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PATH TO DEVELOPMENT VIA GENDER EQUALITY: A STRUCTURAL EQUATION MODELING OF FEMALE HUMAN CAPITAL FACTORS

Doç.Dr.Bilge Acar Bolat
İstanbul Üniversitesi
İşletme Fakültesi

Abstract

Women are underrepresented in parliaments creating a gender inequality from the political perspective. While there are policies developed in order to reduce gender gaps in many areas of social life, it is known that there is a lot to be done for empowering women in their participation in national parliaments. Therefore, it is crucial to analyse the factors that will help empowering women's participation in parliaments. In this study, data of upper middle and high income level countries for 2010 in terms of involvement in female education, labour, health and parliament are analysed in order to find the relationships between these factors and to the impacts of them on female participation in national parliaments. Using structural equation modeling, which is an extension of regression analysis and factor analysis and deals with complex relationships simultaneously, it is found that education has a direct positive effect on both employment and health, whereas an indirect effect on rates of female participation in parliament. Finally, both employment and health have a positive effect on participation in parliament.

Keywords: Female participation rate in parliament, female education, female health, female labour force participation, structural equation modeling.

CİNSİYET EŞİTLİĞİ ARACILIĞIYLA KALKINMA YOLU: KADIN BEŞERİ SERMAYE FAKTÖRLERİNİN YAPISAL EŞİTLİK MODELİ İLE İNCELENMESİ

Özet

Kadınlar cinsiyet eşitsizliği nedeniyle siyasi açıdan parlamentolarda daha az temsil edilmektedir. Toplumsal yaşamın birçok alanında cinsiyet eşitsizliğinin azaltılması için politikalar geliştirilirken kadınların yetkisi için ulusal parlamentolara katılımlarında yapılması gereken birçok şey olduğu bilinmektedir. Bu nedenle parlamentolara kadınların katılımını etkileyebilecek faktörleri analiz etmek önemlidir. Bu çalışmada 2010 yılı için üst, orta ve yüksek gelir düzeyindeki ülkelerin kadın eğitimi, kadın işgücü, kadın sağlığına ilişkin değişkenler arasındaki ilişkiler ve bu değişkenlerin kadınların parlamentoya katılım durumu üzerindeki etkilerini analiz etmek hedeflenmiştir. Çalışmada regresyon analizi ile faktör analizinin bir uzantısı olan ve eş anlı karmaşık ilişkilerin aynı anda analiz edilebilmesini sağlayan yapısal eşitlik modeli kullanılmıştır. Analiz sonucunda eğitimin istihdam ve sağlığı doğrudan etkilediği, kadınların parlamentoya katılımını ise dolaylı etkilediği saptanmıştır. Sonuç olarak, istihdam ve sağlığın parlamentoya katılım üzerinde olumlu etkisi olduğu belirlenmiştir.

Anahtar kelimeler: Kadınların parlamentoya katılım oranı, Kadın eğitimi, Kadın sağlığı, Kadın işgücü katılım oranı, Yapısal eşitlik modeli

Introduction

The recent world development reports by World Bank (World Bank, 2012) and United Nations (United Nations, 2011) focus on gender equality and development, and on sustainability and equity, respectively. The starting point of these reports is that there is a lot to be done for progress in closing gender gaps in many areas of life such as education, health, work and parliament participation rates. In many parts of the world, there have been considerable gains in the patterns of gender gaps. Even though women constitute around 50 percent of the population, the rates of female participation in education, health, employment and parliament participation have been very slow. Therefore, it is very important to analyse the relationships between human capital indicators through the prism of gender which would give us more insight into how to progress in closing the gender gaps resulting in development. As the President of World Bank has said "gender equality is at the heart of development" and that "investing in girls is smart" (World Bank, 2012), there is a need to understand what drives to gender equality.

When the question of "how to close these gaps for development" is dealt with, it is not possible to consider human capital indicators individually and separately. As a result, it is for sure that all the factors of human capital should work together, but in which direction? For instance, it is believed that education of females without providing a healthier environment would be a crippled policy, whereas providing health but not education for females at the end would not lead to a woman to have more voice in her political, work and home environment. Beyond all the human capital indicators, it is believed that providing equality in women's participation rates in politics is the final outcome. Taking into consideration the overall share of women parliamentarians, measured as the proportion of seats held by women in national parliaments, it is seen that it increased only from 10 percent to 17 percent between 1997 and 2010. The progress in closing the gender gaps in other areas is much better than the parliamentary aspect. As a result, for obtaining more progress in this area, one should understand how the educational, work and health factors of human capital affect women's representation in the parliament while having a detailed analysis of all of these factors.

With this aim, Structural Equation Modeling (SEM) is adopted to analyse the inter relationships between the four aspects of gender inequality that were highlighted in the world development reports as well as analyzing the effects of education, labour force participation and health of females on female political involvement in the parliament. For this purpose**,** 2010 data of upper middle and high income level countries where there is a lot to be done for progress in reducing the gender gaps are used.

1. Literature Review

Women's participation in the parliament is a key figure showing how democratic the country is and how much the female population is represented in the politics. This study aims to shed light on understanding the underlying factors that have a direct and indirect effect on women's parliament participation rates. Women's voice in the parliament is very important since it is believed to be a final outcome of gender equality. Moreover, this figure has been found to have a positive impact on economic growth. As a result, the factors that would enhance or reduce women's representation in the parliament will be reviewed and analysed since it is believed that women representation in the parliament is very important in terms of both economic and social development.

Before analyzing these effects and discussing the findings, it will be given a brief summary of the literature on research done for analyzing the factors that affect women's participation in parliament. There are many research papers trying to find out which of the factors affect women's participation rates in the parliaments. Most of the research papers focus on political factors such as the electoral system, regime, and political culture. On the other hand there are also research papers that focus on the structural and socio-economic factors that have an impact on women's participation in the parliament.

