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Khan, Azima and Masih, Mansur

INCEIF, Malaysia, Business School, Universiti Kuala Lumpur,
Kuala Lumpur, Malaysia

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Does women empowerment Granger-cause economic growth or the other way around? evidence from Iceland

Azima Khan¹ and Mansur Masih²

Abstract:

Women empowerment is a subject that is considered crucial for the development and economic progress of a country. It is a much discussed and highlighted issue in the international arena with the United Nations and other leading financial and human development organizations. On an international level, countries like Iceland, Ireland and Norway are ranked as the most gender-empowered, while Muslim countries like Pakistan, Syria and Yemen rank as the least. We use the standard time series techniques for the analysis and use Iceland as a case study. Our empirical results tend to indicate that there exists a bidirectional Granger-causality between the focused variables. The women empowerment factors have a substantial effect on economic growth and vice versa. The findings are plausible and have strong policy implications.

Key words : Women empowerment, GDP growth, Granger-causality, Iceland

¹ INCEIF, Lorong Universiti A, 59100 Kuala Lumpur, Malaysia.

² **Corresponding author**, Senior Professor, UniKL Business School, 50300, Kuala Lumpur, Malaysia.

Email: mansurmasih@unikl.edu.my

1. Significance of the study:

Even though out of the 7.3 billion population of the world, 3.6 billion are women¹, they are not treated as equal to men. Women's rights, their protection and wellbeing is a matter of much concern since the very existence of mankind. Much more so over the last century, when the subject of women's rights and their empowerment has been a much discussed issue. The United Nations has included women empowerment and gender equality as part of the Millennium Development Goals (MDGs) that have been adopted in 2000. These goals, that target reduction of extreme poverty in the world, also acknowledge the important role of women in improving the overall quality of life.

Although Islam as a religion has given women more rights, protections and an elevated status in society, than other religions, the practice, unfortunately, is far from the ideals given by Islam. It is no surprise then to see that it is the majority non-Muslim western countries, that rank most highly on the Islamicity Index, an index that ranks countries as per their compliance with the Quranic values.

Considering women empowerment, the scenario is similar. The country that has the smallest gender gap, according to the World Economic Forum's 2015² World Gender Gap report is Iceland followed by other Nordic countries. While Pakistan, Syria and Yemen rank the lowest. The questions that come to mind immediately is what are the high ranking countries doing right and what lessons can we learn from these countries ?

The subsequent sections are our modest attempt in trying to find answers to these questions. We shall begin with elaborating further on what motivated our study followed by an explanation on the data and research methodology used. We then proceed to empirical testing and discuss the results of the testing. In the end we conclude by providing implications and policy recommendations based on our findings.

2. Objective and Motivation of the study

The purpose for undertaking this study is to gain insight into the influence of key women empowerment indicators in affecting and driving growth of a country. We endeavor to find empirical evidence of whether such a causal relationship exists between improving the lives of women of a country and economic growth. Since most of the Muslim countries do not measure high on the gender empowerment measures, we seek to gain insight from a country who ranks first in gender equality and attempt to analyze what they are doing right and how to apply the lessons to the rest of the world. Finally we shall endeavor to answer the question of which women empowerment indicator between Labor force

¹ World population bureau: <http://www.prb.org/>

² <http://www.weforum.org/reports>

participation, health, political empowerment and education, which is the most prominent influence on growth. The key questions that we shall endeavor to answer are as follows;

- If a country wants to influence and improve growth, do women empowerment indicators play any role?
- Within the indicators of women labor force participation, health, political empowerment and education, which is the most prominent influence on growth ?
- For a country seeking to enhance growth, which women empowerment indicator needs to be focused upon?

The country of Iceland has been chosen for the simple fact that it has been ranked as the best in Women Empowerment in the world. ³ Therefore Iceland suits our purpose of study as we want to empirically analyze how the influence and causality between growth and women empowerment indicators of the country ranked as number one in this area. The variables used to represent key women empowerment indicators represent the health, education, financial independence and political influence of the women of Iceland over the years. The GDP percentage growth of Iceland is being used as a proxy for financial growth of the country. These variables are discussed in further detail in the data and methodology section.

