authors

Source: Authors

3.3 Data description

We used BankScope as a data source for European cooperative banks and we enriched the dataset by Czech credit unions' data retrieved from their annual reports to cover the lack of data about Czech credit unions in international databases. To deal with double-counting issue, we used, similarly as in work of Hesse and Čihák (2007), consolidated bank statements only in case that no unconsolidated statements were available for given institution.

We used dataset for years 2006 to 2013 because of data availability. We included only cooperative banks which were active (had financial statements uploaded) for all sample time periods in order to have balanced dataset. Because disproportionally large share of all cooperative banks in the sample was from Germany and Italy, we randomly deleted some of them to receive more representative quantities for individual countries.

Altogether, our data sample includes data from 15 European countries and consists of 283 cooperative banks. Data sample contains full set of 11 Czech credit unions that were in operation for the whole period.

Table 2: Number of banks in data sample by country

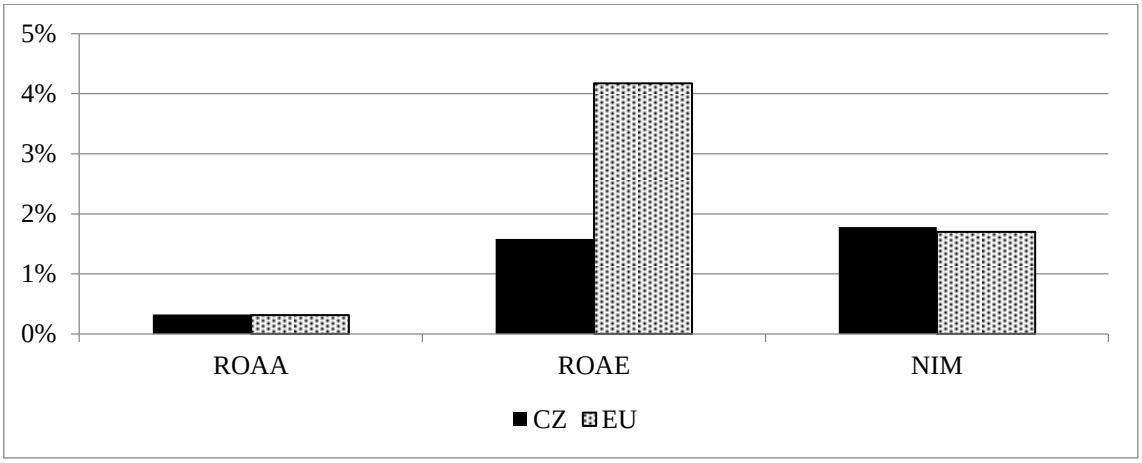
Country	Count	Share	Country	Count	Share
Austria	17	6.0%	Finland	1	0.4%
Belgium	1	0.4%	France	7	2.5%
Bulgaria	1	0.4%	Greece	1	0.4%
Cyprus	1	0.4%	Croatia	1	0.4%
Czech Rep.	11	3.9%	Italy	87	30.7%
Germany	139	49.1%	Malta	1	0.4%
Denmark	2	0.7%	Slovenia	1	0.4%
Spain	12	4.2%	**SUM**	**283**	**100%**

Source: Authors

Let us take a look on medians of performance measures with Czech credit unions separated from the rest of the sample. Figure 1 shows similar profitability of Czech and other European banking cooperative in terms of ROAA but Czech credit unions reached significantly lower levels of ROAE. The difference in these two profitability measures can be explained by high capital to asset ratios of Czech credit cooperatives (see Table A.3 in the appendix) that reflect higher risk of their business because their capital adequacy ratios are relatively small as is shown by CNB (2014) which reported 14.3% capital adequacy of Czech credit unions sector at the end of 2013 whereas other European cooperatives in our sample (those with available figures) had capital adequacy 2 percentage points higher. This implies assets with higher risk

weights in portfolios of Czech credit unions (for further details see Matejašák and Teplý, 2013).

