MEASURING SOCIAL RESPONSIBLE BANKS' EFFICIENCY AND PRODUCTIVITY – A NONPARAMETRIC APPROACH[1]

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Abstract

The paper investigates a sample of commercial banks that voluntarily and publicly committed to becoming promoters of sustainability in the financial industry, by applying in their regular banking activity a set of principles related to environmental and societal responsibility.

To assess the individual financial profile of these banks and the similarities in terms of business behavior it has been performed several steps. First, it has been computed the descriptive statistics of key financial indicators, namely the market share, the liquidity position, the financial structure, the operational efficiency, profitability, capital adequacy and the individual contribution of each bank to the domestic financial depth. Secondly, to proxy the performance in achieving their objectives, it has been employed the Data Envelopment Analysis nonparametric technique to estimate the relative efficiency scores. Two models' configurations have been tested, in the assumption of a financial intermediation approach and respectively profit efficiency approach. Then, to gain a comprehensive and dynamic picture, it has been computed the Malmquist productivity index in order to illustrate not only socially responsible banks' productivity's changes over time but also the main sources of changes, in terms of catch-up effect and technological progress.

Keywords: *sustainable bank, social and environmental responsibility, Data Envelopment Analysis, efficiency frontier, Malmquist index*

1. Introduction

Financial industry representatives, practitioners and academia agree that, at present, we are all witnessing momentum in sustainable banking. Mainstream banking business behavior is recording a continuous shift and re-assessment toward increased social and environmental awareness and responsibility. This trend overlaps on the sustainable and inclusive economic growth actively promoted by the European Commission and the process of countries' rethinking of regional development (Davidescu, Strat 2014).

At the origin sustainable banks are traditional, commercial banks that have started to make steps toward implementing several sustainability or social responsibility criteria in their business model, especially in terms of lending decision making. Their common

denominator is the public communication related to their new focus on relationship banking, in which customer centricity is a key attitude.

Sustainable banks' top management has become aware of the direct and tight interdependencies between financial intermediaries' long term business ongoing and viability and its contribution towards economic development, healthier environment and societal wellbeing. Consequently, their stated mission is twofold: maintaining banks financial position, soundness and stability, and at the same time meeting customers' needs and environmental objectives, by adapting banking products and services offering to responsible criteria. It is acknowledged the special role to play both in the global financial industry field, as well as in local, domestic economy and community.

The present paper extends the qualitative research performed in a previous one (Boitan, 2014), that aimed at investigating through an analytical analysis the main international sustainability frameworks and principles that worldwide financial institutions could join, on a voluntary basis. The aim of that paper had been to assess, through a country-by-country survey, where contemporaneous European Union's banking industry stands within the broad sustainability stream and which is the most widespread sustainable standard across the European Union's banks.

The paper found out that 16 countries out of the 28 EU member ones comprise at least one conventional bank that voluntarily adhered to different widespread sustainability frameworks. By restricting the analysis to banks that joined several sustainability frameworks, it has been uncovered a sample of 13 European banks that committed to align their activity at the same three sustainability standards, simultaneously (Equator Principles, the United Nations Global Compact and the United Nations Environment Program Financial Initiative).

The aim of the present paper is to perform an in-depth, bank-level empirical analysis so as to investigate whether these particular 13 sustainable banks depict common features of their business models, as a result of adhering to the same guiding frameworks or on the contrary have strategy specificities.

The paper is structured as follows: part one summarizes the features of the 13 sustainable banks, in terms of their individual financial profile. Part two describes the research hypotheses and employs the Data Envelopment Analysis non-parametric approach to assess the individual degree of efficiency in fulfilling the fundamental financial intermediation role. The third part computes the Malmquist productivity index for each sustainable bank and decomposes it in two components. Last part concludes.

2. Overview of sustainable banks' individual financial profile

The three international sustainability frameworks directly related to financial industry are represented by the United Nations Environment Program – Financial Initiative (UNEP FI) whose aim is to increase banks' understanding and monitoring of environmental issues, as well as to estimate the exposure to environmental risks, the United Nations Global Compact which requires its signatory members to adopt a set of core principles in the areas of human rights, labor standards, the environment and anti-corruption and the Equator Principles, which are applied for investment projects that exceed the value of USD 10 million, are relate to identifying, assessing and managing environmental and social risks.

Their common denominator is the fundamental goal of encouraging financial industry to implement socially responsible behavior, as well as the requirement for greater

transparency and regular reporting related to the progress achieved in implementing these principles. In addition, the frameworks have a complementing nature. Consequently, banks that decide to sign the statements of several sustainability frameworks have to mandatory commit at fulfilling them and aim at transmitting a message of increased responsibility and transparency.

