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Abstract

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Keywords: African countries, Developing countries, gender gap, Latin American countries, OECD countries, output, per capita output

JEL Code: D63, I24, F43

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Women Empowerment and Good Times: Which One Leads to the Other?

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1. INTRODUCTION

The conditions of women around the world have significantly improved over the past century. In most countries, rich and poor, women have more participation in classrooms as well as a greater voice in the workforce and household-decision making than they did not too long ago. Presently, women have additional social and legal rights. However, a wide gender gap still persists. Hitherto, women earn less, have less power in decision making, and have less political as well as legal representation in most parts of the world. In certain developing countries, they are likely to die relative to men. Accordingly, the following questions remain. (1) Does closing the gender gap benefit only women? (2) Do nations as a whole gain from significant equality between men and women?

Our first hypothesis tests how closing the gender gap will affect the economic progress of a country. The second hypothesis tests how economic progress affects gender outcomes. We use the Global **Gender Gap Index** (GGGI) published by the World Economic Forum to test our hypotheses. The index is a composite measure based on the following sub-indices: economic participation and opportunity, educational attainment, health and survival, as well as political empowerment of women. Moreover, we analyze the effect of gender gap as measured by the different sub-indices for the sample of developing countries. The gender gap pattern has evolved in a differential manner. To provide conclusive policy inferences, we examine the differential effect of gender gap in countries at various stages of development. Our analysis focuses on four samples consisting of rich and poor countries, namely, Latin American countries, African countries, all developing countries, and OECD countries.

Three main channels exist through which closing the gender gap can improve the real per capita output of a nation. Encouraging wide women participation in the labor force, by creating a highly congenial workplace environment where women are not coerced to care for their child and old family members outside of work as well as by removing barriers against them from working in specific sectors and occupations, constitutes the first channel. This channel increases labor productivity through the proper allocation of resources considerably suited to women's

skills and talents, which, in turn, increases per capita output (Klasen,1999). The second channel elucidates that women's significant voice and control over household resources can benefit children (World Bank, 2011 and Klasen, 1999). Increased expenditure on food and education occurs, which, in turn, will drive economic growth. Moreover, female education and labor force participation reduce fertility as well as increase savings and growth. The third channel highlights that the broad representation of women in different economic, political, social, and legal spaces influences policy decision in creating an environment highly suitable for women.

The effect of economic progress (or income) on gender outcomes is determined by interactions among household decisions, market activities, and institutions. In terms of market, high income growth implies considerable job opportunities for women, whereas institutions imply an increased number of schools, colleges, and hospitals available at low costs. Additionally, a high income economy implies a household's expanded budget set, overall closing the gender gap by leading to improved health and education outcomes for women.

To examine our hypotheses, we first assess the output and gender gap nexus through a panel Granger causality test. Many cross-country studies (Kabeer and Natalie, 2013) emphasized only on the correlation between the two variables of interest and not on the (Granger kind of) causality. We conduct a bivariate[1] analysis to focus on the direct causal relation between the two variables. Evidently, a significant bidirectional long-run causal relationship between gender gap index and output (or growth) exists.[2]

Another concern (Kabeer and Natalie, 2013) in many cross-country regressions is the existence of causality and reverse causality between the two variables where disentangling the effect of gender equality on output and that of output on gender equality becomes necessary. A panel VAR (PVAR) analysis is appropriate in this scenario given that this approach treats all variables as endogenous. We extend our model to a four-variable PVAR comprising the key

[1]A multivariate analysis can be misleading as the two variables may not have any direct causal relation. However, causality could be shown to exist through the existence of other variables in the model.

[2]The results are robust to different forms of output (level of output, per capita output, and respective growth rates) and different lags.

variables of a standard growth regression, namely, per capita output, gender gap index, as well as physical and human capital. We generate shrinkage impulse response functions based on Minnesota prior to capturing the homogeneities and interdependencies existing among different countries in the sample. We take the necessary step given that estimating an unrestricted PVAR as large as ours will provide inaccurate estimates due to lack of degrees of freedom. Our empirical results confirm the theoretically expected behavior of various variables due to different exogenous shocks validating the identifying assumptions used in our PVAR model. For example, output responds favorably due to positive shocks to physical and human capital. In turn, shocks in human capital help close the gender gap.

Our PVAR results corroborate the fact that good times, in general, will encourage equity between men and women in all nations. Additionally, policy measures geared toward gender parity help middle- and low-income countries prosper. Further, closing gender gaps in such nations is shown to significantly increase human capital. The sample of Latin American and African nations shows similar responses to shocks in real output per capita and those in GGGI representative of all developing nations. The effect is, in fact, quantitatively greater for both samples than that of developing nations. Additionally, both shocks have long-run effects for Latin American economies. However, such effects of gender parity are not established for OECD output. Most OECD nations are profoundly near to closing the gender gap and additional policy measures devised to further reduce the gender gap may deviate resources away from productive activities. Our PVAR results confirm a negative effect on output due to the increase in equality (captured by the percentage increase in GGGI) consistent with those of Ramanayake and Ghosh (2017) who analyzed these differential effects on their sample of developing and OECD countries.

We further analyze the effect of gender equality in terms of different sub-indices on the sample of developing countries. Among the four sub-indices, closing the gender gap in education has the most significant effect on per capita real GDP followed by gender equality in economic participation and opportunity as well as political empowerment. Encouraging a high level of female education unambiguously increases the human capital of all nations. Similar results are found for equality in economic participation and opportunity as well as political empowerment. Furthermore, an increase in economic prosperity has the most contribution to the political

empowerment of women followed by high gender equality in women's economic participation and opportunity as well as education. However, the relation between the two variables is not robust when gender equality is measured in terms of male as well as female health and survival. An improvement in female health and survival occurs at the cost of sacrificing per capita output and an increase in per capita output. However, foregoing this improvement can cause a minor decline in the health and survival of women. The result also corroborates that high investment in human capital helps in elevating women's health and survival status.

On the basis of our results, we recommend policies that encourage gender gap reduction for low- and middle-income countries. These policies should be channeled mainly through higher investment in female education and training among other channels to close the gender gap. Gender gap reduction will have an immediate favorable impact on output as shown by the impulse responses of low- and middle-income countries Although Appiach and McMahon (2002) emphasize that empirical literature has not acknowledged the true rewards of female education, our model does capture the significant effect of gender equality in female education through its direct effect on output and indirect effect of increasing future human capital and hence, long run economic growth. Moreover, further increasing output will encourage an equitable society in general.

2. LITERATURE REVIEW

Hakura et al. (2016) asserted that gender inequality arises due to gaps in opportunities captured by unequal access to education, legal system, and finances or outcomes, such as low female participation in employment, low wages, and reduced political power. Seguino (2016b) presented evidence of a declining trend in the ratio of men to women employed in the industrial sector. A UN Women's report (2015–2016) explained that, on average and globally, women are paid rates 24% less than those of men. Further, gaps for women with children are wide. The gender gap remains high, particularly in developing countries, despite the effort exerted by the government and various international organizations. Globally, only half of women participate in the labor force compared with three quarters of men. In developing regions, up to 95% of

women's employment is informal and involves jobs that are unprotected by labor laws as well as lacking in social protection.

Khera (2016) corroborated that India has a high level of gender inequality and that, despite the increasing education levels of women, female labor participation has been declining in rural as well as urban areas. In Bangladesh, female wage is observed to be only two-thirds of the male wage (Rahaman and Islam, 2013). Dollar and Gatti (1999) verified that educational attainment in Latin America stands out as relatively low compared with that in East Asia or Europe and Central Asia. However, low gender inequality exists there. Dasgupta and Verick (2016) affirmed that women's labor force participation increased in Latin America and in the Caribbean from 40% in 1991 to 53.7% in 2014. Hakura et.al (2016) confirmed that gender inequality in the sub-Saharan Africa (SSA) region remains one of the highest and is declining slower than other regions. According to the GGGI data, Swaziland shows the highest level of equity among other African countries. However, the country's average GDP per capita growth rate is 0.8% from 2006 to 2015 (according to the World Bank data). Accordingly, we reconsider the questions of whether gender gap (inequality) affects growth and high economic growth closes the gender gap.

A considerably large body of literature that investigated the effects of gender-specific policies on growth aspects exists. Alesina and Rodrik (1994), Persson and Tabellini (1994), as well as Larrain and Vergarra (1998) argue that gender gap can slow down growth. Particularly, Blackden and Bhanu (1999) asserted that gender inequality may limit the ability of women to accumulate capital and, thus, hinder growth. Stotsky (2006) elucidated that reducing gender inequality and improving the status of women may contribute to increased rates of economic growth and improved macroeconomic stability, especially in developing countries.

Seguino (2016a) validated that a large body of empirical and theoretical research exists, which confirms that the degree of equity in education, health, unpaid labor, employment and wage can have a substantially wide range of effects on growth. Klasen (1999; 2002) as well as Klasen and Lamanna (2009) confirmed that gender gaps in labor force participation had a negative effect on growth. Costa, Silva, and Vaz (2009), using micro-simulations for Latin

American nations, corroborated that policies encouraging high labor force participation promoted high income. Elborgh-Woytek et al. (2013) asserted that high female labor force participation increases growth by mitigating the effect of a shrinking workforce. However, Baliamoune-Lutz and McGillivray (2007) proved that great female participation in the labor force negatively and significantly affects growth for SSA and Arab countries. In SSA, much of the female participation was as unskilled laborers and in the agricultural sector. Meanwhile, oil-producing nations had significantly high rates of growth with inconsiderably low female participation in their labor force.