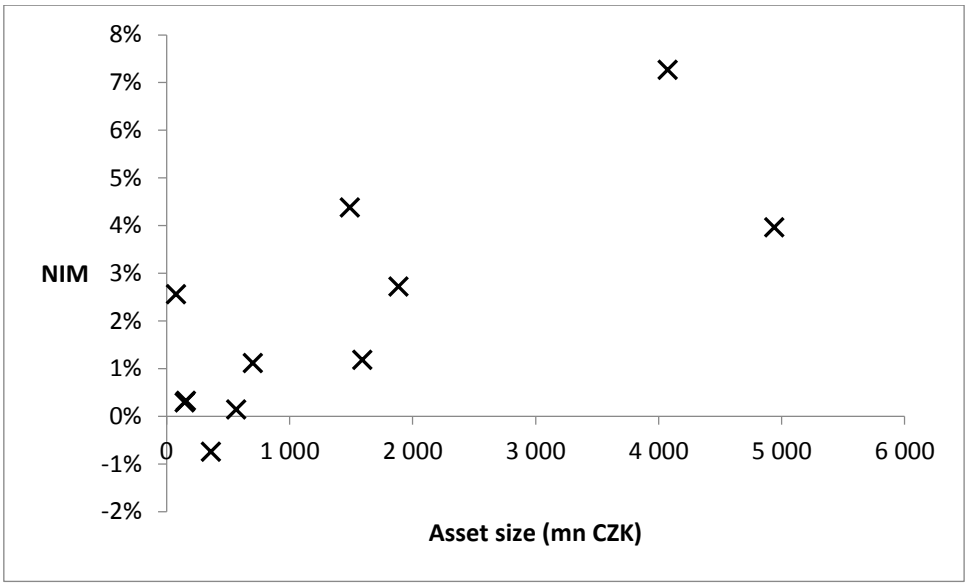
Figure 1: Medians of profitability measures



Source: Authors, based on BankScope and annual reports

Even though median NIM of Czech credit unions is only slightly higher compared to the rest of our sample, Figure 2 reveals positive relation between asset size and NIM of Czech credit cooperatives, hinting that especially bigger Czech credit unions perform risky business. Both high need for capital and high NIM may be implied by the fact that credit unions are under Czech law not allowed to grant mortgage loans and therefore, they must focus on riskier activities such as consumer lending or real estate loans.

Figure 2: Dependency of NIM size of Czech credit unions, 2013

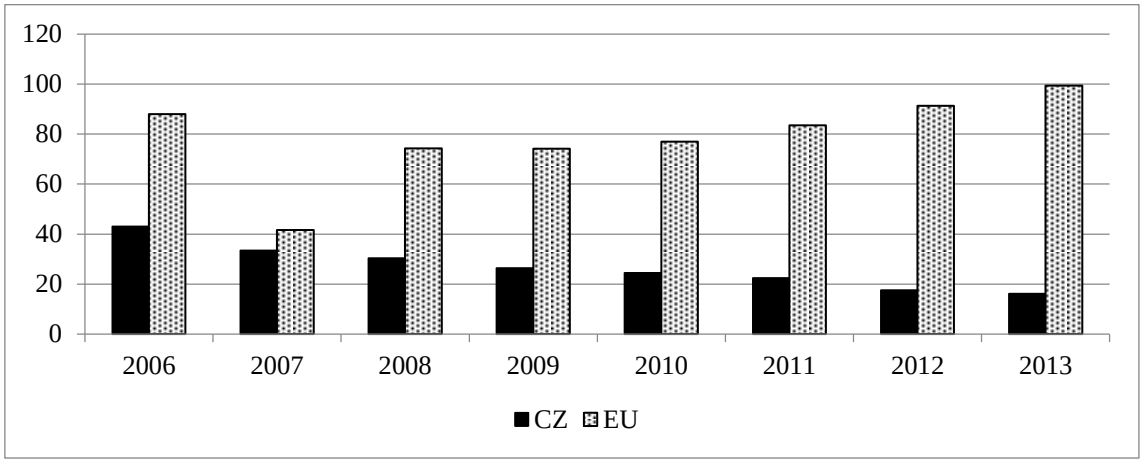


Source: Authors, based on BankScope and annual reports

Strikingly different was development of Z-Score for both groups (see Figure 3). Whereas median Z-Score of Czech credit unions decreased considerably in time, median of other European cooperative banks increased and proved strong resiliency of cooperative banking

scheme in time of crisis which was discussed by Ayadi et al. (2010) or by Liikanen et al. (2012).

