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Evaluation of women entrepreneurship performance in OECD countries - Data Envelopment Analysis approach*

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ABSTRACT

The importance of women entrepreneurship increases day by day as it has a significant contribution to economic development, job creation, and innovation. Thus, policymakers put more emphasis on the criticality of standardized data, comparative studies, and measurement methods for women's entrepreneurship because these are essential to developing public policy and incentive/support systems. Within the scope of the study, women entrepreneurship performance of OECD countries was evaluated via Data Envelopment Analysis (DEA) and a comparative analysis presented. Input-oriented Charnes Cooper Rhodes (CCR) model was used and the established model was solved using EMS (Efficiency Measurement System). Results show that 11 countries (Denmark, Finland, France, Greece, Lithuania, Luxembourg, Netherlands, Norway, Portugal, Sweden, Switzerland) are efficient countries with their women entrepreneurship performance and as an output of the analysis the inefficient countries and their references are shared. Turkey took 29th place among 30 countries in the means of women entrepreneurship performance and Turkey, France, and Portugal should be taken as references for the improvement activities.

Keywords: Woman Entrepreneurship, Measurement of Woman Entrepreneurship, Data Envelopment Analysis, DEA.

JEL Codes: A13, C14

OECD ülkelerinin kadın girişimciliği performanslarının değerlendirilmesi – Veri Zarflama Analizi uygulaması

ÖZ

Kadın girişimciliğinin önemi ekonomik kalkınmaya, istihdam yaratılmasına ve yenilikçiliğe katkısından dolayı her geçen gün artmaktadır. Bu nedenle, politika yapıcılar, standartlaştırılmış verilerin, karşılaştırmalı çalışmaların ve kadın girişimciliği için ölçüm yöntemlerinin kritikliğine daha fazla vurgu yapmaktadır; zira, bunlar, kamu politikası ve teşvik / destek sistemleri geliştirmek için gereklidir. Çalışma kapsamında OECD ülkelerinin kadın girişimcilik performansı Veri Zarflama Analizi (VZA) ile değerlendirilmiş ve karşılaştırmalı bir analiz sunulmuştur. Girdi yönelimli Charnes Cooper Rhodes (CCR) modeli kullanılmış ve oluşturulan model EMS (Efficiency Measurement System) kullanılarak çözülmüştür. Sonuçlar, 11 ülkenin (Danimarka, Finlandiya, Fransa, Yunanistan, Litvanya, Lüksemburg, Hollanda, Norveç, Portekiz, İsveç, İsviçre) kadın girişimcilik performansları ile verimli ülkeler olduğunu göstermiş ve analizin çıktısı olarak verimsiz ülkeler ile referansları paylaşılmıştır. Türkiye, kadın girişimcilik performansı açısından 30 ülke arasında 29. sırada yer alırken, iyileştirme faaliyetleri için Fransa ve Portekiz'i referans alma gerekliliği tespit edilmiştir.

Anahtar Kelimeler: Kadın Girişimciliği, Kadın Girişimciliği Ölçümü, Veri Zarflama Analizi, VZA.

JEL Kodları: D91, D23, M12, J53.

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I. Introduction

Recently, entrepreneurship is considered as one of the fundamental tools of economic development, innovation, and job creation, and it plays a critical role in regional and national development (Audretsch,2012, p. 756; Demirağ, 2018, p. 2). From a dynamic perspective, entrepreneurs are representatives of change as they start new businesses, apply new techniques and business models, form new organizational structures, introduce new products and solutions, and even create new markets (Fernández-Serrano et al., 2017). In this context, the importance of entrepreneurship is increasing day by for national development and gaining competitive advantage; thus, encouraging entrepreneurship is becoming the focal point in public policies (Bianchi and S. Biffignandi, 2012, pp. 36-38; Yiğit and Gök, 2019, pp. 74-77). However, academic studies on entrepreneurship - although it contains a very high level of conceptual developments - still need improvement on developing measurement theories and addressing basic conceptual ideas from an analytical perspective (Anokhin et al., 2011, p. 40). In fact, when entrepreneurship is not measured properly, it is not possible to understand the factors affecting entrepreneurship and to evaluate the effects of public policies (Bianchi and S. Biffignandi, 2012, p. 36). In this respect, in recent years, there has been a growing interest in methodologies that deal with entrepreneurship and economic development at the country level, and offer comparative analysis (Fernández-Serrano et al., 2017).

