

EFFICIENCY OF THE BUILDING SOCIETIES IN THE CZECH REPUBLIC

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Abstract

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This paper is the first attempt to analyze efficiency of building societies in the Czech Republic. We apply non-parametric method Data Envelopment Analysis on data from all building societies in the sector over the period 2002–2008. Having deposits received and administrative expenses as inputs and volume of loans disbursed as output we estimate efficiency scores of all individual building societies as well as calculate the average efficiency in the industry. For this purpose we use two alternative models that allows for constant and variable returns of scale respectively. The results suggest that there is no significant improvement in efficiency of building societies during the estimation period. Furthermore, most of the building societies have not been operating at appropriate size. We also found that Českomoravská stavební spořitelna, a. s. was the most efficient building society in the Czech Republic according to the both models applied. In order to increase efficiency, we suggest reduction in the number of external employees and agents or increase of their productivity, more sophisticated products that can outperform the standard services and effective response to changes in the legislature.

efficiency, data envelopment analysis, CCR model, BCC model, constant returns to scale

The transformation process of the Czechoslovakia's economy from central planning to the market environment began at the end of the 1980s. It was necessary to carry out a total reform of the banking sector and set up a two-tier banking system. However, a legislative framework for some institutions, which would be able to help people finance their housing, was still missing until mid 1993. First of all, it is worth to mention that these banks handled – and still do – a considerable amount of public funds that are significantly supported by state funding. This is also an important fact that has led to very high competitiveness towards the other alternatives of long-run saving. Secondly, not only savings but also loans and particularly low interest rates as well as never-let-down trust in reliability of these institutions have built up a strong and stable base for their profitable business.

The aim of the paper is to estimate the efficiency of building societies in the Czech Republic for the years 2002–2008. The work has been the first of its kind, even though some partial analysis in various

financial sectors has already been done in the past. The first section of the paper introduces relevant approaches to efficiency measuring. The second part provides some literature review. The third part presents main development trends in the building societies' sector. The fourth section reports results of the efficiency estimation. The last section gives discussion of the results.

Theoretical approaches to efficiency measuring

Sometimes, the efficiency is referred to as productivity or profitability. Needless to say, those terms are far from being a synonym. The overall economic efficiency presented in Farrell's (1957) seminal paper can be further divided into technical and allocative efficiency.

Sengupta (2000) defines allocative efficiency as the ability of successful setting of inputs with given input costs. The technical efficiency is described as relation between production frontier and maximization of outputs with given set of inputs.

Although one can measure the efficiency in many ways, five main techniques are used the most and may be further divided into parametrical (stochastic) or non-parametrical (deterministic, linear-programming) methods. However, a relevant literature does not provide any consensus on which approach is the superior. Therefore, many efficiency studies apply simultaneously more estimation techniques if character of the data used allows for such an approach.

As far as parametrical methods are concerned we can distinguish the following most frequently used ones: Stochastic frontier approach, Thick frontier approach and Distribution free approach. In contrast to stochastic approaches, some non-parametrical methods are Data envelopment analysis and Free disposal hull analysis.

In these methods, the construction of the curve – which literally envelops all units, whereas the best performing ones compose the vertices and lie at the frontier – has a different manner of computation compared to the former ones.

The main advantage of non-parametrical approaches lays in suspending the need of having predetermined functional specification for the units. We have to emphasise though, that the main disadvantage are the random errors. They could markedly affect the results if we had low-quality data.

Data envelopment analysis (DEA)

In this study, we apply solely DEA to estimate efficiency of building societies in the Czech Republic. There are several reasons for this research strategy. First, although we employ data from all building societies the number of unit comprised in the dataset is still low. Hence, in order to obtain relevant estimation outputs we are forced to reduce the number of inputs and outputs included in the estimation procedure. Consequently, DEA seems to be the best technique in such a specific circumstances. Second, DEA is a suitable method if the research does not require any special functional predetermination for the units analyzed. This is exactly the case of Czech building societies since there is no relevant study on efficiency of building societies operating in a similar legislative and economic framework as in the Czech Republic. Third, we have reliable data extracted directly from annual reports and, therefore, we eliminate the risk that incomplete or biased data may distort the estimation results.

As for DEA itself, it has been first published in Charnes *et al.* (1978). Since then, this method has undergone series of modifications as well as practical applications in many fields – mainly hospitals, universities, financial institutions, and other entities. For further details see Cooper *et al.* (2004).

