Technical Efficiency and Profitability in Retail Production of Bank Branches

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Abstract
In this paper, the spatial disparities in technical efficiency and profitability of providing banking services in the case of a commercial bank that operates a large retail branch network all over Slovakia are studied, visualized and graphically explored. The aim of the paper is to investigate how in the production process of the bank's branches technical efficiency contributes to profitability in order to assess the performance profile of the concerned bank's branches on a comparative level. Founding the investigation on correspondence maps and cartograms, the paper deepens understanding between these two key qualitative indicators of bank branch production and provides evidence of a positive link between them. Spatial disparities are found to be a factor affecting the technical efficiency and profitability of the bank's branches, yet it seems that individual managers have still enough room to show their skills and expertise in managing their branches.

Keywords: technical efficiency, employee profitability, correspondence map, cartogram, bank branch
JEL codes: D24, G21, R21

1. Introduction

The traditional model of distributing retail banking services is maintained through operating a branch network. In spite of the emergence of online banking and the digitalization of banking services, face-to-face distributional channels prevail and are of popularity in Slovakia. Of course, there have been changes taking place in the recent two decades in the Slovak banking sector that have necessitated a transformation of the old banking network of maladroit and robust branches congested with executing payment instructions into a network of lean branches selling banking services, providing financial advice and offering support to their customers. This transformation has already been done but is still in progress embracing information and communication challenges of the contemporary era and adjusting to them. The expected results of these changes is that bank branches will act as highly-efficient and profitable sales and advice outlets giving a competitive advantage to the commercial bank. The achievement of this outcome is secured by enforcing new standards of performance laid upon individual bank branches, which are formulated into a number of criteria such as volume, profitability or quality of banking services that they offer. Bank branches are then reviewed on a regular basis as to whether they manage or fail these criteria and the information on their performance is an inevitable and valuable input to managerial decision-making at the bank level.

This paper centers upon the first two mentioned criteria, volume and profitability of banking services. Whilst performance of delivering banking services in terms of size is studied here from the standpoint of technical efficiency and is measured by a comprehensive indicator computed in a data envelopment (DEA) framework, performance in terms of profitability is captured by means of a simple profitability indicator. As follows from the overview studies complied by Berger and Humphrey (1997), Berger (2007), Fethi and Pasiouras (2011) and Paradi and Zhu (2013), these two performance criteria are crucial to bank business and the relationship between them is intensively analyzed in many a study (e.g. Camanho and Dyson, 1999; Portela and Thanassoulis, 2007; Yang and Liu, 2012). The aim of the present paper is to examine this relationship for a large commercial bank with a long tradition in Slovakia which, in the past years, has converted its extensive branch network into a system of branches ranging from large regional establishments to small local outlets reacting

thus to the competitive pressures for higher efficiency and profitability. This bank whose name shall remain undisclosed runs a number of branches scattered all over Slovakia, which are classified territorially into nine regions and categorized into four size categories. Both these classifications are internal and are adopted by the bank for its own purposes, therefore these definition of nine regions does not comply with any official territorial classification or administrative breaking-up of Slovakia into administrative units. Yet, individual branches are still localized and identified with one of the 79 administrative districts in Slovakia. Out of the 79 districts named after the town functioning as their administrative centre, the capital city of Bratislava is divided into 5 districts and the city of Košice into 4 districts. The affiliation of bank branches with one of the nine regions and their placement in one of the 79 districts is an important environmental characteristic that may influence the operations and performance of individual branches. This is the research question pursued in this paper and is addressed in the background of developing a consistent framework for assessing the performance of individual branches. The management of the bank is interested in assessing the performance of their branches to the extent which is controllable by individual bank managers. The requirement of controllability precludes environmental factors from performance assessment as they are outside the control of bank managers. The fact that they are not incorporated directly in performance assessment presses for an examination of their actual effect upon branch performance. The spatial aspect of operations carried out by individual branches is one of these factors and is studied in the paper. In this regard, the paper investigates: (1) whether there is a relationship between the technical efficiency and profitability of the bank's branches, (2) how the spatial characteristic of the bank's branches (i.e. their regional affiliation and district localization) impacts upon their technical efficiency and profitability, and (3) how this spatial characteristic affects the relationship present between the technical efficiency and profitability of the bank's branches. This investigation is conducted by means of graphical visualization, and prompts a number of crucial decisions operationalizing the concepts of branch performance to make therewith. Accommodating the views and preferences of the bank's senior managers, these decisions pertain especially to the specification of the production model (or the input-output set) of the bank's branches, the choice of indicators measuring their technical efficiency and profitability and the selection of analytical methods or graphical instruments for fulfilling the research goal. Concerning the first point, the production model of the bank's branches stands upon the production approach to banking business and is commixed with their intermediation function, which is also vital in retail operations of the bank's branches. As to the second point, technical efficiency is measured by the non-oriented slacks-based measure (SBM) utilized in a context of DEA, whereas profitability is taken relative to the chief input of the bank's branch production controllable at the level of branch managers. This chief input represents labour force. Hence, profitability is understood as employee profitability and expressed as the profit generated on average by one branch employee. Finally, the paper makes use of correspondence maps of correspondence analysis and cartograms of geoanalysis in investigating the influence of the spatial characteristic upon the technical efficiency and profitability of the bank's branches.