Another issue that stands out in the entrepreneurship literature is women entrepreneurs; the developing literature suggests that women have a considerable critical role in entrepreneurship and economic development (Sarfaraz et al., 2014, pp. 2-4). However, the issue of women entrepreneurs, which is currently one of the biggest sources of entrepreneurship, is a concept that has not been addressed and enlightened enough. Little is known about the current economic suitability of women entrepreneurs, policy tools for women entrepreneurship encouragement, and the broad economic implications of women's higher level of engagement activities (OECD, 2012a). As a result, there is a persistent need to investigate the various dimensions of female entrepreneurship. Current theoretical concepts should be expanded to better explain the uniqueness of women entrepreneurship as an important research topic (Yadav and J. Unni, 2016). The interest in this problem has been accepted by international structures and has been started to be studied (Bianchi and S. Biffignandi, 2012, p. 37). The OECD-Eurostat Entrepreneurship Indicators Program (EIP) has started to collect internationally comparable data on women entrepreneurship (OECD, 2012a). Although entrepreneurship is an increasingly important resource in women's employment in many countries, it has been seen that women's participation in entrepreneurship activities is still quite low compared to men's (Ribes-Giner et al., 2018). In this context, OECD provided guidance on the improvement of women entrepreneurship in the "Gender Equality in Education, Employment and Entrepreneurship Report" prepared in 2012. One of the most important issues highlighted in the report is the need to expand methodologies for measuring women entrepreneurship. The importance of presenting comparative reports, especially at the country level was mentioned. (OECD, 2012b). In this study, the performance evaluation of women entrepreneurship will be carried out using data envelopment analysis (DEA) by using OECD data and a comparative evaluation will be presented within the scope of OECD countries.

II. Literature Review

Entrepreneurship culture has been on the rise in Western countries and Turkey since the 1980s and has become a phenomenon that is more talked about and thought about (Soysal, 2010, pp. 84-86). Moore (1990) argues that women entrepreneurship appeared in the literature as a relatively new phenomenon towards the end of the 1980s and that period can be counted as the beginning stage of the paradigm development process. At the same period, women entrepreneurship attracts attention as the number of women entrepreneurs increased faster than male entrepreneurs in Western countries (Ljunggren and Kolvereid, 1996, p. 4). For this reason, laying the theoretical foundations of women entrepreneurship has become a critical issue (Fischer,1993, p. 152). During the 2000s, women entrepreneurship has begun to be handled with many different dimensions in the literature. Topics such as the characteristics of women entrepreneurs, reasons for starting a business, barriers and solution suggestions, organizational tendencies seem to be prominent. Table 1. summarizes women entrepreneurship studies in the literature after 2000.