Nonetheless, a multiple weighted output and input ratio gives us the simplest picture of how DEA actually works. Each output and input is

transformed into one virtual output and one virtual input (see also Cooper *et al.*, 2007 or Ray, 2004).

$$\frac{\text{virtual output}}{\text{virtual input}} \quad (1)$$

Consider having a set of homogeneous units – here known as Decision Making Units (DMUs) – where each produces r outputs while consuming i inputs. The whole process runs for every analyzed unit separately while weights equalise the differences among DMUs. Furthermore, weights serve as variables. They are changed by the iteration method to achieve maximal attainable efficiency. Computation stops when, either analyzed or other DMU gain – with currently valid weights – a 100% score.

Another considerable factor, which crucially influences evaluations of DMUs, is the capability of dealing with returns to scale. In practical use we distinguish:

- CCR model – named after Charnes, Cooper and Rhodes (1978),
- BCC model – first applied in Banker, Charnes and Cooper (1984).

The BCC model has been modified from the CCR model, since the former one was not able to handle the variable returns to scale (VRS). The linear programming model runs as follows:

$$\max h_0(u, v) = \frac{\sum_{r=1}^s u_r y_{r_0}}{\sum_{i=1}^m v_i x_{i_0}} \quad (2)$$

Subject to

$$\frac{\sum_{r=1}^s u_r y_{r_j}}{\sum_{i=1}^m v_i x_{i_j}} \leq 1, \quad j = 1, 2, \dots, j_0, \dots, n \quad (3)$$

$$u_r \geq 0 \quad r = 1, 2, \dots, s,$$

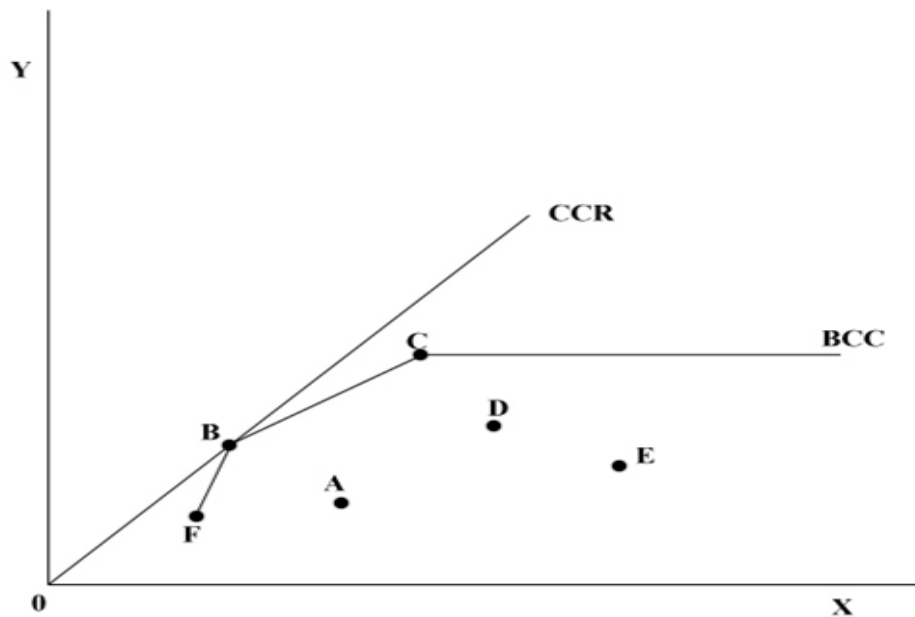
$$v_i \geq 0 \quad i = 1, 2, \dots, m,$$

where:

- h_0 efficiency score of analyzed unit
- u_r, v_i weights of individual inputs and outputs
- y_{r_j} observed value of outputs r for j -unit
- x_{i_j} observed value of inputs i for j -unit
- r identifier of these from s outputs
- i identifier of these from m outputs
- j identifier of each unit from all n units.

Furthermore, after consideration of characteristics of the preceding computation, the transformation developed by Charnes and Cooper (1962) changes variables from (u, v) to (μ, v) and introduces the constant:

$$\sum_{i=1}^m v_i x_{i_0} = 1. \quad (4)$$



1: Comparison of CCR and BCC models

Next, all linear programming problems reach the stage, where too many constraints may affect the result's credibility. By bringing the dual theorem of linear programming into play, we can easily reduce the number of constraints to the minimum.