Early cross-country studies on growth, such as those of Barro and Lee (1994), Barro and Sala-i-Martin (1995), as well as Perotti (1996), confirmed a negative effect of female education on growth. However, their results were challenged and attributed to econometric issues, such as omitted variables bias, specification problems, as well as multi-collinearity and endogeneity given that the regressions included (highly correlated) male and female schooling for comparisons. Hill and King (1995), by contrast, confirmed a significant positive effect of female education on per capita output for another group of developing countries, such as SSA, South Asia, the Middle East and North Africa, East Asia and the Pacific, as well as Latin America and the Caribbean. In addition to women's educational participation rate and other control variables, they regressed gender education gap on per capita GDP to account for multi-collinearity. They proved that gender inequality in education also had a negative effect on life expectancy as well as a positive effect on infant mortality and fertility rates. However, they failed to address the issue of reverse causality or simultaneity bias. Klasen (1999; 2002) also verified that gender equality in education (measured by the female-to-male ratio of years of education in 1960 and changes in the ratio over the period studied) positively affects growth in developed and developing countries. Esteve-Volart (2000) asserted that an overall increase in education and reduction in gender inequality in primary education led to an increase in growth for the sample of 87 countries covering the period from 1965 to 1989. Baliamoune-Lutz and McGillivray (2007) obtained the same result for 41 SSA and Arab countries. Knowles, Lorgelly, and Owen (2002) affirmed that a percent increase in female education would increase GDP per worker by 0.37%, which captures the high labor productivity achieved through it. Erica Siegel (2005) elucidated that the reduction of gender gap, through considerable access to education for example, will

increase the quantity and quality of female human capital. This increase will increase economic growth by means of reduction in population growth as well as increase in productivity and positive externalities.

However, another stream of literature confirmed that gender gap increases economic growth, especially when gender gap is measured through gender wage gap. Blecker and Seguino (2002) proved that East Asian economies are characterized by low gender education gap and high gender wage gap, which led to rapid growth via export-oriented industrialization. Seguino (2000a,b) established the hypothesis using data from a set of semi-industrialized export-oriented economies. Gender–wage inequality can stimulate investments with highly productive but low-cost labor. Low wages for women increase demand for female labor, leading to increased production in the manufacturing sector as well as large export and GDP growth. Seguino (1997) further corroborated that gender–wage inequality positively affects output and export growth in South Korea, Taiwan, Hong Kong, as well as Singapore. These countries have insufficient feminist economic policies for the labor market and strongly different structure for the economic opportunities of men and women. Mitra-Kahn and Mitra-Kahn (2008) also verified that gender wage gap promotes growth as claimed by Seguino but only for countries at the early stages of export-led growth. The relationship becomes nonlinear as the countries further develop. However, Seguino (2007; 2010) argued further that, with high capital mobility, women lose their power to bargain for high wages.

Analyzing the effect of economic growth on gender inequality may not be as straightforward as analyzing the effect of gender inequality on economic growth. Gender inequalities in certain societies are the result of historically existing social norms as well as patriarchal structures and ideologies, which remain unchanged despite high income (Naila Kabeer, 1996). Consequently, the effect of output on different dimensions of gender gap will be able to efficiently capture the facts given the existing social and cultural preconditions of the nations.

Baliamoune-Lutz (2006) used data from 62 countries covering the period 1990–1999 (with 30 SSA countries and 32 non-SSA countries separately regressed) to examine the effect of economic growth on gender gap in literacy rates of youths and adults. They also used various

controls in their regressions. Their study concludes that economic growth mainly has a negative impact on female literacy rates in SSA and is insignificant in other countries.

Kapsos (2005) elucidated that the employment elasticity of growth for the period 1991–2003 was consistently higher for women than for men in most regions of the world, except for Central and Eastern Europe and the Commonwealth states. Additionally, he asserted that export-oriented growth was associated with increased female employment elasticity. Gaddis and Klasen (2011) as well as Braunstein and Seguino (2012) confirmed weaker employment elasticities for women in oil-producing African economies. Seguino (2003) further proved that male and female unemployment declined during upturns but that males obtained additional benefits, which raises the gender gap. Oostendorf (2009) analyzed the impact of per capital GDP on gender wage gap at the global level using ILO data for 83 countries covering the period 1983–1999. Low- and lower middle-income countries as well as high and higher-income countries were separately analyzed. The main results confirmed that economic growth led to a decrease in gender wage gap in rich countries but also led to an increase of gender wage gap in poor countries. Seguino (2000c) argued that women employment was highly concentrated in the export sector in certain countries where they have less bargaining power given that capital was mobile and employers could move to low-cost locations. This scenario explains the increase in gender gap in Taiwan and South Korea's manufacturing sectors during 1981–1992.

Dollar and Gatti (1999) examined the effect of per capita income growth on gender gap using different measures of gender gap and various controls. They confirmed a convex relation between per capita income growth and gender inequality in secondary educational attainment. The result confirms that the latter decreased with the increase in per capita income. Increasing growth had inconsiderable impact on gender equality for low to lower-middle income countries but has a significant impact on middle and high-income countries. The authors affirmed that the low income in developing countries is generally characterized by market failures to promote policies and investment in female education. A similar convex relationship was found between per capita income growth and gender gap capturing women's legal economic rights as well as number of women in parliament. However, with regard to equality in life expectancy, the relation was strongly negative. The study also suggested that 'culture' is an important

determinant of gender equality. Gender inequality is considerable in countries with Muslim, Shinto, and Hindu majorities.

Seguino (2006b) compared the correlation between economic growth and the composite gender gap index (developed by Dijkstra (2002) that covers gender gap in education, life expectancy, and labor force participation in senior occupational position as well as parliamentary seats) using data from 101 countries spanning 1980–1995. She affirmed that economic growth was negatively related to gender equality in low-income countries. In addition, the nature of the relationship between the two could be profoundly different for different set of countries. Further, Seguino (2006a) studied the effects of economic growth on gender gap for Latin America and the Caribbean using panel data covering the period 1970–2000 and three different measures of inequality. She asserted that growth had a significantly negative effect on the female to male population as well as female to male gross secondary enrollment ratios and led to an increase in the ratio of adult female to male mortality rates (per 1000 relative to the reference population of Sweden). She attributed such observations to the characteristics of the growth process where globalization causes capital to be highly mobile, thereby hurting women's negotiability powers for their well-being. Seguino (2002) had obtained a similar weak effect of growth on gender gap for 8 Asian countries for the period covering 1970–1990.

3. EMPIRICAL METHODS, SAMPLES AND DATA SOURCES

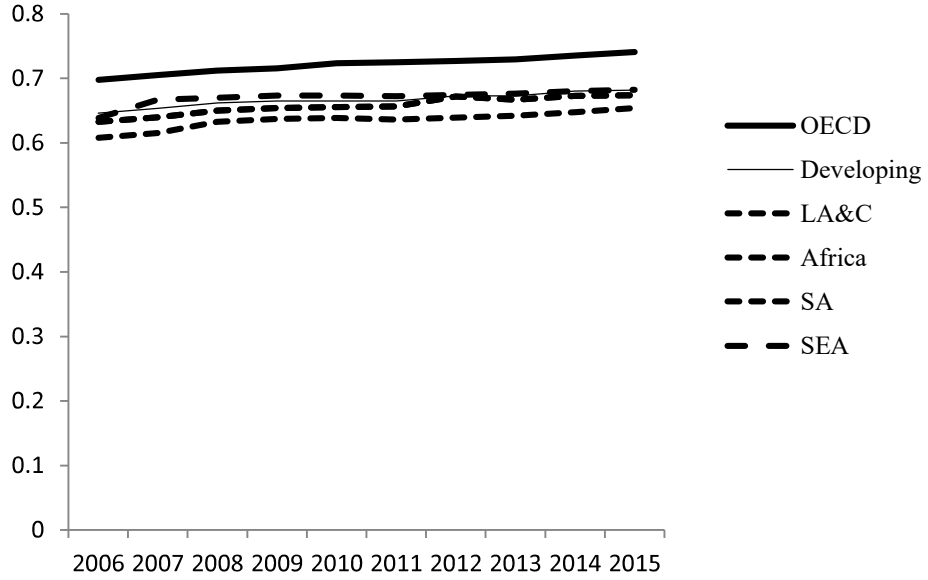
Data

The study uses panel Granger causality test and the Panel VAR (PVAR). The data is annual average data covering period from 2006 to 2015. We consider 84 developing, 32 OECD (high income), 18 Latin American-Caribbean, and 27 African countries in our samples. Except for the GGGI data, all the other variables are from the World Bank-World Development Indicators online database. A detailed explanation of the definitions of the variables and the data sources is presented in Appendix Table 2.

Global Gender Gap Index (GGGI)

For gender inequality variable, we use the GGGI from the World Economic Forum introduced in 2006 for capturing the magnitude of gender-based disparities and tracking their progress. There are three basic concepts underlying the GGGI. First, the index focuses on measuring gaps rather than levels. Second, it captures gaps in outcome variables rather than gaps in input variables. Third, it ranks countries according to gender equality rather than women's empowerment. GGGI is independent from the countries' levels of development. In other words, the index is constructed to rank countries on their gender gaps not on their development level. And this examines the gap between men and women in four fundamental categories (sub-indexes): Economic Participation and Opportunity, Educational Attainment, Health and Survival and Political Empowerment (Appendix Table 1).