Table 1. Studies on Women Entrepreneurship After 2000

Author	Year	Content
Mankelow & Merriless	2001	They explain the marketing activities of Australian rural women entrepreneurs.
O'Neill & Viljoen	2001	They present the opportunities and barriers and supportive practices for women entrepreneurship in South Africa with a qualitative research.
Gundry et al.	2002	They explain the factors such as industry, family, culture, and motivation that affect women entrepreneurship in developing countries.
Verheul et al.	2004	They compare 29 countries i the context of men and women entrepreneurship.
Bedük	2005	He makes research on place of women, women entrepreneurs, challenges for women entrepreneurs in Turkey.
Ahl	2006	He emphasizes that the scope of research on women entrepreneurship should be expanded, including comparisons and quantitative analysis.
de Bruin et al.	2006	They investigate current situation, potentials, and development areas of women entrepreneurship.
Shelton	2006	He addresses the role conflicts of women entrepreneurs in family life.
de Bruin et al.	2007	They mention that the existing studies could be improved and more detailed and layered analyzes are needed to get rid of the superficiality of women entrepreneurship studies.
Ecevit	2007	He presents an overview of the work done on female entrepreneurship in Turkey.
Gürol & Maşrap	2007	They study on the definition of women entrepreneurship and how it is handled in international organizations.
Ruta et al.	2007	They present comparisons of women entrepreneurs in transformation economies in Lithuania and Ukraine.
Nayır	2008	He addresses the solution strategies developed by women entrepreneurs regarding work-family conflict over the textile and IT sectors.
Brush & diğ.	2009	By putting another layer of 2M (motherhood, macro environment) on the 3M strategy in marketing, they present a model that evaluates women entrepreneurs with a 5M perspective.
Ahl & Nelson	2010	They introduce a new perspective determined on gender independent social roles that reshaped the concept of gender in entrepreneurship.
Soysal	2010	By presenting the characteristics of women entrepreneurs and the problems they faced, they offered solutions through the example of Kahramanmaraş province.
Özdemir	2010	He discusses the motivation factors (push/pull) of women entrepreneurs.
Sayın	2011	He provides a descriptive analysis of the problems and challenges of women entrepreneurs.
Sullivan & Meek	2012	They carry out a process modeling on gender and entrepreneurship.
Ahl & Marlow	2012	They approach entrepreneurship from a neo-liberal perspective and discussed the correctness and depth of current gender descriptions.
Hughes et al.	2012	They argue that existing studies on women entrepreneurship remain at the national level and mention the development areas for international studies.
Jennings & Brush	2013	They review the last 30 years of literature on women's entrepreneurship.
Goyal & Yadav	2014	They address the obstacles to women entrepreneurs in developing countries.
Çabuk & diğ.	2015	They conduct a case study in Adana province regarding the business life processes of women entrepreneurs.
Henry & diğ.	2016	They scan the last 30 years of gender and entrepreneurship studies over 18 journals.

Table 1. Continue

Bayrakçı & Köse	2019	They conduct a qualitative research on female digital entrepreneurs through the use of social media and opportunities.
Lezki & Cengiz	2019	They present the factors that affecting the motivation of women entrepreneurs through the example of Eskişehir province.

II. Methodology

II.I. Purpose of the Study

The purpose of the study is to present a comparative analysis of women entrepreneurship performances of OECD countries with the data envelopment analysis (DEA) method. Accordingly, through the data explaining the women entrepreneurship activities and their effects, the countries that are efficient in women entrepreneurship and the countries that need to be referenced in order to be efficient will be determined. Especially, determining the current situation of countries and presenting comparisons between countries are critical for developing public policy, and the study is aimed to be a guide in this context.

Data Envelopment Analysis (DEA) is a non-parametric method designed to measure the relative effectiveness of decision-making units that produce the same type of outputs using the same type of inputs and that operates according to the principles of linear programming (Sarı, 2019). The DEA method, which initially had aimed to measure the relative effectiveness of non-profit institutions (hospitals, universities, etc.), was later started to widely be used to measure the relative effectiveness of multi-branch companies and profit production and service sectors (Budak, 2011, p. 96). DEA,developed by Charnes, Cooper and Rhodes in1978, measures the relative effectiveness of decision-making units in two stages (Yolalan, 1993):

1. The best observations (or decision units that make up the boundary of effectiveness) producing the maximum output composition with using the minimum input combination in any set of observations, are determined.

2. The efficiency limit formed by efficient decision units is accepted as a reference and distances (efficiency levels) of inefficient decision units from the efficiency limit are measured.