3. Literature review

There is a plethora of literature on Women Empowerment and economic progress. An in depth literature review however was limited and a rudimentary review was done. The literature on gender issues approach women empowerment issues in different ways. One method talks about the using the human development approach to women empowerment by focusing on health, education and living conditions of women. The other method takes a structural approach to the subject by talking about the awareness of women on their rights, discrimination issues and social justice. (Moreau, 1990). While Shields (1995) gives insight on women's perspectives on how they view gender empowerment by as development of the inner sense of self and their ability to act upon that sense, Wallace and March (1991) discuss it from the human development point in terms of the impact global issues have on quality of living of women.

Analyzing both sides of women empowerment- growth nexus, Duflo (2011) argues that women empowerment and economic development are closely related, with both having the ability to influence each other. Economic development plays its role in being able to increase equality between men and women. Women empowerment in turn can also increase growth. She highlights the need for these two factors to work in tandem through dedicated policy enforcement to make an impact.

³ <http://www.weforum.org/reports>

The United Nations is also at the forefront of research on and measurement of gender issues and women empowerment. Promoting gender equality and empowering women is number three on the list of eight Millennium Development Goals as listed in the adjacent table.⁴ The UNDP issues annual reports on Human Development (UNDP, 2015) which include key measures and indexes for quantifying women development and empowerment. Improving health services, income, employment, education are featured as expected. However, other variables such as women participation in the political arena and involvement in law making were also added. The World Bank focuses on gender empowerment by issuing and monitoring relevant statistics as part of their World Development Indicators. (WDI).



It is important to note that while these indicators and indices provide useful information and serve a purpose, they might also have some weaknesses and therefore must be used with caution. Syed (2010) for example, discusses ways in which the UNDP's Gender Empowerment Index might not be limited in its scope as there is a secular and capitalistic bias inherent in it. The study proposes alternative features that might be considered including factors that add value in socio-political terms to religiously diverse societies. In short, what holds true for one region might not hold true for another and changes and improvements may be inevitable. (Mahanta, 2002) talks about the fulfillment of basic need of women, access to health and education, legal rights as key variables to women empowerment.

Chaudhary, Chani, and Pervaiz (2012) discuss the various approaches that can be taken to measure and improve gender empowerment. They analyze the methods of raising women consciousness, overall women's development and economic empowerment of women as a few of the approaches that lead to gender empowerment.

Based on the above limited review conducted above and intuitive reasoning, we are aware of the multitude of variables that exist to measure empowerment of women. This brought to the fore the need to test empirically whether these indicators can provide insight into how and which of the variables can be used to affect economic growth in practical terms. We proceed with our research with this intention in mind.

⁴ Source – UNDP – www.undp.org

4. Data and Methodology

“Data not only measures progress, it inspires it.” Former US Secretary of State Hillary Rodham Clinton

Being aware of the importance of data to research we proceed with selection of the variables to be included in our study. As discussed earlier, the purpose of conducting this study is to ascertain the existence, and the characteristics of the relationship that exists between the empowerment of women and growth of a country. We have selected annual data for Iceland for 34 years starting from the year 1980.

The data on three of the five variables used in this study is essentially from the World Bank-WDI Data base. Having discussed in the previous section the multitude of variables used in gender empowerment studies, we have selected five variables to better suit the scope of our analysis. To measure the economic growth of the country, percentage growth in the GDP of Iceland has been taken.

Gender empowerment has been represented by the percentage of secondary school enrollment of females which it has been collected from Datastream, the political empowerment of women is being measured by the same variable used by both World Bank and UNDP; the percentage of seats held by women in the national parliament. Datastream did not carry complete observations for this variable which was completed by collecting the data from the UNDP Human Development reports and the Centre for Gender Equality Iceland’s reports. (Iceland, 2012). Since the data on four of the variables used in this study is in percentage form, only one variable, life expectancy at birth – female has been logged while the rest have been kept in their original form.

In order to better address our investigation, this study has employed the standard time series techniques to search for evidence on how the selected variables empirically interact with each other. This has been done by using the methods of cointegration, error correction modelling and variance decomposition. Time series techniques are most suitable for our study as they enable us to investigate the relationship without making any prior assumptions, the data decides the relationship between the selected variables. Since we are trying to analyze whether the growth of a country drives gender equality and women empowerment or the other way round, time series will allow us to do just that.

