Measuring Financial Inclusion in the EU: Financial Inclusion Score Approach

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Abstract

Financial inclusion has become a hotly debated topic as part of a wider social and economic inclusion agenda and an effort towards fuller participation by the vulnerable individuals. While financial inclusion as a policy goal and economic objective is well supported, measuring financial inclusion on a country level remains a challenge. The paper proposes a novel approach to measuring financial inclusion in the EU (financial inclusion score) using data envelopment analysis (DEA) and treating financial inclusion as efficiency with which a financial system transforms inputs (key dimensions related to demand, supply and policy) into outputs (use of financial services). Using the DEA method, a financial inclusion index is calculated as a relative measure of ranking of a country's financial system in relation to the best in class, as it is identified by the DEA optimization method.

The study shows that there is substantial variation among the member states in terms of financial inclusion score (FIS) although overall the majority of the countries are fairly advanced in their efforts to make the financial system inclusive. The FIS scores allow to classify the states into four categories: leaders, high performers, aspiring performers and laggards, with the leaders serving as the performance benchmarks for others to follow.

As with every method, FIS has its limitations. It is sensitive to inputs and outputs, and other versions of the index should be tested to find the most appealing and accurate measure of financial inclusion that captures the phenomenon in the EU context. It also provides a synthetic measure of financial inclusion that shows how the financial system as a whole performs but it does not specify which individuals or groups may be excluded, or to what extent, or why such exclusion may be occurring. Therefore a composite measure should be treated as a general indicator that needs to be supplemented with more specific review of potential exclusion cases.

The findings help to operationalize the measure of financial inclusion and offer a simple composite index that is easy to understand, monitor and implement.

The key added value of this research lies in clear definition of financial inclusion and the development of a unique composite index using data envelopment analysis method that assigns weights to inputs and outputs endogenously without prior arbitrary specification of the values of the weights.

Key words: financial inclusion, access to finance, index, DEA

1. Introduction

Determining appropriate financial inclusion policies starts with accounting for numerous complex factors that influence access to, and use of, financial services. Within this, a key challenge is to define and measure financial inclusion in a way that can be operationalized and supported through appropriate programs and policies.

However, the concept of financial inclusion does not lend itself to precise measurement; it encompasses many aspects of supply, demand and policy. Any measure of EU financial inclusion should satisfy several conditions, including:

- Capturing all relevant aspects of financial inclusion
- Allowing comparison of financial inclusion levels across member countries
- Highlighting unique distinct features or pathways to financial inclusion in the different social and economic environments of EU member states.
- Using available data, without the need for additional research.

While a number of attempts to define and measure financial inclusion exist, we still lack a comprehensive measure to capture salient supply-side aspects, as well as actual financial service use (demand side). This paper offers a macro-level measure of financial inclusion that links both sides of the market, and offers a composite financial inclusion score comparable across EU countries based on the available data.

The proposed approach treats financial inclusion as the capacity of the financial system to offer appropriate products and services to all individuals who want to use them. An inclusive financial system functions as an open system, in the sense that it allows anyone to use it (if and when needed) under equal terms and conditions. Therefore, financial inclusion describes the ability of a financial system (including its institutions, products and services, processes and policies) to achieve this on terms and conditions that are affordable, equitable and transparent.

The paper is organized as follows: first, a short literature review summarizes prior efforts to define and measure financial inclusion, including construction of a composite index. Against this backdrop, a new composite measure is proposed – Financial Inclusion Score – which is derived from the application of data envelopment analysis (DEA) treating financial inclusion as efficiency measure of transforming inputs into outputs. Then the paper describes the data envelopment analysis method and data used for the study. The paper then discusses the results and proposes options for future research in this area.

2. Literature Review

So far, there have been several research studies that proposed methodologies for calculating composite financial inclusion indices. The approaches vary in the selection of method and variables used in the calculation.

A number of studies follow the approach developed by UNDP to calculate Human Development Index (HDI) prior and after 2010 when changes in the calculation formula were introduced by UNDP.

Mehrotra et al. (2009) proposed the financial inclusion index (FII) that was computed with the same formula as HDI before 2010[1], that is as a weighted arithmetic average of the various

[1] Before 2010 HDI was calculated as an arithmetic mean which was exchanged for a geometric mean in 2010

dimensions of financial inclusion, where the weights assigned to each dimension are equal, considering that all the dimensions are equally important for financial inclusion.

Amidzic et al. (2014) also used the UNDP approach to calculating the HDI, although the one updated in 2010, and further adapted it by using a weighted geometric average for computing the composite indices. Using weights provides an elasticity of substitution between the dimensions thus addressing the main drawback of the version of the HDI prior to 2010 whereby the use of the arithmetic mean implied that the variables were perfect substitutes of one another.

Sarma's approach (2008) was to replace the average with a measure of the distance from the ideal. Contrary to the assumption of perfect substitutability across the financial inclusion dimensions inherent in the HDI calculation, the distance approach assumes that all dimensions are equally important and the decrease in one can be substituted by the increase in the other. In the first study Sarma (2008) used equal weights while in the later revision (Sarma (2012)) she assigned non-equal weights. Sarma's methodology was used by Korynski (2013) to calculate the financial inclusion score for Belarus where several versions of the index were proposed with different weights assigned for each dimension.

Chakravarty et al. (2010) applied axiomatic measurement approach developed in the human development literature to the measurement of financial inclusion. Their index of financial inclusion enables identification of the dimensions of inclusion that are more/less susceptible to overall inclusion and hence to isolate the dimensions that deserve attention from a policy perspective.