Figure 1: Progress on closing the economics Global Gender Gap across regions



Source: Using Global Gender Gap Index data from World Economic Forum created by the Authors

GGGI rank goes from 0 to 1; where 0 means 100% inequality and 1 means 100% equality. Considering GGGI rank in 2015, on the overall index, no country in the world has fully closed the gender gap, but four out of the five Nordic countries and Ireland have closed more than 80% of it. Yemen, the lowest ranking country has closed over 48% of the gender gap. Figure 1 indicates that OECD is the highest across income groups and the South Asia is the

lowest. According to the GGGI rank in 2016, the global leaders are Iceland, Finland, Norway, Sweden, Rwanda, Ireland, Philippines, Slovenia, New Zealand and Nicaragua respectively.

3.1 *Panel VAR Estimation*

PVARs assume that all variables are endogenous and interdependent. VAR models also make the same assumption. However, PVARs are added with a cross sectional-dimension to it in a setting with macroeconomic variables with several countries. PVARs have emerged as an important tool as they are able to capture both static and dynamic interdependencies and account for cross sectional dynamic heterogeneities between different variables of different countries among other advantages (Fabio Canova and Matteo Ciccarelli, 2013).

A Panel VAR can be represented as

$$x_{it} = B_0 + B(l)x_{it-1} + f_i + u_{it}, i = 1, \ldots . N; t = 1, \ldots . T_i \qquad (1)$$

Where x_{it} is a vector of endogenous variables, B_0 is vector of constants, $B(l)$ is a polynomial in the lag operator and f_i is state specific fixed effects. u_{it} is random disturbances vector with $u_t \sim iid(0, \Sigma_u)$ that is independently and identically distributed.

In our analysis, *i* indicate countries. x_i is a four variable vector {Output (Y), Gender Gap Index (GGGI), Physical Capital (K) and Human Capital (H)}. For robustness check we have used both real GDP and real GDP per capita for output. The logarithmic value of level[3] of output (real GDP or real GDP per capita), physical capital and human capital are used in the VAR. Physical capital and human capital are standard variables used in growth models. We include them in our VAR to control for the changes in output occurring due to changes in K and H in order to capture changes in output only due to exogenous shocks in GGGI.

The variance-covariance matrix of errors in equation (1) may not be diagonal and it is difficult to isolate the shocks to any one of the variables. Hence in order to recover the structural parameters from the reduced form model given by equation (1), we use the Cholesky decomposition of reduced form innovations such that they become orthogonal as suggested by

[3] It is shown that differencing or growth rate of variables do not provide gain in asymptotic efficiency of the model and may throw away information regarding the co-movements in the data like co-integrating relationship between the variables in a VAR. Hence, we have Panel VAR in levels. However, for the Panel Granger causality test, we perform robustness check using growth rates of output variable as well.

Christopher Sims (1980). This imposes a recursive structure defined by equation (2) to identify the model.

$$\begin{pmatrix} \epsilon_t^{Y} \\ \epsilon_t^{GGGI} \\ \epsilon_t^{K} \\ \epsilon_t^{H} \end{pmatrix} = \begin{pmatrix} . & 0 & 0 & 0 \\ . & . & 0 & 0 \\ . & . & . & 0 \\ . & . & . & . \end{pmatrix} \begin{pmatrix} u_t^{Y} \\ u_t^{GGGI} \\ u_t^{K} \\ u_t^{H} \end{pmatrix} \quad (2)$$

u_t is reduced form innovation as given in equation (1) and ϵ_t is the structural form innovation that we derive using Cholesky ordering as in equation (2). The identifying assumption used in equation (2) is that the output variable is not contemporaneously affected by any of the other variables in the model. However, the gender gap of the economy is contemporaneously affected by the output shocks. Apart from its own shock, physical capital in the economy is instantly affected by shocks in output and gender gap index. Similarly, human capital is assumed to be affected by shocks in output, gender gap index and physical capital contemporaneously. All the variables, on the other hand, are allowed to affect each other with a lag.

3.2 *Panel VAR-Granger Causality Wald test:*

A variable x is said to Granger-cause variable y if,given the past values of y and past values of x, y can be predicted better compared to the prediction of y done using only the past values of y. In order to perform the Granger causality test, y is regressed on its own lagged values and on lagged values of x. Then we test the null hypothesis that the estimated coefficients on all lagged values of x are jointly zero. A p-value of less than 0.05 fails to reject the null hypothesis, and the alternative hypothesis of existence of Granger causality is accepted.

We present results from bivariate Granger causality test between gender gap and output. Additionally, for robustness check we use different forms of output in our panel Granger causality analysis namely real GDP, per capita real GDP, real GDP growth and per capita real GDP growth. Allowing for full heterogeneity and independence across individuals, the likelihood ratios are calculated for countries. The likelihood ratio test is performed by summing the individual likelihood ratios and summing their degrees of freedom. Even though few

countries results are coming out to be insignificant, the results from joint tests are significant and establish the significant causal role of the gender gap variable.

Table 1: Granger Causality Test Gender Gap (GGGI) causing Output: Developing Countries

	Real GDP		Real GDP per Capita		Real GDP Growth		Real GDP per Capita Growth	
	Lag 1	Lag 2	Lag 1	Lag 2	Lag 1	Lag 2	Lag 1	Lag 2
Sri Lanka	0.13	0.00*	0.23	0.00*	0.97	0.00*	0.99	0.00*
India	0.21	0.20	0.27	0.04*	0.08	0.08	0.07	0.34
Bangladesh	0.57	0.88	0.63	0.95	0.64	0.22	0.64	0.29
Nepal	0.70	0.47	0.09	0.06	0.62	0.00*	0.64	0.00*
Pakistan	0.93	0.44	0.97	0.42	0.84	0.00*	0.85	0.00*
Maldives	0.11	0.00*	0.13	0.01*	0.04*	0.83	0.06	0.77
China	0.00*	0.00*	0.01*	0.00*	0.00*	0.00*	0.01*	0.00*
Thailand	0.00*	0.01*	0.00*	0.00*	0.19	0.00*	0.20	0.00*
Vietnam	0.16	0.14	0.14	0.11	0.18	0.16	0.18	0.16
Malaysia	0.69	0.05*	0.77	0.05*	0.52	0.07	0.52	0.07
Indonesia	0.01*	0.01*	0.03*	0.03*	0.01*	0.01*	0.01*	0.01*
Albania	0.51	0.00*	0.52	0.00*	0.40	0.02*	0.42	0.02*
Algeria	0.65	0.85	1.00	0.55	0.61	0.03*	0.69	0.10
Argentina	0.15	0.00*	0.18	0.00*	0.13	0.00*	0.13	0.00*
Armenia	0.38	0.00*	0.44	0.00*	0.02*	0.00*	0.02*	0.00*
Azerbaijan	0.38	0.02*	0.44	0.01*	0.09	0.11	0.13	0.10
Belize	0.59	0.00*	0.47	0.00*	0.53	0.93	0.45	0.89
Benin	0.03*	0.00*	0.05*	0.00*	0.01*	0.00*	0.01*	0.00*
Bolivia	0.06	0.01*	0.04*	0.02*	0.01*	0.01*	0.01*	0.01*
Botswana	0.10	0.43	0.07	0.53	0.47	0.06	0.49	0.06
Brazil	0.98	0.93	0.95	0.92	0.70	0.27	0.71	0.28
Bulgaria	0.07	0.00*	0.07	0.00*	0.81	0.00*	0.90	0.00*
Burkina Faso	0.23	0.39	0.27	0.42	0.15	0.17	0.15	0.17
Cambodia	0.00*	0.00	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*
Cameroon	0.90	0.92	0.81	0.83	0.84	0.95	0.83	0.95
Colombia	0.16	0.01*	0.17	0.01*	0.36	0.05*	0.36	0.05*
Costa Rica	0.42	0.42	0.44	0.44	0.92	0.78	0.93	0.77
Dom. Rep.	0.05*	0.10	0.05*	0.11	0.13	0.12	0.13	0.12
Ecuador	0.45	0.02*	0.50	0.01*	0.57	0.03*	0.56	0.03*
Egypt	0.31	0.00*	0.38	0.00*	0.24	0.15	0.25	0.14
El Salvador	0.91	0.04*	0.89	0.04*	0.85	0.14	0.84	0.13
Ethiopia	0.53	0.52	0.47	0.53	0.44	0.00*	0.44	0.00*
Georgia	0.93	0.27	0.79	0.25	0.60	0.21	0.60	0.21
Ghana	0.07	0.05*	0.04*	0.02*	0.10	0.44	0.10	0.44
Guatemala	0.12	0.04*	0.15	0.04*	0.48	0.02*	0.48	0.02*
Honduras	0.11	0.07	0.10	0.07	0.05*	0.16	0.05	0.15
Iran	0.51	0.92	0.52	0.92	0.23	0.01*	0.23	0.01*
Jamaica	0.93	0.13	0.99	0.12	0.46	0.02*	0.46	0.02*
Jordan	0.03*	0.13	0.11	0.60	0.81	0.02*	0.57	0.01*
Kazakhstan	0.19	0.13	0.22	0.27	0.38	0.20	0.41	0.41
Kenya	0.44	0.05*	0.66	0.20	0.88	0.12	0.87	0.14
Kyrgyz Rep.	0.34	0.32	0.41	0.49	0.07	0.14	0.06	0.12
Lesotho	0.79	0.84	0.24	0.38	0.23	0.09	0.24	0.08
Macedonia	0.31	0.36	0.31	0.36	0.05*	0.47	0.05*	0.48