The novelty of the paper consists in the explicit consideration of the spatial aspect in exploring the link that exists between the technical facet and the ultimate monetary outcome of bank branch production. This exploration is undertaken in the paper with the assistance of correspondence maps and cartograms. On the one hand, these diagrammatic representations are in fact relatively common graphical tools for displaying qualitative information; and, on the other hand, by their using the methodology of the paper deviates from the extant research. Whereas correspondence maps after converting technical efficiency and profitability into ordinal variates help identify the typical association patterns between these two performance characteristics and the regional affiliation of individual branches, cartograms make it possible to distinguish in greater detail the spatial differences between individual branches in the area of technical efficiency and profitability as the key dimensions of the bank's branch performance assessment. To the best knowledge of the authors, neither correspondence maps nor cartograms have been used in any study of the sort.

By including only the inputs and outputs controllable by branch managers, technical efficiency of bank branches is instrumental in assessing the managerial abilities of their branch managers. To the contrary, profitability of branches is a proxy for appraising the attractiveness of the local economic environment as well as for the ability of branch employees to find customers for loans, which are the principal creators of profit for bank branches. It is confirmed that technical efficiency is indeed a very

suitable means for identification of the managerial capabilities of branch managers and that technical efficiency scores may form a good base in implementing new practices or policies. Examples of such use include internal rating and monetary stimulation of bank branches or development of corrective strategies for bad-performing branches. In terms of profitability, sometimes better results are attained by branches localized in economically poorer districts, which only proves that the managerial capabilities of branch managers implemented through diligence and assiduousness of labour force are most decisive and may suppress the economic predispositions dictated by the spatial aspect.

The remainder of this paper is further organized as follows: Section 2 explains the circumstances of branch performance assessment in the conditions of the concerned bank and refers to the relevant literature that connects technical efficiency with profitability or that emphasizes the spatial aspect in performance assessment. Section 3 addresses the issue of measuring the technical efficiency and profitability of individual branches and points out some properties of the data set used in the paper. Section 4 then is devoted to exploring the pattern between technical efficiency and profitability with regard paid to the spatial aspect and continues with presenting the results. Finally, Section 5 summarizes the main results and draws the conclusions of the investigation.

2. Setting of Branch Performance Assessment in the Bank Concerned

The bank currently utilizes divers performance measures and quantitative analyses to asses the performance and to determine the strategic profile of individual branches in retail business. Never the less, the senior managers of the bank still feel that not all dimensions of performance are represented in their internal assessment and they wish to develop a comprehensive framework that would capture in a way most simple the complete retail performance profile of the bank's branches. These circumstances give the primary impetus for scrutinizing the relationship between the trio of variables of branch production: technical efficiency, profitability and the spatial characteristic. This section provides an insight into how technical efficiency and profitability are to be treated in performance assessment of the bank's branches and details on the spatial characteristic that may represent an influential environmental factor. This possibility stems from the fact that there are notable economic disparities across Slovakia and they are inevitably propagated into any regional classification.

Starting with the third variable of interest, the spatial characteristic is dictated by (i) the bank's internal classification of the bank's branches into nine regions and by (ii) the localization of the branches in the 79 official districts of Slovakia. Tables 1 and 2 list the nine regions and the 79 districts with the abbreviations adopted henceforth for their names in visual displays.

Table 1: The Adopted Notation for the Regional Affiliation of the Bank's Branches

Code	Region	Code	Region	Code	Region
BA_E	Eastern Bratislava	KE	Košice	TN	Trenčín
BA_W	Western Bratislava	NR	Nitra	TT	Trnava
BB	Banská Bystrica	PO	Prešov	ZA	Žilina

Source: authors´s compilation

The nine regions listed in Table 1 are not consistent with the official administrative division of Slovakia into governmental regions or self-governing higher territorial units. The territorial definition of some regions defined by the bank does not coincide and interferes with the territorial definition of the administrative division, which is perceivable as the internal classification was guided peculiarly by economic reasons rather than the administrative criterion. The situation is somewhat different for the districtual localization of the bank's branches as each branch can be placed uniquely with one particular district of the official administrative classification. Furthermore, each of the districts indicated in Table 2 falls into one particular region from Table 1 recognized by the bank. In other words, the internal classification of regions does not violate the districtual division of Slovakia.

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Table 2: The Adopted Notation for the Districts of Slovakia

Abbr.	District	Abbr.	District	Abbr.	District	Abbr.	District
BN	Bánovce nad Bebravou	KK	Kežmarok	NM	Nové Mesto nad Váhom	SO	Sobrance
BB	Banská Bystrica	KN	Komárno	NZ	Nové Zámky	SN	Spišská Nová Ves
BS	Banská Štiavnica	KS	Košice - okolie	PE	Partizánske	SL	Stará Ľubovňa
BJ	Bardejov	KE I	Košice I	PK	Pezinok	SP	Stropkov
BA I	Bratislava I	KE II	Košice II	PN	Piešťany	SK	Svidník
BA II	Bratislava II	KE III	Košice III	PT	Poltár	SA	Šaľa
BA III	Bratislava III	KE IV	Košice IV	PP	Poprad	TO	Topoľčany
BA IV	Bratislava IV	KA	Krupina	PB	Považská Bystrica	TV	Trebišov
BA V	Bratislava V	KM	Kysucké Nové Mesto	PO	Prešov	TN	Trenčín
BR	Brezno	LV	Levice	PD	Prievidza	TT	Trnava
BY	Bytča	LE	Levoča	PU	Púchov	TR	Turčianske Teplice
CA	Čadca	LM	Liptovský Mikuláš	RA	Revúca	TS	Tvrdošín
DT	Detva	LC	Lučenec	RS	Rimavská Sobota	VK	Veľký Krtíš
DK	Dolný Kubín	MA	Malacky	RV	Rožňava	VT	Vranov nad Topľou
DS	Dunajská Streda	MT	Martin	RK	Ružomberok	ZM	Zlaté Moravce
GA	Galanta	ML	Medzilaborce	SB	Sabinov	ZV	Zvolen
GL	Gelnica	MI	Michalovce	SC	Senec	ZC	Žarnovica
HC	Hlohovec	MY	Myjava	SE	Senica	ZH	Žiar nad Hronom
HE	Humenné	NO	Námestovo	SI	Skalica	ZA	Žilina
IL	Ilava	NR	Nitra	SV	Snina		