Mostly, these factors will be considered from a gender inequality perspective based on the recent World Bank development report. In the report, gender inequalities were presented under four issues: education, employment, health and political involvement (World Bank, 2012). In this study, the direct and indirect effects of female education, employment and health on women's participation in parliament will be examined with structural equation modeling. Since this study focuses only on the structural and socio-economic factors, it will be given a brief overview of the literature only related with the research analysing these factors.

Women's participation in the labour force has been found to have a significant positive effect on women's level of political activity in many research papers. Some research has approached the issue of women's representation in parliament using the influence of structural and cultural factors. Hill (1981) utilized a stepwise multiple regression analysis to explore the impacts of these factors on female political representation in the states of US 1970-1973 data. Female employment in legal profession listed under the cultural factors was not found to be significant possibly due to a multicollinearity problem among the independent variables, which was simply solved by a stepwise approach (Hill, 1981, p. 166-167). A more recent study by Halder (2004) has analysed the women's representation in parliament in Bangladesh and she has divided the factors that affect women's representation in parliament into Supply/Structural and Demand/Political factors. Under the structural factors Halder (2004) lists socio-economic conditions, culture, religion, education and employment, whereas under the political factors she lists the nature of the regime, the

political culture, electoral system and special mechanisms such as reversed seats or quotas (Halder 2004, p. 29). She indicated that in Bangladesh only 37.8 percent of the women parliamentarians had a university degree whereas this figure was more than 90 percent for male parliamentarians. Furthermore 45 percent of women parliamentarians are housewives. These both indicate a relationship of education and employment with women's participation in parliament (Halder 2004, pp. 42-43).

Matland (1998) has analysed the determinants of female representation in national legislatures using a distinction between 24 OECD democracies and 16 less developed countries using regression analysis. He has found that among other variables women's participation in the labour force has a statistically significant positive effect in OECD democracies whereas it is not significant in less developed countries suggesting that a threshold should be passed for less developed countries (Matland 1998, p. 115, 117).

Two very recent research papers written by Iversen and Rosenblutt (2008) and Stockemer and Byrne (2012) found similar results on the impact of female labour force participation. Iversen and Rosenblutt (2008) analysed data from 23 democratic countries for the period of 1945-2000 using fixed effects analysis method. They found that female share of labour force has a positive significant impact on female representation in legislatures (Iversen and Rosenblutt, 2008, 488). Whereas Stockemer and Byrne (2012) analysed data from more than 120 countries for the 1995-2010 period, which covers a broader sample frame. Using multi-level modeling they found that women's labour force participation has a statistically significant and substantively relevant impact on women's representation measured as the percentage of female deputies elected to the lower house of a country's national assembly (Stockemer and Byrne, 2012, p. 815).

Beyond these studies, there is a wide range of work that has been done on the political involvement of females. Most of them found that the share of women in labour force or professional occupations has a role in their involvement in politics (Anderson, 1975; Togeby, 1994; Welch, 1997; Rule, 1981; Norris, 1987; Diaz, 2005; Kenworthy and Malami, 1999).

From the point of education, the literature reveals that education both has a direct and indirect impact on female's political involvement. The direct impact of education has been analysed by Paxton (1997) with a large cross-national sample for two periods of 1975 and 1988. Paxton (1997) used many explanatory variables and measured their direct effects on the percentage of female members in a national legislature of a country. Among the variables used in the study, the percentage of females receiving higher education did not have a statistically significant parameter. In this study, the impact of the percentage of economically active female labour force is also measured and this measure is either found to be statistically insignificant in 1975 and 1988 or negatively significant in the year 1988 (Paxton, 1997, p. 453, 457).

The indirect impact of female education happens via its impact on labour force participation and health level of the citizens in a country. It is evident that the more educated female are, the more they participate in labour force. A micro study based on the Household Budget Surveys on Turkish women living in urban and rural areas in 2002-2008 period shows that education has a positive and statistically significant impact on female's labour force participation decisions (Kızılgöl, 2012).

From the point of education, it is believed and proved that education plays a crucial role in health levels of societies. Educating females not only helps them protect themselves from HIV or other diseases, but also helps them understand the practical health information or prescriptions. There is a wide literature on the effects of female's education on the health levels. Using cross-country regressions based on a data set from 72 developing countries for the period of 1970-1985, Subbarao and Raney (1993, 1995) have found that female education when combined with family planning reduces fertility rates. They also found that female secondary education reduces infant mortality rates (Subbarao and Raney, 1993, p. 10-32; Subbarao and Raney, 1995, p. 114-115, 117). On the other hand, there are some papers with the outcome of insignificant effects of education on fertility (McCrary and Royer, 2006, p. 23-26). McCrary and Royer (2006) use the health data of mothers in Texas and California, US for the period of 1989-2002. They find little evidence that school entry policies of females affect women's fertility and the results obtained suggest that increases in female education lead to small and statistically insignificant changes in fertility choices and infant health (McCrary and Royer, 2006, p. 30).

Another research on the effects of female education is done in Sub-Saharan African countries by Browne and Barrett (1991) and they have well emphasized the fact that education is the key to the process of human-centred development. They have demonstrated statistical figures to support their claim that more educated mothers are likely to use modern preventive health services (Browne and Barrett, 1991, p. 278). This claim, which is all about female's awareness of fertility options and healthy pregnancy behaviours, has been well documented in the literature (Grossman, p. 1972).

In a nutshell, the purpose of this study is to examine and detail the direct and indirect links between education, health, employment and politics with structural equation modeling for upper middle and high income level countries for the year 2010.

2. Methodology

The aim of this research is to examine the factors affecting female participation in national parliaments among upper middle and high income level countries. It is seen in the literature review that there are many factors affecting female's political involvement, which can be classified under three main factors such as female education, female labour force participation and health.

The proportion of seats held by women in national parliaments is used to measure female's political involvement, whereas there are many different measures that are used in order to measure education, labour and health.