Figure 3: Medians of Z-Score



Source: Authors, based on BankScope and annual reports

Moreover, evolution of Z-Score of individual Czech credit unions based on their asset size reveals an interesting pattern (see appendix A.1). Decreasing Z-Score with increasing size of institutions is easily recognizable for Czech credit unions. We can see no such pattern in case of other European cooperative banks (appendix A.2). Explanation for why mainly big Czech credit unions are vulnerable according to the Z-Score measure is quite straightforward. We already showed that Czech credit unions need high share of capital for their business models based on risky assets. Moreover, Czech credit unions are rather young institutions that grow on average much faster than their European peers (see Table A.3 in the appendix). Credit unions can raise capital either through membership shares or through retained earnings. Retained earnings form only negligible share of Czech credit unions equity – in 2013 it was only 3.6% of the equity of the whole sector and therefore, majority of equity comes from membership shares. Nevertheless, Czech credit unions charge only minimal amounts for the membership shares (see MFČR, 2014) in order to attract new members and therefore, they are not able to raise enough equity for their growing business. This everything helps to explain why Czech National Bank in last couple of years revoked licenses of only credit unions that expanded aggressively and belonged among largest institutions of Czech credit union sector.

Table A.3 in the appendix provides descriptive statistics of all the variables used. We can notice that Czech credit unions are generally smaller than European cooperative banks. We already mentioned above that Czech credit unions grow faster and have substantially higher capital to asset ratio. Czech credit unions tend to have similar ratio of loans to asset but they have lower ratio of loans to deposits. European cooperative banks tend to be on average more

effective in terms of cost to income ratio and they have smaller share of their income resulting from fees.

4 Results and findings

In order to use system GMM method correctly, we need to test the persistence of dependent variables to ensure appropriateness of dynamic panel data estimation method. We run autocorrelation test by Wooldridge (2002) for all four financial performance measures and we reject null hypothesis of no autocorrelation in case of ROAA, NIM and Z-Score. We found no autocorrelation of ROAE which is surprising when correlation was found for ROAA. Since Arrelano-Bond AR(1) test found serial correlation of residuals in ROAE regression, we decided to use system GMM as main method for our analysis despite the result of Woolridge test.

Table 3: Woolridge test for autocorrelation in panel data

Variable	ROAA	ROAE	NIM	ZSCORE
F(1, 282)	4.436	0.243	83.253	83.639
Prob > F (p-value)	0.0361	0.6225	0.0000	0.0000

Source: Authors, based on BankScope and annual reports

Our primary interest is effect of Czech credit unions dummy variable and therefore, we leave aside variables that are highly correlated with it to avoid multicollinearity problems (correlation matrix is presented in appendix A.4). We decided to estimate models with following bank specific variables where dependent variable is a profitability measure: growth of assets, liquid asset ratio, loans to deposit ratio and loans to assets ratio. Herfindahl-Hirschman index, GDP growth rate, unemployment and inflation represent country specific variables and moreover dummy variables for Czech credit unions and year dummies are included. For a regression where dependent variable is Z-Score, model does not include liquid asset ratio, Herfindahl-Hirschman index and inflation but on the other hand, we include logarithm of assets and net fee income to total income ratio.

4.1 Profitability regressions results

We estimate two-step system GMM model with robust standard errors. Lagged dependent variable is positive in all three cases and it is not significant only in ROAA regression. Such outcome is assumed because of persistence of banking profitability measures. Regression results show that profitability of Czech credit unions is smaller in terms of ROAA at 1% significance level and in terms of ROAE at 5% significance level. The model was indecisive in case of NIM. The coefficients were significant not only statistically but also economically.

Sign of other explanatory variables was more or less expected: liquidity decreases profitability just as unemployment does. Higher loans to deposit ratio increases profitability but higher share of loans on total assets decreases it. This shows that non-traditional banking activities may be more profitable than loan granting. NIM is higher in environment of higher inflation. Outcome that we did not expect is that GDP growth rate has negative effect on ROAA nevertheless its effect is insignificant in other two profitability regressions.