Source: authors´ compilation

In addition to the internal territorial classification, the branches are internally categorized according their size into branches of Type I to Type IV. The size of a typical Type I to Type IV branch can be expressed by dint of the number of the employees who perform their job tasks at the respective branch. Type I branches usually employ about 20 employees, Type II branches have typically from 10 to 19 employees, whereas Type III branches frequently report from 4 to 10 employees. Type IV branches are small outlets with ancillary (or perhaps more precisely societal) functions and are not run with more than 3 employees. For comparability, these employee numbers are stated in full-time equivalents and comprise only qualified manpower (excluding thus outsourced employees with supportive functions). This size categorization is essential for managing the bank's branches from the headquarter since it captures the hierarchy of functions in the vertical organization of the bank. Whilst, on the one hand, the influence of this categorization upon branch technical efficiency and profitability is not examined in this present paper; on the other hand, it must be somehow taken into account in modelling the production process of the bank's branches. This step is inevitable for technical efficiency considerations and estimation.

The senior managers view the bank's branches as production facilities whose main and distinctive function is to provide banking services and sell the bank's products (irrespective of whether they are produced straight by the bank itself or only intermediated). In this provision of banking services, some inputs are needful for branches to operate and they are expended in some relation to output banking services. In a multiple-input multiple-output production, which a bank branch production is, it is advisable to evaluate the relationship between the volume of consumed inputs and the volume of produced outputs in a context of technical efficiency. This term refers to a situation when the maximum outputs are produced from the minimum quantities of inputs (whereas it is not

possible to attain a higher production of at least one output form the same quantities of inputs, and – vice versa – to achieve the same outputs with less of one or more inputs without increasing the quantities of other inputs. It is the utter desideratum of the senior managers to investigate technical efficiency of the bank's branches at the level which is controllable by individual branch managers. Therefore, only inputs that are under control of branch managers are specified in the production model of the bank's branches, which also entails that branch performance assessment is rather branch manager performance assessment. Incidentally, such a formulation of the production process can aslo be found also elsewhere in the literature (e.g. LaPlante and Paradi, 2015). Branch managers do not decide on the location of their branches, on their equipment or on the outsourcing of support services, but they have sufficient competences to hire labour force and manage it towards a higher provision of banking services. The input-output set thus includes labour force (on the side of inputs) and comprises deposits taken, loans granted and mutual fund shares intermediated (on the side of outputs). Whilst deposits taken and loans granted are typical outputs that comply with the production approach, mutual fund shares intermediated overlap with the intermediation function of bank branches. Formally, mutual fund shares are sold on behalf of the bank's sister company that is engaged in financial asset management. Labour force is measured by yearly-average number of employees expressed as full-time equivalents and is considered as two inputs, managerial labour force and ordinary labour force. Managerial labour force relates to employees who perform managerial functions (managers), whilst ordinary labour force relates to branch employees who offer or provide services to customers or who perform support or administrative tasks (such as bank clerks, sellers or administrative employees). The three output variables are all monetary and are stated in thousand euro in accordance with their respective year-end amounts reported in financial statements. The described two-input three-output production model then underlies technical efficiency measurement at the level of the bank's branches. In measuring technical efficiency of individual branches, the non-oriented SBM model under the assumption of variable returns to scale is used. The non-orientedness trait of the model conforms to the fact that branch managers are capable of controlling and managing both the input and output side of retail branch production. The choice of the SBM model reflects the desire to measure technical efficiency in the sense of Pareto and Koopmans (see e.g. Boďa and Zimková, 2015), and this measurement is then accomplished in a more comprehensive way than common or basic DEA models. Finally, as direct proportional links between inputs and outputs can scarcely be anticipated in the case of bank branch production, it is variable returns to scale that are acceptable as a valid and reasonable assumption. The SBM model yields for each bank branch in the sample an efficiency score (i.e. an estimate of the true value of the SBM) from the interval [0,1]. The value of one therein signifies that the concerned bank branch operates technically efficiently, and it cannot improve further on the quantity of labour force used or the amounts of services produced without affecting its production negatively. The technical details on the SBM model are well described in the paper by Tone (2001) who gave it a solid theoretical foundation.

In this present case, technical efficiency points to excellence or failure of branch managers to manage inputs and outputs in terms of quantities. Whereas the optimization of inputs and outputs in physical units is a natural part of the decision-making process at the level of bank branches, this approach ignores the monetary element of all this effort. This is rectified by considering profitability as a performance criterion that should be appended to technical efficiency and that links bank branch production to the short-term profit maximizing goal of the bank. Unlike technical efficiency that represents the technical aspect of bank branch operations, profitability is intended to capture the profit earning aspect of bank branch operations. Both of them are to be optimized and this task requires the knowledge on the information between them. Out of numerous choices, profitability of the bank's branches is defined as employee profitability and is expressed in the form of a simple indicator. This indicator, called here as the "profit index", is constructed as a ratio of the profit generated by the sale of banking services (net interest income plus fee income plus income from intermediation of mutual fund shares) and the number of employees who contributed to this profit. This indicator is aggregated at the level of individual bank branches and connects the input side of the production process with its output side. The input side is expressed in physical units as opposed to the output side which is measured in monetary units.

