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The relationship between gender equality and growth in BSR countries

Introduction

Modelling and quantifying the relationship between gender equality and economic growth is still a relatively new area of research, even though a few studies investigating this relationship have been published. The aim of the paper is the analysis of this relationship based on modelling using the gender equality index as a proxy for equality and main growth variables. The paper intends to raise awareness that gender equality is an important factor behind economic growth and to help in designing more effective policies to respond to new challenges in post-crisis Europe.

The analysis has been conducted for the Baltic Sea Region (BSR) countries which differ substantially in terms of economic and social development, culture and gender equality. The paper concludes that, despite these differences, there is a positive relationship between GDP growth and gender equality in all countries. This finding is consistent with other studies. The paper brings new elements to the analysis as it looks at changes over time (as opposed to static approach e.g. [Löfström 2009]), uses a single regression model to evaluate the relationship between studied categories and a new composite index of gender equality (GEI_UNDP and GEI of the European Institute for Gender Equality – EIGE).

Review of literature

The discussion of the relevance of gender to macroeconomics, such as economic growth, is relatively recent, even if, at the micro-level, the gender perspective has been incorporated into the economic analysis for a long time as noticed by Stocky [2006]. In terms of a broader perspective, that is links between gender equality and development, there is an extensive theoretical and empirical literature especially in the context of developing countries, including Boserup's pioneering work on women and development [Boserup 1970]. This work opened the way to integrating gender issues into macroeconomics.

The relationship between gender equality and economic growth could be seen as a 'two-way street' as pointed out by Sequino [2009] in a study analysing the situation in countries worldwide. It means that GDP changes have an impact on gender equality but, on the other hand, gender equality could also have an impact on growth rates. The latter broadens the framework of the analysis, focused so far on the former relationship (impact of GDP changes on gender equality). It also puts forward a new research question such as could gender equality be considered as a factor (one of many) affecting GDP changes? This question is central to this paper.

The impact of GDP growth rates on gender equality has been discussed in the literature in the context of structural adjustment and the crisis of the 1980s in Latin America, South- East Asia and other developing countries [Elson 1991]. Empirical studies confirmed that women suffered more than men from the GDP decline and the subsequent tightening of macroeconomic policies, while the benefits from the return to positive growth rates were less obvious and/or took a longer time to be observed [Sequino 2000]. This is explained by less favourable position of women on the labour market as compared to men, their lower pay and income as well as the higher dependence on social protection and public expenditure [World Bank 2006]. Research indicates

also that the impact of economic growth on gender equality varies considerably, depending on the type of growth and key driving factors (such as exports) [Berik and Rodgers 2008; Berik et al. 2009]. The gender bias in sharing the costs of the sharp decline in the GDP in terms of job losses and cuts in social protection has been also clearly demonstrated in the 1990s during the transition process of the countries in Central and Eastern Europe [Ruminska-Zimny 2009].

Studies analysing the gender impact of the economic crisis 2008-2009 present similar conclusions even if women's jobs were in some countries less affected by the GDP decline than men's jobs (especially in the first phase of the crisis). These studies confirm that the main transmission channel of the negative impact of the crisis remain austerity measures, cuts in social expenditure and women's employment in the public sector [Rubery and Karamessini 2014; Smith and Bettio 2008].

The second relationship, that is between gender equality and economic growth, is less explored. There are, however, studies providing theoretical and empirical evidence supporting the hypothesis that gender equality affects GDP growth [Klasen and Lamanna 2009]. It means that gender equality becomes a factor which could stimulate (or limit) economic growth. The impact of gender equality on GDP growth (or decline) is channelled through the increase (or decline) of female employment rates and better (or worse) use of investments in women's education. In a broad sense, equality of opportunities is associated with better use of human resources, that is, talents and creativity of women and men (diversity arguments) and more effective allocation of human and social capital, both of which have a positive impact on economic growth [OECD 2012].

In the past, research on positive impact of gender equality on GDP growth and development focused on developing countries. The crisis in Europe and slow recovery, combined with low activities rates of women in a number of countries as well as ageing population opened the way to investigations in the context of developed market economies. This approach is based on the so-called "women-omics theory" proposed by Matsui et al. [1999]. In this context, studies estimate the positive impact of gender equality on GDP growth by simulating the effects of equal opportunities as measured by higher employment rates for women, better types of work contracts (full-time versus part-time) and higher wages (closing the gender wage gap). Löfström [2009] showed, for example, that provided improvements in equal opportunities in the labour market there is a potential for increasing the GDP by 27-29% in the European Union countries. This study refers to one year (2007). Similar results to Lofstrom were presented by Smith and Bettio formulating a "smart economics" case for gender equality [Smith and Bettio 2008].

The EIGE study on the economic benefits of gender equality is the most recent attempt in this area. It is also the first of its kind to use a robust econometric model to estimate a broad range of macroeconomic benefits of gender equality at the EU level (E3ME model). It studied the impact of reducing gender inequalities in such areas as STEM education (science, technology, engineering and mathematics), employment and pay on economic performance of countries. The study concludes that the improvement in gender equality in one domain, such as more women in STEM education, could lead to positive spill-over effects in other domains such as employment and pay. Overall results show that improvements in gender equality would lead to an increase in the European Union's GDP per capita of up to 10% by 2050 [EIGE 2017].