All F-tests strongly reject that variables are jointly insignificant. Arellano-Bond AR(1) and AR(2) tests for the first and second order autocorrelation have null hypothesis of no autocorrelation. We reject the null hypothesis for AR(1) in all cases which was expected because the first order autocorrelation is assumed by system GMM model with one lag. We cannot reject the hypothesis of no second order autocorrelation and that is why no second lag is included in the model. Validity of instruments is tested by Hansen test. This test uses null hypothesis that all instruments are valid. The null hypothesis of exogenous instruments was not rejected at 5% level in all three regressions.

Moreover, we perform robustness check described by Bond (2002). We run OLS and fixed effects (FE) models and check whether GMM estimate of lagged dependent variable is above FE estimate and below OLS estimate. Both OLS and FE should suffer from dynamic panel data bias that increases estimate of OLS and decreases the one of FE. This test proved validity of our GMM estimates (see appendix A.5).

Table 4: Profitability regression results

Dependent variable	ROAA		ROAE		NIM	
Lagged dependent variable	0.1007		0.3262	***	0.3100	**
	(0.0680)		(0.698)		(0.1437)	
Constant	-0.0043		1.7947	***	0.0800	***
	(0.0019)		(0.6105)		(0.0238)	
gr_As	-0.0002		-0.0013		0.0000	
	(0.0002)		(0.0010)		(0.0001)	
Liquidity	-0.0755		-1.6721	***	-0.0839	***
	(0.0690)		(0.6123)		(0.0236)	
LtD	0.0006	*	0.0027	***	0.0021	**
	(0.0003)		(0.0010)		(0.001)	
LoansRatio	-0.0852		-1.8197	***	-0.068	***
	-0.0689		(0.6242)		(0.0258)	
HHI	0.0143		0.3860	*	-0.0791	***
	(0.0102)		(0.2167)		(0.0244)	
GDPgr	-0.0610	***	0.3897		-0.0403	
	(0.0191)		(0.3785)		(0.0550)	
Unemployment	-0.1560	***	-1.1352	***	0.0010	
	(0.0451)		(0.2259)		(0.0210)	
Inflation	-0.0001		0.2415		0.1524	***
	(0.0872)		(0.8227)		(0.0503)	
CZ	-0.0043	**	-0.0751	***	-0.0142	*
	(0.0019)		(0.0226)		(0.0086)	
Diagnostics						
Number of observations	1981		1981		1981	
Number of instruments	38		38		32	
F-test	309.59	***	357.71	***	312.46	***
Arellano-Bond AR(1) test	-2.18	**	-3.80	***	-2.46	**
Arellano-Bond AR(2) test	-1.61		-1.26		-1.12	
Hansen test	30.30	*	19.08		23.55	*
Year dummies	Yes		Yes		Yes	

Significance codes: *** = 0.01, ** = 0.05,* = 0.1

Source: Authors, based on BankScope and annual reports

4.2 Stability regression results

Despite Woolridge test found serial correlation in Z-Score, Arrelano-Bond AR(1) test found no serial correlation in residuals. Moreover, system GMM model with Z-Score as dependent variable performed generally poorly. We suspect no endogeneity if we exclude lag of dependent variable from our model and we are therefore going to use simpler panel data method. We follow methodology of Beck et al. (2009) who use random effects to estimate bank risk expressed as Z-Score. We prefer random effects method over fixed effects since it

allows us to include time invariant dummy in regression equation which is crucial for our research.

We use Hausman test to justify usage of random effects (appendix A.6). We cannot reject null hypothesis of Hausman test at 5% significance level which means that both fixed effects and random effects are consistent but random effects method is asymptotically more efficient. We also performed Breusch-Pagan Lagrange multiplier test (appendix A.7) and we rejected the null hypothesis. It means that OLS estimate is inconsistent and we should use random effects method.