Madagascar	0.05*	0.87	0.05*	0.78	0.00*	0.02*	0.00*	0.02*
Malawi	0.37	0.00*	0.16	0.00*	0.05*	0.00*	0.05*	0.00*
Mali	0.73	0.81	0.94	0.83	0.36	0.59	0.37	0.64
Mauritania	0.36	0.00*	0.37	0.00*	0.84	0.37	0.84	0.37
Mauritius	0.02*	0.24	0.04*	0.28	0.27	0.01*	0.25	0.03*
Moldova	0.51	0.05*	0.51	0.06	0.25	0.01*	0.25	0.02*
Mongolia	0.04*	0.03*	0.03*	0.04*	0.33	0.02*	0.32	0.02*
Morocco	0.11	0.09	0.10	0.25	0.23	0.02*	0.26	0.09
Mozambique	0.18	0.12	0.18	0.12	0.34	0.08	0.32	0.12
Namibia	0.05*	0.08	0.07	0.04*	0.11	0.15	0.11	0.18
Nicaragua	0.79	0.11	0.77	0.11	0.89	0.15	0.89	0.15
Nigeria	0.35	0.00*	0.11	0.16	0.01*	0.01*	0.01*	0.01*
Panama	0.17	0.07	0.16	0.06	0.13	0.00*	0.13	0.00*
Paraguay	0.35	0.44	0.34	0.39	0.20	0.01*	0.20	0.01*
Peru	0.00*	0.00*	0.00*	0.00*	0.06	0.03*	0.06	0.03*
Philippines	0.58	0.00*	0.32	0.00*	0.32	0.00*	0.30	0.00*
Romania	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*
Russian Fed.	0.81	0.64	0.81	0.42	0.26	0.31	0.22	0.18
South Africa	0.99	0.01*	0.80	0.02*	0.00*	0.00*	0.00*	0.00*
Suriname	0.35	0.00*	0.35	0.00*	0.96	0.94	0.96	0.86
Swaziland	0.11	0.31	0.09	0.30	0.49	0.21	0.61	0.17
OVERALL	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*

Table 1 and table 2 reports the Granger causality tests for the null hypothesis that gender gap index does not Granger-cause output for the sample of all developing countries and all OECD countries, respectively. Note that the results from Latin American nations and African sample are not reported separately as it is already included in the sample of all developing countries. In both samples comprising developing countries and OECD countries, we reject the null hypothesis for different kinds of output. That is, gender gap variable Granger-cause real output, per capita real GDP, real GDP growth and per capita real GDP growth as reported by p-value of 0.00 for developing countries and p-value of 0.00 reported for OECD countries in the last row of table 1 and 2 as 'overall'. The results robust to both models with lag 1 and lags 2.

The tables also report a detailed country-wise analysis of the Granger causality test. China, Thailand, Indonesia, Benin, Bolivia, Cambodia, Peru, Philippines and Romania are among the developing countries which show strong and robust evidence for the existence of Granger causality from gender gap to output. More countries show similar results of causality at lags 2. There exists a significant long-run causal relationship between gender gap index and both real output and per capita real output and also their growth counterparts.

Table 2: Granger Causality Test: Gender Gap (GGGI) causing Output:

OECD Countries

	Real GDP		Real GDP per Capita		Real GDP Growth		Real GDP per Capita Growth	
	Lag 1	Lag 2	Lag 1	Lag 2	Lag 1	Lag 2	Lag 1	Lag 2
Australia	0.99	0.01*	0.90	0.02*	0.64	0.05*	0.77	0.02*
Austria	0.49	0.92	0.52	0.75	0.11	0.43	0.10	0.41
Belgium	0.04*	0.07	0.09	0.29	0.40	0.96	0.47	0.98
Canada	0.02*	0.01*	0.02	0.01*	0.00*	0.00*	0.00*	0.00*
Chili	0.14	0.04*	0.15	0.03*	0.81	0.05*	0.81	0.05
Czech Rep.	0.61	0.20	0.54	0.08	0.72	0.00*	0.75	0.00*
Denmark	0.25	0.45	0.28	0.49	0.49	0.57	0.51	0.60
Estonia	0.00*	0.00*	0.00*	0.00*	0.01*	0.00*	0.01*	0.00*
Finland	0.03*	0.61	0.03*	0.57	0.01*	0.15	0.01*	0.15
France	0.04*	0.01*	0.03*	0.01*	0.09	0.21	0.10	0.23
Germany	0.00*	0.01*	0.01*	0.03*	0.11	0.00*	0.14	0.09
Greece	0.05*	0.08	0.05*	0.08	0.03*	0.15	0.03*	0.17
Iceland	0.07	0.01*	0.12	0.01*	0.70	0.84	0.67	0.75
Ireland	0.26	0.00*	0.27	0.00*	0.24	0.06	0.27	0.14
Israel	0.26	0.01*	0.17	0.01*	0.13	0.00*	0.10	0.00*
Italy	0.06	0.07	0.08	0.04*	0.21	0.04*	0.31	0.04*
Japan	0.28	0.45	0.29	0.48	0.18	0.07	0.18	0.06
Korea	0.02*	0.04	0.02*	0.06	0.69	0.00*	0.83	0.00*
Latvia	0.20	0.19	0.19	0.16	0.07	0.00*	0.08	0.00*
Luxemburg	0.76	0.08	0.64	0.06	0.58	0.58	0.60	0.53
Mexico	0.51	0.32	0.50	0.31	0.56	0.85	0.55	0.85
Netherland	0.83	0.04*	0.79	0.08	0.97	0.13	0.96	0.16
NewZealand	0.00*	0.16	0.00*	0.00*	0.02*	0.48	0.04*	0.57
Norway	0.04*	0.12	0.03*	0.11	0.26	0.22	0.25	0.22
Poland	0.94	0.03*	0.98	0.01*	0.80	0.50	0.79	0.46
Portugal	0.89	0.27	0.94	0.42	0.11	0.48	0.10	0.42
Slovak Rep.	0.76	0.23	0.77	0.23	0.41	0.17	0.42	0.18
Turkey	0.80	0.00*	0.68	0.00*	0.50	0.00*	0.51	0.00*
UK	0.46	0.00*	0.46	0.00*	0.41	0.00*	0.41	0.00*
US	0.28	0.01*	0.29	0.01*	0.51	0.01*	0.52	0.01*
OVERALL	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*

For the OECD countries, Canada, Estonia and New Zealand show that gender gap still Granger causes output. More countries show similar results of causality at lag 2. In fact, Australia, Chili, Finland, Israel, Italy, Korea, Turkey, UK and the US have significant Granger causality running from gender gap to output of all types at lags 2 and for Greece at lag 1. For France and Germany, gender gap caused output in levels but not in growth rates. On the contrary, for Austria, Belgium, Denmark, Japan, Luxemburg, Mexico, Netherland, Portugal and Slovak Republic, we however, accept the null of no Granger causality from gender gap to output.

The reverse Granger causality is reported in table 3 and 4 in the Appendix for the sample of developing countries and OECD countries, respectively. The null hypothesis now is output does not Granger-cause gender gap. In both samples comprising developing countries and OECD countries, we reject the null hypothesis for different kinds of output. Output variable Granger-cause gender gap reported by p-value of 0.00 for developing countries and p-value of 0.00 reported for OECD countries in the last rows of respective tables as 'overall'.

3.3 *Panel VAR - Shrinkage Impulse Response Analysis with Global Gender Gap Index*

This section presents the impulse response functions from the PVAR estimations for the model consisting of real GDP per capita, gender gap *(GGGI)*, physical capital and human capital. A PVAR model extends a typical country vector auto-regression model to many countries. The different macroeconomic variables are assumed to have interactions, interdependencies and linkages across different countries. The PVAR are estimated using shrinkage estimator capturing different dynamics for different countries. Homogeneities can exist between certain groups of countries within the sample. Countries with similar economic structures are expected to have similar dynamics though not identical dynamics. Also there could exist lack of dynamic interdependencies between certain macroeconomic variables across countries. The best way to capture this is by assigning Bayesian priors in an agnostic way as any prior knowledge on which countries are homogenous and which countries lack dynamic interdependencies is impossible to obtain in such a complex and interconnected world. Shrinkage estimators based on the use of Minnesota prior are shown to handle these homogeneities and lack of interdependencies well. Use of such shrinkage estimators is necessary as estimating an unrestricted large[4] PVAR will lead to poor estimates due to lack of degrees of freedom. Additionally, as the coefficients in a VAR are sensitive to scale of the variables, the Minnesota Prior is used in such a way to adjust for the scale. The standard errors from regression estimations of equation i are used to rescale the

[4] For example, for a sample comprising of 50 countries. Our 4-variable PVAR model requires to estimate =4*50=200 variables in total.

standard deviation of the prior for a coefficient on a lag of variable j (Thomas Doan 2012). Lastly, Gibbs sampling is done in the random coefficient model.