Finally, Camara et al. (2014) assumed that behind a set of correlated variables an underlying latent structure can be found. Using a principal component analysis (PCA) they selected relevant variables for each of the dimensions and estimated the parameters (weights) that were used in the calculation of the financial literacy index.

In constructing financial inclusion indices researchers use two approaches to assigning weights to inputs and outputs: exogenous and endogenous. When weighs are assigned exogenously, they are assigned using some arbitrary rule, typically assuming equal weighs to all inputs. Along this approach Sarma (2012) and Chakravarty et al. (2010) assigned the weights arbitrarily. The endogenous weights are derived as part of the model output - Amidzic et al. (2014) obtained the endogenous weights needed in the calculation of the composite index of financial inclusion through the common factor analysis while Camara et al. (2014) used principal component analysis.

The vast majority of studies use the indicators of access and usage of financial services ((Sarma 2008, 2012, Amidzic et al. 2014, Chakravarty et al. 2010) to come up with the dimension scores which are then used in the calculation of the financial inclusion index. Camara et al. (2014) adds a dimension of barriers perceived by those individuals who do not participate in the formal financial system. Korynski (2012) adds other dimensions such as the policy dimension (enabling regulatory environment and the demand-side dimensions of trust and financial capability) but more importantly, distinguishes between the inputs - conditions of access to finance, and the outputs - usage of financial products and services. He uses only the dimensions of the supply, demand and policy to calculate the Index of Financial Inclusion (IFI) while the usage dimension is captured by a separate index (Total Financial Exclusion - TFI) calculated using the methodology proposed by Devlin (2005).

Several papers examine the relationship between financial inclusion, macroeconomic factors and social development (Sarma 2008, Camara et al. 2014). Both studies find positive correlation between financial inclusion and country's GDP per capita as well as adult literacy. Additionally, Sarma et al. (2008) found that Gini coefficient was negatively associated with financial inclusion.

In the same study, urbanization is positively associated with financial inclusion much as the physical infrastructure, like network of paved road, telephone and internet subscriptions.

The relationship between culture and finance has been studied by many researchers over the last years by looking for the answer on how the national culture influences financial behavior of individuals in their personal finance management as well as in the business management of corporations.

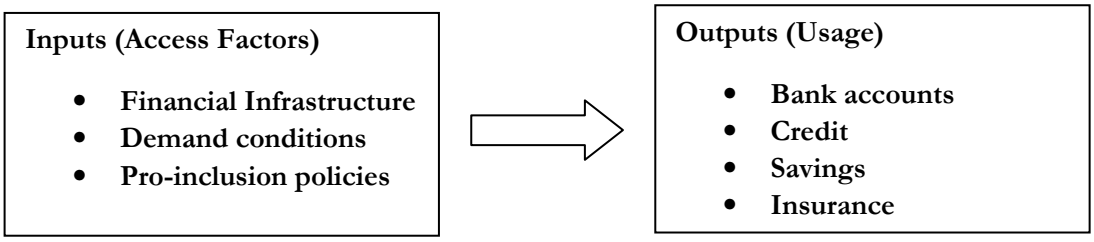
In her meta-analysis of the research on cultural finance Asaad (2013) found 13 studies using Hofsede's cultural dimensions and 5 studies using Schwartz's dimensions to explain business behaviors. Further, Asaad (2013) examined how values and attitudes of nations influence financial decision-making of countries, specifically how national cultures affect financial decisions related to investor rights, stock market development, international financing, debt levels and maturities and the domestic banking and credit markets. Her findings largely confirm relationships that have been established in the literature: increases in individualism and uncertainty avoidance lead to increases and decreases in both market capitalization and international financing, respectively while higher levels of masculinity and conservatism were associated with greater debt levels.

3. Financial Inclusion Score: Conceptual Framework

The financial inclusion of a system can be represented as a set of:

- Outputs: the actual use of basic financial services, including (1) current accounts, (2) consumer credit, (3) savings accounts and (4) life insurance
- Inputs: including (1) supply dimension – infrastructure of financial service delivery, (2) demand dimension – the quality of products and services, or how well they meet the expectations of consumers, and (3) policy dimension – government actions and regulations that advance financial inclusion in a country.

Figure 1. Financial Inclusion as an Input-Output System



The measure of financial inclusion should reflect the multi-dimensional aspect of this phenomenon, and should combine all three aspects of access. In addition, the measure should not rely on an arbitrary assignment of weights for each component (for example, by assuming that all three aspects of access conditions contribute equally to financial inclusion). Rather, weights should be assigned endogenously to avoid arbitrary choice, which can skew results.

In our approach, weights are computed using data envelopment analysis (DEA), a linear programming method used in optimization research that assigns weights endogenously without prior specification of values of the weights.

The Financial Inclusion Score (FIS) describes financial inclusion as the ability of a financial system to offer services in relation to the available inputs, and as such it is a performance measure, rather than an outcomes measure. The FIS score as calculated here is a *relative measure,* ranking a country's financial system in relation to the "best in class", as identified by the DEA optimization method.

An FIS score of "1" means that the system transforms access factors into usage in the most efficient way, and it is an efficiency standard or benchmark for other countries to follow. An FIS score of less than 1 means that a particular financial system is less inclusive (in relative terms) by comparison with the best in class performer. The FIS can be a useful general method of measuring and comparing the state of financial inclusion among EU member states. However, in both cases (FIS=1 and FIS<1), it is still possible that some individuals may be excluded from financial service use, and additional measures should be developed to capture the specific nature and scale of this exclusion.