3. Measurement of the Technical Efficiency and Profitability of the Bank's Branches

This short section makes short methodological notes on measuring the technical efficiency and profitability of individual branches and provides some comments on the data sample used in the paper. The analysis in its entirety is conducted, and the graphical presentations contained in the paper are prepared, in program R (R Core Team, 2013) using the codes compiled by one of the authors.

It must be said first that on account of the specific function of Type IV branches, they are not considered in the paper. The omission of Type IV branches in this investigation correlates with the procedures applied in the bank internal assessment. The bank itself reviews Type IV branches separately from branches of the other three types using different metrics and criteria. Having excluded Type IV branches, the branch network of the bank counts a total of 184 branches. Amongst these branches, one Type III branch do not sell mutual funds shares owing to certain internal and organizational reasons. Hence, this branch reports a zero balance of mutual fund shares which is but in contradiction with the technical assumption of the non-oriented version of the SBM model that all input and output variables be strictly positive. In consequence, only 183 branches are taken into analysis, out of which 19 are of Type I, 48 are of Type II and 116 are of Type III.

The data kindly provided by the senior managers of the bank for the purpose of this investigation date to the fiscal year 2014. As far as the inputs are concerned, managerial labour force and ordinary labour force are measured by the respective numbers of employees, which are expressed in full time equivalents and stated as yearly averages. In contrast, the three outputs – total deposits, total loans and mutual fund shares intermediates – are measures in thousand € as they are reported as of 31 December 2014 (the annual balance sheet date terminating the fiscal year 2014). The data on the five production variables mirror the diverse size of branches of different types, but upon graphical exploration they give no indication that there is any anomaly or outlier at work.

This input-output set consisting of two inputs and three outputs is the basis for estimating a technical efficiency score for each branch of the bank. As clarified in Section 2, the non-oriented SBM model is employed to this end assuming variable returns to scale. This economic assumption is doubled by another and fairly logical economic assumption that each distinct branch type has its own specific production process, which is suggested not only by the different size of individual branch types but also by the existence of a hierarchical structure descending from Type I branches until Type IV branches. That is the reason that technical efficiency scores are estimated with the use of 19 data observations for Type I branches, 48 data observations for Type II branches, and eventually 116 data observations for Type III branches. The distribution of branches across the nine regions is reported in Table 3, which suggests that the regions recognized by the bank are relatively uniformly populated.

Table 3: The Number of Branches in the Individual Regions

Regional affiliation	BA_E	BA_W	BB	KE	NR	PO	TN	TT	ZA
Number of branches	17	18	22	24	19	22	19	21	21

Source: authors´ compilation

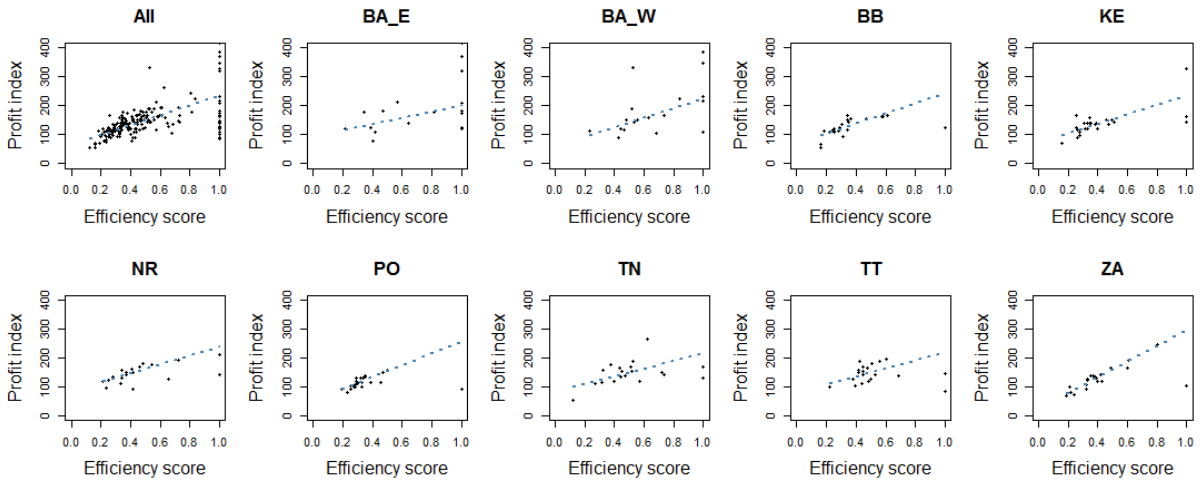
4. Investigation of the Relationship between Technical Efficiency and Profitability Considering the Spatial Aspect

In examinations of the existence of a link between the technical efficiency and profitability of the bank's branches with respect to the spatial aspect, it must be borne in mind that both performance criteria are measured by cardinal variates and the spatial aspect (either expressed as the regional affiliation or the districtual localization) is represented by a nominal variate. Naturally, to a great degree, traditional scatter analysis is equal to this task. Still, a better insight may be gained if technical efficiency and profitability are converted into ordinal variates by introducing meaningful and interpretable categories of values and are investigated in a set-up of contingency tables as is suggested by the fact that the spatial aspect takes form of nominal categories. This is fully reflected in the analysis to come. First, the linkage between technical efficiency and profitability is studied through scatter plots accounting for regional affiliation of branches. Then, correspondence analysis is used to examine the impact of regional affiliation upon both the ordinalized versions of technical efficiency

and profitability. Third, the spatial stratification of technical efficiency and profitability across the districts of Slovakia is further explored by cartograms.