DEA method is an advantageous method with its ability to process many inputs and outputs without having to make conversions to measure the inputs and outputs that can have very different units thanks to its non-parametric feature (Kılıç, 2019). There are basically three stages in the implementation of the method:

1. Determining the decision-making units (DMUs)

2. Determining the input and output variables

3. DEA application and evaluation of the efficiency results

Since DEA is a method used to compare and sort the effectiveness of decision-making units, the first step is the creation of homogeneous decision-making units (management-organization structure, strategies and goals, production technology, etc.) (Gülsevin and Türkan, 2013). The most common situation in practice is that the selected decision-making units should be at least twice the total number of inputs and outputs. However, with a more systematic approach, it can be stated that the number of decision-making units should be at least m + s + 1, where the number of inputs is m and the number of outputs are s (Sarı,2019).

The only way to obtain efficiency values in DEA studies is the use of inputs and outputs. Thus, the stage of determining the input and output variables is the basis of the analysis. This stage is extremely critical in terms of achieving a meaningful result and acceptance of the results by the relevant parties (Ayanoğlu, 2010, p. 42).

DEA models consist of two basic models: CCR (Charnes-Cooper-Rhodes) models, which include models for input and output under the fixed return assumption according to the scale, and BCC (Banker-Charnes-Cooper) models that adopt the variable return assumption according to the scale (Budak, 2011). In input-oriented models, the principle is to use the best input combination to produce the output effectively, whereas in the output-oriented models, the principle is to use the best output combination to obtain the input effectively (Kılıç, 2019). In Table 2, information about how calculations of DEA models are realized is

shared. Accordingly, when E_k = 1, DMU is efficient, otherwise the measured DMU is not efficient. The explanations of the expressions used in Table 2 are as follows:

E_k : efficiency value of DMU k

u_r:weight of output u

v_i: weigt of input i

Y_{rk}: output r produced by DMU k

X_{ik}: input i produced by DMU k

Y_{rj}: output r produced by DMU j

X_{ij}: input i produced by DMU j

ε: small positive number

α: contraction coefficient

β: expansion coefficient

λ_j: density value for DMU

S_i^-: residual for input

S_r^+: residual for output

μ0: variable return according to scale

i = 1, …, m (number of input)

r = 1, …, p (number of output)

j = 1, …, n (number of DMU

Table 2. DEA Models

		Input Oriented	Output Oriented
Fractional Model	CCR	$E_k = \max \left(\sum_{r=1}^{p} u_r Y_{rk} \Big/ \sum_{i=1}^{m} v_i X_{ik} \right)$ $\sum_{r=1}^{p} u_r Y_{rj} / \sum_{i=1}^{m} v_i X_{ij} \leq 1$ $u_r \geq \varepsilon, v_i \geq \varepsilon$	$E_k = \min \left(\sum_{i=1}^{m} v_i X_{ik} \Big/ \sum_{r=1}^{p} u_r Y_{rk} \right)$ $\sum_{i=1}^{m} v_i X_{ij} / \sum_{r=1}^{p} u_r Y_{rj} \geq 1$ $u_r \geq \varepsilon, v_i \geq \varepsilon$
	BCC	$E_k = \max \left(\sum_{r=1}^{p} u_r Y_{rk} - \mu_0 \Big/ \sum_{i=1}^{m} v_i X_{ik} \right)$ $\sum_{r=1}^{p} u_r Y_{rj} - \mu_0 / \sum_{i=1}^{m} v_i X_{ij} \leq 1$ $u_r \geq \varepsilon, v_i \geq \varepsilon, \mu_0 : urs$	$E_k = \min \left(\sum_{i=1}^{m} v_i X_{ik} - \mu_0 \Big/ \sum_{r=1}^{p} u_r Y_{rk} \right)$ $\sum_{i=1}^{m} v_i X_{ij} - \mu_0 / \sum_{r=1}^{p} u_r Y_{rj} \geq 1$ $u_r \geq \varepsilon, v_i \geq \varepsilon, \mu_0 : urs$

Table 2. Continue.