4. Methodology

4.1. Dimension Scores

To calculate the score of a specific financial inclusion dimension, the results of each indicator were compared with the proposed benchmark value, and for each indicator the distance to benchmark was assessed. The score for each indicator was calculated using the following formula:

$$Score_{ji} = (Benchmark_i - Value\ of\ Indicator_i) / Benchmark_i$$

where i – any given indicator under consideration within j dimension

Each score was then adjusted to take values between 1 and 5, so that the interpretation of the score could be more intuitive.

4.2. DEA Analytical Framework

The FIS is calculated using data envelopment analysis, or DEA (Charnes et al. 1978), a non-parametric method used for comparing the efficiency of various decision-making units, or DMUs. The definition of the DMU is flexible; they can be individuals, branches of an organization, or entire organizations (of financial systems as in our case). What is important is not the scale, but that all DMUs exist in the same basic environment and convert the same set inputs into the same set of outputs. Given the similarity of financial systems in the EU member states, this method is appropriate to track the performance of financial systems in terms of their inclusiveness.

DEA is a linear programming methodology for evaluating relative efficiency of each production unit among a set of fairly homogeneous decision-making units (DMUs). It sketches a production possibilities frontier (data envelope or efficient frontier) using combinations of inputs and outputs from best performing units. Units that compose the "best practice frontier" are assigned an efficiency score of one (or 100%) and are deemed technically efficient compared to their peers. The efficiency of the DMUs below the efficiency frontier is measured in terms of their distance from the frontier. The inefficient DMUs are assigned a score between one and zero. The larger the score the more efficient a DMU is.

A DMU's efficiency is defined as the sum of weighted outputs divided by the sum of weighted inputs. Each optimization selects the set of weights that results in the highest possible efficiency for the focal DMU associated with that optimization. These separate optimizations share a common set of constraints: when the set of weights are applied to any DMU, it must not result in an efficiency rating greater than one.

The iterative formulation for the case of s outputs, m inputs, and n DMUs where the y terms represent output levels, the x terms represent input levels, and the u and v terms represent the weights associated with outputs and inputs respectively, as shown below.

$$\text{Maximize} \quad \frac{\sum_{r=1}^{s} u_r y_{r1}}{\sum_{i=1}^{m} v_i x_{i1}}$$

$$\text{subject to} \quad \frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \leq 1 \text{ for } j = 1, \ldots, n, \text{ and}$$

$$u_r, v_i \geq 0, \text{ for } r = 1, \ldots, s \text{ and } r = 1, \ldots, m.$$

We apply the input orientation to calculate the efficiency scores. In the input orientation the usage of inputs is minimized to obtain fixed outputs to show the degree to which inputs have applied efficiently. We chose the input orientation because the decision-makers have influence on the size of the inputs which can be increased or decreased to achieve the outputs more efficiently.

We use Constant Returns to Scale (CRS) model in which the optimal mix of inputs and outputs is assumed to be independent of the scale of operations (country's size of the financial system).

4.3 Statistical Power

Since DEA results are influenced by the size of the sample, it is necessary to confirm the adequacy of the sample size used for the analysis. The size of the sample utilized in the present study is consistent with the guidance available in DEA literature. Cooper et al. (2007) provides two such rules that can be jointly expressed as:

$$n \geq \max \{m*s ; 3(m+ s)\}$$

where n=number of DMUs, m=number of inputs and s=number of outputs. The first rule of thumb states that sample size should be greater than or equal to product of inputs and outputs while the second rule states that number of observation in the data set should be at least three times the sum of the number of input and output variables. Given m=3 and s=4, the sample size (n=27) used in the present study exceeds the desirable size as suggested by the abovementioned guidance to obtain sufficient discriminatory power.

4.4 Tobit Model

To explain the effect of a set of explanatory variables on the efficiency score we used a Tobit model because the distribution of the efficiency scores is confined to the interval (0, 1). In the presence of censored range of the efficiency scores obtained through DEA, the OLS regression method yields inconsistent estimates of the regression parameters.

The Tobit model is defined as:

$$y_i = \begin{cases} y_i^* & \text{if } y_i^* > 0 \\ 0 & \text{if } y_i^* \leq 0 \end{cases}$$

$$y_i^* = \beta x_i + u_i, u_i \sim N(0, \sigma^2)$$

where:

y is the FIS score

u_i is the error term, normally distributed $u_i \sim N(0,\sigma^2)$

y* is the latent (unobservable) variable

β is the vector of unknown parameters which determines the relationship between the independent variables and the latent variable

x_i is the vector of explanatory variables

4.5 Variables and data

Data for FIS calculation comes from various sources:

Inputs

Financial infrastructure: the measure of financial infrastructure is a composite index of the density of outlets where people can use financial services. The index score ranges from 1 (worst) to 5 (best).

Demand conditions: a composite index averages scores for the quality of products and services, and the perceptions and attitudes of consumers towards financial markets. The index score ranges from 1 (worst) to 5 (best).

Policies: the composite measure of the policy sphere takes values from 1 to 5, and reflects achievements in financial inclusion being important policy issue with active government policies to increase access to (and use of) financial services.

Outputs

Outputs reflect the use of four basic types of financial services:

- Bank accounts: share of the adult population with a bank account
- Consumer credit: share of the adult population repaying consumer credit
- Deposits: share of the adult population saving with a financial institution
- Insurance: share of the adult population with life insurance

The measures and definitions of the variables are presented in Table 1.