We can hardly assume companies being operating at an optimal size in real economy as it is suggested by CCR model. Consequently, as Stavarek (2005) puts in, a condition of concavity has to be added to ensure that each unit would be compared with other units of similar sizes. The BCC model envelops all DMUs far more tightly than in the CCR model scenario (Fig. 1). Moreover, all types of VRS are considered in the BCC model used in this paper – increasing, decreasing, non-increasing and non-decreasing.

The axis X represents input whereas axis Y displays output. Then, if considering VRS in BCC model we can observe that units C and F are deemed as efficient even though they are inefficient in CCR model that assumes CRS.

Literature review

Although this paper is the first of its kind in Czech Republic, we can find some similar studies in the sector of building societies in the United Kingdom or Australia. Probably the first one was Drake and Weyman-Jones (1992). They used non-parametrical methods to analyse the overall technical efficiency of UK building societies and to decompose this measure into its subcomponents, pure technical and scale efficiency. Drake and Weyman-Jones (1996) extended the previous work in the area in two main ways. First, the latter study focuses upon allocative and technical efficiency. Secondly, the results obtained in the first work are contrasted with

the results acquired using a stochastic frontier cost function approach.

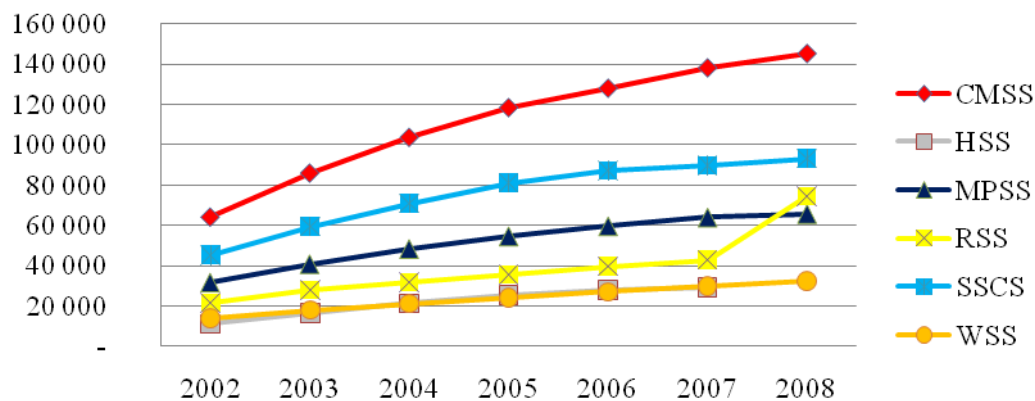
By contrast, a parametric approach was used by Worthington (1998) for 22 Australian building societies in the period 1992–1995. The cost inefficiency scores indicated that building societies' costs were 20% above what could be considered necessary. Technical efficiency and technological change in Australian building societies was analyzed in Worthington (2000). The results indicated that building societies were productive as a consequence of technological progress rather than efficiency improvement.

Development trends in the Czech Republic's sector of building societies

This part of the paper gives a short overview of the key trends in the sector of Czech building societies (BS) during the period 2002–2008. The sector is consisted of six (five since 2008) BSs. For further details on the sector development see Leksovský (2010).

- Českomoravská stavební spořitelna, a. s. (CMSS)
- Hypo stavební spořitelna, a. s. (HSS)
- Modrá pyramida stavební spořitelna, a. s. (MPSS)
- Reiffeisen stavební spořitelna, a. s. (RSS)
- Stavební spořitelna České spořitelny, a. s. (SSCS)
- Wüstenrot stavební spořitelna, a. s. (WSS).

Market shares of individual BSs have remained relatively stable. The only exception was RSS whose market share increased substantially in 2008 due to a merger with HSS (see Fig. 2). Nevertheless, the leader of the market according to the volume of deposits was CMSS, with an overall value of deposits being CZK 64 008 mln. in 2002. SSCS handled



2: Development of deposits received (in CZK mln.)
Source: Annual reports of individual BSs

CZK 45 325 mln. while MPSS had the third biggest volume in deposits, concretely CZK 31 840 mln. 12% of the market was gained by RSS with CZK 21 656 mln., so neither of two last building societies reached at least CZK 15 000 mln.

Proportional market structure towards 31 December 2008 did not differ too much from 2002 and for that reason, we can term this market as very stable. Fig. 2 shows a development of deposits throughout this period of time.

