Gender Equality, Governance, and Economic Growth

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Contents

Introduction

The traditional growth theory uses variables such as capital accumulation, accumulation of human capital, and technology to explain why some countries perform better economically than others and thus have stronger and faster growth. Not all, however, agree that the traditional growth models fully captures the factors that might influence economic growth and this debate has formed the basis for a new branch in growth theory that focuses on institutional and qualitative factors, e.g. social infrastructure and governance, that also could have an impact in the matter.

Some researchers have pushed even further focusing on gender equality with respect to how it influences economic growth through demographics and gender distribution in the participation in developing institutions.

Roger Mörtvik thus wrote in the OECD-Observer.

"The importance of the link between institutional reform and economic growth is now taken for granted, and was one of the great successes of economic research in the late 1990s, resulting in a Nobel Prize in Economics for economic historian Douglass C. North. But we must now also take demographic change seriously, not just because of pension pressures and so on, but because of the proposition that those populations that evolve and adapt are likely to be economically stronger in the long run." (Mörtvik, 2005)

This paper aims to examine the influences of gender equality both on economic growth and institutional development, thus the main problem of the paper is as follows:

Does gender equality have any direct influence on economic growth or an indirect influence through the development on institutions or both?

To answer the problem multiple regressions with GDP per capita as the dependant variable and indices for gender equality and governance as the key explanatory variables will be run to see if the is a relationship.

There are several different measures of gender equality; e.g. GDI – Gender-related Development Index, SIGI – Social Institutions and Gender Index, and GEM – Gender Empowerment Index. Of the three GEM is, despite the names of the others, the most focused on the formal institutions of the society and therefore it is GEM that is the most relevant for analyzing the problem of this paper.

The model used in the regressions is based on a model developed for a bachelor's thesis in 2009 entitled "The Influence of Institutions on Economic Growth".

Theory and Empirics

This chapter aims to review the traditional growth theory, and a newer field dealing with qualitative factors and their impact on economic growth where the institutional focus will be on gender equality. Furthermore, the model and the data, which will be used in the analysis, will be described.

When differences in growth rates between countries are to be explained, the traditional growth theory of accumulation focuses on physical capital, human capital and technological development. Some economists would, however, like to examine whether there is a deeper explanation and thereby ask the question of why some communities have succeeded in accumulating more capital and grow faster than others. In the light of this there has been researched quite a lot in the impact of institutions on economic development and here especially Douglass C. North's contribution could be mentioned. He uses an evolutionary approach to the concept of institution:

”The central issue of economic history and of economic development is to account for the evolution of political and economic institutions that create an economic environment that induces increasing productivity.” (North, 1991: 98).

Citing this concept of institutions, Robert E. Hall and Charles I. Jones (HJ) developed the concept of "social infrastructure" which they model with economic growth to demonstrate that differences in capital accumulation and productivity is driven by differences in institutions and governance structure. Furthermore there are other approaches within this branch of growth theory, but HJs concept is considered as being a key contributor today.
According to modern research an institution such as gender equality could have an important impact on economic growth. It might help explaining the difference in growth between the countries. This is substantiated by the growing debate on equality and socio-economic development. The debate could e.g. be represented by David Dollar and Roberta Gatti who found that women in poorest quartile of countries were severely undereducated compared to men whilst in the countries in the richest quartile the level of educational attainment is more equal. Furthermore, the women’s health and legal rights were also inferior to those of the men in the poor countries (Dollar, 1999: 1).

Thereby there is an increased focus on qualitative explanatory models rather than the more quantitative models. Below both the quantitative theory direction, represented by Solow and Romer, and the qualitative theory directions, including both social infrastructure and gender equality, are described.