Table 1: Indicators used as input and output variables

Indicator	Data Source	Description
INPUTS		
Financial infrastructure		
Bank penetration	Financial Access Survey, IMF	Number of bank branches per 100,000 adults
ATM penetration		Number of ATMs per 100,000 population
POS penetration	European Central	Number of POS per 100,000 population

Indicator	Data Source	Description
	Bank	
Demand conditions		
Account maintenance cost	EC: Data collection for prices of current accounts provided to consumers 2007	Average charges on products connected to current account in Euro (account maintenance, direct debit, debit card, checks, credit transfer) to GDP per capita adjusted 2009
MPI banking cluster	EC consumer scoreboard - Market Monitoring	Perception of banking products quality in terms of comparability, trust, problems and complaints; score range 0-100
MPI insurance cluster		Perception of insurance products quality in terms of comparability, trust, problems and complaints; score range 0-100
Availability of written product information	Special Eurobarometer 373 2011	Share of customers who received written information
Perception of over-indebtedness	Eurostat SILC module	Share of adults with heavy financial burden of repayment of debts from hire purchases or loans
Public trust	Gallup 2012	Share of adults who trust financial institutions
Consumer confidence	EC Consumer Confidence Index monthly average 2013	Relative value of confidence over time
Financial behavior - saving	Global Findex 2011	Share of adults who save money
Financial behavior - borrowing		Share of adults who borrow money
Policy		
Promotion of access to the national payment system and other forms of payments.	Bank Regulation and Supervision in 180 Countries from 1999 to 2011	Access to well-functioning payment systems through various channels is available.
Interest rate policies		Central bank promotes market interest rates and does not apply interest rate ceiling restrictions
Transparency and disclosure requirements		Regulations specify the transparency and disclosure requirements for banks
Consumer protection		Regulations introducing consumer protection principles exist
Policies and regulations promote competition in the financial sector		Legal framework exists and is conducive to the healthy competition in the banking and non-banking sector.
Credit bureau and collateral registry	Doing Business 2014	Existence of credit bureau and quality of service
Deposit insurance	Bank Regulation and Supervision in 180 Countries from 1999 to 2011	Regulations stipulate the existence of a Deposit Insurance Fund and deposit insurance is widely available
Active government policies to increase access to and use of financial services		Simple (no frills) accounts to all citizens. Government actively supports the establishment of savings and pension plans through matching plans or tax incentives.
Financial inclusion as an important policy issue		Financial inclusion is a public policy issue
OUTPUT		
Bank account	Special	Share of adults with a bank account

Indicator	Data Source	Description
Consumer credit	Eurobarometer 373, 2011	Share of adults repaying consumer credit
Deposit		Share of adults saving with a financial institution
Insurance		Share of adults with life insurance

Explanatory variables

In order to understand the differences in the FIS score across the countries we use several variables which in previous studies were found to correlate with financial inclusion. We grouped these variables into four groups of country's macroeconomic, social, culture and composite variables.

Macroeconomic variables

We use indicators of country's income per capita (GNI per capita) and its distribution (GINI coefficient).

Social variables

We use variables relating to education, gender equality, and distribution of the population.

Cultural variables

We used Hofsede's dimensions of culture. The cultural dimensions represent independent preferences for one state of affairs over another that distinguish countries (rather than individuals) from each other. The six dimensions of national culture are based on extensive research done by Professor Geert Hofstede, Gert Jan Hofstede, Michael Minkov and their research teams.

Composite variables

Indicators which capture several dimensions of the development include Human Development Index capture (social and economic dimension of country's development) and Global Competitive Index (indicators of institutional, infrastructural, human and market development).

Table 2: Indicators used as explanatory variables

Indicators	Data source	Description
Macroeconomic variables		
GNI per capita (PPP$)	World Development Indicators (2014)	Gross national income (GNI) converted to international dollars using purchasing power parity rates.
GINI coefficient		Measure of the extent to which the distribution of income among individuals or households within an economy deviates from a perfectly equal distribution.
Financial sector variables		
Banking Z-score	Global Financial Development Database (2014)	Captures the probability of default of a country's commercial banking system. Z-score compares the buffer of a country's commercial banking system (capitalization and returns) with the volatility of those returns.
Net interest margin (%)		Accounting value of bank's net interest revenue as a share of its average interest-bearing (total earning) assets.
Social variables		
Mean years of schooling	UNESCO Institute for Statistics (2015)	Mean of years of schooling for adults aged 25 years and more
Gender Inequality Index	UNDP (2015)	Measure of gender inequalities in three important

Indicators	Data source	Description
(GII)		aspects of human development—reproductive health, empowerment, and economic status.
Urban population (%)	World Development Indicators (2014)	Share of the population living in urban areas
Cultural variables		
Power Distance Index (PDI)	The Hofsede Centre	Degree to which the less powerful members of a society accept and expect that power is distributed unequally.
Individualism (IND)		Preference for a loosely-knit social framework in which individuals are expected to take care of themselves and their immediate families only.
Masculinity (MAS)		Preference in society for achievement, heroism, assertiveness and material reward for success.
Uncertainty Avoidance (UAI)		Degree to which the members of a society feel uncomfortable with uncertainty and ambiguity.
Long-term Orientation (LTO)		Dealing with society's search for virtue. Societies with a short-term orientation generally have a strong concern with establishing the absolute Truth. In societies with a long-term orientation, people believe that truth depends very much on situation, context and time.
Indulgence (IND)		Indulgence stands for a society that allows relatively free gratification of basic and natural human drives related to enjoying life and having fun.
Composite variables		
Global Competitiveness Index	World Economic Forum (2015)	Index capturing concepts that matter for productivity such as institutions, infrastructure, macroeconomic environment, health and primary education, higher education and training, goods market efficiency, labor market efficiency, financial market development, technological readiness, market size, business sophistication, and innovation.
Human Development Index (HDI)	UNDP (2015)	Summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and have a decent standard of living.