The objective of the present paper is much more limited and is considered by the authors as the first step towards more in-depth quantification of the relationship between gender and growth. The main research questions are:

1. Is there a correlation between gender equality (measured by a composite index) and economic growth (measured by GDP growth) in BSR countries using a single regression model?
2. How did the strength of this correlation change over time (2000-2014)?

The authors are aware that there are multiple factors behind economic growth. However, as the purpose of this paper is to investigate the correlation between only two variables – that is gender equality and economic growth – the assumption is made that other factors affecting economic growth remain constant.

Methodology

For the first time in Polish literature discussing gender equality we use a simple regression model as a method. The analysis consists of expressing the relationship between variables in the language of mathematics. The first step is to find a mathemati-

cal function f(x) which describes in the best way the relationship in question. The function could take different forms, the most simple is the linear function. If we investigate the relationship between two variables Y and X, the dependent variable is Y while X is the independent variable.

The objective of a regression analysis is to determine the value of a dependent variable (Y) at a new value of the independent variable (X) which did not exist before. It should be noticed however that these are estimates because many other factors could have an impact on the dependent variable. Also, even if we prove a strong correlation between the variables in question, confirmed by a good match of the regression function, this does not mean that there is always a causality. The variable X may not be the cause and the variable Y the result. We could determine the causality only after further analysis based on established rules of a given area of science, relevant for the variables in question.

Linear regression model takes the following form:

$$\hat{Y}_i = \beta_o + \beta_1 X_i \qquad (1)$$

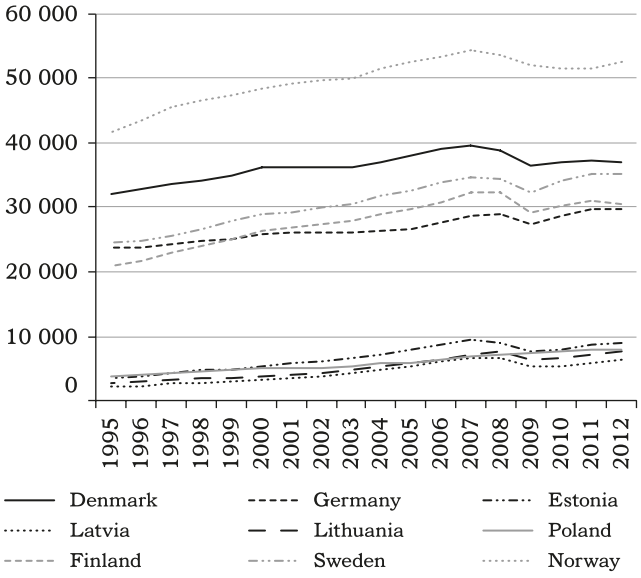
where:
$\hat{Y}_i$ – theoretical values of the dependent variable,
X_i – independent variable,
β_o – constant,
β_1 – the slope coefficient.

In order to verify the robustness of the estimated model the authors determined the measures of the fit of the model [Studenmund 2010]:
R^2 – the coefficient of determination that measures the percentage of the variation of the Y explained by the of X.
R^2 adj. – adjusted for the degrees of freedom,
S_e – standard errors of the coefficients,
t – values indicating the significance of the coefficients,
p – the probability.

Empirical analysis of the relationship between gender and economic growth

Over the period of 1995-2007 all BSR countries enjoyed steady growth of the real GDP per capita. In 2008 this trend was reversed as a result of the global economic crisis. The high-income countries were more affected as compared to low-income ones. Starting from 2010 GDP per capita has been rising for all countries but at a much slower rate than in the first 12 years covered in this analysis (see Figure 1).

Figure 1. Real GDP per capita in BSR countries (in Euro)



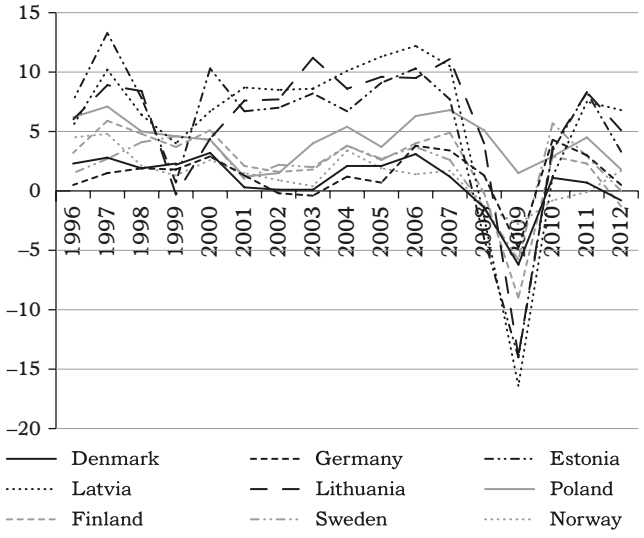
Source: own calculations on the basis of the Eurostat data.