Table 5: Stability regression results

Dependent variable	ZSCORE					
Method	RE		FE		pooled OLS	
Constant	208.26	***	2166.6	***	76.907	***
	(17.917)		(17.549)		(25.942)	
ln_As	-7.0836	***	-7.8037	***	2.7133	*
	(1.0228)		(1.0483)		(1.4726)	
gr_As	0.0458	**	0.0486	***	-0.0864	
	(0.0174)		(0.0174)		(0.0803)	
LtD	0.4414	**	0.4238	**	-1.7354	**
	(0.1921)		(0.1913)		(0.8455)	
LoansRatio	-1.0667		0.1079		-30.523	***
	(5.3763)		(5.4048)		(11.835)	
FeeRatio	-0.6392		-0.7767		19.843	**
	(1.7464)		(1.7354)		(8.2267)	
GDPgr	-7.5781		-9.5529		181.83	***
	(9.4333)		(9.3724)		(52.341)	
Unemployment	-228.44	***	-226.00	***	-440.41	***
	(16.137)		(16.042)		(78.812)	
CZ	-64.547	***	omitted		-26.474	**
	(24.338)				(10.680)	
Diagnostics						
Number of observations	2264		2264		2264	
F-test			41.21	***	12.36	***
Wald test	282.13	***				
R-sq.	0.1273		0.1275		0.042	
Year dummies	No		No		No	

Significance codes: *** = 0.01, ** = 0.05,* = 0.1

Source: Authors, based on BankScope and annual reports

Nevertheless, we still run regression using fixed effects and pooled OLS for comparison. Results of regressions are stated in Table 5. We also estimated random effects with robust errors but the difference was only minimal. Results of random and fixed effects regression are very similar which points to the robustness of our estimates. We are not very concerned by different OLS estimates for their inconsistency. Regression results showed that Z-Score of Czech credit unions is considerable lower than that of other European cooperative banks in our sample and hence Czech credit unions are much riskier.

4.3 Results summary

Broadly speaking, outcomes of our models showed poor performance of Czech credit unions both in profitability and stability measures. We found that Czech cooperatives are less profitable than other European cooperative banks in terms of ROAA and ROAE. The difference in NIM was statistically insignificant which is surprising in the eyes of criticism on high deliquency and riskiness of credit unions' loan portfolios (Matejašák and Teplý, 2013; ČNB, 2014). Nevertheless, Figure 2 shows that NIM of big Czech credit unions is higher than average and their business model can be considered more risky. Problematic is also very low stability of Czech credit unions compared to European ones. Moreover, Figure A.1 depicts decreasing trend of Z-Score of Czech credit unions which is striking especially for bigger institutions. Another important fact is that Czech credit unions are relatively small in size and their capital stock in absolute value is together with risky asset portfolio deadly combination and it may be one of the reasons why are larger Czech credit unions currently under such pressure.

Table 6 shows that our results are often in line with other studies focused on stability of cooperative banks, especially with Hesse and Čihák (2007). We find only partial consensus with other surveyed studies. We estimated that higher growth rate of bank's assets promotes stability which is just an opposite of results of Beck et al. (2009) and Köhler (2012). This may be caused by different phase of economic cycle of this paper from cited works. Another variable which shows different sign in our model than in other studies is GDP growth in profitability regressions. We estimated mostly no statistically significant effect but results of others (Iannotta et al., 2006; Beckmann, 2007) were strictly positive. This may be once again caused by different time periods included in the dataset: this study's dataset is affected by current economic crisis whereas surveyed works are from pre-crisis times of moderate GDP growth. Otherwise, we see no clear contradiction to surveyed studies.

Table 6: Results comparison with existing literature

Dependent variable	Profitability			Stability		
	Sign	In line with	Against	Sign	In line with	Against
Size				-	Hesse and Čihák (2007) Ayadi et al. (2010)	+ Beck et al. (2009) 0 Iannotta et al. (2006) 0 Köhler (2012)
Growth of Assets	0			+		- Beck et al. (2009) - Köhler (2012)
Liquidity	-		0 Iannotta et al. (2006)			
Loans to dep. ratio	+			+		0 Köhler (2012)
Share of loans	-			0	Hesse and Čihák (2007) Köhler (2012)	+ Iannotta et al. (2006)
Income diversity				0	Hesse and Čihák (2007) Köhler (2012)	+ Beck et al. (2009)
Market concentr.	0	Beckmann (2007)	- Goddard et al. (2010)			
GDP growth	0		+ Iannotta et al. (2006) + Beckmann (2007)	0	Iannotta et al. (2006), Hesse and Čihák (2007) Köhler (2012)	
Unemployment	-			-		
Inflation	0					
CZ	-			-		

Source: Authors, based on cited papers

4.4 Further research opportunities

Interesting idea for future research that may well accompany this paper would be to compare performance of Czech credit unions with credit unions from other new EU countries focusing on influence of different legislative frameworks. Such international comparison would shed more light on effects on following cooperative practices advised by WOCCU. Problematic in this case will be poor data availability which was already mentioned above.