In order to examine the dependencies between the factors that affect female's political situation, a structural equation model (SEM) that is a multivariate statistical method is employed. Structural Equation Modeling (SEM) is an extension of regression analysis and factor analysis and deals with complex relations that are analysed simultaneously (Schumacker and Lomax, 2004, p.p. 1-3). A regression analysis is applied when a single dependent observed variable is tried to be explained by one or more independent observed variables. Clearly, an independent variable, which is sometimes referred to as an exogenous variable, is a variable that is not influenced by any other variables. On the other hand, a dependent variable is a variable that is influenced by other variables in the model. Different than a regression analysis, multiple and interrelated dependencies among variables can be analysed in a SEM. A dependent variable in a SEM can be an independent variable in another model enabling us to explore the relations between more than one dependent variable in one single model (Maruyama, 1998, p. 22). This complex feature of a SEM relies on a strong theoretical foundation between the variables. As a result, the researcher should be aware of which of the variables are dependent and which of them are independent as well as knowing the relative importance of the effects (Hair, Anderson, Tatham and W. Black , 1996, pp. 578-586). Therefore SEM is also often used to test the causal theoretically known relations.

The fundamental characteristics of SEM include the estimation of multiple and interrelated simultaneous dependencies as well as the ability to represent unobserved factors in these dependencies. The unobserved variables are often called as latent variables and the observed variables are used to define or infer the latent variables. Those variables in a SEM that are defined as either observed or latent variables can also be defined as independent or dependent variables. This underlying structure behind SEM comes from the theoretical model hypothesized by the researcher.

SEM is a method that includes both a measurement and a structural model. The measurement model helps to measure the associations between the observed and the latent variables. The researcher assigns which observed variables are associated with which latent variables specifying a factor loading of zero to those that are not associated with the latent variable in consider. As a result this makes SEM different than a factor analysis where all variables are associated with the factors each having a factor loading. This use of measurement model in SEM is often called as a confirmatory factor analysis. The structural model on the other hand measures the association between the independent and dependent variables.

A very simple SEM model that can be constructed in a series of dependence relations

between 3 dependent and 2 independent variables is expressed as follows:

$$Y1=b_{y1x1}X_1+b_{y1x2}X_2+ey_1 \quad (1)$$

$$Y2=b_{y2x1}X_1+b_{y2x2}X_2+b_{y2y1}Y_1+ey_2$$

$$Y3=b_{y3x1}X_1+b_{y3x2}X_2+b_{y3y1}Y_1+b_{y3y2}Y_2+ey_3$$

Here it can be seen that the variables Y1 and Y2 are present in all of the equations as both a dependent and an independent variable. For this reason, the estimation of the parameters is applied using a SEM.

The early development of SEM models was due to Joreskog (1973), Keesling (1972), and Wiley (1973) including the development of the linear structural relations model (LISREL) software program using a matrix command language (i.e., Greek and matrix notation) (Schumacker and Lomax, 2004, pp. 1-3). Therefore following their procedure and summarize the general SEM model as follows (Timm, 2002, p. 559; Kaplan, 2000, p. 55):

$$\eta i\ (m\times 1) = B\ (m\times m)\ \eta i\ (m\times 1) + \Gamma\ (m\times n)\ \xi i\ (n\times 1) + \zeta i\ (m\times 1) \quad (2)$$

Here,

ηi : latent dependent variables

ξi : latent independent variables with ($\sim Nn(0, \Phi)$).

ζi : random structural errors with ($\sim Nm(0, \Psi)$).

The measurement model between the observed and latent variables is shown in the following structure (Timm, 2002, p. 560; Kaplan, 2000, p. 55):

$$yi\ (p\times 1) = \Lambda y\ (p\times m)\ \eta i\ (m\times 1) + \varepsilon i\ (p\times 1) \quad (3)$$

$$xi\ (q\times 1) = \Lambda x\ (q\times n)\ \xi i\ (n\times 1) + \delta i\ (q\times 1)$$

Where,

yi : observed variable vector that construct the latent dependent variable vector of ηi

xi : observed vector of variables that construct the latent independent variable vector of ξi

εi : measurement error vector of the first measurement model with ($\sim Np(0, \Theta\varepsilon)$)

δi : measurement error vector of the second measurement model with ($\sim Nq(0, \Theta\delta)$)

Λy : regression coefficient between y and η

Λx : regression coefficient between x and ξ

Once the measurement model is joined with the structural model, the SEM is expressed as

follows:

$$\eta = B\eta + \Gamma\xi + \zeta \quad (4)$$

$$y = \Lambda y\eta + \varepsilon$$

$$x = \Lambda x\xi + \delta$$

Here, B, Γ, Λy and Λy are matrices that show the direct effects.

After having built the theoretical model, the main issue is to estimate the parameters. Estimation involves determining the value of the unknown parameters and the error associated with the estimated value. Since the number of parameters to be estimated is large, it is required to have a large sample size. In order to estimate the parameters, either maximum likelihood method (ML), asymptotic distribution free (ADF) method, generalised least squares (GLS) (Kaplan, 2000, p. 24) or weighted least squares methods can be used. Researchers must select which estimation method to use prior to conducting their analysis; one deciding factor is whether the data are normally distributed. ML and generalized LS methods assume multivariate normality, whereas LS and ADF do not. LS estimation does not provide a valid inference to the population from the sample, but ADF does when the sample size is sufficiently large. One of the most common techniques, ML, is robust to moderate violations of the normality assumption (Weston and Gore, 2006). For further details on the estimation of the parameters, one can refer to Hair, et al. (1996), Timm (2002), Schumacker and Lomax, (2004), Kaplan (2000) among the many others.

The reason to use SEM in order to analyse the factors affecting female political involvement levels measured as the proportion of seats held by women in national parliaments could be summarised as follows:

- The effects of latent variables that are constructed using the observed variables can be measured with a SEM. As an example the educational level of a country is measured with several observable variables that will construct the latent variable named female education.
- In SEM, it is possible to test and predict the associations between the latent variables as well as testing the associations between the observed variables.
- The direct and indirect effects of causal relationships between the observed and latent variables can be calculated in SEM. Direct effects are the effects in between two variables whereas the indirect effect of a variable on another variable is measured with its effect via other variables.