5. Estimation of the theoretical model and the empirical results

6.1 TESTING STATIONARITY OF VARIABLES

To begin, we shall first ascertain the stationarity of our variables, i.e., whether their mean, variance and covariance remain constant over time. We therefore need to empirically test whether each of the variables is non-stationary in its level form or $I(0)$ and stationary in its differenced form $I(1)$. This can be done through conducting test for unit root.⁵

The differenced form of the variables has been created by taking the difference of the variables in their level form.⁶ Once the variables have been differenced, the ADF (Augmented Dickey-Fuller) test was conducted for each variable in both its level and differenced form. The results are given below.

Variables in Level Form - (regressions include an intercept and a linear trend)			
Variable	Test Statistic	Critical Value	Implication
GDP	-3.3429	-3.5731	Non Stationary
LWH	-3.8159	-3.5731	Stationary
WPL	-3.7769	-3.5731	Stationary
WE	-1.631	-3.5731	Non Stationary
WL	-2.4011	-3.5731	Non Stationary
Variables in Differenced Form -(regressions include an intercept but not a trend)			
Variable	Test Statistic	Critical Value	Implication
DGDP	(AIC) -4.1029	-2.9706	Stationary
DGDP	(SBC) -5.9848	-2.9706	Stationary
DWH	-3.0044	-2.9706	Stationary
DPL	-4.905	-2.9706	Stationary
DWE	-3.4391	-2.9706	Stationary
DWL	-3.2999	-2.9706	Stationary

The ADF test provides the critical values and the test statistics for each variable in both the level and differenced form. These test statistics have been selected as they are corresponding to the highest value of

⁵ The Augmented Dickey-Fuller, Philips-Perron and Kwiatkowski, Phillips, Schmidt and Shin (KPSS) stationarity tests.

⁶ Only the female life expectancy variable has been logged, the rest are differenced in their original form.

AIC and SBC ⁷ in the variables' ADF regression results. Where these two values have differed, both test statistics have been noted. However, as evident from the above table, this difference does not have conflicting implication/outcome (DGDP is stationary at I(0)). We therefore proceed further with the conclusion that the variables we are using in this analysis are I(1) i.e. they are stationary when differenced once. This is one of the conditions to proceed further.

6.2 DETERMINATION OF THE ORDER OF THE VAR MODEL

In preparation to test for cointegration, we need to determine the number of lags that will be used or the order of the vector auto regression (VAR). The results that we received are conflicted in the sense that the optimal order as generated by the two different choice criteria (AIC & SBC) are different.

As per AIC 4 lags are recommended while SBC provides an optimal lag order of zero.

CHOICE CRITERIA		
	AIC	SBC
OPTIMAL ORDER	4	0

In order to ensure that the selection of the lags is correct, each variable was checked for serial correlation. The results are given in the table below.

Variable	Chi-Sq p-Value	Implication at 10%
DGDP	0.02	There is Serial Correlation
DWH	0.149	There is no Serial Correlation
DWPL	0.476	There is no Serial Correlation
DWE	0.554	There is no Serial Correlation
DWL	0.294	There is no Serial Correlation

As per the evidence provided by the diagnostics test in the above table, there exists autocorrelation in one of the five variables. This has implication on the choice of lag order we select. On one hand, in order to mitigate the effects of autocorrelation, we may select the highest lag order of 4. On the other, considering the small number of our

⁷ Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC)

observations we must consider the effects of over-parameterization. Keeping both these aspects in mind, we decided to selected **VAR order of 4**.

The diagnostics tests also confirm that our model's functional form is correct and that there is no problem of heteroscedasticity.

6.3 TESTING COINTEGRATION

Equipped with the information from the aforementioned tests, once we have confirmed that all our variables are I(1) and our VAR lag order is 4, we proceed to check for cointegration. Cointegration test is used to check the existence and stability of long run equilibrium relationship amongst the variables being used for econometric research. The advantage of using Johansen's cointegration test is that it uses maximum likelihood method to check for cointegration vector in Vector Autoregressive setting (Johansen & Juselius, 1990). As per the results shown in the table below, the Eigen value shows two cointegrating vectors, Trace test shows four and AIC, SBC and HQC show five.