By analyzing the signatory financial institutions of these most widely adopted international sustainability frameworks, it have been identified 13 European commercial banks that committed, on a voluntary basis, to implement in their current activity the standards and principles of increased social and environmental awareness. Figure 1 illustrates the geographical spread of these sustainable banks across EU countries. Banking systems in UK and Netherlands comprise each a number of three sustainable banks, France, Italy and Sweden have 2 sustainable banks while Portugal only one.

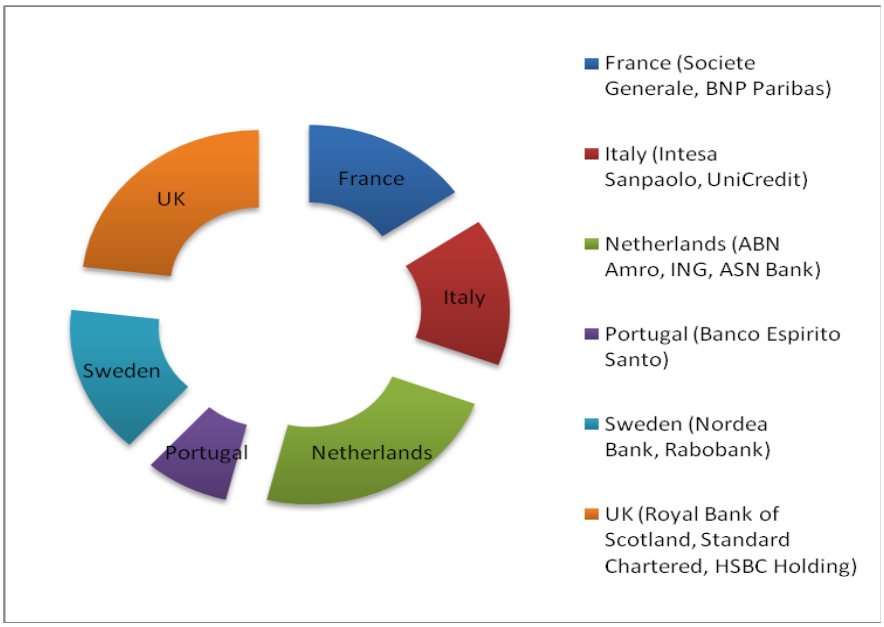

Figure 1. Sustainable banks' country of residence
Source: Boitan (2014)

To gain a comprehensive insight into the financial profile of each bank above mentioned, it have been computed several financial ratios, namely: the market share, the liquidity position, the financial structure, the operational efficiency, profitability, capital adequacy and the individual contribution to the domestic financial depth. The source of data are banks' annual financial statements at end 2013, European Central Bank's Statistical Data Warehouse (the aggregated balance sheet of euro area monetary financial institutions, at December 2013) and Eurostat statistics database (GDP at market prices in millions euro, at end 2013).

The market share hold by a sustainable bank in the banking system of the origin country is represented by the ratio of bank's total assets in domestic banking system's total assets. The liquidity indicator has been proxy by the ratio of loans to customers in total deposits attracted from customers. The financial structure has been assessed by means of two ratios: customer loans to total assets and the share of customers' deposits in total liabilities. Operational efficiency has been computed as a cost to income ratio, capital adequacy is represented by the tier 1 ratio while profitability by two indicators: return on

equity (ROE) and return on assets (ROA). The ratio of a bank's total assets in the GDP of the resident country was computed to measure sustainable banks' individual contribution to the domestic financial depth.

The primary descriptive statistics have been illustrated in the table below.

Table 1. Descriptive statistics

	ROA	ROE	Tier 1	Loans/ Deposits	Loans/ Assets	Deposits/ Assets	Cost/ Income	Market Share	Assets/ GDP
Mean	0.57	5.73	13.28	109.96	53.55	49.77	64.35	18.78	76.22
Maximum	4.1	16.7	21.7	170.59	95.78	94.13	99.04	46.13	179.311
Minimum	0	0	9.4	72.85	27	27.903	49.21	0.46	1.78
Standard deviation	1.09	5.12	3.35	26.00	17.80	16.90	15.47	11.86	49.44
Skewness	2.90	0.52	1.18	0.71	0.81	1.19	1.10	0.71	0.67
Kurtosis	9.99	2.61	4.01	3.43	3.60	4.81	3.12	3.46	2.78

Source: computations using the Eviews software, Boitan (2014)

Standard deviation provides important clues on data features. According to economic theory, it measures the dispersion of a variable's values around its mean. Large values of the standard deviation suggest that data is spread out over a large span of values or the presence of extreme, outlier values. Standard deviation recorded its highest values in the case of total assets to GDP (49.44), followed by loans to deposits ratio (26). Consequently, during 2013 these variables have fluctuated most across the sample of 13 sustainable banks. The four variables that proxy the financial structure, the market share and the operational efficiency show moderate fluctuation between the minimum and maximum values. The smallest variation across banks has been recorded by ROA, with 1.09 followed by Tier 1 with 3.35 and ROE with 5.12. ROA, tier 1 and deposits to assets are leptokurtotic, meaning that the likelihood of an extreme value to occur is higher than if the variable would have had a normal distribution, while all remaining variables depict a kurtosis around 3. The three previously mentioned variables depict an asymmetric distribution with positive skewness, while all other variables record skewness around zero, depicting relatively symmetric distribution.