As far as the GDP per capita values are concerned, throughout the whole analysed period the BSR countries fell into three categories:
- the first group: Norway, where the observed variable value was substantially higher than in other countries,
- the second group: wealthy Scandinavian countries, such as Denmark, Sweden, Finland, and Germany, where GDP per capita was lower than in Norway but much higher than in the remaining BSR countries,
- the third group: lower income BSR countries – Estonia, Poland, Lithuania and Latvia which transformed their centrally planned economies into market democracies in the late 1980s and the early 1990s.

The GDP growth rate is a percent rate of increase in the GDP over time. Figure 2 shows annual GDP growth rates in the period of 1995-2012. There were two serious slumps in the analysed period. The first one took place in 1998-1999 as a result of the economic crisis in Asia, which affected some European countries and caused slowing down of GDP growth. The second considerable drop was the effect of the global crisis of 2008-2009 that was triggered by the collapse of the US housing market. The crisis quickly spread to the European banking

system and was aggravated by the euro crisis. This time GDP growth turned negative in all European countries except Poland. Most European countries experienced the declines in the production volumes, employment, income, consumption and investment. The recovery process was slow in the majority of European countries and the quality of life of some population groups in Europe has evidently deteriorated. There are different views on the roots of this crisis – from specific problems of the financial sector in the era of internet trading (poor regulatory framework) or proliferation of high risk financial products (derivatives) to structural problems of functioning of the post-II world economic governance system and its institutions (including raising inequalities among and within countries) [Stiglitz, Sen, Fitoussi 2010].

Figure 2. GDP growth rate in BSR countries (in %)



Source: own calculations on the basis of the Eurostat data.

The deepest economic slump in BSR countries was observed in Latvia, Estonia and Lithuania. In 2009 the GDP growth rate was (-16)% in Latvia and (-14)% in the two latter countries. Poland was the only country in the BSR region, and in Europe, called "a green island" which had a positive GDP growth in 2009 (1.5%) and during the entire crisis. This could be explained by several factors:

- good condition of financial and real estate sectors (lack of bad debts) before the crisis,
- timely mix of macroeconomic policy; non-expansionary monetary policy before the crisis in 2001-2005 was followed by loosening this policy at the beginning of the crisis in 2007-2008,
- flexibility of the exchange rates of national currency (depreciation of zloty),
- the implementation of large infrastructure projects based on EU structural funds.

The combination of these factors allowed to maintain the level of private consumption, exports and investments cushioning the negative impacts on production and employment of the deep decline of external demand of key partners abroad [Gomułka 2017].

What is the relation between the GDP per capita or the GDP growth rate and gender equality in the analysed countries? In order to answer this question we need to decide how to measure gender equality, what is the nature of the most popular indices, how they differ and what periods of time they refer to.

Measuring gender equality

The most commonly used indices of gender equality include:

1) GEI – Gender Equality Index by the European Institute for Gender Equality (EIGE),
2) GGG – Global Gender Gap Index by the World Economic Forum,
3) GII – Gender Inequality Index by United Nations Development Programme (UNDP), which replaced GDI Gender Development Index and GEM Gender Empowerment Index.

The **GEI by EIGE** is a multi-dimensional measure of gender equality in the 27 European Union member states published since 2013 every 2 years. It encompasses 6 principal areas: work, money, knowledge, time, power and health. It also includes two satellite domains: intersecting inequalities and violence. The index adopts values from 1 to 100, where 1 means total gender inequality and 100 denotes total gender equality. The methodology of determining the GEI by EIGE is transparent and consistent with 2008 recommendations by the OECD Joint Research Centre and the European Commission [EIGE 2013]. The most striking gender gap was observed in such domains as power, time and violence.

Levels of GEIs by EIGE varied greatly across the BSR countries. The highest scores, above 70% are seen in Scandinavia (in GEI 2015 with 74.2 points in Sweden, 70.9 in Denmark and 72.7 in Finland). On the other hand, in the remaining BSR countries, the ones which had undergone an economic transformation, the Gender Equality Indices were the lowest: in Poland – 43.7, Lithuania – 40.2, Latvia – 46.9

and Estonia – 53.6 [EIGE 2015]. The above results confirm the legitimacy of the question about the relationship between the BSR countries' wealth and the effectiveness of their gender equality policies.

The **GGG by the World Economic Forum** is determined for over 100 countries (in 2017 there were 144) which represent approximately 90% of the global population. Both the above-discussed index and the one to be presented further in the article are multidimensional measures, owing to which we can compare countries in reference to four domains characterising gender equality: (1) economic activity, pay and professional practice, (2) literacy and the level of education, (3) health and survival, and (4) political activity. The GGG index adopts values from 1 to 0, where 0 means a total absence of gender equality and 1 – a total equality. It has been determined on the yearly basis since 2006. Its annual character allows for the analysis of the changes in gender equality because the methodology of its subsequent editions remains the same. The comparison of different measures of gender equality will never bring results that are as reliable as the observation of an individual measure over time. In their approach to this problem the authors of this index focus on three issues. Firstly, they concentrate on measuring gender gaps rather than equality levels. Secondly, the outcome variables are more important than input variables. And finally – they are more interested in gender equality than in women's empowerment.