Organized into 10 scatter plots, Figure 1 shows for all the bank's branches regardless of their regional affiliation ("All") and for the branches in the individual regions ("BA_E" to "ZA") the mutual relationship that exists between technical efficiency (plotted on the horizontal axis) and profitability (plotted on the vertical axis).

Figure 1: The Relationship between the Technical Efficiency[†] and Employee Profitability[§] of the Bank's Branches in the Individual Regions



Note: [†)] Captured by SBM efficiency scores. [§)] Expressed in thousand € per employee.

Source: authors´ compilation

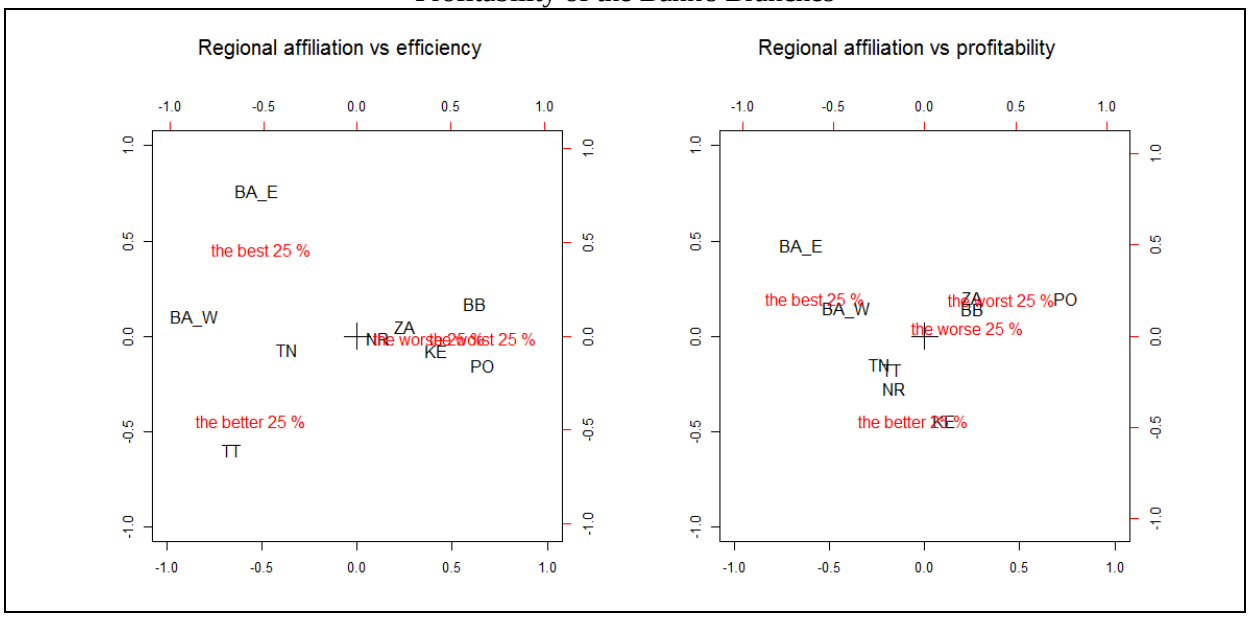
Each scatter plot in Figure 1 is equipped with a robust fit of the regression line (estimated using an M-estimator by iterated re-weighted least squares) indicating the direction of the relationship (the upward or nearly levelled-off orientation of the slope), the intensity with which profitability reacts to changes in technical efficiency (the magnitude of the slope) and assisting in judgments about the intensity of the relationship. The ten scatter plots point to the existence of a number of observations that would normally be termed as "outliers" or "influential observations". These observations are mostly caused by branches which attain full technical efficiency but they do not show excellence in profitability. In order to avoid their rotating the regression line and affecting its slope, they were removed prior estimating the regression line. A visual inspection attested the correctness of this methodological route as the resulting regression lines pass more closely through the trend suggested by the mass of observations. A change is discernible especially for the "BB", "KE", "PO", "TN" and "TT" regions. Despite the presence of some anomalous observations, it is apparent that employee profitability tends to be higher for higher technical efficiency. A positive relationship is manifest in each of the nine regions as well as for the entire sample.

In the further analysis, the technical efficiency scores and profit indices estimated or computed for the 183 branches were converted to ordinal variables by classifying the branches into four categories: "the worst 25%", "the worse 25%", "the better 25%" and "the best 25%". As suggested by the labelling, these categories were set up by means of quartiles. All though several options are conceivable, to make sure that the resulting categories are – in the highest degree possible – constructed in an objective way and sufficiently populated by branches, four categories were determined by means of the three cut-off values answering to the lower quartile, the median and the upper quartile. As a result of this ordinal transformation, 46 branches were designated as "the worst 25%" if their technical efficiency scores were from [0.122, 0.32], 46 branches were labelled as "the worse 25%" if their scores ranged in (0.32, 0.414], 45 branches were assigned as "the better 25%" if their scores fell into (0.414, 0.564] and as "the best 25%" for scores in (0.564,1]. Concerning profitability, 46 branches with profit indices in [55.2, 116] were classified as "the worst 25%", other 46 branches with profit indices in (116, 135] were labelled as "the worse 25%", 45 branches having

profit indices from (135, 163] were tagged as "the better 25%" and the remaining 46 branches were tagged as "the best 25%" for profit indices ranging in (163, 415].