Furthermore, as soon as enough data are available, one may test effectiveness of new Czech credit union regulation that came into force in 2015 and focused on promoting cooperative spirit among members to see whether new legislation changed behavior of Czech credit unions and their members.

To verify outcomes of this paper, study using different methodological approach or alternative proxies for financial performance measures is also more than welcome. Distinct performance

measures such as economic value added, cost to income ratio or loan portfolio quality may be tested as dependent variables.

5 Conclusion

This paper empirically investigated performance of Czech credit unions in relation with other European cooperative banks. We aimed to statistically confirm poor stability and profitability of Czech credit unions as was suggested by previous researches. To do that, we created unique dataset of 283 European cooperative banks spanning 2006 – 2013 period. Because numerous recent studies pointed at persistency of profitability and stability measures, we decided to employ dynamic panel data methods (system GMM) where applicable as a main econometric tool. Profitability was measured in terms of ROAA, ROAE and NIM. Z-Score was used as stability measure.

Regression results proved poor performance of Czech credit unions which were outperformed by other European cooperative banks in ROAA and ROAE, showing lower profitability of Czech credit union sector. We found no difference in NIM for Czech cooperatives. Moreover, Czech credit cooperatives also suffer from lower stability. Especially striking is adverse development in Z-Score of Czech credit unions which was not observed in other countries. Signs of dependent variables used in our models are in line with findings of Hesse and Čihák (2007) whereas we find only partial consensus with other surveyed studies. This is not surprising since these studies often draw contradictory conclusions, however.

To sum up, dangerous mix of low profitability, instability and pseudo-cooperative nature of Czech credit unions form a very dangerous mix. Therefore we argue that with current capital management policies, especially bigger Czech credit unions will fall into serious financial problems in the near future.