Linear Model	CCR	$E_k = \max\left(\sum_{r=1}^{p} u_r Y_{rk}\right)$ $\sum_{i=1}^{m} v_i X_{ik} = 1$ $\sum_{r=1}^{p} u_r Y_{rj} - \sum_{i=1}^{m} v_i X_{ij} \le 0$ $u_r \ge \varepsilon, v_i \ge \varepsilon$	$E_k = \min \sum_{i=1}^{m} v_i X_{ik}$ $\sum_{r=1}^{p} u_r Y_{rk} = 1$ $\sum_{r=1}^{p} u_r Y_{rj} - \sum_{i=1}^{m} v_i X_{ij} \le 0$ $u_r \ge \varepsilon, v_i \ge \varepsilon$
	BCC	$E_k = \max\left(\sum_{r=1}^{p} u_r Y_{rk}\right) - \mu_0$ $\sum_{i=1}^{m} v_i X_{ik} = 1$ $\sum_{r=1}^{p} u_r Y_{rj} - \sum_{i=1}^{m} v_i X_{ij} - \mu_0 \le 0$ $u_r \ge \varepsilon, v_i \ge \varepsilon, \mu_0 : urs$	$E_k = \min\left(\sum_{i=1}^{m} v_i X_{ik}\right) - \mu_0$ $\sum_{r=1}^{p} u_r Y_{rk} = 1$ $\sum_{r=1}^{p} u_r Y_{rj} - \sum_{i=1}^{m} v_i X_{ij} + \mu_0 \le 0$ $u_r \ge \varepsilon, v_i \ge \varepsilon.\mu_0 : urs$
Envelopment Model	CCR	$E_k = \min \alpha - \varepsilon \sum_{i=1}^{m} S_i^- - \varepsilon \sum_{r=1}^{p} S_r^+$ $\sum_{j=1}^{n} X_{ij}\lambda_j + S_i^- - \alpha X_{ik} = 0$ $\sum_{j=1}^{n} Y_{rj}\lambda_j - S_i^+ - Y_{rk} = 0$ $\lambda_j \ge 0, S_i^- \ge 0, S_r^+ \ge 0$	$E_k = \max \beta + \varepsilon \sum_{i=1}^{m} S_i^- + \varepsilon \sum_{r=1}^{p} S_r^+$ $\sum_{j=1}^{n} X_{ij}\lambda_j + S_i^- - X_{ik} = 0$ $\sum_{j=1}^{n} Y_{rj}\lambda_j - S_i^+ - \beta Y_{rk} = 0$ $\lambda_j \ge 0, S_i^- \ge 0, S_r^+ \ge 0$
	BCC	$E_k = \min \alpha - \varepsilon \sum_{i=1}^{m} S_i^- - \varepsilon \sum_{r=1}^{p} S_r^+$ $\sum_{j=1}^{n} X_{ij}\lambda_j + S_i^- - \alpha X_{ik} = 0$ $\sum_{j=1}^{n} Y_{rj}\lambda_j - S_i^+ - Y_{rk} = 0$ $\sum_{j=1}^{m} \lambda_j = 1$ $\lambda_j \ge 0, S_i^- \ge 0, S_r^+ \ge 0$	$E_k = \max \beta + \varepsilon \sum_{i=1}^{m} S_i^- + \varepsilon \sum_{r=1}^{p} S_r^+$ $\sum_{j=1}^{n} X_{ij}\lambda_j + S_i^- - X_{ik} = 0$ $\sum_{j=1}^{n} Y_{rj}\lambda_j - S_i^+ - \beta Y_{rk} = 0$ $\sum_{j=1}^{m} \lambda_j = 1$ $\lambda_j \ge 0, S_i^- \ge 0, S_r^+ \ge 0$

II.II. Data Set

Within the scope of the study, 30 of the 37 countries that are members of the OECD were examined as DMUs (decision making unit). Other countries (Colombia, Czech Republic, Estonia, Iceland, Israel, Korea, New Zealand) are excluded from the analysis, as they may affect reliability due to missing data.