Traditional Growth Theory

A lot of the research carried out on economic growth is seeking to explain differences in growth rates between countries and thus to explain why some countries are rich while others are poor. Especially Robert Solow has contributed to this research with the so-called Solow model, to which he attributes capital accumulation and technological progress a major impact on economic growth. Capital accumulation plays a particularly important role in Solow's work as his basic model is based the following production function:

$$Y = F(K,L) = K^{\alpha}L^{1-\alpha}\ , \tag{1}$$

where capital, K, is accumulated by using the following function,

$$\Delta K = sY - dK, \tag{2}$$

while labor, L, is given by this exponential function:

$$L = Le^{n}\ . \tag{3}$$

Capital accumulation is thus, through gross investments, created by economic agents who invest their entire savings. The accumulated capital is part of the production function as an input factor on equal terms as labor. Thus the economic growth is fundamentally driven by the economic agents' savings and the amount of labor, which depends on population growth rate, *n* (Jones, 2002:20-26). The model can also be extended to include human capital, which also will be part of the production function. In the extended model a country's economic growth is thus driven by the same factors as the basic model and agents' accumulation of human capital. The model, however, operates with constant returns to scale, which means that it does not explain the sustained growth (Jones, 2002:194).

$$Y = K^{\alpha}(AL_{Y})^{1-\alpha}, \tag{4}$$

Given Solow's work Paul Romer has also developed an economic model that highlights the technological progress better as the driving force behind a country's economic growth. The model

explains how countries achieve sustained economic growth, but it can only be used on developed countries or on the world as a whole. Romer's basic model consists of a production function similar to Solow's, but here technology, A, appears as an input factor in the form of a stock of ideas that grows with investment in R & D:

$$Y = K^{\alpha}(AL_Y)^{1-\alpha} \tag{5}$$

the technology factor, A, is growing at the rate:

$$\Delta A = \bar{\delta} L_A . \tag{6}$$

L_A and L_Y are the percentage of the workforce there are engaged in respectively R & D and production and is the rate at which new ideas are discovered. The capital is accumulated in the same manner as in the Solow model above. This interpretation of the technology allows, in contrast to Solow, an assumption of increasing returns to scale. The model may help to explain that only countries that are able to exploit advances in technology are experiencing sustained economic growth (Jones, 2002:96 - 101).

The available empirical data substantiates Solow and Romer's models, as the rich countries often are having the highest investment rates in physical capital and human capital, but it is also often these countries that have the highest productivity and thus these who are most adept to exploiting the available resources to the best effect. Neither of these two models, however, explains the underlying forces that cause that some countries invest more or has a better productivity than other countries (Jones, 2002:194). As stated in the introduction, this has formed the basis for further research on growth theory, which thus takes a more qualitative direction.

Social infrastructure and governance

Douglas C. North is a strong representative of the more qualitative and institutional approach to economic growth. Early research on the influence of institutional factors emphasises that the role of institutions is to minimize the transaction and production costs and thus increase the incentive to produce and thereby drive the economy forward. North, however, finds this research insufficient as he thinks that institutions, such as property rights, are taken for granted. He stresses that history is

very important since it will reveal which economies have failed in establishing successful institutions and thereby have not been able to obtain sustainable growth. North thus concludes that it is the development of political and economic institutions that has the bearing role in the growth of economies (North, 1991: 98).

Using North's approach to institutions Robert E. Hall and Charles I. Jones (HJ) have developed the concept, social infrastructure, which they model with economic growth HJ are convinced that the differences in economic growth among different countries are caused by differences in social infrastructure. A social infrastructure that favours high output per worker must help to create an environment that inspires and supports productivity, capital accumulation, both physical and human, innovation, and technology transfers. It also has to build institutions that prevent diversion, which is rent seeking, e.g. through theft or corruption, and it is therefore an important corner stone for economies that wish to maintain or obtain high output per worker. HJ say that the State is the number one protector against diversion but at the same time it has also proven to be a leading agent in diversion through e.g. expropriation, high tax rates, and corruption (HJ, 1999: 84). They construct the following econometric model:

$$\log\left(\frac{Y}{L}\right) = \alpha + \beta S + \varepsilon, \qquad (7)$$

where S is an index for social infrastructure that consists of several different variables such as the degree of diversion and economic openness (Hall and Jones,1999: 98). Besides from the model they build their results on other research from Romer, among others. These results, however, diverge from the earlier research because HJ emphasize the role of productivity in the production function more strongly than Romer did. To them the traditional production functions are only the first step to understanding the differences in income across the countries of the world. In their analysis of more than 127 countries they find a strong link between output per worker and measures of social infrastructure. Countries that follow anti-diversion policy produce more output per worker than countries that allow for diversion to exist. Through this approach HJ give a more qualitative explanation than the traditional growth theory (HJ, 1999:83-86).