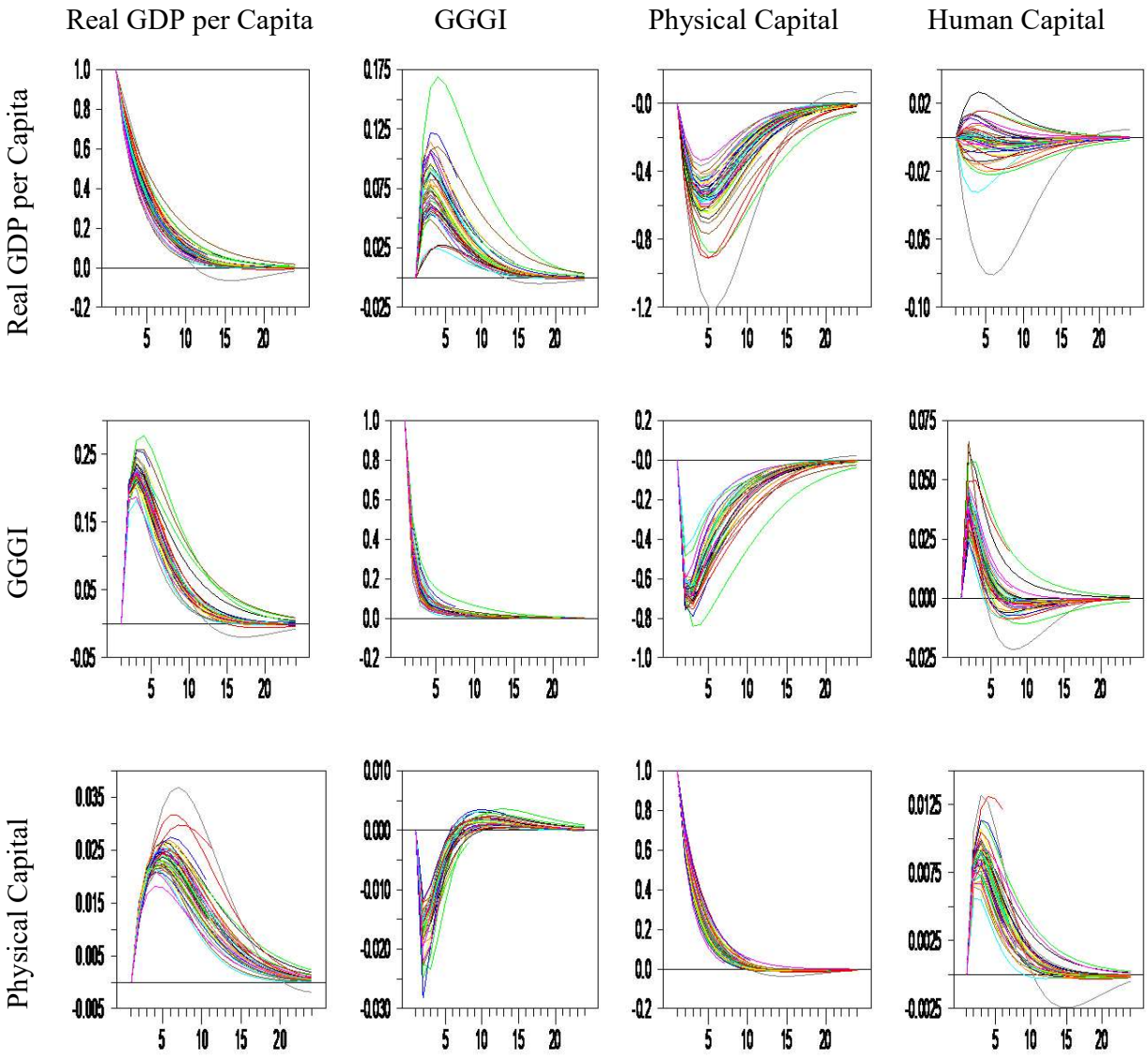
Figures 2, 3, 4 and 5 presents the impulse responses of the model for the four samples: Developing countries, OECD countries, Latin American countries and African countries, respectively. The different colors capture the shock and response variables in each country in the given sample. The row variables are the variables shocked and the responses are captured by column variables. We use a smaller developing sample of 46 countries (see table 2 of Appendix) than the original developing sample for this section mainly due to the unavailability of data in human capital for many of the developing countries.

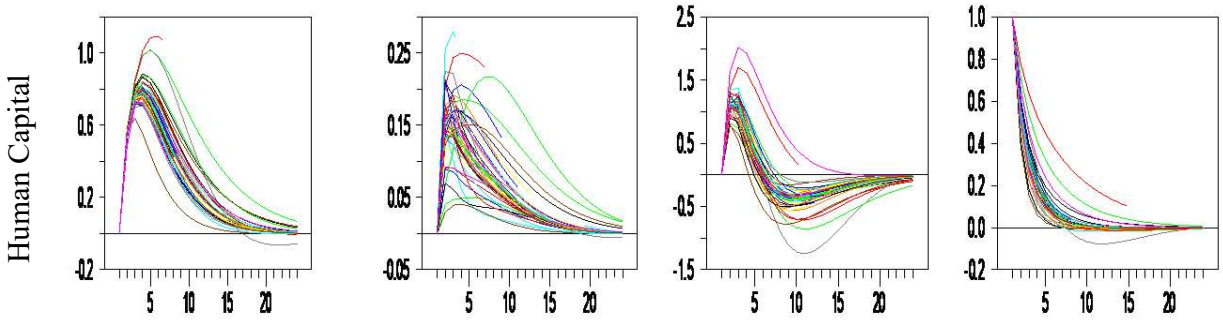
A positive unit shock to real per capita output, causes the GGGI to increase by approximately in the range 0.05% to 0.11% for majority of developing nations in figure 2. The effect persists till 15 periods before it diminishes to 0. Note that a positive shock to GGGI implies an increase in equity. The index lies between 0 and 1 and the index value moves closer to 1 as country's gender equity increases. For a developing nation having a good time, in general, is shown to close the gender gap considerably. It is realized through creation of more job opportunities, more schools, colleges and hospitals etc. and additionally bigger household budget set, all leading to better health and education outcomes in women.

A positive unit shock to GGGI, in figure 2, on the other hand, causes the real per capita output to increase by approximately 0.18% to 0.25% for many developing nations. Policy measures encouraging greater labor force participation of women, removal of so called barriers against women which limit them to only specific jobs (like agricultural jobs etc.), better allocation of resources to women, will increase the per capita output. Also, a greater autonomy to women drives economic prosperity by helping her make better choices for her children leading to better health and human capital outcomes for the future generations. This is captured in our impulse response functions. A positive unit shock to GGGI, causes the human capital to increase within the range 0.02% to 0.06% for all the developing nations. From growth theory we can say that the favorable effect on human capital in turn, will positively affect the long run economic

growth. This is also shown by our results in the last row of figure 2 which captures the macroeconomic effects of a percentage point shock to human capital.

Figure 2: Impulse Responses for Developing Countries



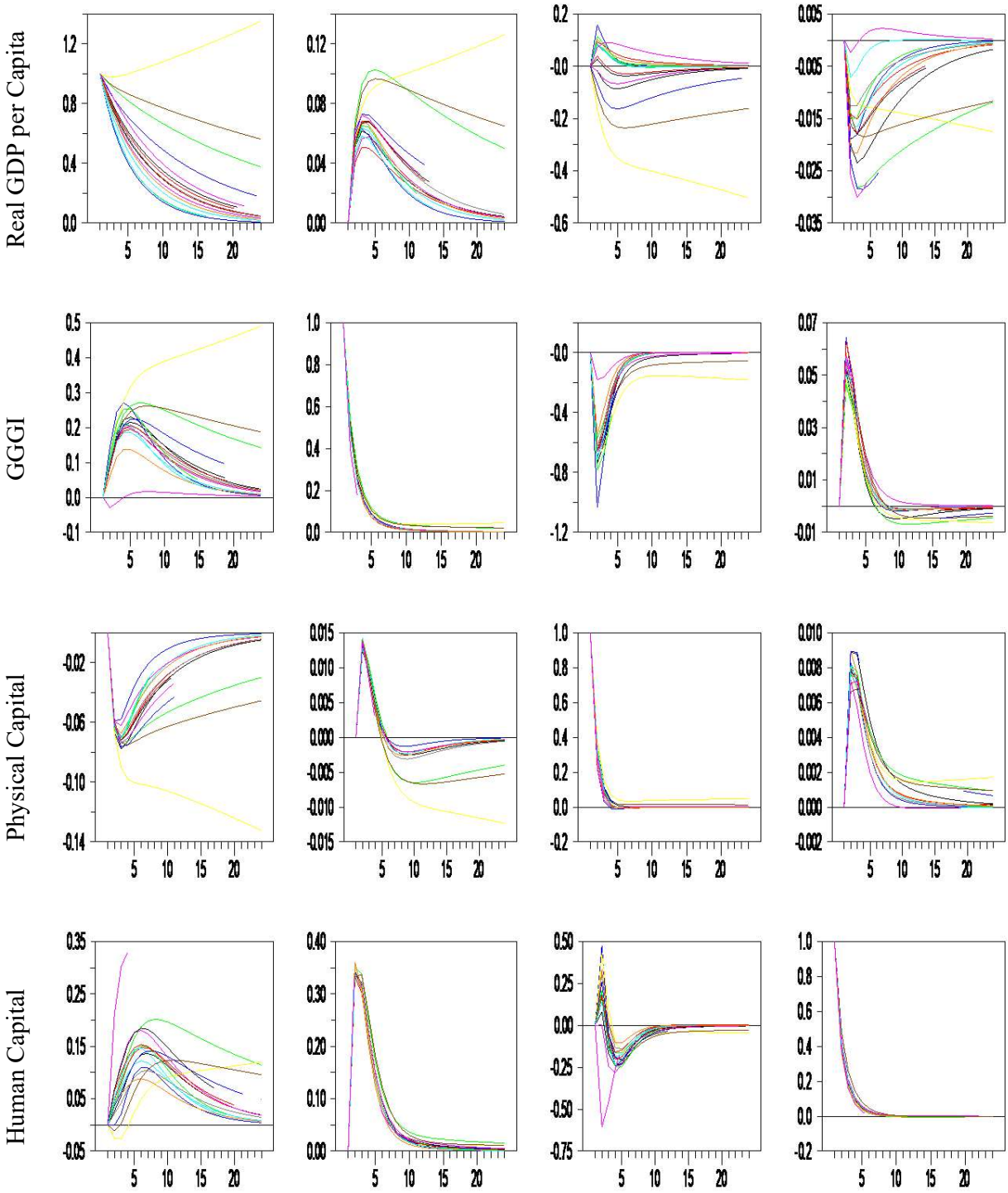


In figure 2, per capita real output responds in an expected way to a positive unit shock to physical capital and to a positive unit shock to human capital. So an increase in both human capital and physical capital, is increasing the per capita output in the sample as predicted by the traditional growth models. This also validates our identification assumptions. Also positive unit shock to human capital increases GGGI. This is expected from theory and further validates our empirical model. The range of effect varies from 0.04% increase in the index for some nations to even 0.25% increase for some. More importantly, the effect persists in the long run (beyond 15 years).