In the process of determining the input and output variables of the study, the entrepreneurship measurement framework of OECD and EUROSTAT (2007) was used. Accordingly, the impact of entrepreneurship activities is assessed at the level of countries and regions through the categories of economic growth, job creation and poverty reduction. In the framework prepared, entrepreneurship activities are expressed in the form of the ratio of self-employed people in total employment, the ratio of people who started a business in total employment and the ratio of inventors. In this context OECD has started to detail this data specifically for women entrepreneurs and in this study data from 2017, which is the nearest year that data integrity among all countries was achieved, is used.

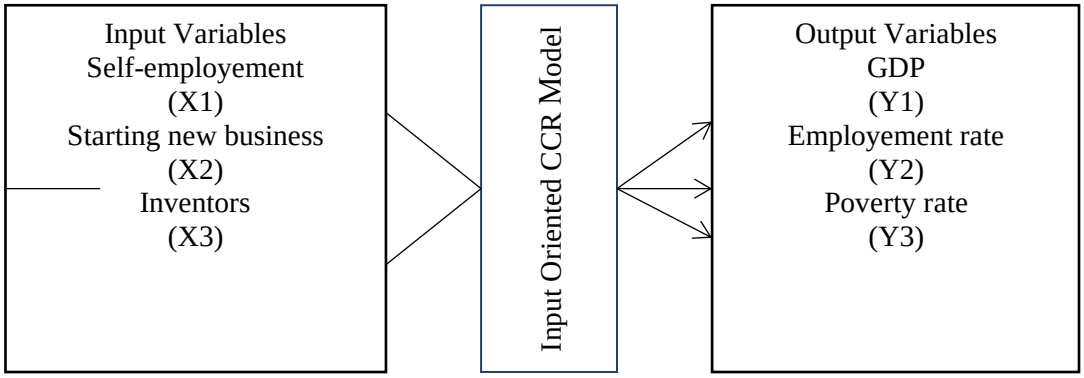

Figure 1. Data envelopment model

With 3 inputs, 3 output variables and 30 DMU, the condition of number of decision-making units should be at least m + s + 1 is satisfied. Since the DEA CCR model is processed with the principle of minimizing the inputs and maximizing the outputs, input variables were converted into the form of (100-value) in order to avoid confusion. Current data expression of OECD -data in percentage- made this situation easier. The poverty rates of the countries were subtracted from 1 and thus the data was made compatible with DEA.

Table 3. Data Set of Analysis

Country	Self-employed women (%)	Women who started new business (%)	Women inventors (%)	GDP	Employement rate (%)	Poverty rate (%)
Australia	4,1	35,6	11,4	51297	73,0	0,124
Austria	2,6	18,4	5,1	54652	72,2	0,094
Belgium	2,5	29,9	13,1	50726	63,1	0,102
Canada	2,6	37,2	12,1	48634	73,4	0,121
Chile	2,4	8,7	26,8	23597	62,7	0,165
Denmark	1,5	39,1	9,5	55046	73,2	0,058
Finland	1,9	34,3	9,8	47481	70,0	0,063
France	2,2	28,9	12,8	44651	64,7	0,081
Germany	2,3	18,9	7,0	53012	75,3	0,104
Greece	4,6	9,3	20,5	29089	53,5	0,126
Hungary	2,8	14,5	8,4	29529	68,2	0,08
Ireland	2,2	27,0	9,6	78211	67,7	0,09
Italy	3,6	11,6	9,5	41785	58,0	0,139
Japan	0,5	14,7	7,1	40885	75,3	0,157
Latvia	1,3	12,2	26,4	33821	70,4	0,173
Lithuania	3,1	6,4	24,0	28505	70,1	0,166
Luxemburg	2,1	37,2	6,1	112702	66,2	0,122
Mexico	2,3	3,9	12,0	20023	61,1	0,166
Netherlands	2,3	44,6	8,7	55349	75,9	0,083
Norway	1,0	51,4	9,0	62940	74,0	0,084
Poland	2,4	14,2	15,8	29802	66,1	0,096

Table 3. Continue.