Governance is closely related to social infrastructure in that it also involves the social institutions that must lead the economy in the direction of sustainable economic growth. The World Bank defines governance like this:

The way public officials and institutions acquire and exercise authority to provide public goods and services, including education, health care, infrastructure, and a sound investment climate (WDI, 2008:259).

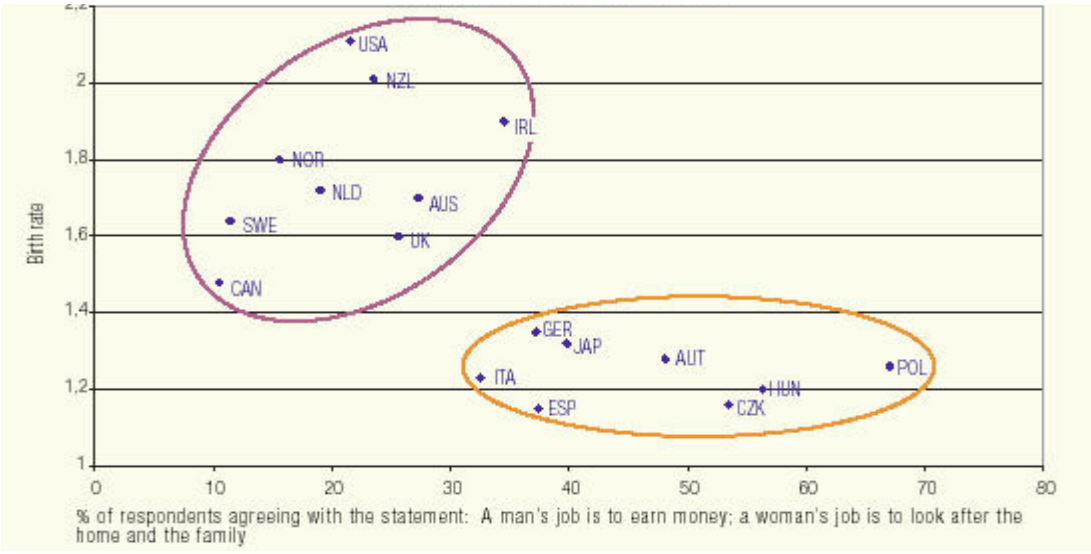
In other words governance has to do with the way the State acts in relation to society. The greater interest in governance and social infrastructure has led to an explosive increase in qualitative data on the area. The World Bank has published research and data based on governance indicators aiming to test whether these indicators have an effect on economic growth or not. There are several different indicators of governance e.g. law and order or the implementation of rules in a society. Furthermore researchers at the World Bank have created a governance index (WDI, 2008:261).

Gender Equality

In modern research a lot of focus has been put on gender equality taking different approaches to its influence on economic growth.

One is a demographic approach that has found that there is a relationship between birth rates and attitudes towards gender equality in a range of countries that shows that gender equality strengthens long-term economic development. Analysis states that for some countries the more traditional family structure in modern economies faces chronically low birth rates while there in countries where gender equality is more developed the birth rate slope is positive and the demographic structure more balanced as can be seen on figure 1 below.

Figure 1: The relationship between birth rates and gender equality



Source: Mörtvik, 2005

The demographic aspects are, thus, important due to the fact that in the long run, those populations that evolve and adapt their attitudes towards gender equality are more likely to be economically stronger because they can maintain a certain population size and, thus, labour force that can help to secure sustainable growth (Mörtvik, 2005).