The GGG index shows a similar pattern to GEI EIGE in ranking countries by the level of gender despite differences in the composition of both indexes. According to the Global Gender Gap Report [GGGR 2017], Iceland is the leader of the list with the score 0.878 followed by Norway with the score 0.830 and Sweden (5) with the score 0.816. The post-transformation BSR countries occupy lower positions: Latvia (20), Lithuania (28) and Poland (39) with scores ranging from 0.756 to 0.28 respectively.

GII by UNDP illustrates gender inequality in only three dimensions: reproductive health, labour market, and empowerment. Reproductive health is measured by two indicators: the maternal mortality ratio and the adolescent fertility rate. The labour market dimension is measured by the labour force participation rate of women. Empowerment is measured by the share of parliamentary seats held by each sex and by the attainment at secondary or higher education. The GII adopts values from 0 to 1, where 0 is a total equality and 1 is a total inequality between men and women in terms of the examined variables.

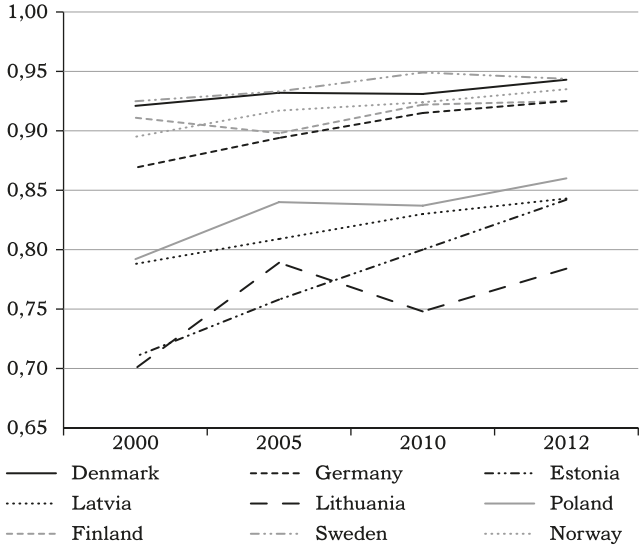
GII by UNDP was presented for the first time in 2010 Human Development Report. It replaced previously used measures: the GDI (Gender Development Index) and the GEM (Gender Empowerment Index) which were criticised for their extensive focus on income levels. As a result they were more suitable for assessing gender equality in developed countries with relatively balanced income levels, that in countries with low-income and low levels of gender equality. The new measure, GII does not incorporate information about income levels but it has been also criticised for the choice of indicators. It should be noted, however, that the process of selecting indicators of every composite index embodies arbitrary and subjective assumptions. Therefore, as it has been mentioned, the conclusions from such studies including the ranking of countries must be drawn with caution.

In the paper, for the purpose of the analysis of gender equality, the authors decided to use the reversed GII called the GEI_UNDP. The reversed GII seems to be the best choice as a proxy as it focuses on equality as compared to GII and GGG which are based on measuring gender inequalities (gaps). This refers also to some extent to GEI EIGE, which was, however, used as a measure of gender equality in 2014. The values of parameters demonstrating the strength of the relationship with the GDP per capita would be the same for the GII as for the GEI_UNDP, the only difference being the reversed relationship from the negative (the minus sign of the parameter value) to the positive (the plus sign). Before we focus on the correlation analysis, let us look at the values of the GEI by UNDP in 2000-2012 (Figure 3).

The GEI values are determined in compliance with the IHDI (Inequality adjusted Human Development Index) methodology. Over the period of this study in the majority of the BSR countries, the GEI was going up, which is a good sign – it should be remembered that the higher the GEI, the more gender equality there is in a given country. Yet, some countries saw the decrease in the index in 2010 in comparison to 2005. It could have been the effect of the economic crisis and subsequent worsening of women's position on the job market as well as their economic status in general. The highest fall in the GEI was seen in Latvia in 2010 in comparison to 2005, and in Finland in 2005 in comparison to 2000.

The pattern of differences among BSR countries by GEI_UNDP index is similar to that described for GEI EIGE, GGG and GII. The BSR countries can be divided into two groups: the first one consists of

Figure 3. Gender Equality Index GEI_UNDP in BSR countries



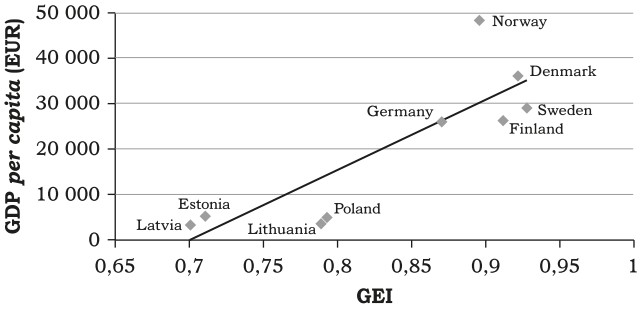
Source: own calculations on the basis of the UNDP data.

high-income countries: Norway, Sweden, Finland, Denmark with high levels of gender equality (GEI); the second group includes lower income Poland, Estonia, Lithuania, Latvia with a higher inequality rate. In the former group, the GEI ranged from 0.93 (Finland) to 0.95 (Sweden), i.e. from 93% to 95%. In the latter group, the index was between 0.78 (Latvia) and 0.86 (Poland), that is ranging from 78% and 86%. Changes in the value of GEI_UNDP between 2000-2012 point out that, except Estonia and to some extent Germany, even high-income countries (such as Sweden or Finland) were some losses in gender equality. These losses were often seen around 2010 (Sweden, Norway, Denmark, Poland, Latvia).