In respect of the variables that depict sustainable banks' positioning in the domestic banking system and their individual contribution to country's financial depth, raw data show that, irrespective the indicator chosen (market share or total assets in domestic GDP ratio) banks' hierarchy is the same. The highest values are recorded by ING in Netherlands, followed by Nordea Bank and Rabobank, both located in Sweden.

The variables depicting banks' micro features in terms of business strategy and risk profile are relatively heterogeneous. The liquidity indicator and the operational efficiency fluctuate most across the 13 banks, for both of them the minimum values being recorded by HSBC Holding from UK. It is a favorable financial position, as the liquidity indicator is situated at a moderate, comfortable level, the bank not being exposed to liquidity constraints on short to medium term, and the operational costs do not erode the operational income (costs represent almost 50% of operational revenues).

The two complementing indicators related to banks' balance sheet financial structure (loans to assets and deposits to liabilities ratios) record similar values across the sample of banks considered. The lowest levels for both variables (27%, respectively 27.903%) are depicted by Societe Generale in France, while the highest (95.78%, respectively 94.13%) by ASN Bank in Netherlands. This striking difference is a direct consequence of the business model implemented by each of the two banks: the one in Netherlands has as main source of funds the deposits collected from customers and as main use of these funds the loans granted. The one in France has diversified its sources of financing as well as their uses, a fact that explains the low reliance on the two basic banking products (Boitan, 2014).

3. Nonparametric estimation of efficiency

As the sustainable banks in the sample have committed to be more aware and sensitive to local community needs and environmental challenges, the first research direction is to evaluate the manner in which the fundamental financial intermediation role is fulfilled, by assessing their individual degree of efficiency.

It has been employed a nonparametric Data Envelopment Analysis (DEA), to calculate relative efficiency. At the core of this method is the solving of a linear programming problem. The outcome is the computation of efficiency scores, to empirically assess the performance of a given financial unit, and the construction of a best practice or efficiency frontier. In respect of the analytical form of the production function, one of the advantages of DEA is that it does not require an a priori hypothesis; it simply determines the production function by applying minimization or maximization techniques on the available data (Scippacercola, Sepe 2014).

According to the broad literature devoted to DEA, it is argued that the state of inefficiency is caused by the management, but it can be controlled and corrected. Consequently, DEA methodology appears to be related on the microeconomic concept of efficiency and the microeconomic view of production functions (Ferreira 2011, p.7).

The efficiency frontier is composed by all the best-practice input and output combinations. All banks that reached a score of 1 lie on the frontier and are called efficient meanwhile the others are perceived as inefficient. The amount of inefficiency for each bank can be computed by simply subtracting the score obtained from 1.

A peculiarity of DEA is the relative efficiency scores it provides, which means that a bank is qualified as efficient only in relation to those already included in the sample. In other words, it is possible that this fully efficient bank become inefficient when expanding the initial sample. Thus, the results obtained cannot be extrapolated to wider samples. However, in the viewpoint of Repkova (2014), this DEA feature might prove a useful decision-making tool for benchmarking different entities included in a sample.

Our study is not affected by this drawback, as the sample comprises all the sustainable banks. The study relies on an output-oriented model, thus the DEA model's mathematical configuration is :

$$max\ \theta = \alpha + s + e \quad (1)$$

$$\sum_k \mu_k\ y_{ik} = \alpha y_{i0} + s_i\,,\quad i = 1, 2, \ldots . I \quad (2)$$

$$\sum_k \beta_k\ x_{ik} = x_{j0} - e_j\,,\quad j = 1, 2, \ldots . J \quad (3)$$

$$s_i \geq 0,\ \ i = 1, 2, \ldots . I \quad (4)$$

$$e_j \geq 0,\ j = 1, 2, \ldots . J \quad (5)$$

$$\beta_k,\ \mu_k \geq 0,\ k = 1, 2, \ldots . . n \quad (6)$$

where:

θ = the relative efficiency score of each bank in the sample

n = the number of banks in the sample

I = the number of output variables

J = the number of input variables

μ = the weight of each output variable, belonging to each bank

β = the weight of each input variable, belonging to each bank

y = vector of output variables

x = vector of input variables

α = parameter that shows the amount by which the vector of output variables increases, in the hypothesys of relatively constant inputs

s = parameter depicting deficiences in achieving the output *i*

e = parameter depicting the excessive use of input *j*

It will be tested two DEA output-oriented models, in the assumption of an intermediation approach, respectively of a profit approach. In the intermediation approach banks act as mediators between the demand and the offer of money, between savers and investors.