Portugal	2,8	23,5	25,5	33086	67,8	0,107
Slovakia	1,8	23,0	5,8	30912	66,2	0,085
Slovenia	2,4	17,2	11,0	36661	69,2	0,085
Spain	3,2	30,3	19,1	39627	61,1	0,148
Sweden	1,4	46,2	7,3	52693	76,9	0,093
Switzerland	3,2	28,0	9,1	67139	79,8	0,091
Turkey	1,3	10,9	18,6	28209	51,6	0,172
UK	1,4	25,9	10,0	45988	74,1	0,119
USA	1,2	31,6	11,8	59984	70,1	0,178

Considering the controllability of chosen input and output variables on country-level entrepreneurship, it is seen that input variables are much more controllable, and thus input oriented CCR model was used for analysis. Analysis was conducted with the help of excel based EMS (Efficiency Measurement System) package program.

IV. Findings

As a result of the analysis performed, the efficiency values of women entrepreneurship of OECD countries are shared in Table 4. Accordingly, there are 11 efficient DMUs, 19 inefficient DMUs.

Table 4. Efficiency Scores of Countries

Country No	DMU	Value	Rank	Country No	DMU	Value	Rank
17	Luxemburg	100,00%	1	4	Canada	97,57%	16
20	Norway	100,00%	1	2	Austria	97,32%	17
22	Portugal	100,00%	1	15	Letonia	97,17%	18
27	Switzerland	100,00%	1	23	Slovakia	97,06%	19
10	Greece	100,00%	1	1	Australia	96,80%	20
26	Sweden	100,00%	1	3	Belgium	96,68%	21
7	Finland	100,00%	1	5	Chile	95,17%	22
16	Lithuania	100,00%	1	29	UK	94,52%	23
6	Denmark	100,00%	1	25	Spain	94,13%	24
19	Netherlands	100,00%	1	11	Hungary	93,61%	25
8	France	100,00%	1	13	Italy	92,98%	26
12	Ireland	97,95%	12	14	Japan	92,00%	27
9	Germany	97,93%	13	30	USA	91,89%	28
24	Slovenia	97,68%	14	28	Turkey	89,51%	29
21	Poland	97,61%	15	18	Mexico	89,03%	30

The list of inefficient countries as a result of the analysis carried out with the EMS program and the DMUs that should be referenced in order to be efficient are shown in Table 5. In addition, the values in parentheses in the reference field explain with which rates they should reference the relevant DMUs.

Table 5. Results for Inefficient DMUs

NO	DMU	Efficiency Score	Input1 {I}{V}	Input2 {I}{V}	Input3 {I}{V}	Output1 {O}{V}	Output2 {O}{V}	Output3 {O}{V}	References
12	Ireland	97,95%	1	0	0	0	0	0,98	7 (0,98)
9	Germany	97,93%	1	0	0	0	0	0,98	7 (0,98)
24	Slovenia	97,68%	0,93	0	0,07	0	0	0,98	7 (0,70) 8 (0,27)
21	Poland	97,61%	0,71	0	0,29	0	0	0,98	8 (0,75) 22 (0,23)
4	Canada	97,57%	0,05	0,17	0,78	0	0,8	0,18	20 (0,04) 22 (0,21) 26 (0,48) 27 (0,25)
2	Austria	97,32%	1	0	0	0	0,17	0,8	7 (0,77) 27 (0,20)
15	Letonia	97,17%	0,04	0	0,96	0	0,57	0,4	10 (0,42) 16 (0,50) 22 (0,06)
23	Slovakia	97,06%	1	0	0	0	0	0,97	7 (0,97)
1	Australia	96,80%	0,58	0,08	0,34	0	0,34	0,62	6 (0,25) 10 (0,07) 19 (0,29) 27 (0,34)
3	Belgium	96,68%	0,47	0,06	0,47	0,07	0	0,9	7 (0,72) 10 (0,12) 17 (0,01) 22 (0,12)
5	Chile	95,17%	0	0	1	0	0	0,95	22 (0,94)
29	UK	94,52%	0,85	0,02	0,13	0	0,21	0,73	6 (0,22) 7 (0,06) 10 (0,19) 27 (0,49)
25	Spain	94,13%	0,46	0,13	0,41	0,02	0	0,92	6 (0,06) 7 (0,31) 20 (0,06) 22 (0,51)
11	Hungary	93,61%	1	0	0	0	0	0,94	7 (0,93)
13	Italy	92,98%	1	0	0	0	0	0,93	7 (0,91)
14	Japan	92,00%	0,62	0	0,38	0	0,92	0	10 (0,05) 27 (0,90)
30	USA	91,89%	0	0,14	0,86	0,15	0,48	0,28	10 (0,13) 17 (0,04) 20 (0,19) 27 (0,55)
28	Turkey	89,51%	0,72	0	0,28	0	0	0,9	8 (0,42) 22 (0,49)
18	Mexico	89,03%	0,93	0	0,07	0	0	0,89	7 (0,29) 8 (0,60)