With these advantages of SEM and the nature of the complex interrelated relations between the variables that have been used in the literature to explain the levels of female political involvement, such as female education, health and female labour force participation, SEM technique is employed. SPSS package AMOS is used to provide SEM results. The variables

and observations will be explained in detail in the next section.

3. Data

In this study, annual data on female education, female health, female labour force participation and female political involvement in national parliaments are analysed for the year 2010. The data are obtained from World Bank's database and analysed for all of the upper middle countries where data are available. The variables with non-random missing values are excluded from the data set whereas the random missing data are replaced with previous year's value when applicable and if the 2009 data are missing then the missing values are replaced with their income level group mean in year 2010. The list of the countries is given in the Appendix Table 1.

Women's political participation in the parliament is measured in terms of proportion of seats held by women in national parliaments. Educational, employment and health indicators are included in the model with their sub-indicators. The summary statistics for the variables included in the model are given in the Appendix in Table 2, and the names of the sub-indicators of the educational, employment and health variables with their expected signs in the parenthesis are as follows:

-Labour force participation indicators:

- *(La1): Labour force, female (% of total labour force)*
- *(La2):Labour participation rate, female (% of female population ages 15+)*
- *(La3):Labour participation rate, male (% of male population ages 15+)*
- *(La4):Labour participation rate, total (% of total population ages 15+)*
- *(La5):Ratio of female to male labour participation rate (%)*

It is believed that an increase in the female labour force participation rate also increases the women's participation rates in the parliament. As a result, employment ratio of females is expected to have a positive impact whereas unemployment rate to have a negative impact.

-Education indicators:

- *(Ed1):Primary completion rate, female (% of relevant age group)*
- *(Ed2:)Ratio of female to male primary enrollment (%)*
- *(Ed3): Ratio of female to male secondary enrollment (%)*
- *(Ed4):Ratio of female to male tertiary enrollment (%)*
- *(Ed5):School enrollment, primary, female (% net)*
- *(Ed6):School enrollment, secondary, female (% net)*
- *(Ed7):School enrollment, tertiary, female (% gross)*

Education of females in a country is thought to have a positive impact on women's participation rates in the parliament since the more educated the females are the higher the probability of a woman entering in the parliament is.

-Health indicators:

- *(He1): Adolescent fertility rate (births per 1,000 women ages 15-19)*
- *(He2):Birth rate, crude (per 1,000 people)*

- *(He3):Fertility rate, total (births per woman)*
- *(He4):Life expectancy at birth, female (years)*
- *(He5):Mortality rate, adult, female (per 1,000 female adults)*
- *(He6):Survival to age 65, female (% of cohort)*

It is believed that life expectancy ratio and survival to age 65 have a positive impact on economic growth since both are the indicators of a healthier generation with better life standards and therefore better quality in human capital. On the other hand, high female adult mortality rates show that life standards are not good in quality and as a result it is expected to have a negative impact.

- *Political involvement in parliaments indicators:*

- *Proportion of seats held by women in national parliaments (+)*

Female participation in the parliament is believed to have a positive impact on income per capita since high participation rates of females in the parliament show the level of democracy and the importance given to females. Therefore the main aim is to find the factors affecting this ratio. In the following section findings obtained using SEM will be summarized.

4. Empirical Evidence

Literature review revealed that the human capital indicators of *female parliament participation rates* are mainly analysed under the *female education, health* and *female labour force participation rates*. As a result, It is mainly focused on these variables in this study to explain the determinants of *female parliament participation rates* of upper middle and high income level countries in year 2010.

Though, when considering the data of 122 countries among the upper middle and high income level countries, it can be seen that there are some missing observations for various countries or missing variables for the year of 2010. In some of the resources on structural equation modeling, it is mentioned that the data set has to have at least 5 to 15 observations per the number of parameters to be estimated. Therefore in order not to have very small degrees of freedom, the missing values were not excluded. Instead of excluding the missing values, 2009 values were used whenever it was possible assuming that the macro economic variables do not change dramatically in a year. If a country did not have either of the 2010 or 2009 data, the mean value of the income level group for the variable in consideration have been used. When observing the outliers, the Mahalanobis distances were used and those 24 countries that had a Mahalanobis distance value with a significance level less than 0,1 percent (Kline, 2005) were excluded from the data set. In the final step, the data set included 98 countries from upper middle and high income levels. The list of the countries included in this research can be seen in Appendix Table 1.

Multinormality is examined using Mardia's test and since the test value of 1.535 was smaller than 1.96 which is the critical standard normal value at a significance level of 5

percent, it has been concluded that the multivariate normality was satisfied.

After examining the missing values and outliers and seeing that the multivariate normality was satisfied, SEM was applied in order to find the associations and the impacts between *female health, education, labour force participation rates* and *female parliament participation rates. Health, education* and *employment levels* are included in the model as latent variables with their corresponding observed variables. All the available observed variables that construct each of the latent variables are examined according to whether or not they are clustered in one dimension (unidimensionality). Those variables that are not clustered in one dimension are excluded from the analysis. After finding which of the variables construct the three latent variables, confirmatory factor analysis was applied.

The confirmatory factor analysis of latent variables revealed that the following observed variables significantly construct the corresponding latent variables:

- *Female Labour Force Participation Latent Variable:*
  La1 : Labour force, female (% of total labour force)
  La5 : Ratio of female to male labour participation rate (%).
- *Female Education Latent Variable:*
  Ed5 : School enrollment, primary, female (% net)
  Ed6: School enrollment, secondary, female (% net)
  Ed7: School enrollment, tertiary, female (% gross)
- *Female Health indicators:*
  He4: Life expectancy at birth, female (years)
  He6: Survival to age 65, female (% of cohort)

It is clearly seen that *the labour force participation* latent variable can be represented with two observed variables such as *La1* and *La5*, *education* latent variable with three observed variables such as *Ed5*, *Ed6* and *Ed7* and the *health* latent variable with two observed variables such as *He4* and *He6*.