Another widespread approach is an institutional one. As stated in the previous chapter Douglass C. North showed the importance of the link between institutional reform and economic growth. A fact that now is taken for granted, but it is still an important chain of reasoning. North emphasises the importance of secure property rights which for some countries is closely related to gender. This corresponds well with the fact that the legal rights of women in less developed countries are quite poor which seems to be leading to even slower growth. On top of this, gender equality or inequality can also be viewed as a social institution that, besides from legal rights, has great influence of the investment in women's education and thus the ability of women to contribute to society and the economic development. Finally, economic development might also have an influence on gender equality as they seem to be mutually reinforcing (Dollar, 1999: 1-3).

As is evident of the above there are quite a few different researchers that conclude that gender equality is an important factor in the countries' growth and development. As mentioned earlier different indicators have been used to make these conclusions. Among others the Gender-related Development Index (GDI), developed in the UN and used in the annual Human Development Report, is frequently used. The GDI reflects the inequalities between men and woman by adjusting the average achievement. (UNDP, 2007: 358) The OECD Social Institutions and Gender Index (SIGI) is another important index that composite measure of gender equality (OECD).
Also the Gender Empowerment Measure (GEM) that likewise is developed of the UN and used in the annual Human Development Report, is an often used index that measures inequalities between men and women's opportunities in a country, especially with focus on the women's opportunities rather than their capability. (UNDP, 2007: 360)

This paper will mostly focus on the institutional approach an there for GEM is chosen as the variable for gender equality. This, however, does not necessarily exclude the importance of the demographic aspects since they will somehow be endogenous in the gender equality variable.

The model

The model that will be used in the analysis originates, as mentioned above, from a bachelor's thesis in 2009 entitled "The Influence of Institutions on Economic Growth". The model was developed to include both the traditional growth theory, and thus including data for physical and human capital, and the institutional approach, by including governance variables (Ejstrup, 2009:9). To fit the analysis in this paper a fourth explanatory variable for gender equality is added resulting in the following model:

$$\log y = a + b\log\left(\frac{K}{Y}\right) + c\log h + d\log Gov. + e\log GEM + \varepsilon \qquad (8)$$

The model coefficients will be estimated using Ordinary Least Squares (OLS)[1] that has the following assumptions:

- Linearity in parameters: The correct functional form, according to OLS, is linear.
- Random sampling: Indicated by the existence or nonexistence of correlations between the explanatory variables and the residuals.
- No perfect collinearity between the explanatory variables.
- Homoskedasticity: The variance in the residuals, conditional on the explanatory variables, must be the same for all combinations of outcome of the explanatory variables.
- Normality: The unobserved residuals are assumed to be normally distributed in order to make the distributions of the estimated coefficients manageable (Wooldridge, 2000: 82-86, 93,113).

Data

In this section the data and the calculations of this data, that will be used in the analysis is described. The dataset is constructed by several different variables and spans over the period from 1990 to 2006. It should be noticed that all data, besides from the GEM-index, has been drawn from the World Bank which makes them more comparable. Subsequently, however, some of the data has been processed. These calculations, and the data drawn directly from the World Bank, will be described in this chapter.

[1] The models will be estimated using PASW

National Accounts Data

Data for Y, drawn from the World Bank, has been deflated to 1990-prices in order to make it comparable with capital stock data that too is posted in 1990-prices. Since it was not possible to find data for the collective capital stock K is calculated in the following manner:
It is assumed that the economy in growing in a steady state equilibrium which is represented by the following equation:

$$\Delta k = sy - (n+d)k = 0, \tag{9}$$

where Δk is the change in the capital stock, s is savings, Y is output, n is the population growth rate, and d is the depreciation rate of the capital stock. It should be mentioned that output and capital stock are stated per worker. To find the total capital stock the equation above is multiplied by L which represents the labour force. This generates the following expression:

$$sY = (n+d)K \tag{10}$$

K is thus:

$$K = \frac{sY}{(n+d)} \tag{11}$$

This is rewritten to according to the methods of Hall and Jones:

$$K_{1990} = \frac{I_{1990}}{g+d} \tag{12}$$

(HJ, 1999: 89)

Data for I_{1990} is from the World Bank and it is a percentage of GDP and g is calculated as the geometric average of *I* from 1991 to 2000. On the basis of the initial capital stock in 1990 the capital stock of 1991 is found by adding the gross investments in 1991 and subtracting the investment of 6%. The subsequent projections, until 2006, are conducted in the same manner (Ejstrup, 2009: 10).