How strong is the relation of gender equality with the GDP per capita and the GDP growth rate in the analysed countries? The findings of the empirical analysis conducted to answer this question are presented in the figures below. The relationship is strong when R^2, the determination coefficient, is higher than 0.6. Its direction, that is if it is positive or negative, determines the position of the linear regression function, as shown in black in figures below. If the line is close to 45' towards the horizontal axis, the relationship is positive. If the line has an opposite shape then the relationship is negative (Figures 4-8).

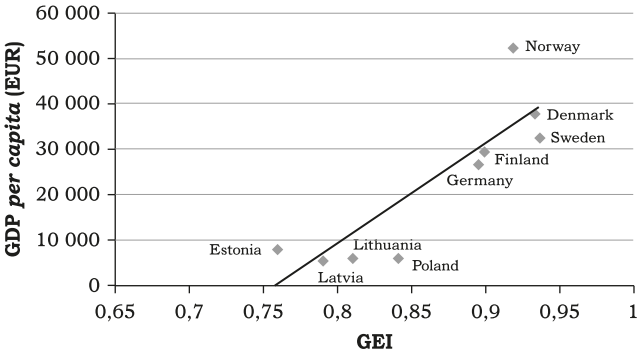
The empirical analysis has proven a strong correlation between the GDP per capita and gender equality in the BSR countries as reflected by the value of determination coefficient above 0.6. for five years. The direction of this relationship was always positive which means that with an increase of one variable (GEI) there was also the increase of another (GDP per capita). It should be noted that the value of the GEI index is between 0 and 100 where the former means no equality and 100 means full equality.

Figure 4. GEI and GDP per capita in BSR countries 2000



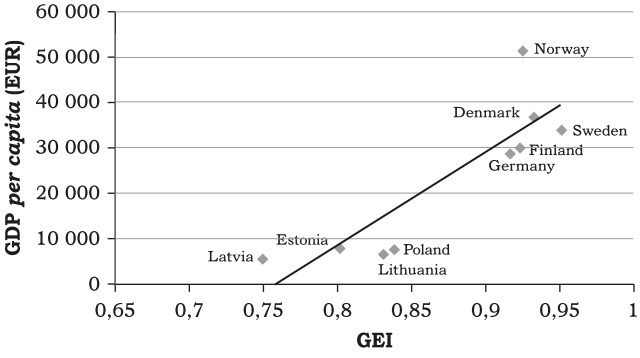
Source: own calculations on the basis of the UNDP and the Eurostat data.

Figure 5. GEI and GDP per capita in BSR countries 2005



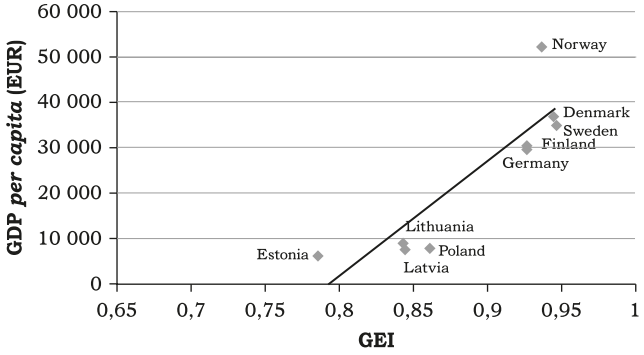
Source: own calculations on the basis of the UNDP and the Eurostat data.

Figure 6. GEI and GDP per capita in BSR countries 2010



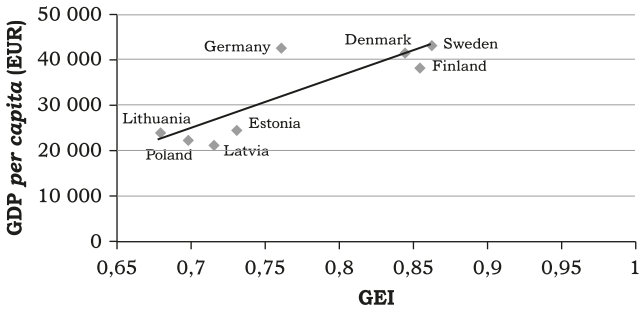
Source: own calculations on the basis of the UNDP and the Eurostat data.

Figure 7. GEI and GDP per capita in BSR countries 2012



Source: own calculations on the basis of the UNDP and the Eurostat data.