The second step of a SEM is to construct the structural model. The following model given in Figure 1 is analysed using SEM. Here it is clear that all of the latent variables are considered to have a direct impact on *female parliament participation rates* that is the dependent variable. Since SEM has been constructed in a way that each latent variable has a direct impact on the dependent variable, this model can be considered as a multiple regression analysis, which will be denoted as Model 1. On the path diagram given in Figure 1, the numbers represent the standardized coefficients of the model indicating the level of association between the two variables. For example in Model 1, 0,63 on the arrow between *female education* and *health* latent variables indicate that the level of association between these two variables is 0,63.

Figure 1: Path Diagram of Model

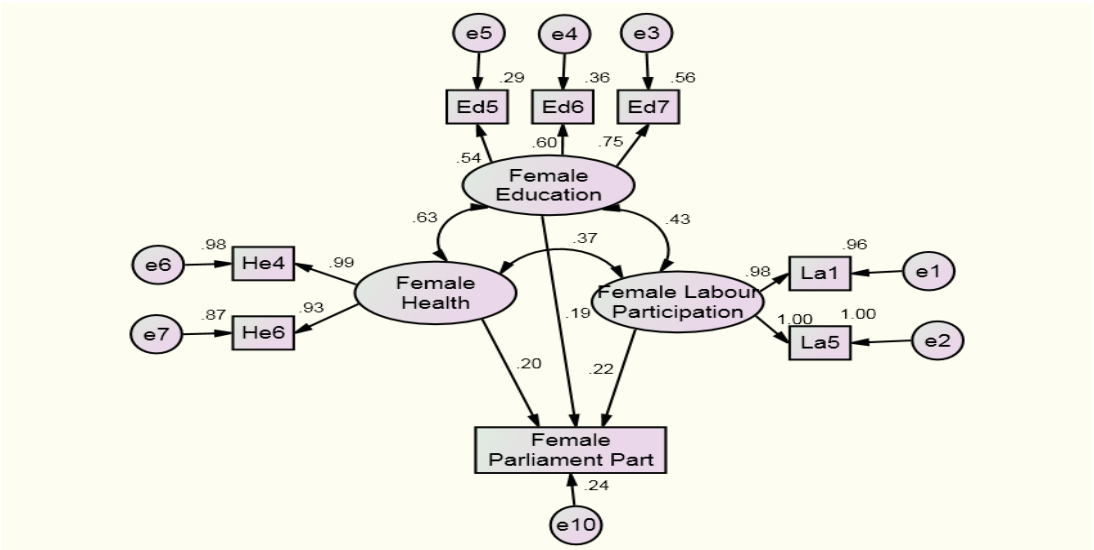


Table 1 provides the unstandardized regression coefficients of Model 1 and the significance levels of each coefficient. When looked at the coefficients between "*Parliament Participation* <---*Health*" (Estimate: 0,608) and "*Parliament Participation* <---*Education*" (Estimate: 0,095), it can be seen that these coefficients are not statistically significant with p-values of 0,130 and 0,245, respectively. Arrows indicate the direction of influence between the variables in consideration. The critical values (C.R.) of the estimates can also be compared with the critical standard normal value of 1,96 at 5 percent significance level and it is obvious that the critical values of the estimates (1,516 and 1,162, respectively) are smaller than 1,96, which reveals the same conclusion.

Table 1: Unstandardized Weights of Model 1

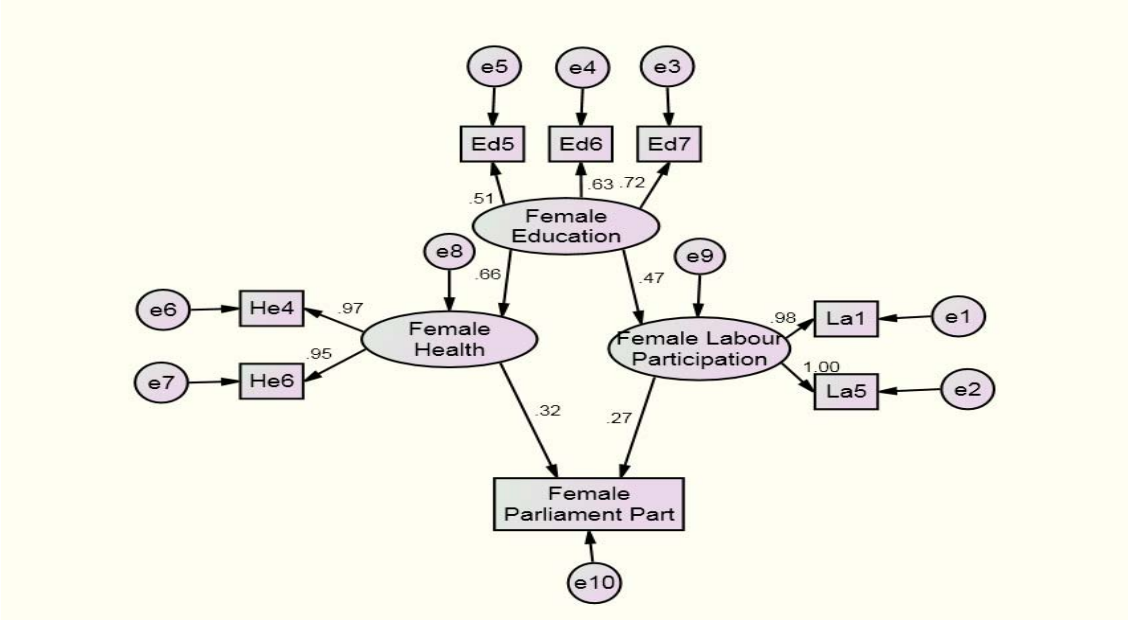
			Estimate	S,E,	C,R,	P
La1	<---	Labour	,443	,010	43,369	,000***
La5	<---	Labour	1,000			
He6	<---	Health	1,303	,094	13,795	,000***
He4	<---	Health	1,000			
Ed5	<---	Education	,151	,035	4,278	,000***
Ed6	<---	Education	,248	,054	4,603	,000***
Ed7	<---	Education	1,000			
Parliament Participation	<---	Health	,608	,401	1,516	,130
Parliament Participation	<---	Labour	,149	,071	2,092	,036*
Parliament Participation	<---	Education	,095	,082	1,162	,245

*** indicates that the coefficient is significant at a 0,1% significance level, ** indicates that the coefficient is

significant at a 1% significance level, * indicates that the coefficient is significant at a 5% significance level. S.E. stands for standard error. C.R. stands for critical ratio. <--- indicates the direction of the association between the two variables.