Criteria	Number of cointegrating vectors
Eigen value	2
Trace	4
AIC	5
SBC	5
HQC	5

Considering the facts discussed in the literature review and also from familiarity, based on research and observation, with the way the variables are interconnected to each other as evidenced by the numerous Gender Empowerment and Development indices constructed ⁸ and the "connection" of the variables to each other, for the purpose of this study we shall accept the statistical result from Eigen Value. We proceed with the assumption of two cointegrating vectors.

⁸ UNDP & World Bank, to name a few.

6.4 LONG RUN STRUCTURAL MODELLING (LRSM)

In order to establish a link between our empirical results and to ascertain that the relationship between the variables under observation is not spurious. Amongst other things, the long run structural modelling (LRSM) checks whether there is a theoretical relationship between the variables and whether they are in equilibrium in the long run. Through this process we normalized the variable we are interested in (GDP) and obtained the following results.

Variable	Coefficient	Standard Error	t-ratio	Implication
GDP	-	-	-	-
WE	-4.7321	0.1611	-29.38	Variable is significant
WL	0.9694	0.1045	9.27	Variable is significant
LWH	91.4282	62.6198	1.46	Variable is insignificant
WPL	0.2229	0.0536	4.16	Variable is significant

As displayed in the table above, we calculated the t-ratios manually and found that three of the variables were significant these are WE, WL and WPL. Which implies that each of these variables contains information for the prediction of the other variables which is consistent with our understanding of them.

We wanted to investigate further the reason for one of the variable representing health and life expectancy of women in Iceland (LWH) showing as insignificant. To thoroughly verify the significance of the variables, we applied over-identifications to the variables, one at a time. The results confirmed that WE, WL and WPL were significant.

Variable	Chi Square P Value	Implication
LWH	0.158	Variable is insignificant
WE	0.000	Variable is significant
WL	0.000	Variable is significant
WPL	0.000	Variable is significant

However, when we applied over-identification restrictions on WE, WL and WPL and check for the significance of WH, we find that as per the Chi square p value for the result, the variable WH is still not significant. This is however not in consistence with theory as discussed, women's life expectancy is related to improvement in women education. Conversely, economic development is a major influence in improving health and life expectancy. Therefore, although a relationship exists between our focus variable GDP and WH, we need to further investigate the extent of the relationship, which shall be done next.

6.5 VECTOR ERROR CORRECTION MODEL (VECM)

From our analysis thus far, we have established the statistical significance or lack thereof for each of our variables. We have observed that four of our variables are cointegrated to an extent. We do not have any information on the causality, which would give us the answer of which variable is most effected by the changes in other variables. In other words, which variable is the leader and which is the follower. Through VECM we shall identify this exogeneity/endogeneity. This would provide us information on the leading variable which receives exogenous shocks initially which causes deviations in the equilibrium but then transfers the shocks to the other variables. For policy makers, this provides insight into which variable to monitor for performance and to manage in the short term and to what extent in order to bring long term equilibrium. Using the principle of Granger Causality, VECM not only distinguishes the short term and long term components of each variable, it also gauges the extent of change in one variable due the change in another variable in another period.

As displayed in the results table below, we check each variable's ECM(-1) or error correction term for significance and find that three of our variables are exogenous while two are endogenous.

Variable	ECM(-1) t-ratio p-value	Implication
GDP	0.092	Variable is endogenous
WE	0.004	Variable is endogenous
WL	0.582	Variable is exogenous
WH	0.995	Variable is exogenous
WPL	0.395	Variable is exogenous

The implications of this result for policy makers is that women's health, maintaining and increasing female labor force participation and an increase in their participation in the political and policy making arena will have an effect on economic growth and female education levels. Looking at the coefficient statistic of the error correction term we are also able to ascertain for each variable the time it will take to get back to equilibrium if that variable is shocked. For example the coefficient of GDP is -0.75749 which means that when GDP is shocked, it would take 7.5 years for it to reach back to being in equilibrium with the other variables. The value also suggests that there is partial adjustment.⁹

⁹ Coefficient falls between -1 and 0.