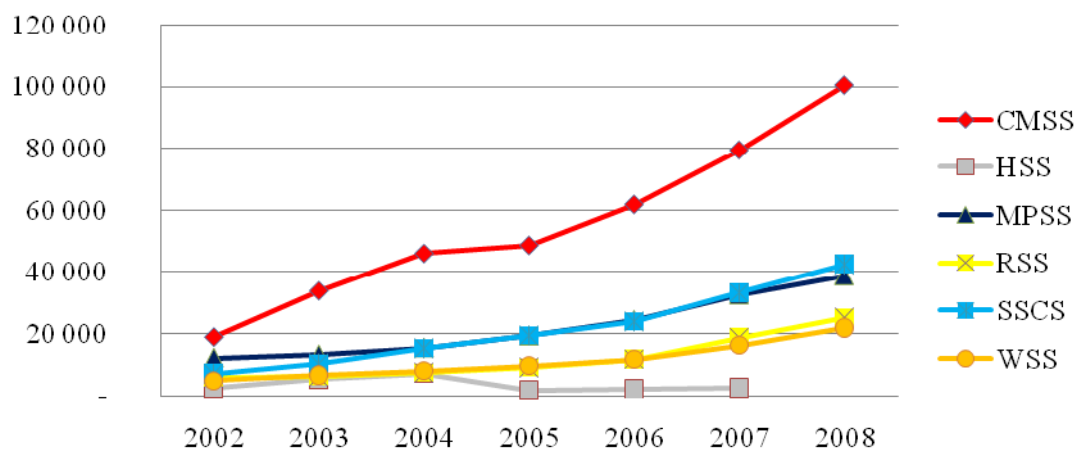
The second key aspect of BSs' performance that has to be overviewed is the development of loans disbursed. Until the end of 2002, CMSS occupied the first place among building societies with a total value of loans being CZK 19 078 mln. in 2002. The second biggest amount of provided loans, CZK 12 132 mln., was reported by MPSS and the imaginary third place was shared between SSCS with CZK 7 154 mln. and RSS with CZK 5 792 mln. It is interesting to note that WSS – a founder of building saving in the world – had a 9% share in 2002, which meant a sum of CZK 4 825 mln. HSS had provided only CZK 2 603 mln. until the end of 2002.

In next seven observed years, see also Fig. 3, the situation on the market reached the point where CMSS held almost 50% of the whole market. This leader was followed by MPSS and SSCS, their positions being almost similar all the time. The same situation applied for WSS and RSS, even though with lower shares. Market portion of HSS was trivial.

Efficiency estimation

As outlined above, the efficiency rate of building societies in the Czech Republic for the years 2002 to 2008 has been estimated with a non-parametrical model – Data envelopment analysis tool. For the computation itself, we use EMS 1.3.0 software (Efficiency measurement system, EMS) created by Holger Scheel.

Building societies are considerably specific institutions. Therefore, it is important to consider their legislative limitation as well as number of market players. Both of these conditions are taking part in the inputs and outputs setting. Their activity corresponds with the intermediation approach – first proposed by Sealey and Lindley (1977). These



3: Development of loans disbursed (in CZK mln.)
Source: Annual reports of individual BSs

authors deem banks as organizations converting deposits into loans with the lowest possible costs.

If we admit this assumption and also realize that too many inputs and outputs would negatively affect results, we will find an optimal setting as:

Inputs

- Deposits received
- Administrative expenses.

Outputs

- Loans disbursed.

All data is taken from annual reports of analyzed BSs. Although deposits and loans have been mentioned already, there is one missing point to clarify – the administrative expenses. They contain staff costs and other administrative expenses.

All in all, the efficiency rate has been calculated for each BS. The constant returns to scale have been considered in the CCR model whereas the variable returns to scale have been taken into account in the BCC model. Tab. I summarizes results obtained

from the CCR model at 1% significance level. Tab. II reports results of the BCC model estimation

BSs gained a higher efficiency score in the BCC model as can be observed in tables. Both models though, show a similar trend in average values – an average efficiency decrease by 5% in the BCC and by 7% in the CCR model in 2003. Then, a slight increasing trend continued for three years, starting in 2004. The above-mentioned merger of RSS and HSS caused a huge fall of efficiency for RSS and therefore also the average value dropped down.