Figure 8. GEI and GDP per capita in BSR countries 2014



Source: own calculations on the basis of the UNDP and the Eurostat data.

When comparing the above five periods/years we can see that the relationship was getting increasingly stronger. The values of Pearson's coefficient were growing throughout the time of study from 0.84 in 2000 to 0.88 in 2012.

Also, the overall fit of the linear regression model to empirical data was getting better. The values of R^2 tell us what percentage of the variation in the GDP per capita can be explained by the GEI variable. As to be seen in Figures 4-8 the values of R^2 were higher period after period. In 2012 R^2 was 0.77, which means that in the BSR countries 77% of the variation of the GDP per capita can be explained by the GEI. This is a significant proportion. In general terms, it means that gender equality pays off. Yet, we should keep in mind that correlation does not mean causation. The nature of the associations presented above is not co-existential, casual or goal-oriented. The two latter types of relationship would require time delay of variables.

Löfström in her work *Gender equality, economic growth and employment* draws similar conclusions [Löfström 2009]. She confirms a positive and significant correlation between gender equality and the GDP per capita. In this analysis, equality is measured by the GDI (Gender Development Index) and the GGG (Global Gender Gap Index). Her analysis covered only one year (2007) and referred to EU-27 countries.

In this paper the GDP per capita which was estimated as a function of the GEI in the BSR countries. The linear regression model for the subsequent years of study is as follows:

- for 2000:

$$\hat{Y}_i = -110149 + 156813 \cdot GEI_i \qquad (2)$$

(31109) (37077)
t = –3,54 4.23
p = 0,009 0,003
R^2 =0,72 Adjusted R^2 = 0,68 N = 9

- for 2005:

$$\hat{Y}_i = -110149 + 156813 \cdot GEI_i \qquad (3)$$

(42650) (49261)
t = –4,0 4,56
p = 0,005 0,002
R^2 =0,75 Adjusted R^2 = 0,71 N = 9

- for 2010:

$$\hat{Y}_i = -110149 + 156813 \cdot GEI_i \qquad (4)$$

(38994) (44536)
t = –3,99 4,61
p = 0,005 0,002
R^2 =0,75 Adjusted R^2 = 0,72 N = 9

- for 2012:

$$\hat{Y}_i = -200868 + 253339 \cdot GEI_i \qquad (5)$$

(45604) (51194)
t = –4,40 4,95
p = 0,003 0,002
R^2 =0,78 Adjusted R^2 = 0,75 N = 9

- for 2014:

$$\hat{Y}_i = -2121,02 + 61509,83 \cdot GEI_i \qquad (6)$$

(8787) (15103)
t = –0,21 4,07
p = 0,82 0,006
R^2 =0,86 Adjusted R^2 = 0,73 N = 8

Where:

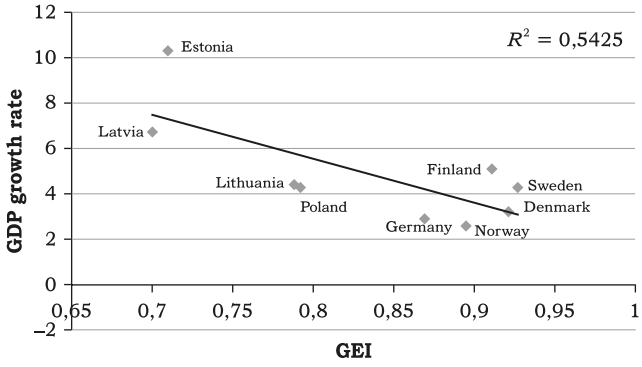
$\hat{Y}_i$ – theoretical values of the dependent variable GDP *per capita*,

GEI_i – Gender Equality Index, a reversed Gender Inequality Index by UNDP.

All the estimated models are characterised by good overall fit to empirical data. The fit was getting better period after period reaching its highest values in 2014 when the coefficient of determination R^2 reached 86%. All the model parameters were statistically significant. How to interpret these parameters? In 2000, along with the GEI growing by 1%, the GDP per capita rose by 156,813 Euro. In 2012 the increase in the GEI by 1% was accompanied by the GDP in capita rising by 253,339 Euro. In 2014 the increase in the GEI_EIGE (which is similar yet slightly different to GEI_UNDP) by 1% was accompanied by the GDP in capita rising by 61,509 Euro.

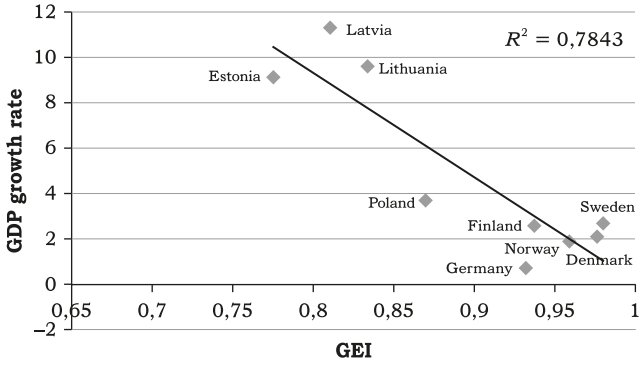
The relationship between gender equality and GDP could also be tested using GDP growth rates. The charts below show the relationship between the GEI and the GDP growth rate in the BSR countries between 2000 and 2014 (Figures 9-13).