The interpretation of the results in Table 5 for Turkey, with 89% efficiency value Turkey is an inefficient DMU. That inefficiency is mainly based on the negative effect of rate of self-employed women and rate of inventors on the overall score. Improvement on self-employed women rate will affect the overall score with a 72% rate and improvement on inventors' rate will affect the overall score with a 28% rate. In order to be efficient Turkey should take France and Portugal as reference. The reference rates of these efficient countries are 42% and 49% respectively. The main reason for Ireland, Germany, Slovakia, Hungary, and Italy not to be efficient is the rate of self-employed women, and these countries need to reference Finland in order to be efficient.

In Table 6, scores of 11 efficient countries and number of referencing of each are shared. Hereunder, Finland was taken as reference by 11 countries and has the highest referencing number. As a result of the analysis, there is no country that is efficient but not referenced to other countries.

Table 6. Results for Efficient Countries

NO	DMU	Efficiency Score	References #
6	Denmark	100,00%	3
7	Finland	100,00%	11
8	France	100,00%	4
10	Greece	100,00%	6
16	Lithuania	100,00%	1
17	Luxemburg	100,00%	2
19	Netherlands	100,00%	1
20	Norway	100,00%	3
22	Portugal	100,00%	7
26	Sweden	100,00%	1
27	Switzerland	100,00%	6

V. Conclusion

With its critical contribution to economic development, employment rate, and innovation, women entrepreneurship finds itself a rising trend in the strategic planning of countries. In today's world, where the creation of incentive and support policies are critical, the necessity of creating standard data on women entrepreneurship, comparative analysis, and measurement methodologies is emphasized day by day because of the "you cannot manage it unless you measure it" point of view. Similarly, in the literature on women entrepreneurship, while the conceptual framework and theoretical developments are frequently included, analytical studies based on data are still needed. As of 2012, OECD has started working on systematic data collection to serve this need and detailed women entrepreneurship activities at the country level. In this study women entrepreneurship performance of OECD countries was evaluated and a comparative analysis was presented with data envelopment analysis (DEA) based on OECD data.

Results show that 11 countries (Denmark, Finland, France, Greece, Lithuania, Luxembourg, Netherlands, Norway, Portugal, Sweden, Switzerland) are efficient countries with their women entrepreneurship performance and as an output of the analysis the inefficient countries and their references are shared. In the study, in which women entrepreneurship activities are associated with being self-employed, starting a new business and making inventions, the outputs of entrepreneurship activities at the country level were calculated based on gross domestic product, employment rate, and poverty rate data. As a result of the analysis, Turkey took 29th place among 30 countries in the means of women entrepreneurship performance, and Turkey, France, and Portugal should be taken as references for the improvement activities.

Creating public policies for increasing awareness on entrepreneurship can be a career path for women and increasing financial support for women entrepreneurs, developing public programs to support potential and existing women entrepreneurs, and creating business/partnership networks can be listed as strategic actions to increase women's entrepreneurship performance. Comparable results supported by data like the analysis in the study are highly critical in the formulation of public policies to manage the process correctly and effectively.

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