Due to sample-size constraints, the models to be tested are single input-single output. The selection of variables is grounded on the theory of bank behavior, in terms of a producer of banking products and services or as an intermediary. In respect of the profit efficiency approach, Morita and Avkiran (2009) argue that expert knowledge or generally accepted practices can be useful in selecting the suitable variables.

In the following it has been tested two DEA models, named M1 and M2. Model M1 reflects the intermediation approach and consists of total deposits collected from customers as input variable and total loans provided to customers as output variable. Model M2 corresponds to the profit efficiency approach and comprises interest expenses as input variable and interest income as output variable. Both models have been estimated under the output orientation, in order to highlight banks' potential for increasing or optimizing the amount of outputs given the same level of inputs.

The distance between each bank and the production frontier has been computed through the radial distance or Debreu-Farrell-measure, as its interpretation is intuitive, by depicting the necessary improvements when all relevant variables are improved by the same factor equiproportionally.

For the empirical study it has been employed bank-level data on 13 sustainable banks across Europe, the analysis being run for each year in the time span 2007 – 2013.

Table 1 synthesizes the main conclusions obtained by running the DEA method. M1 represents the first research hypothesis (an output oriented model, financial intermediation approach) and M2 is the output oriented model, in the profit efficiency approach.

Table 1. Summary of results obtained

Year	DEA model	Number of efficient banks	Average efficiency score	Standard deviation of efficiency scores
2007	M1	1	184.26%	1.18
	M2	1	143.07%	0.29
2008	M1	1	200.03%	1.63
	M2	1	138.70%	0.26

Year	DEA model	Number of efficient banks	Average efficiency score	Standard deviation of efficiency scores
2009	M1	1	216.14%	1.75
	M2	1	169.63%	0.44
2010	M1	1	201.69%	2.04
	M2	1	163.97%	0.47
2011	M1	1	216.54%	2.02
	M2	1	166.11%	0.49
2012	M1	1	205.10%	1.87
	M2	1	174.54%	0.53
2013	M1	1	169.94%	0.44
	M2	1	182.13%	0.58

Source: author's computation by means of EMS software

By running both models, in each year during 2007 – 2013 periods, the findings show that a single socially responsible bank had achieved the status of full efficiency. Hence, the production frontier is different for each year considered. On average, the highest inefficiency has been observed for the intermediation approach (model M1), where the presence of outlier scores has been more pronounced. The average inefficiency increased gradually from 2007 to 2009, a time span that overlaps on the financial crisis onset, recorded a small decrease in 2010, then in 2011 arrived at the same level as in 2009. Further it entered on a decreasing path, the lowest inefficiency being recorded in 2013.

Model M2 that illustrates the profit efficiency approach, in other words the manner in which banks succeeded to manage interest expenses so as not to erode interest income and achieve a satisfactory net interest margin, had been relatively more stable than the preceding one. The values of the standard deviation indicate that the efficiency scores estimated are closer to the sample's efficiency mean. The lowest average inefficiency has been recorded in 2007 and 2008, while the highest values belong to 2012 and 2013 years.

The figures 2 and 3 provide a disaggregated picture of the efficiency scores' evolution in each year considered and for each socially responsible bank.