For Latin American countries, we see similar effect as developing countries (see figure 3). To a positive unit shock to real per capita output, the GGGI rise by more than 0.06% for most Latin American countries. A positive unit shock to GGGI, causes the real per capita output to increase in the range of 0.2% to 0.3% for most nations in the sample, an impact greater than developing nations. More interestingly, both of these shocks have considerable long run effects. A positive unit shock to GGGI, also causes the human capital to increase temporarily. A positive unit shock to human capital, can increase GGGI up to 0.38%.

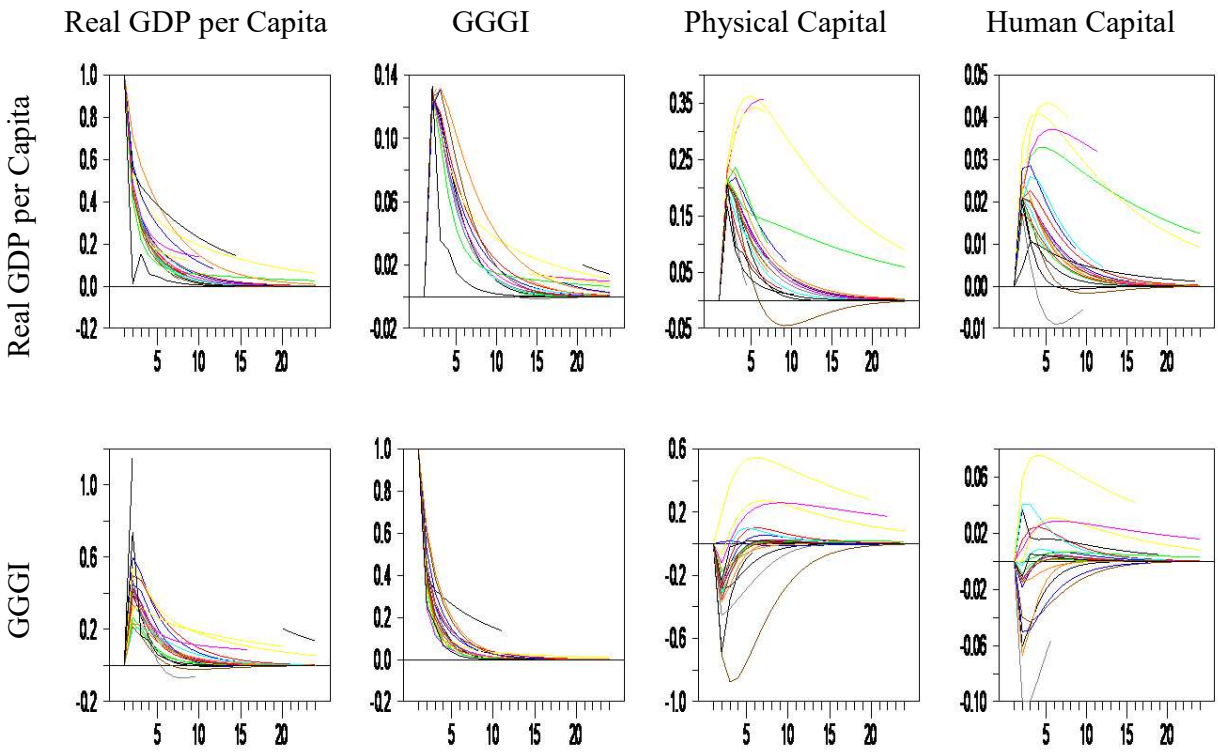
Figure 3: Impulse Responses for Latin American Countries

Real GDP per Capita GGGI Physical Capital Human Capital


Real GDP per Capita
GGGI
Physical Capital
Human Capital

We see similar effect for the African countries (see figure 4). To a positive unit shock to real per capita output, causes the GGGI to rise. Also a positive unit shock to GGGI, causes the real per capita output to increase. For some African nations, the increase in output is significantly more due to shocks to GGGI compared to increase in the group of Latin American countries or the sample of all developing nations. However, the effects are not permanent. A positive unit shock to GGGI, causes human capital to increase for many African countries except some outliers. A positive unit shock to human capital, on the other hand, can increase GGGI in the range 0.25% to 0.45% and the effect persists in the long run (beyond 15 years).

Figure 4: Impulse Responses for African Countries



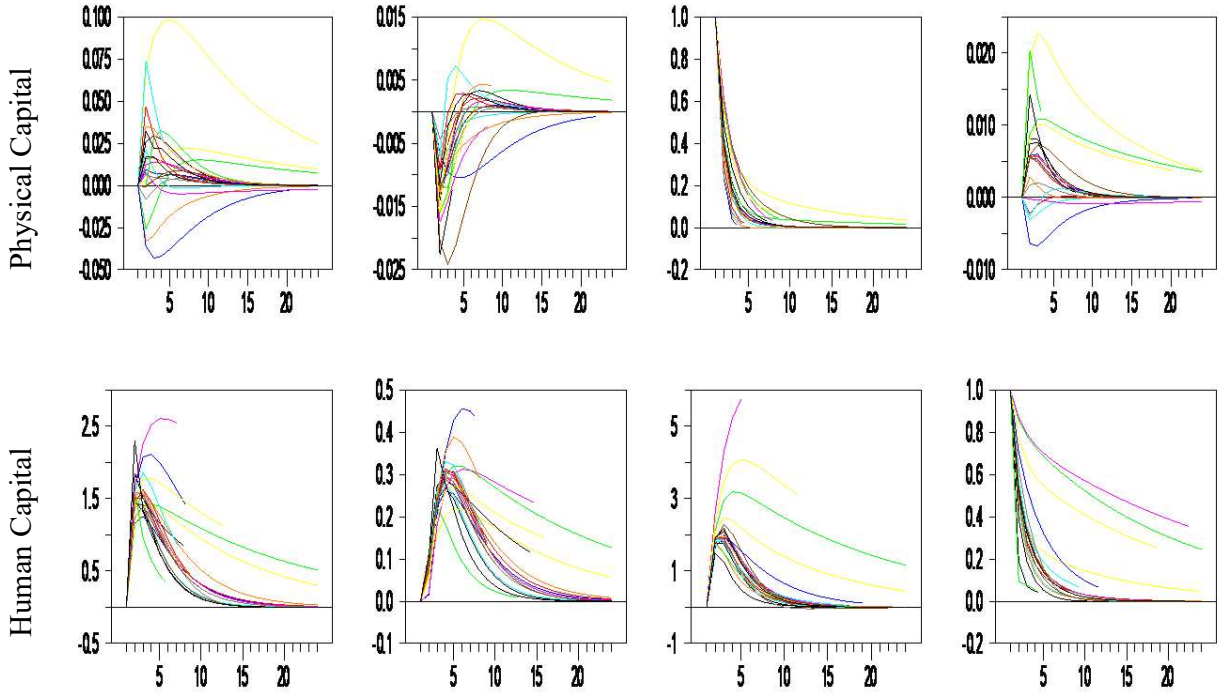


Figure 5 presents the impulse responses for the OECD countries. A positive unit shock to real per capita output, show an initial temporary decline of GGGI for few countries in the OECD sample. But the index shows an unambiguous rise for almost all countries after few periods due to the output shock. The amount of such increment is lower compared to developing nations in general. A positive unit shock to GGGI, in figure 5, on the other hand, causes the real per capita output to fall by the amount -0.15% to -0.25% for the OECD nations. This result is in sharp contrast to results obtained from previous samples. An increase in income level, in general, helps achieve greater equity between genders, but a rise in GGGI may not affect incomes positively for OECD nations as it did for the low and middle income countries. This is because they already have achieved high gender equity in terms of economic participation and opportunity, education, health and survival etc. As predicted by theory, a positive unit shock to human capital pushes the equity index further with GGGI responses increases initially for the majority of the nations, but the positive effect starts waning and even becoming negative for some nations after couple of periods before reaching zero. Such response could be attributed to the fact that human capital for these economies are already at the optimal level. Similarly, a positive unit shock to GGGI, causes the human capital to increase for few years ahead, consistent with theory.