L has not been calculated or processed but is drawn directly from the World Bank. The figure represents the number of people in the work force in the respective country.

Educational attainment data

Data for the average number years the population attends school in each country forms the basis for the calculations of *h*. Subsequently the following equation has been used to obtain human capital:

$$H = e^{\phi E} L \tag{13}$$

As mentioned earlier ϕ is set to 0.10. It should be noticed that the data for average number of years of schooling is from 2000 since it was not possible to find newer data. It is assumed that there has not been a significant in the number from 2000 to 2006 whereas this should not have any implications for the regressions.

Governance data

This index for governance originates from a paper, written under the World Bank, which relates governance to fiscal decentralisation. The Index is composed by four other indices of government's ability to:

- secure political transparency and that the people has a voice.
- secure a competent and efficient public service.
- promote the health and welfare of the people.
- create an environment that favours economic growth.

These indices are based upon data for indicators such as political freedom and stability, judicial and bureaucratic qualifications, the degree of corruption, income equality, human development, independence of the central bank and the debt ratio. The collective index is created for 80 countries as an average of the individual country's score in each index. The numbers have been rescaled to have an average of 50. Countries with governance above average are said to have good governance while countries with an average below 40 are said to have poor governance. Countries that score between 40 and 50 are said to have fair governance (Huther, 1998: 2-3, 6).

Gender Empowerment Measure

As mentioned in the introduction the GEM-index is the measure that will be used for this analysis. The GEM-index is constructed to measure gender equality in three areas:

- Political participation and decision-making indicated by the gender distribution in parliamentary seats. The calculation of this measure is based upon variables such as gender population shares and gender parliamentary shares with and index ideal of 50%.
- Economic participation and decision-making indicated by the gender distribution among legislators, senior official, and managers and by the gender distribution in professional and technical positions. This measure is calculated using gender shares in these two indicators and gender population shares.
- Power over economic resources indicated by the estimated income for each gender (PPP $US).

For each area a population-weighted average is calculated and the GEM-index is calculated as a simple average of the three weighted averages with 1 being the highest score possibleand 0 being the lowest (UNDP, 2007: 360).

There was only full data for 49 countries, whereas, the sample size used in the analysis is 49.

Analysis

As mentioned earlier the models in this chapter will be estimated using OLS and thus they will also be tested against the OLS-assumptions. The estimation of the models serves to purpose of giving us an idea about the impact of gender equality on economic growth. Firstly a model that contains all of the explanatory variables will be estimated. Secondly, in comparison, a model that excludes GEM will be estimated to see how the results differ with and without gender equality. Finally a model that fulfils the OLS-assumption the most possible will be estimated to see what role gender equality plays, if it even plays a role. The results of the models will be discussed throughout the analysis.

Model 1

The data analysis in this section is using OLS and thus the models will be tested to see if they correspond with the OLS assumptions. Firstly output per worker will be regressed on the capital-output ratio, educational attainment, governance, and the gender empowerment index to see what

relationship is found. The model is in other words identical to the one described in the 'Theory and Empirics'- chapter. The regression generates the following estimated model:

$$\log y = \underset{-3.816}{-8.802} - \underset{-2.203}{0.636}\log\left(\frac{K}{Y}\right) + \underset{0.750}{0.424}\log h + \underset{7.616}{4.74}\log Gov. + \underset{1.349}{0.592}\log GEM + \varepsilon \qquad (14)$$

The model has a coefficient of determination, R^2, of 0.882 which means that 88.2% percent of the variation in output per worker is explained by the model. The governance index has the highest absolute t-value of the explanatory variables and it is thus the most significant variable while the capital-output ratio is the second most significant, GEM is the third most significant variable, and the educational attainment is the least significant variable.