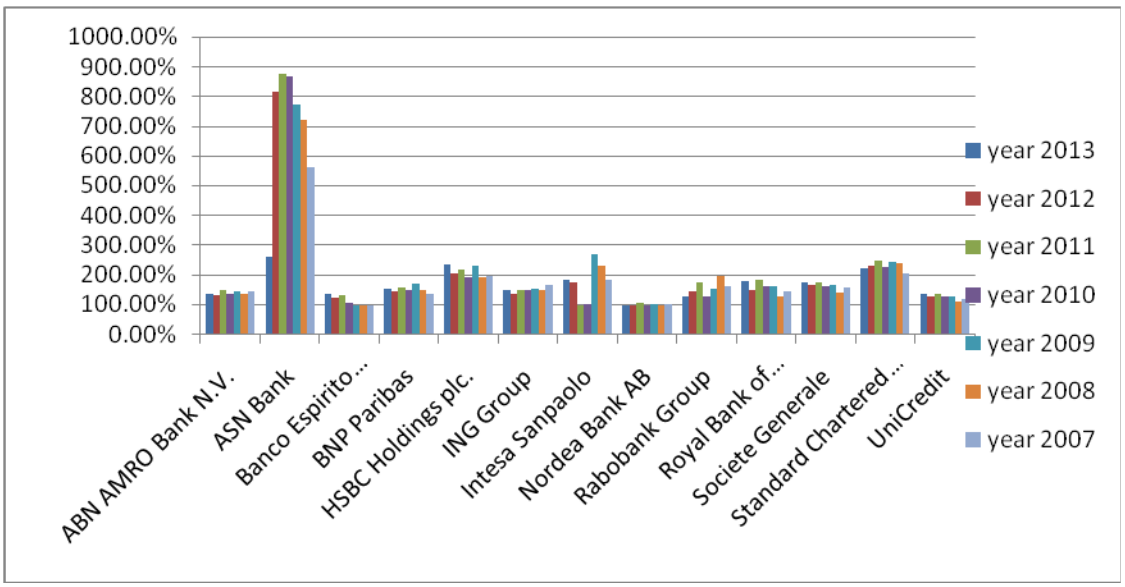

Figure 2. Efficiency trends under model M1

Source: author

A noticeable trend has been recorded by ASN Bank from Netherlands, with huge inefficiency during 2007 – 2012 (varying from a score of 564% to 873%). At end-2013 the inefficiency decreased sharply, to a level of 265%. The explanation of bank's inability in fulfilling its intermediation function lays in its balance sheet peculiarities. The bank depicts a prudent, risk-averse lending strategy, as the deposits collected from customers exceed the amount of loans provided.

HSBC Holdings and Standard Chartered Bank, both from UK, had a relative steady state of inefficiency, of around 200% during the entire period. Most remaining banks recorded lower inefficiency levels that gravitate more closely to the 100% benchmark.

Each year, the efficiency frontier is composed by one bank. In 2007 and 2009, Banco Espirito Santo from Portugal recorded 100% efficiency; in 2011 Intesa Sanpaolo Bank from Italy positioned itself on the frontier. The most efficient bank, from the viewpoint of the financial intermediation role accomplished, is Nordea from Sweden as it positioned most on the best practices frontier (in 2008, 2010, 2012 and 2013). Also, in the other three years considered, it recorded very low, almost negligible levels of inefficiency.

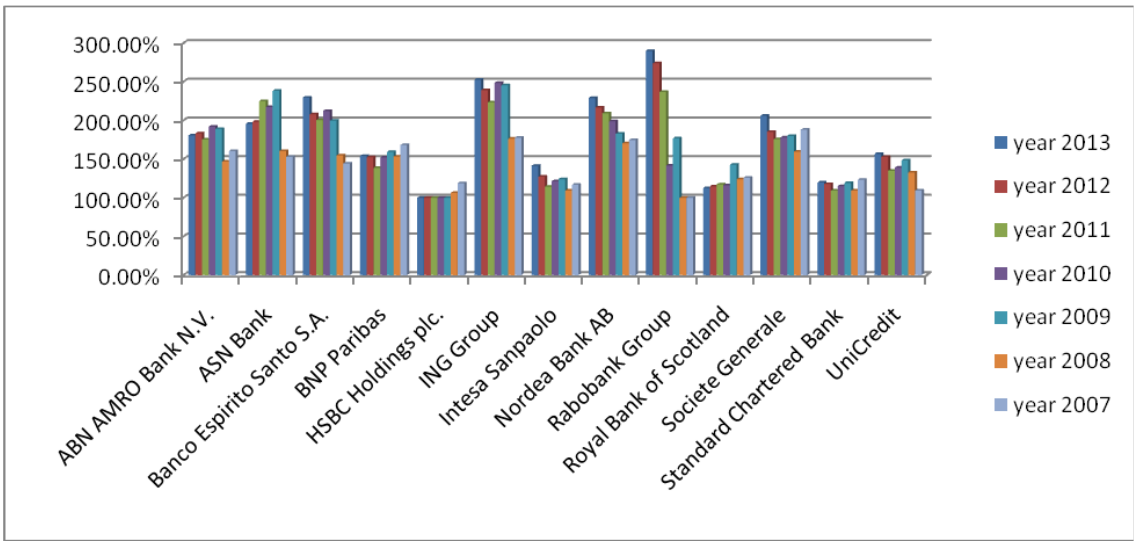

Figure 3. Efficiency trends under model M2
Source: author

From a profit efficiency standpoint, the state of inefficiency is relatively balanced across most banks. Three banks (Intesa Sanpaolo, Royal Bank of Scotland, Standard Chartered Bank) recorded scores in the vicinity of the 100% threshold. The efficiency frontier comprises Rabobank Group from Sweden in 2007 and 2008, while the entire period between 2009 and 2013 is dominated by HSBC Holdings in UK. By looking at its income statements, interest expenses amount to less than half of interest revenues.