5. Results

5.1. Financial Inclusion Score (FIS)

Table 3 presents the FIS scores of 27 EU countries (calculated using the DEA method), and their FIS ranking.[2] Using these FIS scores, countries can be grouped into four categories:

- Leaders: FIS = 1 (11 countries)
- High Performers: 1.00 > FIS > 0.90 (8 countries)
- Aspiring Performers: 0.90 > FIS > 0.70 (6 countries)
- Laggards: FIS <0.70 (2 countries)

[2] Croatia is excluded, as it lacks much of the the data needed for index calculation.

Table 3: Financial inclusion score and rankings for 27 EU countries

Category	Country	Rank	FIS Score
Leaders	Sweden	1	1,000
	Denmark	2	1,000
	Finland	3	1,000
	Ireland	4	1,000
	France	5	1,000
	Cyprus	6	1,000
	Slovenia	7	1,000
	Germany	8	1,000
	Latvia	9	1,000
	Spain	10	1,000
	Netherlands	11	1,000
High Performers	Malta	12	0.999
	Austria	13	0.996
	Belgium	14	0.987
	Estonia	15	0.964
	UK	16	0.962
	Slovakia	17	0.930
	Czech Rep.	18	0.921
	Luxemburg	19	0.904
Aspiring Performers	Portugal	20	0.876
	Hungary	21	0.841
	Greece	22	0.840
	Italy	23	0.800
	Lithuania	24	0.753
	Poland	25	0.747
Laggards	Bulgaria	26	0.567
	Romania	27	0.554

Figures 2 and 3 show country groupings according to their relative financial inclusion performance.

As Table 3 and Figures 2 and 3 illustrate, there is substantial variation among member states in terms of their FIS, although the majority of countries are fairly advanced in their efforts to make the financial system inclusive. The following are some of the notable aspects of the comparison of the member states:

- The EU-27 has a high average FIS of 0.91 indicating an overall high level of inclusion
- 11 countries out of 27 (41%) have FIS score of 1, indicating that their financial systems are inclusive to the extent that the available inputs allow
- Of these 11 countries, three (Sweden, Finland and Denmark) were assigned the score of 1, indicating few differences between them in terms of financial inclusion outcomes.
- Among the best performers, three (Latvia, Slovenia and Cyprus) joined the EU as recently as 2004, indicating that financial inclusion is not limited to "Old Europe".

- 70% of member states (19 countries) have a financial inclusion score exceeding 0.9, indicating high levels of financial inclusion (the average score for this group is 0.97)
- The remaining 8 countries have an average score of 0.75.
- Two countries (Bulgaria and Romania) have significantly lower FIS scores (0.57 and 0.55 respectively), which are half those of the best performers.

Fig 2: EU countries according to FIS scores (from 1 to 0.55, dark color denotes top ranking)

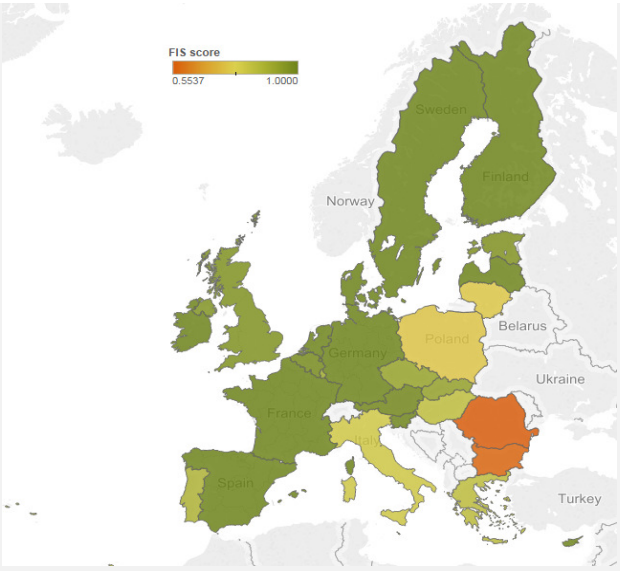
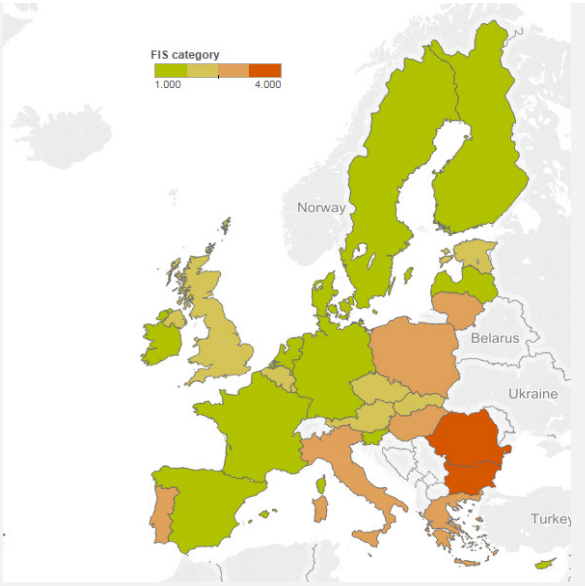


Fig 3: EU countries by FIS clusters (1 - leaders, 4 - laggards)