Theoretical hypothesis have confirmed that banks are more efficient when VRS are considered. Together with the BCC model, many banks were operating on the efficiency frontier. Tab. III and Tab. IV display the development throughout all analyzed years. The most considerable difference in values between CCR and BCC was revealed for HSS. On the contrary, the lowest – actually no difference – was estimated for CMSS.

CMSS was 100% efficient in the CCR model. The second best average result was obtained by WSS with 92.52%. Anyway, although MPSS had

I: Descriptive statistics of efficiency scores in the CCR model (in %)

	No. of BSs	Mean	Median	St. deviation	Min	Max
2002	6	85.36	86.15	13.79	69.20	100.00
2003	6	79.52	81.11	16.24	59.53	100.00
2004	6	73.11	73.16	18.00	52.14	100.00
2005	6	73.83	83.34	30.96	17.17	100.00
2006	6	72.51	84.38	30.80	15.21	100.00
2007	6	77.19	91.39	33.08	14.98	100.00
2008	5	86.30	97.42	21.82	48.83	100.00

Source: Authors' calculations

II: Descriptive statistics of efficiency scores in the BCC model (in %)

	No. of BSs	Mean	Median	St. deviation	Min	Max
2002	6	94.35	100.00	9.95	75.56	100.00
2003	6	89.55	91.78	11.97	72.92	100.00
2004	6	85.39	88.32	16.32	67.26	100.00
2005	6	95.04	100.00	7.70	84.19	100.00
2006	6	96.33	100.00	5.74	87.84	100.00
2007	6	96.14	100.00	6.10	86.54	100.00
2008	5	88.53	100.00	18.92	56.41	100.00

Source: Authors' calculations

III: Efficiency estimation for each BS in the CCR model (in %)

	2002	2003	2004	2005	2006	2007	2008	mean
CMSS	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
HSS	70.65	80.91	75.07	17.17	15.21	14.98	N/A	45.67
MPSS	100.00	81.30	71.25	85.23	84.38	88.35	85.24	85.11
RSS	81.49	59.53	52.14	61.59	61.32	65.41	48.83	61.47
SSCS	69.2	62.08	55.41	81.45	84.37	100.00	100.00	78.93
WSS	90.81	93.30	84.78	97.51	89.78	94.42	97.42	92.57

Source: Authors' calculations

IV: The efficiency estimation for each BS in the BCC model (in %)

	2002	2003	2004	2005	2006	2007	2008	mean
CMSS	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
HSS	100.00	100.00	100.00	100.00	100.00	100.00	N/A	100.00
MPSS	100.00	83.55	76.64	86.06	87.84	90.28	86.23	87.23
RSS	90.54	80.82	67.26	84.19	90.12	86.54	56.41	79.41
SSCS	75.56	72.92	68.46	100.00	100.00	100.00	100.00	88.13
WSS	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: Authors' calculations

a relatively worse second and third year – this was caused by receiving the highest score in 2002 – an average value for the whole period placed MPSS in the top three, more accurately 85.11%. SSCS was getting better almost every year, so 2007 and 2008 have been the most positive ones for this BS. An average efficiency was 78.93%. It is obvious that the fall in amount of loans disbursed from CZK 7 165 mln. in 2004 to CZK 1 800 mln. in 2005 contributed to a huge efficiency decline for HSS. Surprisingly, it did not affect results in the BCC model though. As for RSS, a merger with HSS produced a fall of the efficiency rate by 25.35% in CRS and 34.82% in VRS.

Three of six building societies have been fully efficient in the BCC for the whole time. Namely, CMSS, WSS and HSS. Efficiency scores of the remaining BSs fluctuated between 79–88%. Concretely MPSS and SSCS had an almost similar 88% average efficiency. Here, the worst score was received by RSS – 79%.

Fig. 4 indicates that a difference between CCR and BCC values gives banks evidence of not having a proper size. The reported values are averaged for the whole sector and some interesting findings shall be discussed.