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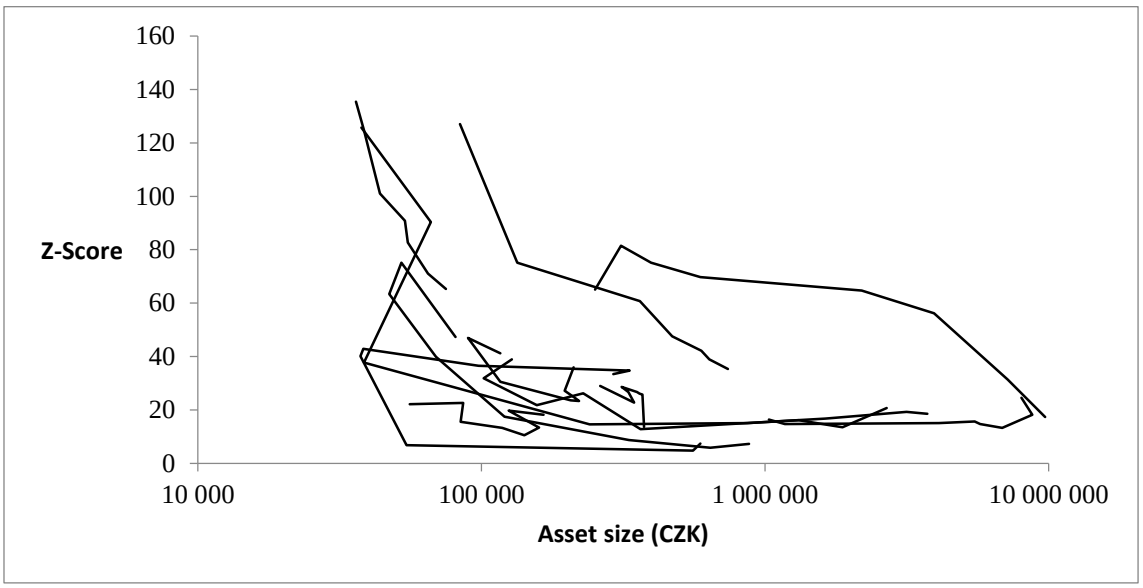
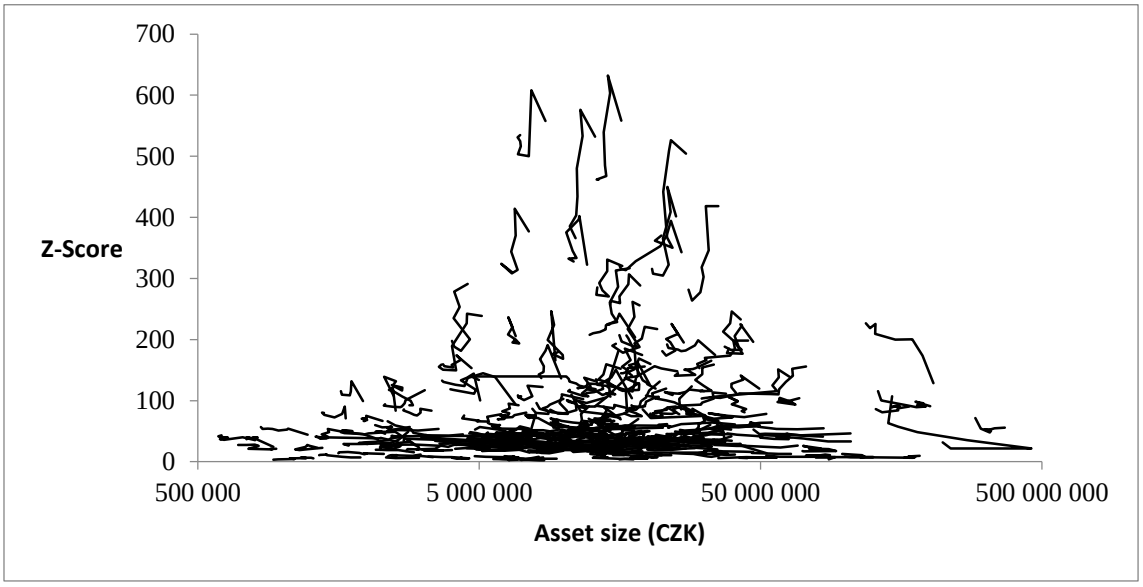
Appendix

Figure A.1: Z-Score evolution of Czech credit unions



Source: Authors, based on BankScope and annual reports

Figure A.2: Z-Score evolution of European cooperative banks



Source: Authors, based on BankScope and annual reports

Table A.3: Descriptive statistics

Variable		Minimum	1st quartile	Median	3rd quartile	Maximum
ROAA	CZ	-7.0%	0.0%	0.3%	0.9%	3.8%
	EU	-10.2%	0.2%	0.3%	0.6%	4.3%
ROAE	CZ	-36.9%	0.1%	1.6%	5.2%	24.0%
	EU	-70.5%	2.8%	4.2%	6.4%	37.2%
NIM	CZ	-0.7%	0.9%	1.8%	2.8%	7.3%
	EU	0.2%	1.5%	1.7%	2.0%	4.9%
ZSCORE	CZ	5	16	27	51	137
	EU	1	29	45	91	632
ln_As	CZ	10	12	13	14	16
	EU	13	16	16	17	25
gr_As	CZ	-68%	0%	12%	54%	567%
	EU	-38%	0%	3%	7%	81%
CAR	CZ	3%	13%	19%	32%	100%
	EU	2%	6%	8%	10%	42%
Liquidity	CZ	0%	19%	38%	70%	100%
	EU	3%	25%	35%	45%	100%
LtD	CZ	0%	37%	76%	112%	5838%
	EU	9%	70%	88%	129%	2542%
LoansRatio	CZ	0%	29%	59%	77%	100%
	EU	0%	52%	62%	72%	93%
CostIncome	CZ	0%	73%	83%	95%	431%
	EU	19%	61%	67%	74%	500%
FeeRatio	CZ	-591%	0%	3%	17%	191%
	EU	-100%	22%	28%	34%	180%
HHI	CZ	0.10	0.10	0.10	0.11	0.11
	EU	0.02	0.02	0.03	0.04	0.37
GDPgr	CZ	-4.8%	-0.7%	2.2%	3.4%	6.9%
	EU	-14.7%	0.4%	1.7%	3.6%	10.4%
Unemployment	CZ	4.4%	6.4%	6.9%	7.0%	7.3%
	EU	3.4%	6.1%	7.4%	8.4%	24.5%
Inflation	CZ	0.6%	1.4%	2.1%	3.1%	6.3%
	EU	0.0%	1.6%	2.1%	2.7%	12.0%
InterestRate	CZ	2.1%	3.5%	3.8%	4.4%	4.8%
	EU	1.4%	3.1%	4.0%	4.3%	22.5%