Figure 9. GEI_EIGE and GDP growth rate in BSR countries 2000



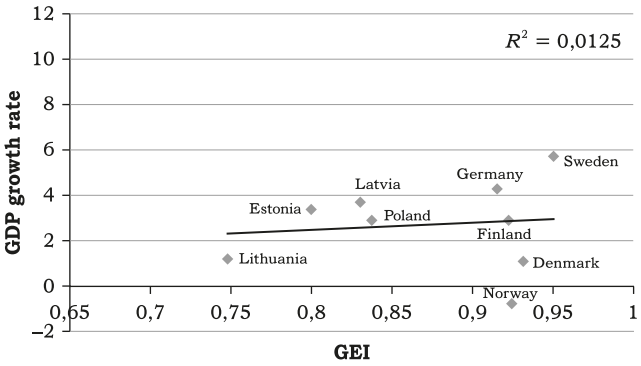
Source: own calculations on the basis of the UNDP and the Eurostat data.

Figure 10. GEI_EIGE and GDP growth rate in BSR countries 2005



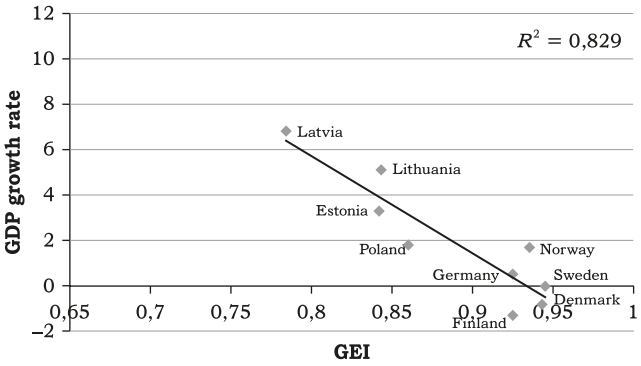
Source: own calculations on the basis of the UNDP and the Eurostat data.

Figure 11. GEI_EIGE and GDP growth rate in BSR countries 2010



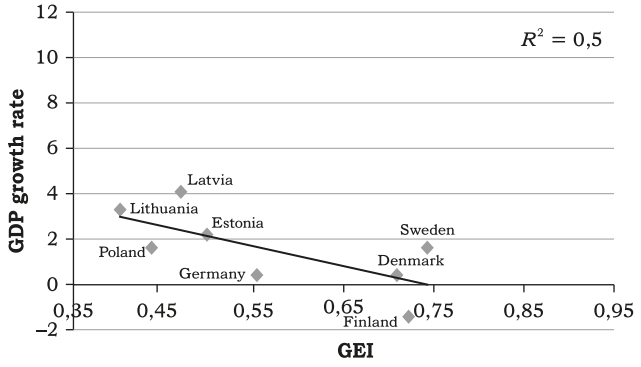
Source: own calculations on the basis of the UNDP and the Eurostat data.

Figure 12. GEI_EIGE and GDP growth rate in BSR countries 2012



Source: own calculations on the basis of the UNDP and the Eurostat data.

Figure 13. GEI_EIGE and GDP growth rate in BSR countries 2014



Source: own calculations on the basis of the UNDP and the Eurostat data.

The link between gender equality (GEI_UNDP) and economic growth (GDP growth rate) is apparently weaker than the link between gender equality

and GDP per capita. This is especially reflected in the years in which the determination coefficient R^2 was below 0.6 (2014, 2010 and 2000).

The model's overall fit to empirical data, marked with a black straight line, in Figures 9-13 with GDP growth is also worse than in the case of Figures 4-8 including GDP per capita. In 2000, 2005 and 2012 the coefficient of determination R^2 took the values of 0.54, 0.78 and 0.83, respectively. The value of GEI is also between 0 and 100, where the latter means full equality.

The negative relationship seen in Figures 9-13 means that when one of the variables (GEI) is growing, the values of the other one (the GDP growth rate) decline. These figures show also differences in the strength of correlation among countries. While in countries with high levels of gender equality it is more difficult to notice a positive impact of gender equality on economic growth in less advanced countries this impact is more visible. This could be partly explained by the advantage of "catching up" countries where GDP growth is easier to achieve due to its lower level at the starting and generally lower growth rates in countries with high level of GDP *per capita*.

The economic crisis was another factor which deeply disturbed the relation between the variables in question. These "turbulences" one can clearly see within the modelled relationship especially in 2010 (reflecting 2008 data) followed by their phasing out in the next period of time (2014). Linear regression models measuring the relation between the GDP growth and the GEI are presented below.