Testing the model

The results of the tests are listed in the table below:

Table 1: Test result for model 1

OLS-assumption	**Test**	**Test Statistic**	**Critical Value**	**Result**
Linearity in parameters	RESET	0.352	2.57	The model is linear
Random sampling	Durbin Watson	1.943	1.34 - 1.77	The sample is random
No perfect collinearity	VIF	4.045[2]	4	Collinearity in the Govenance Index
Homoskedasticity	White	16.513	23.68	The residuals are homoskedastic
Normality	Jarque Bera	25.070	5.99	The residuals are nor normally distributed

According to the testing of the model it has the correct functional form meaning that it is linear in its parameters. The sample is random and the residuals have homogenous variances which also fulfils the OLS-assumptions.

When it comes to collinearity and normality of the residuals, however, the model does not perform quite as well. The residuals are not normal distributed and there is a problematic degree of collinearity within the governance variable meaning that it is correlated with one or more of the explanatory variables.

[2] This is the VIF-value for the governance parameter. VIF for GEM is 2.665, VIF for K/Y is 1.083, and 3.161 for h.

Model 2

In this model GEM is removed to see what impact it has on the estimation of the model, including the coefficient of determination and the t-values of the explanatory variables. The new regression estimates the following model:

$$\log y = \underset{-5.962}{-10.766} - \underset{-2.424}{0.698}\log\left(\frac{K}{Y}\right) + \underset{1.065}{0.592}\log h + \underset{9.355}{5.145}\log Gov. + \varepsilon \tag{15}$$

The model has a coefficient of determination of 0.877 which means that 87.7% of the variation in output per worker is explained by the model. The t-value of the Governance index has now increased from the previous regression making the parameter even more significant. The t-value for the capital-output ratio parameter has also increased, although not as much, and it is now the second most significant variable. The increase in the t-value for the educational attainment parameter is even smaller making it the least significant of the variables.

Testing the model

This is how the model concords with the OLS-assumptions:

Table 2: Test results for model 2

OLS-assumption	**Test**	**Test Statistic**	**Critical Value**	**Result**
Linearity in parameters	RESET	0,131	4.4	The model is linear
Random sampling	Durbin Watson	2.191	1.38 – 1.72	The sample is random
No perfect collinearity	VIF	-[3]	4	No perfect collinearity
Homoskedasticity	White	14.7	16.92	The residuals are homoskedastic
Normality	Jarque Bera	7.32	5.99	The residuals are not normally distributed

By testing of model 2 it is found that a model that is linear in its parameters is still the model that best explains the data. The sample is still random and the residuals have homogenous variances which also fulfils the OLS-assumptions. Is this model, however, there is no problematic collinearity. This change can be attributed to the removal of the GEM parameter that was strongly correlated with the governance parameter. Still, this model does not fulfil the assumption of normality either.

[3] There are no VIF-values greater than 4. The VIF is 3.101 for governance, 1.056 for K/Y, and 3.006 for h.

Discussion of the impact removing the GEM from the model

First of all, removing the GEM parameter increases the significance of the other variables meaning that GEM is partially explained by the other explanatory variables this is also the reason for the removal of problematic collinearity from model 1 to model 2. This makes the model concord better with the OLS-assumptions but the coefficient of determination is reduced by 0.5% which means that the GEM parameter does have some explanatory power on its own.

Model 3

This third model is made to try to construct the best model possible. To overcome the collinearity issue of model 1 one of the variables should be removed like it was done in model 2. GEM, however, was not necessarily the most optimal variable to remove since it was not the least significant of model 1. The educational attainment parameter was the least significant and, according to the table below, the variable that correlates the most with the governance parameter.

Table 3: Correlation between the governance variable and each of the other variables.

Variable	Coefficient
Educational attainment (h)	0.815
Gender Empowerment Measure (GEM)	0.770
Capital-Output Ratio (K/Y)	0.210

It is thus educational attainment that should be removed to improve the model. This is done by assuming that it is endogenous in the Governance parameter.