Even though it has been found that *health* and *education* do not have a statistically significant effect on *female parliament participation rates*, knowing that in theory these two variables somehow have an effect on *female parliament participation rates*. Moreover, there is a vast literature on the associations between the latent variables considered in this analysis. For this reason, taking into account the indirect effects of the latent variables on the dependent variable is important. For example, the fact that *education* has a positive impact on *health* and *labour force participation rates* cannot be ignored. From that point of view, a basic simple regression analysis would fail to capture these indirect and interrelated associations reveal that the two important latent variables actually are not statistically significant. This is simply a matter of correlation between the variables and this issue has found a huge interest in the literature with the name of multicollinearity. Given that weakness of a regression analysis and the strength of SEM that can deal with the interrelated relations, the following model given in Figure 2 is built.

Figure 2: Path Diagram of Model 2



In the second model (Model 2), it is explicit that the previously insignificant variables are now significant having an indirect effect on *female parliament participation rates*. On the path diagram given in Figure 2, the numbers similarly represent the standardized coefficients of the model indicating the level of association between the two variables. For example 0,66 on the arrow between *female education* and *health* latent variables indicate

that the *female education* latent variable has an impact of 0,66 on the levels of *female health*.

Table 2: Unstandardized Weights of Model 2

			Estimate	S,E,	C,R,	P
Labour	<---	Education	,354	,093	3,822	,000***
Health	<---	Education	,111	,023	4,857	,000***
La1	<---	Labour	,443	,010	43,362	,000***
La5	<---	Labour	1,000			
He6	<---	Health	1,348	,094	14,281	,000***
He4	<---	Health	1,000			
Ed5	<---	Education	,149	,036	4,114	,000***
Ed6	<---	Education	,270	,056	4,782	,000***
Ed7	<---	Education	1,000			
Parliament Participation	<---	Health	,961	,297	3,233	,001**
Parliament Participation	<---	Labour	,182	,065	2,797	,005**

*** indicates that the coefficient is significant at a 0,1% significance level, ** indicates that the coefficient is significant at a 1% significance level, * indicates that the coefficient is significant at a 5% significance level. S.E. stands for standard error. C.R. stands for critical ratio. <--- indicates the direction of the association between the two variables.

The significance levels of each variable in the second model in Figure 2 are provided in Table 2. When taking into account these significance levels it can be seen that *female education* has a significant impact on both *female health* ("*Health <---Education*") and *female labour force participation levels* ("*Labour <---Education*") with p-values of 0,000. It is also clearly seen that *female health* and *labour force participation rates* have significant impacts on *female parliament participation* with a significance level of 0,001 and 0,005, respectively. Beyond the relations between the latent variables and their impacts on the dependent variable, it is seen that the observed variables that construct the latent variables are also significant. For example the observed variables *He4* and *He6* that construct the *health* latent variable are significant. From Figure 2 that provides the standardized coefficients, it is seen that they are 0,97 and 0,95 for *He4* and *He6*, respectively. Since these standardized regression coefficients belong to the observed variables that construct the latent variables, they are also called as factor loadings. As a result it can be said that the constructs are meaningful.

The overall assessment of a SEM is diagnosed by absolute and relative fit indices, which determine how well the theory fits the sample data (Hooper, Coughlan and Mullen, 2008). "These measures provide the most fundamental indication of how well the proposed theory fits the data" (Hooper, Coughlan and Mullen, 2008, p. 53). Chi-Square test, root mean

square error of approximation (RMSEA), goodness of fit statistic (GFI), adjusted goodness of fit statistic (AGFI), root mean square residual (RMR) and standardised root mean square residual (SRMR) are the absolute fit indices and normed-fit index (NFI) and comparative-fit index (CFI) are the relative fit indices one can calculate to assess the overall goodness of the model. When small samples are used Chi-Squared test statistic is less powerful therefore the ratio of the Chi-square test to degrees of freedom, called normed Chi-square, is calculated (Hooper, Coughlan and Mullen, 2008, p. 54). In order to define a model as a good fit this normed Chi-square value is expected to be in between 2 and 5. In a well fitted model the fit indices are expected to be in the following criteria given in Table 3 which has been summarised from Hooper, Coughlan and Mullen's work (2008, p. 53-55):

Table 3: Fit Indices' Assessment Criteria for a Well-Fitted SEM

Fit indice	Cut-off values for a well-fitted model
Normed Chi-square	2 – 5
RMSEA	0 – 0,08
GFI	>0,90
AGFI	>0,90
RMR	<0,05
SRMR	<0,05
NFI	>0,90
CFI	>0,90

SPSS Amos provides all of these indices except for the SRMR. In Table 4 fit indices for the second model (Model 2) are given.

Table 4: Fit Indices for Model 2

Fit indice	Value
Normed Chi-square	2,177
RMSEA	0,110
GFI	0,915
AGFI	0,831
NFI	0,938
CFI	0,965

The normed Chi-square fit index is 2,177, GFI is 0,915 and NFI is 0,938, all of which point to a well-fitted model. Moreover, RMSEA and AGFI indices are not far away from being a good assessment criterion. As a result it can be concluded that Model 2 is a well-fitted model according to the fit indices.