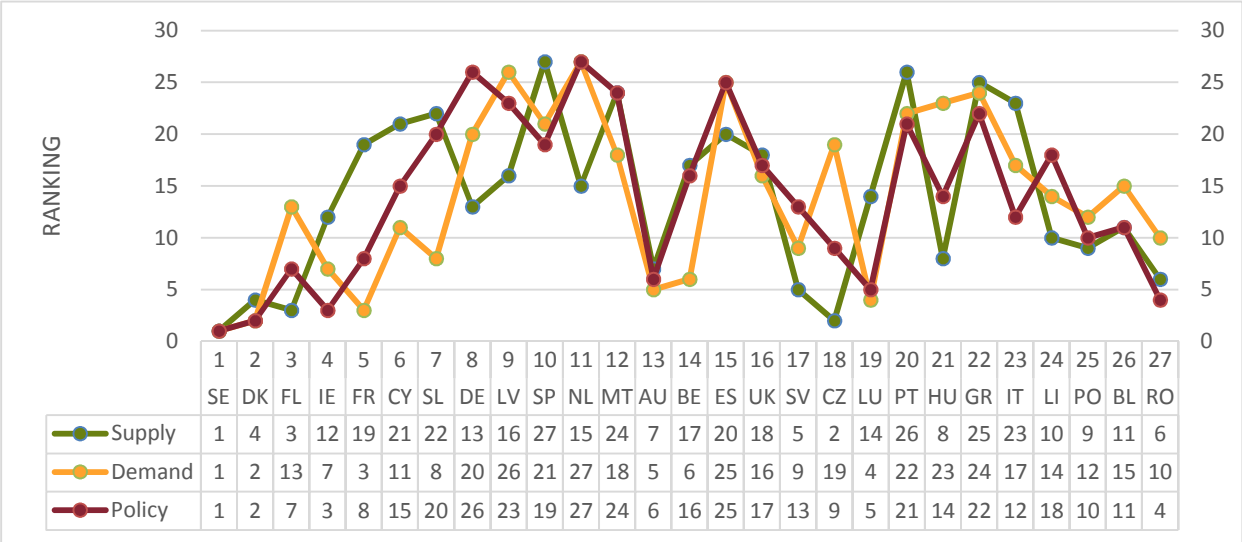
5.2. FIS by Input Component

Analyzing variations in FIS input components (supply, policy and demand) provides additional granularity to the rankings. The rankings are derived using the concept of "slack", or the amount of inputs in excess of that of the best performer, in order to accomplish the current outputs (use of financial services). Slack highlights the inefficiency of each input to the FIS score: the lower the rank, the more inputs are used to accomplish what the best-performing financial system presently achieves.

As the Figure 4 shows, Sweden (as the best performer among all EU countries according to its FIS score[3]) serves as the benchmark for all other countries. The figure also demonstrates that there is great variation in the ranking of inputs for each country, which indicates that there are differences in levels of inefficiencies that contribute to overall FIS ranking. Some of these results are surprising. For example, the Netherlands, with its high overall ranking (number 11) shows two inputs ranked the lowest of all countries, indicating that fewer resources could be used without compromising financial inclusion outcomes. The lowest-ranked country (Romania), by contrast, appears to be applying financial access inputs fairly efficiently, although the overall outcome is still quite inefficient. For some countries, the FIS score and input rankings are quite similar (UK, Greece) while for other countries there are significant differences.

[3] Even though three countries were assigned the score of 1, the statistical program ranked Sweden as number 1.

Figure 4: Ranking of Countries by FIS Inputs



5.3. Descriptive Statistics of the Efficient and Inefficient Countries

Table 4 presents the descriptive statistics of inputs and outputs of the efficient and inefficient countries. Efficient countries are those which have the efficiency score of 1, while inefficient countries are those with the FIS score below 1.

Table 4: Input and output score values for efficient and inefficient countries

	Efficient countries (FIS =1)				Inefficient countries (FIS<1)				Mean efficient /inefficient (%)
	mean	stdev	min	max	mean	stdev	min	max	
Input									
Supply	4.16	0.63	3.21	5.00	3.81	0.73	2.79	5.00	109%
Demand	4.23	0.32	3.52	4.56	4.20	0.40	3.09	4.72	101%
Policy	3.82	0.28	3.39	4.31	3.97	0.32	3.30	4.58	96%
Output									
Savings	0.43	0.16	0.13	0.64	0.32	0.16	0.05	0.58	133%
Insurance	0.39	0.14	0.15	0.60	0.27	0.13	0.05	0.43	145%
Account	0.95	0.05	0.85	1.00	0.82	0.16	0.45	1.00	115%
Credit	0.21	0.10	0.07	0.38	0.13	0.04	0.06	0.21	160%

When compared, efficient countries use the same or fewer resources to produce more users of financial services than the inefficient countries. The major difference comes from the outputs - the efficient countries use on average 102% of inputs of the inefficient ones, and they produce on average 38% more outputs.

5.4. Efficiency Improvements

In addition to calculating technical efficiency scores, DEA methodology allows to calculate input reductions and/or output increases needed to make individual countries efficient, in relation to the best performing ones.

Table 5 shows the average input savings from inefficient countries. It shows by how much inputs could be reduced to accomplish the current level of output, thus reducing the inputs without reducing the output. On average inputs can be reduced by about 14%.

Table 5: Average Input Savings in Inefficient Countries

Input	Actual input	Input decrease	Percentage change	Optimal input use
Supply	3.81	-0.59	-15.6%	3.22
Demand	4.20	-0.60	-14.3%	3.60
Policy	3.97	-0.59	-14.9%	3.38

Table 6 presents by how much outputs should be increased to make efficient use of the current inputs in relation to the best performing countries. The output increase ranges from 0% to 33% percent for different categories of outputs (financial services provided) and in general is higher (in absolute terms) than the percentage reduction of inputs to achieve efficiency, which is consistent with the earlier statement that countries could make better use of their inputs to improve financial inclusion.