Model 3, without h, is estimated to the following:

$$\log y = \underset{-4.455}{-9.512} - \underset{-2.260}{0.648}\log\left(\frac{K}{Y}\right) + \underset{10.016}{5.014}\log Gov. + \underset{1.561}{0.664}\log GEM + \varepsilon \qquad (16)$$

The model has a coefficient of determination of 0.88 which means that 88% of the variation in output per worker is explained by the model. The t-value of the Governance index has now increased from the first regression making the parameter more significant than in model 1. The t-value for the GEM parameter has also increased, although not as much, and it is now the second

most significant variable. The increase in the t-value for the capital-output ratio is even smaller making it the least significant of the variables.

Testing the model

Table 4: Test results for model 3

OLS-assumption	Test	Test Statistic	Critical Value	Result
Linearity in parameters	RESET	0.26	4.4	The model is linear
Random sampling	Durbin Watson	2.23	1.38 – 1.72	The sample is random
No perfect collinearity	VIF	-[4]	4	No perfect collinearity
Homoskedasticity	White	14.01	16.92	The residuals are homoskedastic
Normality	Jarque Bera	8.62	5.99	The residuals are not normally distributed

According to the testing of the new model a model that is linear in its parameters is still the model that best explains the data. The sample is random, as was the case in the previous model, and the residuals have homogenous variances which also fulfils the OLS-assumptions. In this model, however, there is no problematic collinearity. This change can be attributed to the removal of the educational attainment parameter that was strongly correlated with the governance parameter. Still, this model does not the assumption of normality either.

Discussion of model 3 vs. model 1 and 2

Although the coefficient of determination of model 1 is larger than that of model 3, model 1 does not fulfil the OLS-assumptions as well as model 3 which makes model 3 the better model. Besides model 1 only explains 0.2% more than model 3 which emphasises the insignificance of the educational attainment parameter.

In comparison to model 2, model 3 has the larger coefficient of determination of 0.88 against a coefficient of 0.877 which implies that GEM is more explanatory power than educational attainment. Endogenising *h* also increases the t-value of the GEM, emphasising its significance to the model. This can be explained by a correlation coefficient of 0.714 between the two, meaning that a great part of the educational attainment of a population can be explained by gender equality or vice versa.

[4] There are no VIF-values greater than 4. The VIF is 2.644 for governance, 1.079 for K/Y, and 2.535 for GEM.

Model 4

As showed earlier, on the graph in figure 1, Mörtvik has found that, within the industrialised countries, there is a positive relationship between the degree of gender equality and birth rates. Thus it could be interesting to shift the focus from the entire world to the group of countries. This would make it possible to examine if gender equality plays an important role in explaining the differences in economic performance among these countries, that all have governance values over 50, meaning good governance. Thus, GEM might have a greater explanatory power. Therefore a fourth model is constructed to investigate this thesis. The model is now estimated on the basis of a sample of 30 countries that all fall in the category "good governance". The model is estimated to the following:

$$\log y = \underset{-0,074}{-0.338} \underset{-0.038}{-0.014} \log\left(\frac{K}{Y}\right) + \underset{0.623}{0.394} \log h + \underset{2.296}{2.653} \log Gov. + \underset{2.212}{1.558} \log GEM + \varepsilon$$

This model has a quite low coefficient of determination of 0.603. The t-values of the capital-output ratio and educational attainment are also low; in fact they are close to zero, making these variables almost insignificant to the model while both the governance index and GEM have t-values around 2 and thus are almost equally significant.

Testing the model

Table 5: Test results for model 4

OLS-assumption	**Test**	**Test Statistic**	**Critical Value**	**Result**
Linearity in parameters	RESET	2.022	2.689	The model is linear
Random sampling	Durbin Watson	1.984	1.14 – 1.74	The sample is random
No perfect collinearity	VIF	-[5]	4	No perfect collinearity
Homoskedasticity	White	25.89	23.68	The residuals are not homoskedastic
Normality	Jarque Bera	14.386	5.99	The residuals are not normally distributed

[5] VIF for governance is 2.137, VIF for GEM is 1.892, VIF for h is 1.436, and VIF for K/Y is 1.201

The model performs well in the first three OLS-assumptions but the residuals are neither homoskedastic nor normally distributed making this model inferior to the other models estimated in this analysis.