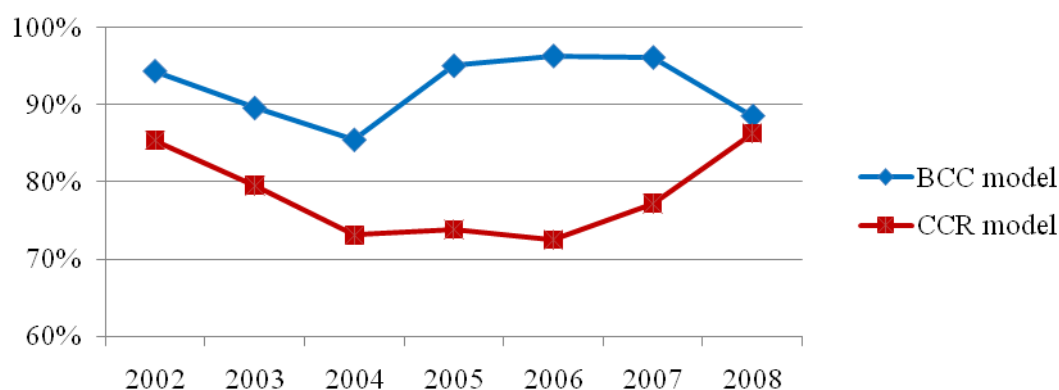
Firstly, the larger is difference between the curves in Fig. 4, the more BSs operate at inappropriate size. However, in 2008, there is almost a perfect match of both models used. Therefore, one can conclude the sector of BS found in average a suitable setting of inputs and outputs regarding to the size of the sector. However two BS (MPSS and RSS) were still losing the efficiency due to inappropriate size.

Secondly, until the end of 2004, an average efficiency has been decreasing in both models. It is a striking finding since the deposits and loans have been increasing throughout the whole period. It is necessary to compare the development of inputs and outputs and try to explain their relations. Nonetheless, BSs which influenced the decrease of average efficiency the most (SSCS, RSS and HSS) had the worst performance in the loans/deposits ratio.

Finally, the CCR as well as the BCC model are input oriented. That means that another significant ratio – administrative expenses/deposits – could be a clue to a better understanding of the results. Although we cannot specify a direct correlation between this ratio and the efficiency score, it is possible to point out to one trend. In each year analyzed, the most efficient BS had the lowest ratio of administrative expenses/deposits and the least efficient BS had the lowest ratio observed.

Recommendations for improvement of efficiency

The last part of this paper is concerned with discussion about potential measures for efficiency improvement. The first possible way for improvement can be seen in administrative expenses. In particular, the CCR model estimation indicated that WSS should reduce administrative expenses in the same proportion in which it is lacking in the efficiency score. The same applies for HSS and MPSS. An appropriate measure ensuring the necessary cost reduction could be a reduction



4: Average efficiency score for the whole sector

Source: Authors' calculations

of external employees such as agents and brokers or substantial increase of their productivity.

On the other hand, the BS with the least efficient utilization of deposits was SSCS. However, the total volume of deposits and loans is not very easy to affect. Nevertheless, one possible way how to achieve this goal is to offer higher interest rates on deposits, lower interest rates on loans and to

implement more sophisticated marketing strategy and public relations.

The BCC model shows that far more BSs were operating with 100% efficiency score. Nevertheless, the core weakness of MPSS in all analyzed years was the level of administrative costs. By contrast, RSS suffered from not effectively utilized deposits over the whole observed period.

SUMMARY

This paper aims to estimate the efficiency scores of the Czech building societies during the years 2002–2008. A legislative framework for such institutions has been in force since 1993 and the sector has consisted of six (five since 2008) building societies.

In order to fulfil the goal of this paper, we have employed the Data Envelopment Analysis in its most used variations – CCR and BCC models. Thus, we could measure the efficiency concurrently considering the constant and variable returns to scale to find out whether BSs were operating at appropriate size. We also present a brief overview of the key trends in the Czech sector of building societies.

The paper is structured as follows. The first part represents a theoretical base for the efficiency estimation as it comprises a concept of efficiency and overview of the efficiency measurement method with focus on Data Envelopment Analysis. The second part provides a review of relevant literature. In the third part, we report the key characteristics and development trends of the sector of building societies. The last parts bring up the efficiency estimation of individual building societies as well as the whole sector along with discussion of the results obtained.

The results obtained indicate some interesting findings. We discovered that there is no significant improvement of the efficiency of Czech BSs. Moreover, a substantial difference between the CCR and BCC values shows that BSs have not been operating at appropriate size during the most of the period analyzed. We also found that ČMSS was the most efficient building society in the Czech Republic according to both models applied. Stemming from the detailed estimation results, we suggest a cutting of administrative expenses in the field of external employees and agents and development of more sophisticated and competitive products as possible measures to increase efficiency of some BSs.

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