Having seen that this model is well-fitted, the direct and indirect effects of variables can be

interpreted. In this study, the first and most important finding, which is different than the rest of the literature, is that *female education* has an indirect effect on *female parliament participation rates* via *female health* and *labour force participation* variables. This finding is mainly basic contribution to the literature where the indirect effect of *education* on *parliament participation rates* can be calculated as follows using the standardized regression coefficients:

$$0{,}66\times0{,}32+0{,}47\times0{,}27=0{,}34$$

This value shows that *female education* has an indirect effect of 0,34 on *female parliament participation rates*. Similarly, second contribution to the literature is that it is possible to define the structural equations as follows:

$$\text{Labour}=0{,}47\times\text{Education}+e9$$

$$\text{Health}=0{,}66\times\text{Education}+e8$$

$$\text{Parliament}=0{,}32\times\text{Health}+0{,}27\times\text{Labour}+e10$$

These structural equations include *female labour force participation* and *female health* as both dependent and independent variables. As a result, it is concluded that to increase *female's participation* in national parliaments it is crucial to improve *female educational* levels as well as *female health* and *female labour force participation* levels. Moreover, it is revealed that these human capital measures work together simultaneously.

Conclusion

In this study, annual data on female education, female health, female labour force participation and female political involvement in national parliaments are analysed for the year 2010 for all of the upper middle countries where data is available. The data set includes 98 countries.

In order to examine the dependencies between the factors that affect female's political situation, a structural equation model (SEM) that is a multivariate statistical method is employed. Structural equation modeling (SEM) is an extension of regression analysis and factor analysis and deals with complex relationships that are analysed simultaneously. SEM is a method that includes both a measurement and a structural model. The measurement model helps to measure the associations between the observed and latent variables whereas the structural model measures the association between the independent and dependent variables.

Health, education and *employment* levels are included in the model as latent variables with their corresponding observed variables. The confirmatory factor analysis of latent variables revealed *female labour force participation* latent variable can be represented with two observed variables such as *female labour force* (as a percentage of total labour force) and

ratio of female to male labour participation rate; *education* latent variable with three observed variables such as *female primary net school enrolment rate*, *female secondary net school enrolment rate* and *female tertiary gross school enrolment rate* and the *health* latent variable with two observed variables such as *female life expectancy rates at birth* and *female survival rate to age 65*.

Firstly, a model (Model 1) is built that was similar to a multiple regression analysis where all of the latent variables are considered to have a direct impact on *female parliament participation rates*. Though in this model, it has been found that *health* and *education* do not have a statistically significant effect on *female parliament participation rates* which contradicted with the literature review. Therefore another model, where the indirect effects are also included, is developed. In this model all of the observed variables that make up *female education*, *health* and *labour force participation* latent variables are significant as well as the effects of latent variables on *female parliament participation* dependent variable. The major finding in this research is that *female education* has an indirect effect on *female parliament participation rates* via *female health* and *labour force participation variables*.

In summary, it is crucial to improve female educational levels if a country is willing to have more females involved in parliaments and to reduce the discrepancies between male and female parliament participation rates. Apart from that, in order to obtain more progress in female's parliament participation rates and to close the gender gap in the political area, one should understand that the educational, work and health factors of female human capital work together and simultaneously.

To conclude, this research could be extended using other income level countries but in less developed countries the data is more incomplete which prevented using less developed country data. Moreover time dimension could be included to see the effects of time on the variables included in this analysis.

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Appendix

Appendix Table 1: List of the Countries used in the Analysis.

High Income: NonOECD	**High Income: OECD**	**Upper Middle Income**
Andorra, Aruba, Bahamas, The, Barbados, Brunei Darussalam, Cayman Islands, Channel Islands, Croatia, Cyprus, French Polynesia, Guam, Hong Kong SAR, China, Macao SAR, China, Malta, New Caledonia, Puerto Rico, Singapore, Trinidad and Tobago, Turks and Caicos Islands, Virgin Islands (U.S.)	Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Rep., Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom, United States	Albania, Algeria, Antigua and Barbuda, Argentina, Azerbaijan, Belarus, Bosnia and Herzegovina, Brazil, Bulgaria, Chile, China, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, Grenada, Iran, Islamic Rep., Jamaica, Jordan, Kazakhstan, Latvia, Lebanon, Libya, Lithuania, Macedonia, FYR, Malaysia, Maldives, Mauritius, Mexico, Montenegro, Panama, Peru, Romania, Russian Federation, Serbia, Seychelles, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Thailand, Tunisia, Turkey, Uruguay, Venezuela, RB
n=20	n=31	n=47

Appendix Table 2: Summary Statistics of the Variables used in the Analysis.

Variables	**N**	**Range**	**Minimum**	**Maximum**	**Mean**	**Std, Deviation**
Ed5	98	24,46	75,52	99,98	92,86	5,54
Ed6	98	37,64	62,36	100,00	84,31	8,26
Ed7	98	119,26	,07	119,33	57,44	26,64
He4	98	13,07	73,32	86,39	79,47	3,31
He5	98	74,68	73,32	148,00	80,58	8,03
He6	98	18,63	76,09	94,72	87,60	4,58
La1	98	33,51	16,90	50,41	42,05	6,49
La2	98	56,10	14,70	70,80	50,42	10,83
La4	98	34,90	41,10	76,00	60,64	7,07
La5	98	70,04	20,50	90,54	71,03	14,37
Parliament Participation	98	42,20	2,80	45,00	20,79	9,85

İ. Ü. İşletme Fakültesi İşletme İktisadı Enstitüsü Yönetim Dergisi
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OECD VE BRIC ÜLKELERİNİN ENERJİ GÖSTERGELERİ AÇISINDAN ÇOK BOYUTLU ÖLÇEKLEME ANALİZİ İLE KARŞILAŞTIRILMASI[1]