Table 6: Average Output Increase for Inefficient Countries

Output	Actual output	Output increase	Percentage change	Optimal output
Account	0.82	0	0.0%	0.82
Savings	0.32	0.09	26.8%	0.41
Credit	0.13	0.04	32.8%	0.17
Insurance	0.27	0.06	21.6%	0.32

5.5. Factors Explaining FIS Score Differences

In order to identify which factors contribute to higher FIS scores and, therefore, indicate more efficient financial systems we ran a series of Pearson correlations to identify statistically significant variables and then construct a Tobit model to observe the interplay between these variables.

We argue that countries with higher economic development will be more efficient in providing financial services and will well balance the inputs to maximize the outputs. We expect that the demand for financial services will be higher in countries with higher achievements in the sphere of education and with more egalitarian societies and thus the economies of scale will be easier to achieve. Similarly, cultures focusing on individual needs and fulfillment will facilitate higher demand and expectation of appropriate access to services.

Table 7: Pearson Correlations

			1	2	3	4	5	6	7	8	9	10	11	12	12	14	15
1	FIS_score	Pearson Correlation	1	.665(**)													
		Sig. (2-tailed)		.000													
		N	26	26													
2	Ln GNI per capita (PPP)	Pearson Correlation	.665(**)	1													
		Sig. (2-tailed)	.000														
		N	26	27													
3	GINI coefficient	Pearson Correlation	-.092	-.159	1												
		Sig. (2-tailed)	.661	.438													
		N	25	26	26												
4	Mean years of schooling	Pearson Correlation	.179	.173	-.421(*)	1											
		Sig. (2-tailed)	.381	.389	.032												
		N	26	27	26	27											
5	Urban population (%)	Pearson Correlation	.443(*)	.551(**)	.032	.020	1										
		Sig. (2-tailed)	.023	.003	.878	.919											
		N	26	27	26	27	27										
6	Bank_Z_score	Pearson Correlation	.045	.194	-.201	-.081	.043	1									
		Sig. (2-tailed)	.829	.331	.326	.688	.832										
		N	26	27	26	27	27	27									
7	Net interest margin	Pearson Correlation	-.750(**)	-.786(**)	-.186	-.011	-.518(**)	.019	1								
		Sig. (2-tailed)	.000	.000	.364	.958	.006	.925									
		N	26	27	26	27	27	27	27								
8	Power Distance Index	Pearson Correlation	-.532(**)	-.558(**)	-.096	-.276	-.399(*)	-.002	.696(**)	1							
		Sig. (2-tailed)	.005	.003	.647	.172	.044	.992	.000								
		N	26	26	25	26	26	26	26	26							
9	Individualism	Pearson Correlation	.446(*)	.490(*)	-.052	.509(**)	.508(**)	-.132	-.460(*)	-.532(**)	1						
		Sig. (2-tailed)	.022	.011	.804	.008	.008	.521	.018	.005							
		N	26	26	25	26	26	26	26	26	26						
10	Masculinity	Pearson Correlation	-.247	-.024	.003	.042	-.244	.105	.326	.250	.094	1					
		Sig. (2-tailed)	.224	.906	.990	.839	.230	.609	.104	.217	.648						
		N	26	26	25	26	26	26	26	26	26	26					
11	Uncertainty Avoidance	Pearson Correlation	-.350	-.409(*)	.287	-.664(**)	-.144	-.127	.285	.553(**)	-.583(**)	.138	1				
		Sig. (2-tailed)	.080	.038	.164	.000	.484	.538	.158	.003	.002	.501					
		N	26	26	25	26	26	26	26	26	26	26	26				
12	Long-term Orientation	Pearson Correlation	-.120	-.074	-.106	.373	.074	.051	.137	.139	.178	.095	.001	1			
		Sig. (2-tailed)	.560	.719	.615	.060	.721	.805	.505	.498	.383	.643	.997				
		N	26	26	25	26	26	26	26	26	26	26	26	26			
13	Indulgence	Pearson Correlation	.661(**)	.774(**)	-.305	.127	.603(**)	.120	-.570(**)	-.496(*)	.378	-.087	-.381	-.408(*)	1		
		Sig. (2-tailed)	.000	.000	.138	.535	.001	.559	.002	.010	.057	.671	.055	.038			
		N	26	26	25	26	26	26	26	26	26	26	26	26	26		
14	GCI	Pearson Correlation	.603(**)	.775(**)	-.217	.371	.560(**)	.180	-.733(**)	-.643(**)	.590(**)	-.229	-.609(**)	-.008	.663(**)	1	
		Sig. (2-tailed)	.001	.000	.286	.057	.002	.368	.000	.000	.002	.260	.001	.968	.000		
		N	26	27	26	27	27	27	27	26	26	26	26	26	26	27	
15	HDI	Pearson Correlation	.764(**)	.882(**)	-.218	.411(*)	.447(*)	-.006	-.767(**)	-.595(**)	.561(**)	-.070	-.548(**)	-.117	.778(**)	.786(**)	1
		Sig. (2-tailed)	.000	.000	.285	.033	.019	.975	.000	.001	.003	.733	.004	.569	.000	.000	
		N	26	27	26	27	27	27	27	26	26	26	26	26	26	27	27

** Correlation is significant at the 0.01 level (2-tailed), * Correlation is significant at the 0.05 level (2-tailed).

We also seek to confirm that our FIS score of financial inclusion correlates with other indicators of banking sector efficiency and stability.