4. Productivity assessment

The basic indicators for measuring productivity are usually represented by output/input ratios. However, these indicators provide a static snapshot, at a given moment in time, without providing clues on the leading factors that trigger changes in productivity level. Malmquist productivity index represent a reliable alternative to the traditional

approach, as it depicts not only the productivity's changes over time but also the sources of changes.

An extension of DEA method is to compute Malmquist indices based on bank panel data, to estimate total factor productivity and to decompose it in two components: technical efficiency change (catch up effect) and technological progress, for each bank in the sample. The first step in computing a Malmquist index is the estimation of distance functions, by means of DEA, under different time periods technologies.

In this paper it has been employed the formula proposed by Caves, Christensen, Divert (1982) because it is suited for the output oriented models (one of the assumptions of this study).

$$M_{t,t+1}(y^t, y^{t+1}, x^t, x^{t+1}) = \left[\frac{D^t(y^{t+1}, x^{t+1})}{D^t(y^t, x^t)} \times \frac{D^{t+1}(y^{t+1}, x^{t+1})}{D^{t+1}(y^t, x^t)} \right]^{1/2} \quad (7)$$

where:

$M_{t,t+1}$ = Malmquist productivity index during t and t+1period

y^t, y^{t+1} = output vectors at t, respectively t+1 period

x^t, x^{t+1} = input vectors at t, respectively t+1 period

D^t, D^{t+1} = distance function based on period t, respectively t+1 technology

The first ratio is computed for moment t and measures the productivity change during the t, t+1 period, having as reference point the technology in period t. The second ratio reflects the productivity at t+1 moment, having as benchmark the technology of t+1 period. Values that exceed the threshold 1 indicate productivity growth, meanwhile a value lower than 1 depicts productivity regress. When the Malmquist index equals 1, it is assumed that there is no change in the productivity level.

According to Fare et al. (1989), to better outline the two components of the Malmquist index, the basic formula could be rewritten as follows:

$$M_{t,t+1}(y^t, y^{t+1}, x^t, x^{t+1}) = \frac{D^{t+1}(y^{t+1}, x^{t+1})}{D^t(y^t, x^t)} \times \left[\frac{D^t(y^{t+1}, x^{t+1})}{D^{t+1}(y^{t+1}, x^{t+1})} \times \frac{D^t(y^t, x^t)}{D^{t+1}(y^t, x^t)} \right]^{1/2} \quad (8)$$

where:

$\frac{D^{t+1}(y^{t+1}, x^{t+1})}{D^t(y^t, x^t)}$ represents the technical efficiency change or the catch-up effect. It indicates the extent to which the estimated distance might vary between the observed production frontier and the maximum potential production frontier during the period t, t+1.

$\left[\frac{D^t(y^{t+1}, x^{t+1})}{D^{t+1}(y^{t+1}, x^{t+1})} \times \frac{D^t(y^t, x^t)}{D^{t+1}(y^t, x^t)} \right]^{1/2}$ represents the technological change and indicates the amplitude of the production frontier's shift, as a consequence of technology developments.

Technological efficiency, which is deemed to cause frontier shifts, might be attributed to several developments of banking activity, directly or indirectly driven by information technology, such as the diversification of financial services supplied to customers (electronic payments, internet banking, self banking, e-banking, mobile banking), the improvement of back-office activity, by using economic and statistical models to evaluate the credit, liquidity, market and operational risks and sophisticated, rigorous scoring techniques and discriminant analyses to decide whether to finance or not the credit demands (Dardac, Boitan 2008).

According to Berger (2003), the economic effects of employing financial and software technologies on banking system's productivity consist of improving the quality of banking products and services and extending their range, increasing the processing speed of banking regular operations, and last but not least enhancing the degree of satisfaction felt by clients. On the other hand, costs incurred by the acquisition and use of software techniques, as well as those required by employees' training are a debated issue. Some banks might choose to bear them entirely, while others might be tempted to transfer a fraction of them to customers. However, it is difficult to obtain an accurate, quantitative measure of technological efficiency.

Ho and Mallick (2006) have identified two ways information technology might improve bank performance, namely by diminishing operational cost and by facilitating transactions among customers sharing the same network. By reviewing and analyzing banking developments in the last 25 years, Frame and White (2009) concluded that it have occurred substantial changes in terms of new products or services and new production processes, due to financial innovations driven by technological change (e.g. subprime mortgage loans, online banking, asset securitization, credit scoring, bank risk management through value-at-risk and stress-testing tools). Saeed and Bampton (2013) argue that in developed countries, information and communication technology acts as an engine for challenges in modern banking, its effects being related to lowering costs, providing efficient banking services to customers and enhancing profits.