Figure 5: Impulse Responses for OECD Countries

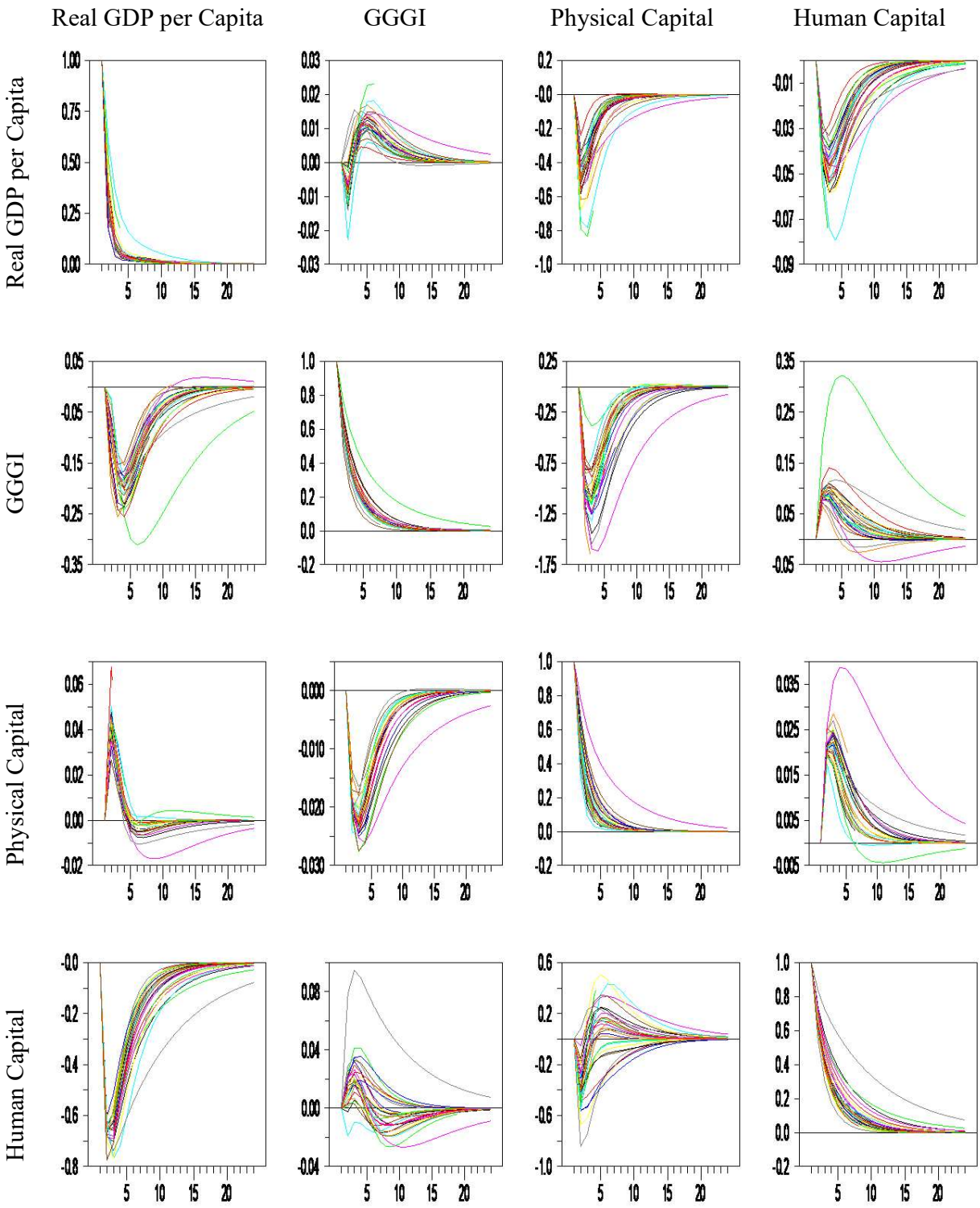
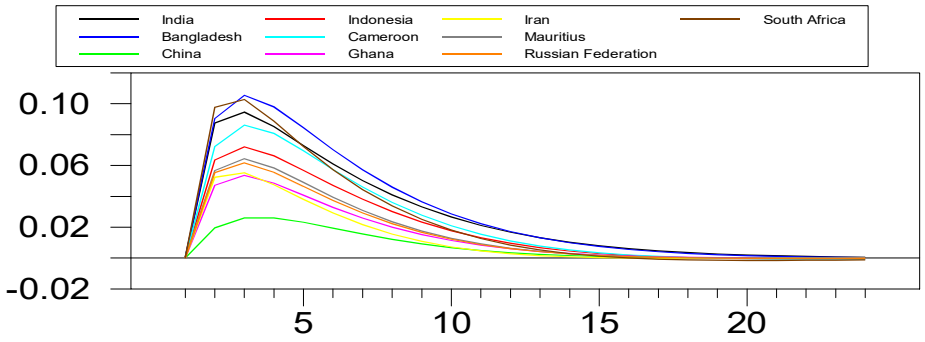


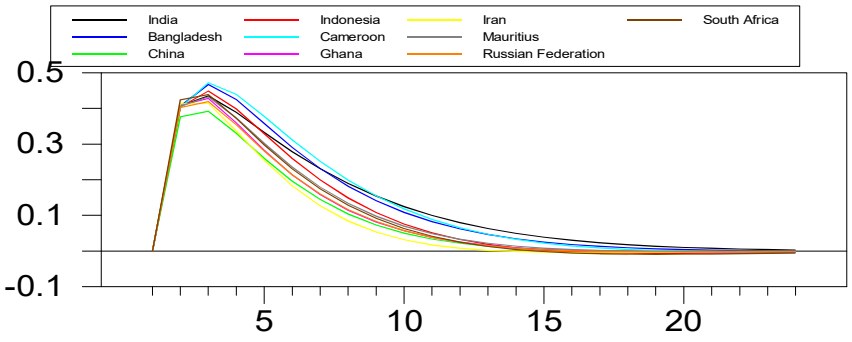
Figure 6 and figure 7 presents some of the responses of our interest for few selected countries from the group of Developing countries and OECD countries, respectively. We present the results for India, Bangladesh, China, Indonesia, Cameroon, Ghana, Iran, Mauritius, Russian Federation and South Africa among the Developing nations in figure 6. Due to a shock to real GDP per capita (see figure 6A), Bangladesh seems to benefit most in terms of achieving equality, followed by India and South Africa and Cameroon. China is shown to have marginal gains in GGGI due to such positive output shocks. A shock to GGGI (see figure 6B), increases real output per capita in the approximate range 0.4% to 0.5%, with China having the lowest response and Cameroon having the highest response among the countries considered for the analysis. A response to the same shock (see figure 6C), increases human capital most for India followed by Cameroon and Indonesia. Lastly, Cameroon tend to benefit the most in achieving equity by increasing the GGGI (see figure 6D), ensued by India, Bangladesh and South Africa due to a positive shock in human capital.

Figure 6: Impulse Responses for Some Selected Developing Countries

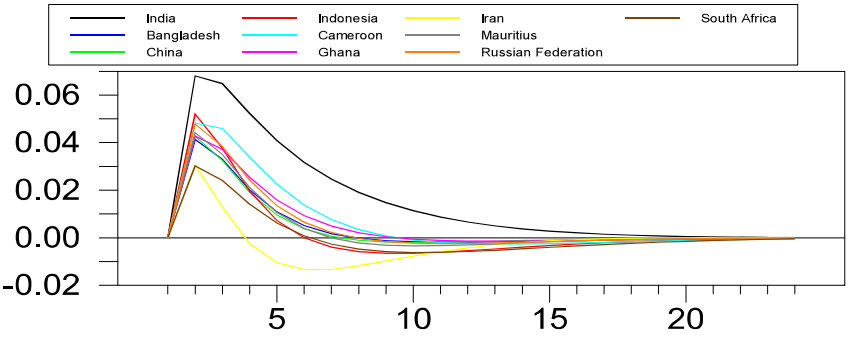
A. Response of GGGI to shocks in Real GDP per Capita



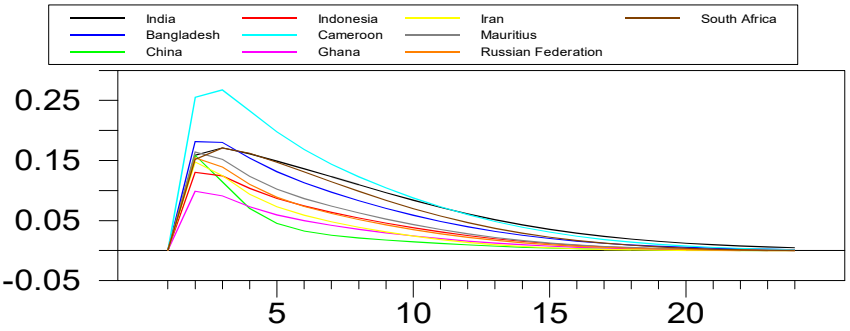
B. Response of Real GDP per Capita to shocks in GGGI



C. Response of Human Capital to shocks in GGGI



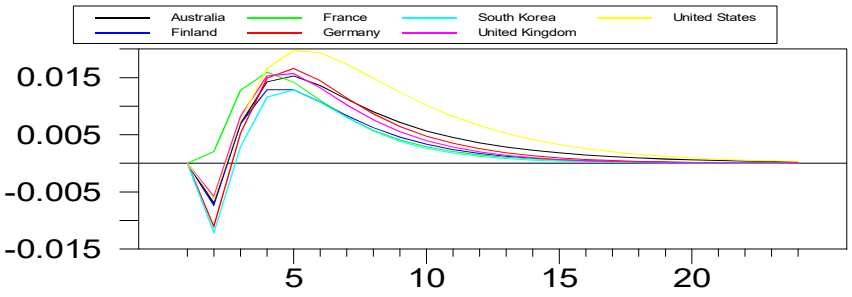
D. Response of GGGI to shocks in Human Capital



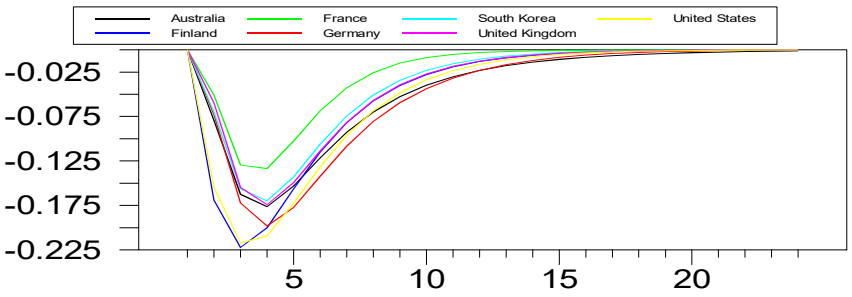
We present the results for Australia, Finland, France, Germany, South Korea, United Kingdom and the United States among the OECD nations in figure 7. Due to a shock to real GDP per capita (see figure 7A), United States benefits the most in terms of achieving equality. A shock to GGGI (see figure 7B), reduces real output per capita for Finland the most, followed by United States and Germany. A response to the same shock (see figure 7C), increases human capital in the same three countries Finland, United States and Germany at the highest level for the sample under consideration. Finally, Australia, Finland and South Korea tend to benefit the most in achieving equity by an increase in the GGGI (see figure 7D).