In 2000:

$$\hat{Y}_i = 21{,}21 - 19{,}61 \cdot GEI_i \qquad (7)$$

(5,71) (6,81)
t = 3,72 –2,88
p = 0,07 0,23
R^2 =0,54 Adjusted R^2 = 0,48 N = 9

In 2005:

$$\hat{Y}_i = 50{,}88 - 53{,}30 \cdot GEI_i \qquad (8)$$

(9,15) (10,56)
t = 5,56 –5,05
p = 0,0008 0,001
R^2 =0,78 Adjusted R^2 = 0,75 N = 9

In 2010:

$$\hat{Y}_i = 0{,}04 - 3{,}06 \cdot GEI_i \qquad (9)$$

(9,02)(10,30)
t = 0,004 0,297
p =0,997 0,775
R^2 =0,01 Adjusted R^2 = (–0,12) N = 9

In 2012:

$$\hat{Y}_i = 38{,}89 - 42{,}72 \cdot GEI_i \qquad (10)$$

(6,53) (7,34)
t = 6,10 –5,82
p = 0,0005 0,0006
R^2 =0,82 Adjusted R^2 = 0,80 N = 9

In 2014:

$$\hat{Y}_i = 6{,}57 - 8{,}89 \cdot GEI_i \qquad (11)$$

(2,11) (3,63)
t = 3,11 –2,45
p = 0,02 0,05
R^2 =0,5 Adjusted R^2 = 0,42 N = 8

In 2000 the increase in GEI by 1% was accompanied by the decline in GDP growth rate on average by 0.20 percentage point. Both model parameters were statistically significant. The fitted measured R^2 was relatively good at 0.54, meaning that the growth variability could be explained in 54% by the variability of the independent variable GEI. It is worth remembering that it is the relationship of coexistence, not causality.

In 2005 the situation was slightly different. Together with the GEI rising by 1%, the GDP growth rate was falling down by a mean of 0.53 percentage point. All the model parameters were statistically significant and the overall fit was better than in the previous period of time with the determination coefficient R^2 at 0.78.

As far as 2010 is concerned it was not possible to construct a good model of linear regression. Both model parameters were insignificant and the fit was close to 0. In 2012 the characteristics of the relationship between the GDP growth and the GEI resembled the situation in 2005. The one-percent rise in the GEI accompanied the 0.42 percentage point fall in the GDP growth rate. The test confirmed the statistical significance of the model parameters. The overall fit was very good at 0.82.

Conclusions

The overall context affecting the relationship between gender equality and economic growth is undergoing deep changes over time. This is why it is essential to conduct continuous studies, both qualitative and quantitative in character that will help us understand better the very nature of this relationship.

In this paper, the authors measured the strength of the relation between gender equality and economic growth as expressed by the GDP per capita and the GDP growth rate. The monitored Baltic Sea Region countries differ substantially in terms of economic and social development falling into three groups: wealthy Norway; then well-off Denmark, Sweden, Finland and Germany, and worse-off Poland, Lithuania, Latvia and Estonia which experienced economic transformation since the beginning of the 1990s.

The principal regularities that the authors observed include:

1. In the BSR countries, a positive correlation between gender equality indices and the GDP per capita could be observed. Gender equality was measured by means of the index proposed by the UNDP, i.e. by the reversed GII_UNDP and GEI EIGE (for 2014). The GII has been reversed because we decided to focus on equality rather than on inequality. Econometric models showed that the link between the examined variables was getting stronger period to period. The constructed models of linear regression were of increasingly high quality.
2. The authors have proven a strong negative correlation between gender equality and the GDP growth rate in the period of 2000-2012, which means that the higher the growth rate, the lower are the values of the equality coefficient. The negative character of the relation results from the short observation time. If we could observe the relation for several decades, the relationship might look differently. Another explanatory factor could be related to limits in improvement in high-income and high-equality BSR countries as compared to lower-income and lower-gender equality countries (advantages related to "catching up" process).
3. The above correlation was severely disturbed around 2008 as a result of the economic crisis. On the one hand, the disturbance was caused by the deterioration of gender equality. On the other hand, it was the effect of the dramatic slump of the GDP growth rates in the majority of the monitored countries.

The authors realize that the proposed approach to investigate the relationship between gender and growth does not represent the link between gender and development. It is limited in particular by taking GDP as a proxy to development. The way GDP is calculated is subject to serious criticism, among other on the ground of excluding goods and services which are provided outside the market (such as household production and work) and missing and/or miscalculating some costs, such as environmental pollution or treating speculative bubbles, like those on financial markets and in real estate, as the GDP increase [Stiglitz, Sen, Fitoussi 2010].

In the next step of the research the authors intend thus to investigate the relationship between gender equality and sustainable growth. This will require introducing a measure of sustainable growth and development. Few approaches existing in the literature could be further explored such as Korol's [2007] proposal on sustainable development of indices in the modelling of economic processes. Further work to go deeper into the relationship between gender and GDP should be also explored. The OECD approach to sustainable development and its measure, called a Better Life Index (11 individual indices) could provide a framework for investigation. Another issue would be to quantify the contribution of men and women to the gross value added. Lis [2010] in his study proposes a quantitative approach to the GDP estimation as well as the results of advanced methods of modelling the gross value added. If this methodology would be gender-oriented it could be possible to find the answer which part of the value added is generated by women and which by men. Further work could also look at models, which include other factors affecting economic growth in addition to gender equality.

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