Model 5

Now the focus is turned on the countries that have governance-values lower than 50 to see what role gender equality plays in these countries. The sample size is now 19 and the estimated model looks as follows:

$$\log y = \underset{-2.157}{-7.792} \underset{-2.261}{-1.103} \log\left(\frac{K}{Y}\right) + \underset{0.605}{0.629} \log h + \underset{3.953}{4.371} \log Gov. - \underset{-0,104}{0.072} \log GEM + \varepsilon$$

The coefficient of determination is 0.713 meaning that 71.3% of the variation in output per worker is explained in the model. Surprisingly, GEM now has a negative influence on output per worker and its t-value is very low meaning that GEM has very little significance in explaining the economic performance in low-governance countries. Governance is the most significant variable with a t-value of almost 4, while the capital-output ratio and educational attainment are the second and third most significant variables, respectively.

Testing the model

Tabel 6: Test results for model 5

OLS-assumption	**Test**	**Test Statistic**	**Critical Value**	**Result**
Linearity in parameters	RESET	0	2.895	The model is linear
Random sampling	Durbin Watson	1.792	0.90 – 1.83	The sample is random
No perfect collinearity	VIF	-[6]	4	No perfect collinearity
Homoskedasticity	White	14.44	23.68	The residuals are homoskedastic
Normality	Jarque Bera	9.99	5.99	The residuals are not normally distributed

[6] VIF for governance is 1.844, VIF for GEM is 1.262, VIF for h is 1.963, and VIF for K/Y is 1.175

The model fulfils the four first OLS-assumptions but the residuals are not normally distributed, just like in the previous models.

Discussion of the results of model 4 and 5

Focusing the model on countries with governance values over 50 results in a low coefficient of determination, which indicates that some other key explanatory variables are left out and the missing homoskedasticity disqualifies the model when it comes to the OLS-assumptions. The t-value of GEM is, however, considerably larger than in model 1 and almost as large as the t-value of governance. The two variables only correlate by a coefficient of 0.606 with grants GEM more explanatory power on its own. It thus seems that GEM is more important when trying to explain the difference in economic performance between countries with developed governance.

On the other hand it has much less explanatory power when it comes to explaining differences in output per worker in countries with less developed governance. Governance, however, is obviously the most significant of the variables and it has a very low coefficient of correlation with GEM of 0.162.

Conclusion

The problem was to establish whether GEM has a direct influence on economic growth or an indirect influence through the development of institutions or both.

The results of the analysis of model 1 and 2 show that GEM has some explanatory power on its own but that it is also highly correlated with the other explanatory variables, especially the governance and the educational attainment parameters.

When collinearity is removed by endogenising the educational attainment, which was the least significant variable in model 1, the significance of GEM increases and the coefficient is larger than in the model where GEM was omitted. Thus, when looking at a representation of the world as a whole, GEM influences economic growth both directly and indirectly, however, mostly indirectly.

When focusing on countries with a governance value above 50 GEM has more direct influence on the economic performance while is has almost no influence, both direct and indirect, when focus shifted to countries that have less developed governance.

Perspectives

To investigate further it could be interesting to look into how gender equality influences the demographics. Several of the sources to this paper, such as Mörtvik and Dollar and Gatti, mention the degree of gender equality as highly influential on birth rates and thus on demographics. Thus, it could be interesting to look at variables such as differences in birth rates or the average life expectancy and examine how they correlate with output per worker or other measures of economic performance.

Another interesting angle of approach could be to investigate why gender equality plays such different roles when the world is divided into countries with highly developed governance and countries with less developed governance. The focus should in this context be put on which elements in GEM that makes it significant in some countries and insignificant in others.

Furthermore, an exploration of the correlations between governance, educational attainment, and gender equality could help clarify on which areas the GEM has direct influence on the economic performance and where the influence is indirect through the other variables.

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