Table A.4: Correlation matrix

Correlation	ROAA	ROAE	NIM	ZSCORE	ln_As	gr_As	CAR	Liquid.	LtD
ROAA	1								
ROAE	0.82	1							
NIM	0.28	0.16	1						
ZSCORE	-0.06	-0.03	0.02	1					
ln_As	-0.03	0.08	-0.29	0.08	1				
gr_As	-0.02	-0.02	-0.08	-0.02	0.11	1			
CAR	0.08	-0.05	0.21	-0.07	-0.45	-0.01	1		
Liquidity	-0.03	0.02	-0.24	0.09	-0.06	-0.04	-0.06	1	
LtD	-0.07	-0.04	0.06	-0.07	-0.09	0.00	0.49	-0.19	1
LoansRatio	0.05	-0.01	0.23	-0.07	0.04	0.04	0.07	-0.99	0.20
CostInc.	-0.39	-0.33	-0.09	-0.04	-0.22	0.01	0.07	-0.05	0.10
FeeRatio	0.05	0.10	-0.16	0.08	0.24	0.07	-0.17	-0.04	-0.02
HHI	-0.02	-0.08	-0.02	-0.20	-0.09	0.06	0.19	-0.14	0.07
GDPgr	0.05	0.07	0.14	0.09	-0.05	0.00	0.02	0.06	-0.01
Unemploy.	-0.19	-0.22	0.06	-0.13	0.03	0.02	-0.04	-0.14	-0.01
Inflation	0.04	-0.02	0.06	-0.13	-0.09	0.01	0.10	-0.12	0.02
InterestRate	-0.06	-0.15	0.10	-0.32	-0.06	0.00	0.12	-0.24	0.12
CZ	0.01	-0.07	0.07	-0.08	-0.51	0.00	0.54	0.12	0.16

Correlation	LoansRa.	CostInc.	FeeRatio	HHI	GDPgr	Unemploy.	Inflation	InterestR.	CZ
ROAA									
ROAE									
NIM									
ZSCORE									
ln_As									
gr_As									
CAR									
Liquidity									
LtD									
LoansRatio	1								
CostInc.	0.02	1							
FeeRatio	0.03	-0.07	1						
HHI	0.11	0.08	-0.13	1					
GDPgr	-0.05	0.03	-0.01	0.07	1				
Unemploy.	0.11	0.04	-0.01	0.17	-0.18	1			
Inflation	0.11	0.00	-0.10	0.44	0.34	-0.11	1		
InterestRate	0.22	0.05	-0.07	0.20	-0.11	0.55	0.28	1	
CZ	-0.12	0.20	-0.25	0.19	0.05	-0.10	0.06	0.02	1

Table A.5: Profitability regressions robustness check

Lagged dependent variable	FE		GMM		pooled OLS	
ROAA	-0.0085		0.1007		0.2799	***
	(0.0266)		(0.0680)		(0.0233)	
ROAE	0.0526	*	0.3262	***	0.3639	***
	(0.0285)		(0.698)		(0.0244)	
NIM	0.2978	***	0.31	**	0.6819	***
	(0.0265)		(0.1437)		(0.0166)	

Table A.6: Hausman test

chi2(7)=13.67
Prob>chi7=0.0575
Ho: difference in coefficients not systematic

Table A.7: Breusch and Pagan Lagrangian multiplier test for random effects

chi2(1)= 7229.06
Prob>chi2=0.0000

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