6.6 VARIANCE DECOMPOSITION (VDC)

Building on the results of VECM we would like to know the relative exogeneity and endogeneity of the variables under analysis. We do this now through Variance Decomposition (VDC). Variance decomposition makes separations in the variance of the forecast error of a particular variable into parts attributable to shocks in each variable in the system, including its own. The most exogenous amongst the variables is therefore the one that is most explained by shocks in its own past.

The results of the orthogonalized VDCs was checked first. Since our data is annual therefore the horizons selected were 2,4,6,8 and 10 years. The below matrices display the percentage of the variance of the percentage forecast error of each variable into portions attributable to shocks received from other variables (including its own). In the columns the percentages represent the proportions that particular variable contributes in explaining the changes in the other variables. The highlighted portions in the diagonal boxes are the percentage of relative exogeneity of the variables.

		GDP	WE	WL	LWH	WPL
Horizon	GDP	89%	0%	6%	3%	1%
4	WE	62%	22%	7%	10%	0%
	WL	1%	43%	54%	3%	0%
	LWH	8%	1%	18%	73%	1%
	WPL	5%	72%	2%	6%	15%

		GDP	WE	WL	LWH	WPL
Horizon	GDP	83%	1%	10%	5%	1%
8	WE	54%	28%	11%	6%	0%
	WL	0%	46%	52%	1%	0%
	LWH	7%	1%	19%	73%	0%
	WPL	4%	75%	3%	5%	13%

The ranks according to the orthogonalized VDC are given below.

Variable	Exogeneity	Rank
GDP	89.73%	1
LWH	83.37%	2
WL	54.89%	3
WE	21.70%	4
WPL	16.33%	5

It is interesting to note from the above table that the variable that was tested to be endogenous GDP is ranked at the top whereas the variables that were tested as exogenous carry a lower rank. This is due to the limitations of orthogonalized VDC which assumes that when one variable is shocked the others are “switched off” and also is biased towards the order in which the variables are ordered in the VAR. This means that whichever variable is placed first in the VAR order will come out as being the most exogenous followed by the rest as they are placed. Therefore the solution given by Orthogonalized VDC is biased towards the ordering of the variables.

We therefore move on to the Generalized VDC which does not suffer from such bias. The results from this process for each variable add up to be more than 1 and therefore we calculated the percentages by scaling them down to the 100% level and then ranking them according to their relative exogeneity as explained in the orthogonalized VDC section. The results for the selected horizons of 4 and 8 are given below.

		GDP	WE	WL	LWH	WPL
Horizon	GDP	58%	36%	2%	3%	2%
4	WE	34%	45%	8%	11%	2%
	WL	0%	14%	76%	2%	8%
	LWH	7%	5%	11%	73%	4%
	WPL	3%	22%	10%	3%	62%

		GDP	WE	WL	LWH	WPL
Horizon	GDP	54%	31%	6%	7%	2%
8	WE	30%	44%	15%	7%	4%
	WL	0%	13%	76%	1%	10%
	LWH	6%	4%	12%	72%	5%
	WPL	3%	24%	17%	2%	55%

The ranks according to generalized VDC are given below;

Variable	Exogeneity	Rank
WL	75.79%	1
LWH	73.18%	2
WPL	61.84%	3
GDP	57.62%	4
WE	44.66%	5

Looking at the ranking results obtained from generalized VDC we can observe that the rankings are stable over time and there is no change in the rankings across the horizons. These findings also concur with the results observed through VECM in which GDP and WE were identified as endogenous.

With reference to Iceland, these results imply that the country's female labor force participation, their long life or health and representation in politics has effects on its economic growth. It is also interesting to note that women education is the most endogenous variable here, which might not reflect established theory. However, when we consider that the literacy rate of Iceland is 99%¹⁰ we realize that for Iceland, female education is not a concern with respect to empowerment. It is not an influencer of economic growth as female education is a norm and not an exception.