Table 7 presents the results of pair-wise Pearson correlations between the FIS score and country-level economic, financial sector, social and cultural variables. Out of the 14 indicators tested only eight correlate with the FIS score. Country's income level per capita is positively associated with the efficiency of financial inclusion - high-income countries better balance the inputs and output of financial inclusion.

Higher level of social development, evidenced by equal gender rights and the degree of urbanization, is positively correlated with the efficiency of the financial system. More gender equity facilitates larger demand for individual products. Urbanization and thus larger concentration of the population in cities and towns facilitates reaching out to the larger number of clients with fewer resources.

The duration of schooling did not significantly correlate with the FIS score.

The efficiency of the banking system evidenced by net interest margins negatively correlates with the FIS score, supporting the hypothesis that banks in more efficient markets (higher FIS scores) operate on lower interest margins (lower value of net interest margin).

The cultural dimensions also play a role in shaping the efficiency of the financial system - Individualism and Indulgence are positively correlated with the degree of efficiency in provision of financial services while Power Distance Index is negatively correlated. In countries with the acceptance of unequal power distribution financial markets are less efficient in providing financial inclusion.

Two composite indices incorporating both social and economic traits are also positively correlated with the FIS score, again supporting the hypothesis that higher level of development goes together with the efficiency of the financial markets.

The results of the Tobit estimation are presented in Table 8. For each of the models the Prob > $\chi 2$ is close to zero, implying that each set of independent variables considered together satisfactorily explains the variations in the dependent variable.

The results show that when controlled for GNI per capita, only Indulgence and Masculinity significantly predict the FIS score. All the other variables which correlated with the FIS score become insignificant when the country's income is added to the model. When controlled for the country's income level financial systems are more efficient in countries with where the population's lifestyle (Indulgence) drives higher spending and for many individual's higher demand for financial services. The same reasoning can explain higher efficiency of the financial system in countries with less masculine culture, where the society values cooperation, caring for the weak and quality of life thus developing higher social inclusion.

Interestingly, Masculinity did not correlate with the FIS score without the presence of GNI per capita.

Table 8: Tobit Regression Results on FIS Score

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
LN GNI per capita	.165	.2460 **	.2122 **	.2400 ***	.1070	.2711***	.1173
Gender Inequality Index	-.7513						-
Urban population		.0013					
Power Distance Index			-.0018				

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Individualism				.0013			
Indulgence					.0039*		.0037 *
Masculinity						-.0019*	-.0018 *
Constant	-.6881	-1.712 *	-1.174	-1.634 *	-.3481	-1.79 **	-.3611
N observations[4]	26	26	26	26	26	26	26
LR χ^2	11.91	10.27	11.49	10.60	13.26	13.34	16.62
Prob> χ^2	0.0026	0.0059	0.0032	0.0050	0.0013	0.0013	0.0008

***, **, and * refer to significant at p<0.01, p<0.05, and p<0.10, respectively

6. Policy implications

The FIS score shows the relative performance of financial systems in terms of financial inclusion, and allows EU states to measure themselves against the best-performing markets. At the same time, FIS input analysis highlights where countries use more inputs than necessary to accomplish their current financial inclusion outcomes. This highlights the instances where financial inclusion results could be better given the amount of inputs presently expended. It also points to which inputs could be adjusted in order to make gains in financial inclusion outcomes.

The main policy message resulting from this study is that countries need to take into account a number of factors which influence financial inclusion. The same intensity of inputs in two countries may not yield the same results as there may be substantial differences with regards to such factors as culture which so far have not be incorporated into the research on the use of financial services and financial inclusion. Furthermore, more inputs do not necessarily increase financial inclusion.

There are substantial differences in input rankings and some of the most globally efficient countries show lower rankings for individual inputs. This shows that it is not the ranking of individual inputs but rather the mix of inputs, shaped by the local socio-economic and cultural factors that determine the overall efficiency of the financial system to deliver financial inclusion.

Another useful insight from this research is that some countries do better than others, both in general and in terms of specific input allocation. These countries can serve as the best-in-class benchmarks for others, keeping in mind the idiosyncratic differences that need to be taken into account when transferring the best practices to other economic and social environments.

Last but not least, the ranking which result from the proposed methodology, can serve as policy guideposts that may orient the policy makers in different countries to undertake a more critical evidence-based view of financial inclusion policies in their countries.

7. Future research

To the best of authors' knowledge, the paper is the first instance of applying the DEA method to calculating the financial inclusion scores to explain the differences across countries in the EU. As the first attempt the paper has limitations with regards to the depth of analysis and ability to verify various corollaries to the theory presented in this research.

[4] The number of countries is only 26 as some of the variables were not available for all 27 countries covered by DEA

The country ranking in terms of financial inclusion using FIS could be compared to other methods of calculating financial inclusion, to ascertain how the proposed measure compares with other measures of financial inclusion.

Additionally, the DEA methodology itself can be further refined to include correction of estimation biases of DEA estimators using bootstrapping methods to achieve more theoretically precise results. Also, more work could be devoted to the question of endogeneity of the weights and to incorporation of the distance-based score methods into the calculation of the financial inclusion scores.

8. Conclusions

The paper proposed to analyze financial inclusion as efficiency with which inputs – supply, demand and pro-inclusion policies are transformed into the use of financial services. DEA method was used to calculate the relative financial inclusions scores for 27 EU countries without the necessity to assume any predetermined value for weights assigned to inputs and outputs. These endogenously established weights are free from the arbitrary choice of weights and more precisely describe the actual relative state of financial inclusion in comparison to the leaders in this area in the EU zone. By doing this, the paper proposed a simple method that uses publically available data that can used to calculate the financial scores for policy design.

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