Nuray TEZCAN
Haliç Üniversitesi
İşletme Fakültesi
İşletme Enformatiği Bölümü

ÖZET

Enerji kullanımı, ekonomik büyümeyi etkileyen önemli unsurlardan biridir. Bununla birlikte, enerji sanayi üretiminde pahalı bir girdidir ve bu nedenle enerji kaynaklarının kullanımı ve uygulanacak olan enerji politikaları ülkeler için hayati bir önem taşımaktadır. Bugün, OECD ülkeleri enerji üretimi ve tüketiminde lider ülkeler olurken, hızla büyüyen ve gelişmekte olan BRIC ülkeleri bu tüketime ortak olmaktadır. Bu çalışmanın amacı; enerji göstergeleri açısından OECD ülkeleri ile BRIC ülkelerini Çok Boyutlu Ölçekleme (ÇBÖ) Analizi ile karşılaştırmaktır. Çalışmada, değişken olarak enerji üretimi ve kullanımı ile elektrik üretimi ve tüketimi, ihraç edilen enerji oranı, fosil yakıt tüketimi ve alternatif ve nükleer enerji oranı gibi temel göstergeler kullanılmıştır. Analizden elde edilen sonuçlara göre; ele alınan değişkenler açısından özellikle A.B.D, İsveç, Norveç, İzlanda ve Çin diğer ülkelerden farklıdır. Ayrıca A.B.D ile Hindistan hariç BRIC ülkelerinin benzer olduğu görülmektedir. Bu durum, BRIC ülkelerinin, özellikle Çin'in enerji piyasalarında önemli rol oynadıklarını göstermektedir.
Anahtar Kelimeler: Enerji, OECD, BRIC, Çok Boyutlu Ölçekleme

COMPARISON OF OECD AND BRIC COUNTRIES IN TERMS OF ENERGY INDICATORS USING MULTIDIMENSIONAL SCALING ANALYSIS

ABSTRACT

Energy use is one of the most important factor affecting economic development. Energy, however, is expensive input in industry production therefore using of energy sources and policies which will be followed has been critically important for the countries. Today, OECD Countries are leader in energy production and consumption, but BRIC Countries which are fast-growing and developing countries participate this situation. The aim of this study is to compare OECD and BRIC Countries in terms of energy indicators using multidimensional scaling analysis. In this study, basic indicators such as energy production and consumption, electricity production and consumption, energy imports, fossil fuel energy consumption and alternative and nuclear energy were used to carry out analysis. According to results obtained from analysis, U.S.A., Sweden, Norway, Iceland and China are disparity countries while U.S.A. and BRIC countries except India are similar countries in terms of energy indicators employed. This result confirms that BRIC Countries, especilly China, play important role in energy markets.
Keywords: Energy, OECD, BRIC, Multidimensional Scaling

[1]Bu çalışma 15. Uluslararası Ekonometri, Yöneylem Araştırması ve İstatistik Sempozyumu'nda özet bildiri olarak sunulmuştur.

GİRİŞ

Ekonomik kalkınma ve sanayileşme için gerekli temel girdilerden biri olan ve üretimde kullanılan enerji aynı zamanda ekonomik büyüme için de bir gösterge olarak kabul edilmektedir. Bu nedenle, enerji tüketimi ile ekonomik büyüme ve ülkelerin gelişmişlik düzeyleri arasındaki ilişki literatürde çok sayıda çalışmaya konu olmuş ve bu çalışmalarda enerji tüketimi ile ekonomik büyüme arasında tek ya da çift yönlü nedensellik ilişkisi olduğu görülmüştür (Wong S.L., Chang Y., Chia W., 2013, s:51-60; Belke A., Dobnik F., Dreger C., 2011, s:782-789; Chontanawat J., Hunt L.C., Pierse R., 2008, s:209-220; Lee C.C. ve Chang C.P., 2008, s:50-65; Tsani S.Z., 2010, s:582-590; Asafu-Adjaye J, 2000, s:615-625).

Enerji tüketimi ile ekonomik büyüme arasındaki nedensellik ilişkisinin belirlenmesi ile birlikte, enerjinin üretim için maliyetli bir girdi olması enerji tüketimi, enerji üretiminden fazla olan ülkelerin zamanla dışa bağımlı hale gelmelerine neden olmaktadır. Ayrıca, coğrafi konumlarından dolayı özellikle petrol rezervlerine ve yenilenebilir enerji kaynaklarına sahip olan ülkeler, dünya enerji piyasasında söz sahibi olmaktadır.

Bazı enerji kaynaklarının tükenir nitelikte olması mevcut kaynakların en iyi şekilde değerlendirilmesini zorunlu kılmakta ve ülkeleri alternatif enerji kaynaklarına yöneltmektedir. Özellikle karbondioksit emisyonu, çevre kirliliği ve ekolojik denge konusunda bilinçlenmeye başlayan ülkeler uluslararası anlaşmalarla enerji tüketimini sınırlandırmak durumunda kalmışlardır. Yukarıda açıklanan tüm bu nedenlerden dolayı küresel düzeyde ülkeler tarafından izlenecek enerji politikalarının önemini artmaktadır.

Bu çalışmanın amacı, enerji göstergeleri açısından Ekonomik İşbirliği ve Kalkınma Örgütü'ne (OECD) üye ülkeler ile BRIC (Brezilya, Rusya, Hindistan, Çin) ülkelerini Çok Boyutlu Ölçekleme (ÇBÖ) Analizi ile karşılaştırmak ve ülkelerin hangi özellikler bakımından benzer ya da farklı olduklarını belirleyerek, bu farklılaşmanın nedenlerini üzerinde durmaktır.

1. OECD ve BRIC ÜLKELERİNDE ENERJİ TÜKETİMİNİN GENEL GÖRÜNÜMÜ

OECD ülkeleri, dünyanın en büyük ekonomileri olarak kabul edilmektedir. 34 ülkeden oluşan bu örgüte üye ülkeler Dünya Bankası'nın sınıflandırmasına göre Macaristan, Türkiye ve Meksika hariç gelişmiş ülkeler kategorisinde yer almakta ve bu özelliklerinden dolayı uluslararası piyasaları yönlendirmede etkin rol oynamaktadırlar. (OECD, 2014). OECD ülkeleri arasında enerji üretimi ve tüketimi açısından özellikle Amerika Birleşik Devletleri (A.B.D) dikkat çekmektedir. Enerji kaynakları gözönüne alındığında; ham petrol, doğalgaz, kömür, nükleer enerji, elektrik enerjisi ve petrol ürünlerinin üretilmesi, ithalatı ve ihracatı