In order to examine the effect of regional affiliation on the two performance characteristics under scrutiny, the bank's branches were cross-tabulated according their regional affiliation and ordinalized technical efficiency as well as according to their regional affiliation and ordinalized profitability. These two contingency tables were analyzed in the framework of correspondence analysis whose results are exhibited in Figure 2 and Table 4. In this analysis the procedure described in Venables and Ripley (2002, pp. 326-328) was obeyed. Whereas Figure 2 presents the resultant symmetric correspondence maps, Table 4 appends some useful statistics for measuring how the technical efficiency and profitability of the bank's branches are influenced by their regional affiliation. The coefficients of association in Table 4 are suggestive that regional affiliation does exert some influence, and that this influence is stronger in the case of technical efficiency. Also the higher value of the first canonical correlation points out that the interrelationship between regional affiliation and technical efficiency is stronger, and this can also be employed in assessing the strength of correspondence revealed in the correspondence maps in Figure 2. Notwithstanding, the two dimensions of the correspondence map for profitability explain a somewhat greater percentage of inertia than the other correspondence map.

Figure 2: The Correspondence between the Regional Affiliation and Technical Efficiency / Profitability of the Bank's Branches



Source: authors´ compilation

The correspondence maps confirm that (1) the two Bratislava regions ("BA_E" or "BA_W") are superior in both technical efficiency and profitability as they count the bank's branches that belong to the best performers, and that (2) the "BB" and "PO" regions dominate with worse performing branches in terms of both technical efficiency and profitability and the "ZA" region is amongst them as far as profitability is concerned. As to the other regions, in view of technical efficiency, the "TT" region seems to be populated with fairly good performing branches ("the better 25 %) and the "NR", "ZA" and "KE" regions house braches that show rather worse performance ("the worse 25 %" and "the worst 25 %"). Regarding profitability, the bank is represented in "TN", "TT" and "KE" regions with rather profitable branches.

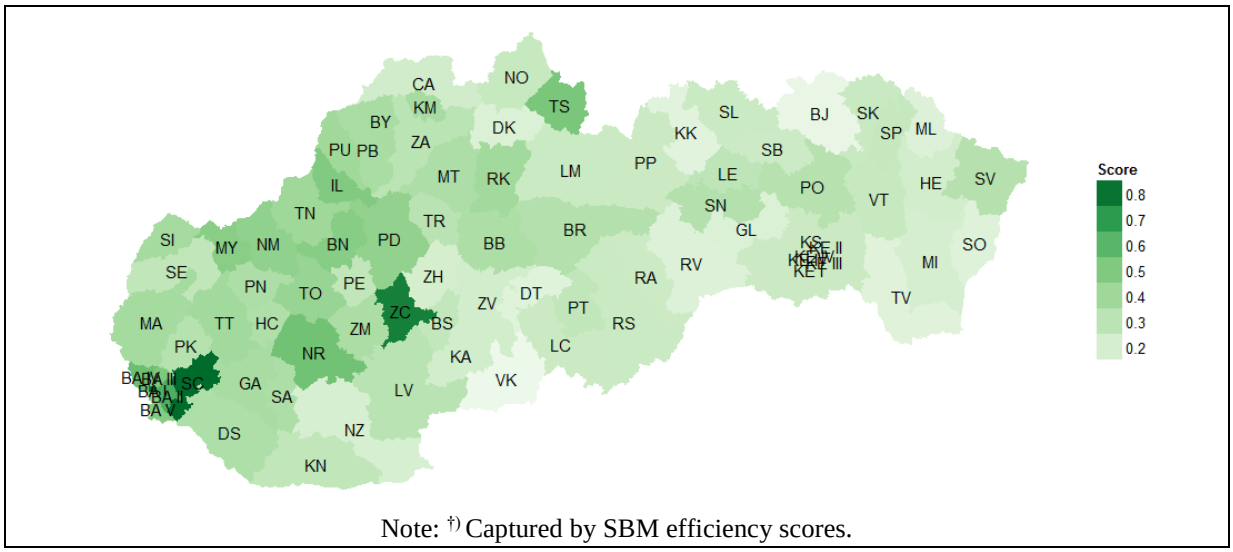
Table 4: The Descriptives of the Correspondence between the Regional Affiliation and Technical Efficiency / Profitability of the Bank's Branches

Variables	Coefficients of association			First canonical correlation	Explained inertia
	φ	Pearson's	Cramér's V		
Regional affiliation vs efficiency	0.670	0.557	0.387	0.541	88.16 %
Regional affiliation vs profitability	0.484	0.436	0.280	0.388	95.79 %

Source: authors´ calculation

The spatial distribution of the technical efficiency and profitability of the bank's branches is more accurately demonstrated in the cartograms of Figures 3 and 4. For each of the 79 districts of Slovakia, they display simple averages of either indicator computed for the bank's branches residing in the respective district.

Figure 3: The Spatial Distribution of the Technical Efficiency† of the Bank's Branches in the Districts of Slovakia