Figure 4 synthesizes Malmquist productivity evolution over the five years considered, for each bank in the sample.

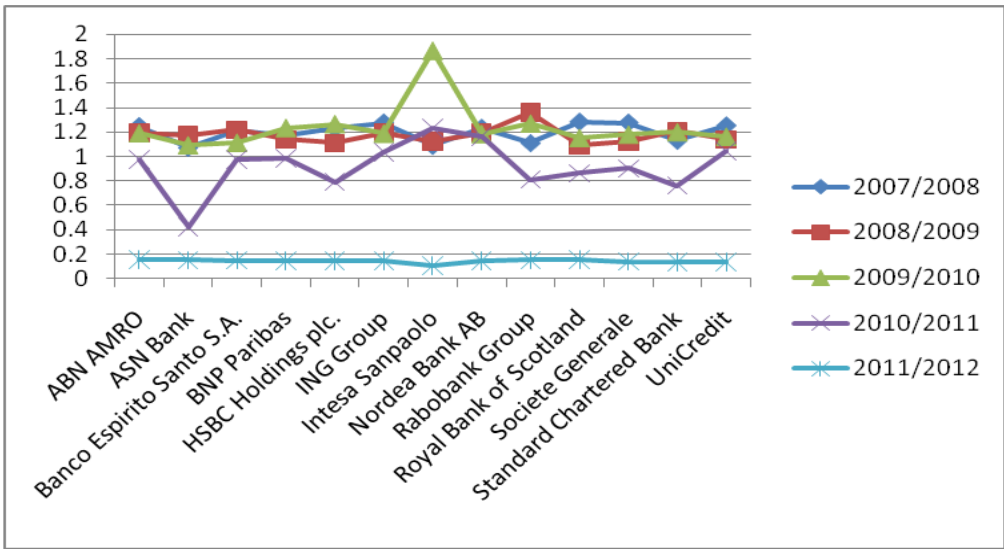

Figure 4. Malmquist productivity change
Source: author

During 2007 – 2010, individual banks' productivity fluctuated in the range 100 – 140%, depicting either no change in productivity level compared to the previous year or productivity gains. Productivity varied most in 2011 compared to 2010, most banks in the sample witnessing productivity declines between 58 percentage points (ASN Bank in Netherlands) and only 2 - 3 percentage points (ABN Amro in Netherlands, Banco Espirito Santo in Portugal and BNP Paribas in France). In 2012 relative to 2011 all socially responsible banks recorded a sharp productivity decline, of around 85 percentage points

(see table 2 for an aggregated picture on the number of banks depicting productivity increase, decrease or stagnation).

Table 2. Features of Malmquist indices – synthesis

	Banks with Malmquist > 1	Banks with Malmquist < 1	Banks with Malmquist = 1
2007 / 2008	13	0	0
2008 / 2009	13	0	0
2009 / 2010	13	0	0
2010 / 2011	4	9	0
2011 / 2012	0	13	0

On average, in 2008 compared with 2007 the productivity increased with 20 percentage points; in 2009 relative to 2008 increased with 17 percentage points; in 2010 the productivity increased most, with 24 percentage points, then it entered on a decreasing path. In 2011 the average productivity compressed with 8 percentage points, while in 2012 it decreased sharply, with 85 percentage points.

To identify the component that contributed most to Malmquist indexes path over time and across banks, it has been have computed the technological and technical efficiency change, the results being summarized in table 3.

Table 3. Sources of total productivity growth

	Catch-up effect (technical efficiency)			Technological efficiency (frontier shift)		
	> 1	< 1	= 1	> 1	< 1	= 1
2007 / 2008	5	7	1	9	4	0
2008 / 2009	11	2	0	7	6	0
2009 / 2010	3	10	0	12	1	0
2010 / 2011	11	2	0	3	10	0
2011 / 2012	1	12	0	0	13	0

Productivity changes recorded by most banks in the sample in 2008 relative to 2007 and 2010 relative to the preceding year are mainly due to a regress of the catch-up effect and increases of technological efficiency. In 2009 and 2011 the productivity levels have been influenced most by increases of the catch-up effect. As expected, the productivity regress in 2013 had been due to decreases in both catch-up effect and technological change.

On average, the catch-up effect has been most prominent in 2011 (increase of around 10 percentage points), followed by 2009 with 8.6 and 2008 with 3.6 percentage points. The frontier shift effect had been very significant in 2010, with an increase of 53 percentage points.