For policy makers these results hold important information as well. As far as women empowerment is concerned, countries that want to improve their ranking can take note that the women empowerment variables have the ability to drive growth and can be used as policy tools to increase economic and financial growth.

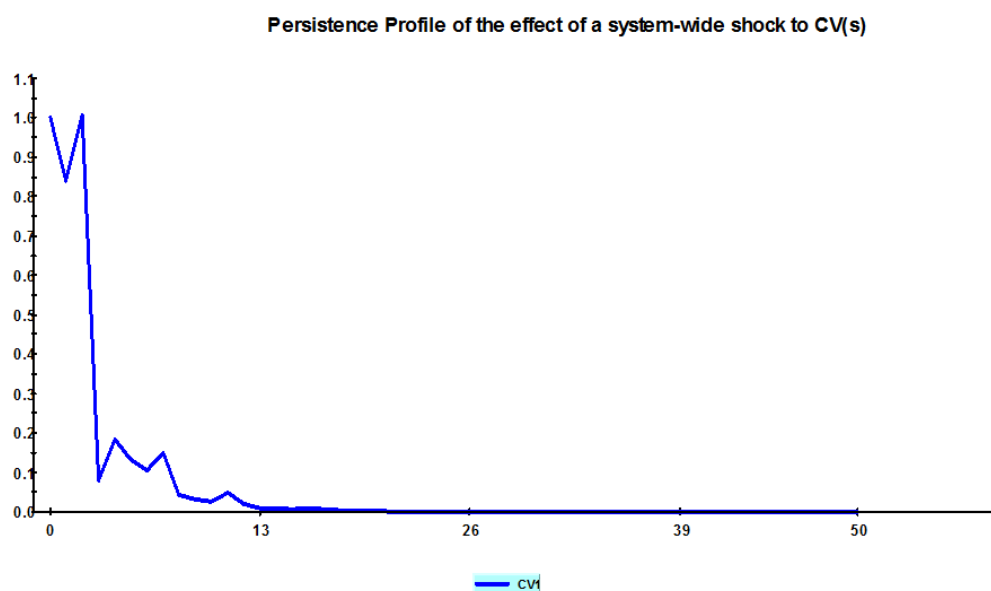
6.7 IMPULSE RESPONSE FUNCTIONS

Impulse response functions are essentially the graphical representation of the VDCs as they provide the same information and map out the response of one variable to the one period standard deviation shock to another variable. We went through the process of producing the complete impulse response functions.

¹⁰ Figure as of 2012 – Iceland Centre for Gender Equality

6.8 PERSISTENCE PROFILE

The persistence profile indicates the time horizon needed to restore equilibrium when the entire system is shocked. The focus here is on the long run relationship amongst the variables and the effect a system wide shock has on the cointegrating equation. According to the Persistence Profile results for our study (displayed below), it would require 14 horizons for the cointegrating relationship to attain equilibrium again.



7 Conclusions Policy & implications

We now recall the questions that were put at the beginning of the study and provide the following answers.

- Women empowerment indicators play a very important role for a country's growth. They exhibit strong influence and have a multiplier effect in acceleration of sustainable growth.
- For Iceland, within the indicators of women labor force participation, health & political empowerment are the drivers or the leaders of economic growth.
- For a country seeking to enhance financial growth, there are lessons to be learnt from this preliminary analysis. For women empowerment, countries that want to improve their ranking can take note that the women empowerment variables have the ability to drive growth and can be included in the group of policy tools to increase economic and financial growth.

Our study has shown that gender empowerment improves growth. However, considering the narrow scope of our study and there are limitations to our analysis that are discussed in the following section.

8 Limitations & Suggestions

We close our analysis by noting possible limitations to our study that could be pursued as further avenues for research.

The variables that we chose for our analysis are but a few out of the multitude of variables available to measure women empowerment as well as economic growth and development. Variables which focus on economic, overall development and enhancing the consciousness of women could yield further insights into the topic and make the analysis more robust.

It also needs to be pointed out that the number of observations used for the analysis need to be larger in order to ensure that the analysis does not suffer from any weaknesses however, data has not been easy to retrieve.

The theoretical background on which research is based is not sound enough and can certainly be improved upon. This may give more substantial and sound conclusions as they would carry more weight.

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