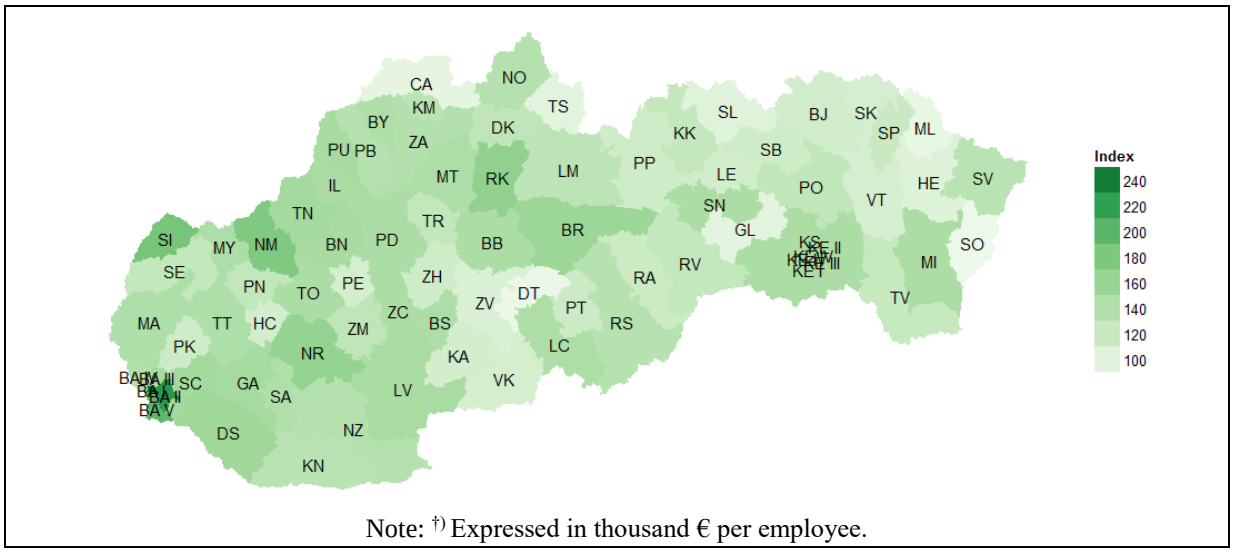


Note: †) Captured by SBM efficiency scores.

Source: the authors´compilation

The cartogram in Figure 3 reveals significant differences between the districts of Slovakia in the average level of the technical efficiency of branches. The lowest average level of technical efficiency in the provision of banking services was attained by the bank's branches in the districts Veľký Krtíš ("VK") and Bardejov ("BJ"), in either case lower than 0.15. These two districts alongside some other districts with a low average level of technical efficiency such as Kežmarok ("KK"), Trebišov ("TV"), Detva ("DT"), Sobrance ("SO"), Medzilaborce ("ML"), Revúca ("RV"), Košice – okolie ("KS") and Gelnica ("GL") belong to the least developed parts of Slovakia. On the contrary, the highest average level of technical efficiency was recorded by the branches in the districts Senec ("SC"), Bratislava I ("BA I") and Žarnovica ("ZC"), in each case higher than 0.80. The districts in which branches with a higher level of technical efficiency prevail are concentrated in Western Slovakia as the most economically developed part of Slovakia.

Figure 4: The Spatial Distribution of the Employee Profitability[†] of the Bank's Branches in the Districts of Slovakia



Note: [†)] Expressed in thousand € per employee.

Source: the authors´compilation

A similar situation is with the profitability of the bank's branches whose spatial scatter all over the districts of Slovakia is displayed in the cartogram presented in Figure 4. It is the districts of the capital of Slovakia, Bratislava I ("BA I"), Bratislava II ("BA II") and Bratislava V ("BA V"), whose branches were most profitable relative to their labour force and they generated a profit of 200 thousand € or more per employee. They are followed by the districts like Skalica ("SI"), Nové mesto n. Váhom ("NM"), Ružomberok ("RK"), Nitra ("NR") or Brezno ("BR"), in which one employee produces an average profit between 156 and 184 thousand €. The worst performing districts with respect to average employee profitability were Sobrance ("SO"), Detva ("DT"), Medzilaborce ("ML"), Košice II ("KE II") and Čadca ("CA"), Tvrdošín ("TS") and Čadca ("CA"), in which the profit index did not exceed the margin of 100 thousand € per employee. All these are typical examples of economically underdeveloped districts of Slovakia.

5. Conclusion and Discussion

Focused on the well-established network of branches run by a certain Slovak commercial bank, the inclusion of technical efficiency and employee profitability into branch performance considerations in this analysis is perfectly intentional, and fully intentional is also the conducted investigation how these factors of branch performance vary with the spatial aspect (represented by regional affiliation or districtual localization). In the specified model of branch production customized to the needs of the commercial bank concerned, technical efficiency maps managerial capabilities of individual bank branch managers. Through a particular selection of the input-output set guided by the desideratum that production variables be fully controllable by branch managers, technical efficiency measurement of branches in point of fact stood in for technical efficiency measurement of managerial skills at the level of branches. Employee profitability then not only points to attractiveness of the local economic environment of the bank's branches, but is an unmediated indicator of employee capabilities to find customers for loans at the branch level. The reason being, loans are the principal source of earnings for bank branches. The logic of the model of production considered here for bank branches suggests that branch managers endeavour to optimize the resources that they use in the direction of a maximum production of banking services, but their optimization commences with decisions about physical quantities of inputs used and continues with attempts at maximum physical quantities of outputs produced. In this process, they manage input labour force in order to maximize output provision of loans and deposits as well as intermediation of mutual fund shares. Such a view is fully consistent with a number of quantitative criteria derived rather from volume variables (such as total deposits made or total loans granted) than from price variables (such as profits made from deposits or loans). Following the traditional model of performance assessment in retail banking, at the initial level

of internal assessment, branch managers are reviewed in terms of volumes, and only then in later stages their performance is scanned for how they contributed to profit generation. These subsequent stages are then reflected in the profit index designed here in the paper to measure employee profitability. This index measures the net effect of a branch's production relative to labour force used, in other words, the amount of profit per employee. It is constructed in such a way that it measures what is controllable by branch managers; whilst in it the side of outputs is monetary, the side of inputs remains in physical units (more precisely in full-time equivalents of employees). By the logic of optimization undertaken by branch managers, at its inception it is begun with technical efficiency and the result is translated into employee profitability. Therefore, a unidirectional link is expectable from technical efficiency and employee profitability. If this optimization is carried out successfully, (higher) technical efficiency implies (higher) employee profitability. Never the less, this link may be severed by a number of environmental factors representing anything outside the control of branch managers, and these are proxied in this study by the spatial aspect representing the local environment in which a branch is located. The spatial aspect is captured here in two levels: through the internal categorization of branches into nine categories defined by the bank (called here as regional affiliation) and via the localization of branches in the 79 districts of Slovakia (addressed here as districtual localization). The considerations then ensue that the spatial aspect may affect both technical efficiency and profitability of branches interfering thus with optimization at the level of branches, and may also affect the interrelationship between these two crucial variables. This is the investigation carried out here in the paper and facilitated the techniques of exploratory data analysis based on regression analysis (scatter plots), correspondence analysis (correspondence maps) and geonalysis (cartograms). It has not been made known to the authors that the relationship between technical efficiency and profitability was explored for bank branches with full regard given to the spatial aspect or that correspondence analysis or cartograms were employed to the selfsame or a similar end.