6. Conclusions

The research question of the paper had been targeted toward socially responsible banks and their financial behavior. Keeping in mind that they have joined the same three, complementary sustainability frameworks and hence committed to implement and fulfill all their principles, it is of interest to examine the manner in which their business models have passed through a convergence process, in terms of main financial indicators.

Consequently, it has been performed an in-depth, bank-level empirical analysis during 2007 – 2013, so as to investigate whether these particular 13 sustainable banks

depict common, resembling features of their business models, or on the contrary have strategy specificities.

The descriptive statistics revealed a relative heterogeneity in terms of several sustainable banks' key financial indicators, namely their individual contribution to the domestic GDP, the market share, the liquidity indicator, the operational efficiency and the financial structure of their balance sheet.

In terms of efficiency estimates, both models tested (intermediation approach and profit efficiency approach) show that in each year considered a single socially responsible bank had achieved the status of full efficiency. Therefore, the production frontier looks different for each year considered. On average, the highest inefficiency has been observed in the case of intermediation approach (model M1).

The efficiency estimates provide, however, a static picture for each bank in each year considered. Accordingly, to gain a comprehensive picture it has been computed the Malmquist productivity index in order to illustrate not only the productivity's changes over time but also the sources of changes, in terms of catch-up effect and technological progress. The findings show that in 2008, 2009 and 2010 all banks recorded productivity growth by comparison with the preceding year, but starting with 2011 they entered slowly on a productivity regress trend.

References

1. Berger, A.N. **The economic effects of technological progress: evidence from the banking industry**, Journal of Money, Credit and Banking, vol. 35, no. 2, 2003
2. Boitan, I. **The social responsibility stream in banking activity. A European assessment**, Conference proceedings SGEM: Political sciences, law, finance, economics and tourism, published by STEF92 Technology Ltd., Sofia, Bulgaria, 2014, pp. 793-800.
3. Caves, D. W., Christensen, L. R. and Diewert, W.E. **The economic theory of index numbers and measurement of input, output and productivity**, Econometrica, 50, pp. 1393-1414, 1982.
4. Dardac, N. and Boitan, I. **Assessment of the Romanian banking system performance. A non-parametric approach**, Policies of Economic and Social Development in Europe, din seria Sofia Conferences on Social and Economic Development in Europe, 2010, pp. 89-97
5. Dardac, N. and Boitan, I. **Malmquist index, an alternative technique for measuring credit institutions productivity**, Theoretical and Applied Economics, Vol. 520, no. 3, 2008, pp. 29-36
6. Davidescu A. A and Strat, V. **Coordinates of a New Romanian Regional Policy - Identifying the Development Poles. A Case Study**, Informatica Economica, vol. 18, no. 2, 2014, pp.88-99
7. Fare, R., Grosskopf, S., Lindgren, B. and Proos, P. **Productivity development in Swedish hospitals: a Malmquist output index approach**, Southern Illinois University Carbondale, Department of Economics Discussion paper, 89(3), 1989

8. Ferreira, C. **Efficiency and integration in European banking markets**, School of Economics and Management, Working Paper WP 08/2011/DE/UECE, 2011
9. Frame, W.S. and White L.J. **Technological Change, Financial Innovation, and Diffusion in Banking**, in Berger, A.N., Molyneux, P. and Wilson, J.O.S. (eds.) "The Oxford Handbook of Banking", Oxford University Press, 2009
10. Ho, S.J. and Mallick, S.K. **The Impact of Information Technology on the Banking Industry: Theory and Empirics**, Queen Mary, University of London, UK, 2006
11. Morita, H. and Avkiran N.K. **Selecting Inputs and Outputs in Data Envelopment Analysis by Designing Statistical Experiments**, Journal of the Operations Research, Society of Japan, Vol. 52, No. 2, 2009, pp.163-173
12. Pisano, U., Martinuzzi, A. and Bruckner, B. **The Financial Sector and Sustainable Development Logics**, **principles and actors,** ESDN Quarterly Report 27 – December 2012
13. Saeed, K.A. and Bampton R. **The Impact of Information and Communication Technology on the Performance of Libyan Banks**, Journal of WEI Business and Economics-December, Vol. 2, No. 3, 2013
14. Scippacercola, S. and Sepe, E., **Principal Component Analysis to Ranking Technical Efficiencies through Stochastic Frontier Analysis and DEA**, Journal of Applied Quantitative Methods, Vol. 9, No.4, Winter 2014
15. * * * **A new global partnership: eradicate poverty and transform economies through sustainable development**, United Nations, May 2013
16. * * * **United Nations Environment Program – Financial Initiative,** http://www.unepfi.org
17. * * * **United Nations Global Compact,** http://www.unglobalcompact.org
18. * * * Equator Principles, http://www.equator-principles.com

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