It is established through the analysis that there is a positive relationship between technical efficiency and profitability, and thus the bank's branches with a higher degree of technical efficiency tend to reveal a higher degree of profitability. The visualizations show that this relationship can be well approximated as linear, yet accompanied with a number of instances of branch performance that would assume the tag of outliers or influential observations, in the terminology of regression modelling. These instances are particularly cases when branches display full technical efficiency but their profitability defies the general tendency to increase with technical efficiency. This may be due to the property of the DEA estimation method to overestimate the true level of technical efficiency. In consequence, as technically efficient are labelled also branches that in fact do not display technical efficiency. None the less, there are differences in the relationship between regions manifested in the intensity with which profitability of branches respond to technical efficiency. In the "ZA" and "PO" regions profitability varies with technical efficiency with a greater intensity, which signals a recommended course for policy-making at the level of the bank: improvements on technical efficiency in the branches affiliated with "ZA" and "PO" regions can be immediately transposed into increased profitability.

Regional affiliation of the bank's branches is found to be a factor affecting their technical efficiency as well as profitability. The branches affiliated with the most developed regions of Slovakia, namely the two Bratislava regions ("BA_E" or "BA_W"), seem to display comparatively higher degrees of technical efficiency and profitability, whilst the branches affiliated with the economically underdeveloped "BB" and "PO" regions yield comparatively the worst performance in terms of both technical efficiency and profitability. On the one hand, this finding attributes a difficult-to-calculate portion of the technical efficiency and profitability displayed by the bank's branch managers to the environmental factors (viz. the regional affiliation) affecting the branches that they manage; and, on the other hand, it must be remarked therewithal that this observation is extracted from the information of too high a degree of aggregation. The aggregation of technical efficiency scores and profit indices at the level of regional affiliation discards sensitive and detailed information on the managing skills and optimization proficiency that is particular of individual branch managers. All the same, the legacy of this, perhaps crude analysis is, that the performance of branches (being in the formulated production model in the hands of branch managers) is actually affected by regional affiliation which may present an advantage to some branches whilst others may be disadvantaged.

That this statements is not of resolute validity is seen from the more detailed analysis elaborated in the paper by dint of cartograms, which reveals that individual managers have still much room to demonstrate their possibly extraordinary skills and put them to use in the process of managing their branches. If the focus is spotlighted to a lower level of the spatial aspect and the technical efficiency and profitability of the bank's branches is investigated at the level of districtual localization, then branch managers even in less developed and economically isolated districts of Slovakia manifest satisfactory or superior performance in terms of either technical efficiency or profitability (or both). Even so, it must be admitted that the general scheme is correlated with expectations – i.e. branches residing in somewhat economically or geographically disadvantaged and less developed districts Slovakia tend to show worse results in terms of both technical efficiency and profitability.

The exceptions to this scheme in terms of technical efficiency are e.g. the districts Žarnovica ("ZC"), Senec ("SC") or Tvrdošín ("TS"). Of interest is especially the district Žarnovica ("ZC") that neighbours with the district Žiar nad Hronom ("ZH"). In spite of the fact that the former district has a worse economic standing and less perspective conditions for economic development than the latter district (amongst others, the rate of unemployment is higher and the mean wage is smaller), the mean technical efficiency score is in Žarnovica ("ZC") about 0.80, in Žiar nad Hronom ("ZH") just 0.21. A similar situation of spatial paradoxes is recorder in the case of technical situation. The examples now include the districts Skalica ("SI"), Brezno ("BR") or Spišská Nová Ves ("SN"). Whilst the first two districts adjoin better developed and more aptly localized districts (such as Pezinok ("PK") or Banská Bystrica ("BB")), their performance in terms of profitability more favourable. The district Spišská Nová Ves ("SN") abuts the district Gelnica ("GL") and they both are rather equally economically disadvantaged and handicapped, yet Spišská Nová Ves ("SN") ranks in profitability to the top 20 branches of the bank whilst Gelnica ("GL") is the 7th worst branch of the bank in respect of this performance criterion.

All in all, this points to the fact that technical efficiency and profitability (and perhaps other performance criteria) of bank branches cannot be solely ascribed only to the economic power of their local environment, but a number of other factors must be at play – such as the expertise of management and branch employees, the position of the bank in a wider area or the serviceability of large corporate customers in the given district. As long as technical efficiency is considered, a secondary consequence is that this criterion is a very appropriate indicator for assessing managerial skills and expertise and might be safely incorporated as an input to an internal rating system of branch performance for its ability to distinguish in this respect. Technical efficiency scores may thus be utilized in monetary stimulating the best performing branches or in developing corrective policy strategies in managing the worst performing ones.

It is only strange that – to the best knowledge of the authors – correspondence maps as well as cartograms, in the face of their compelling evidential value, have not been used in a study of the sort.

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