Figure 7: Impulse Responses for Some Selected OECD Countries

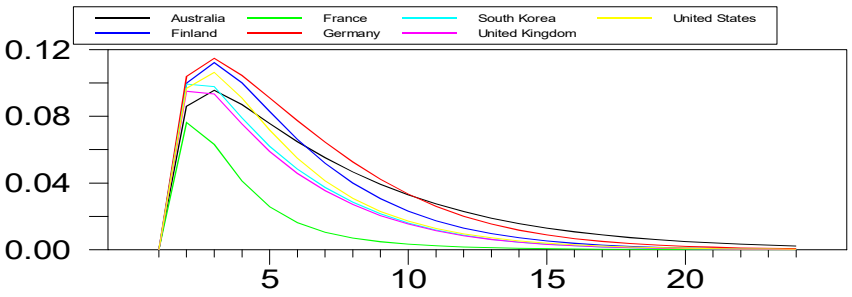
A. Response of GGGI to shocks in Real GDP per Capita



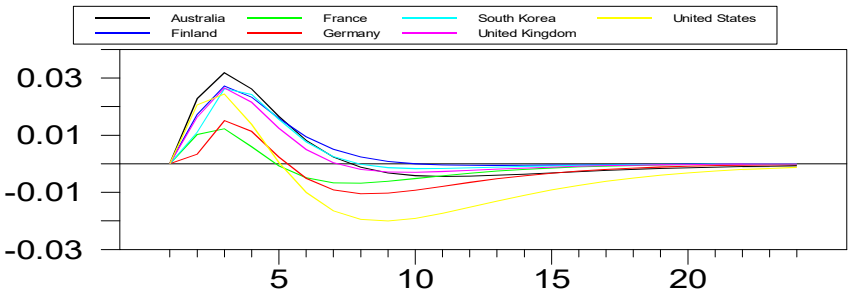
B. Response of Real GDP per Capita to shocks in GGGI



C. Response of Human Capital to shocks in GGGI



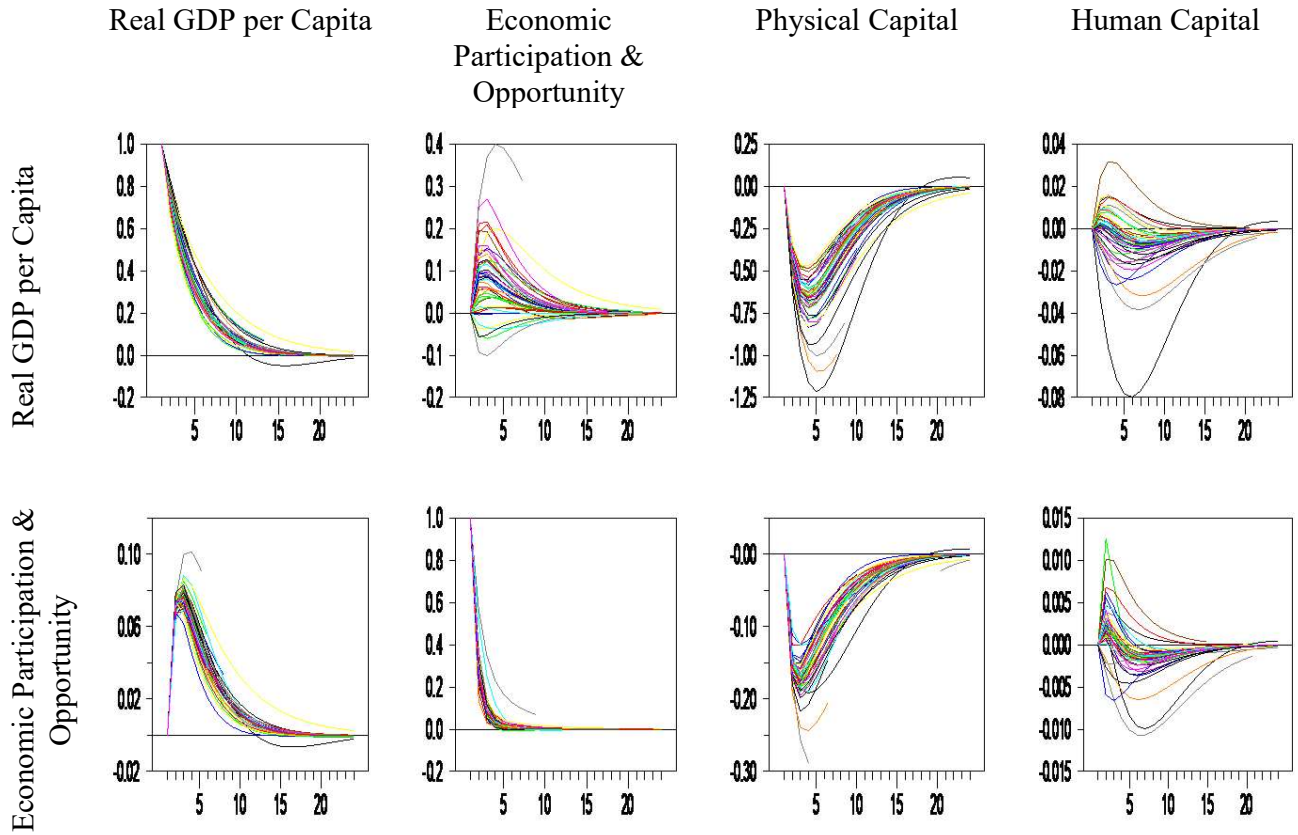
D. Response of GGGI to shocks in Human Capital

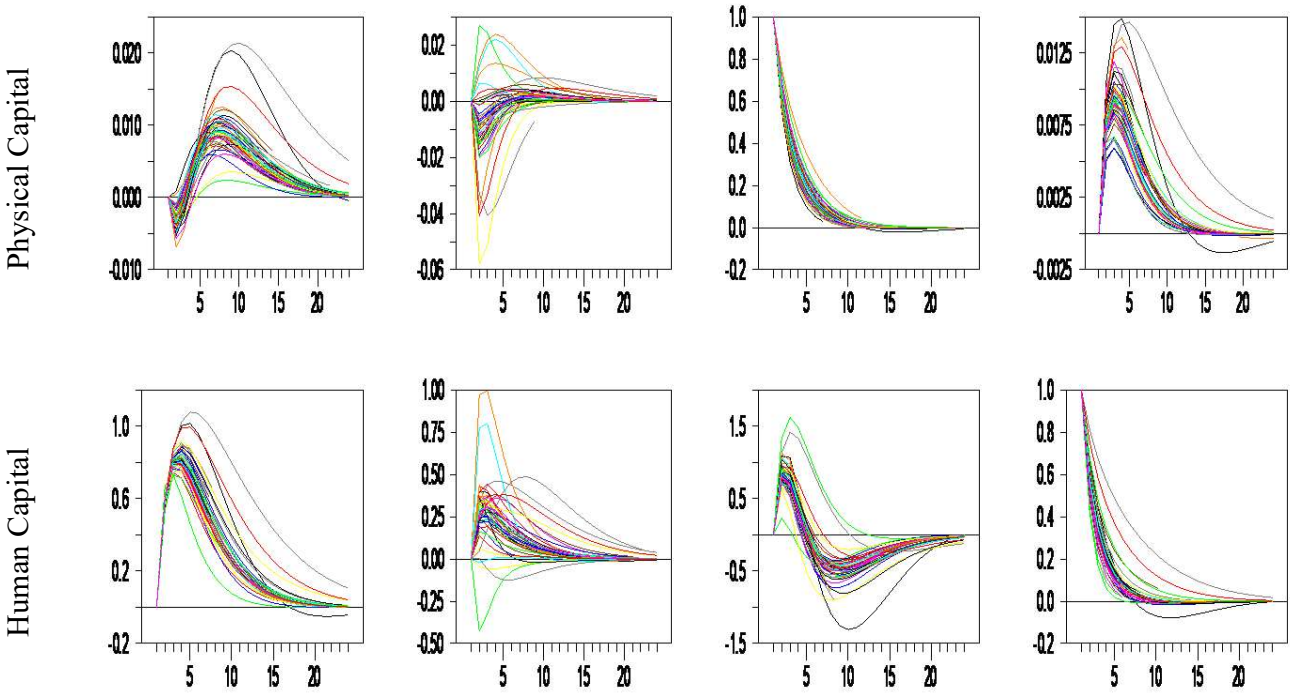


3.4 *Panel VAR - Shrinkage Impulse Response Analysis with Gender Gap Sub-indices*

The section presents the impulse responses of the model for the Developing countries (smaller sample) using the four GGGI sub-indices. The row variables are the variables shocked and the responses are captured by column variables. Figure 8 presents the impulse response functions when the measure of gender gap used is the sub-index economic participation and opportunity. The sub-index captures male and female inequality in outcomes on salaries, participation levels and access to high-skilled employment.

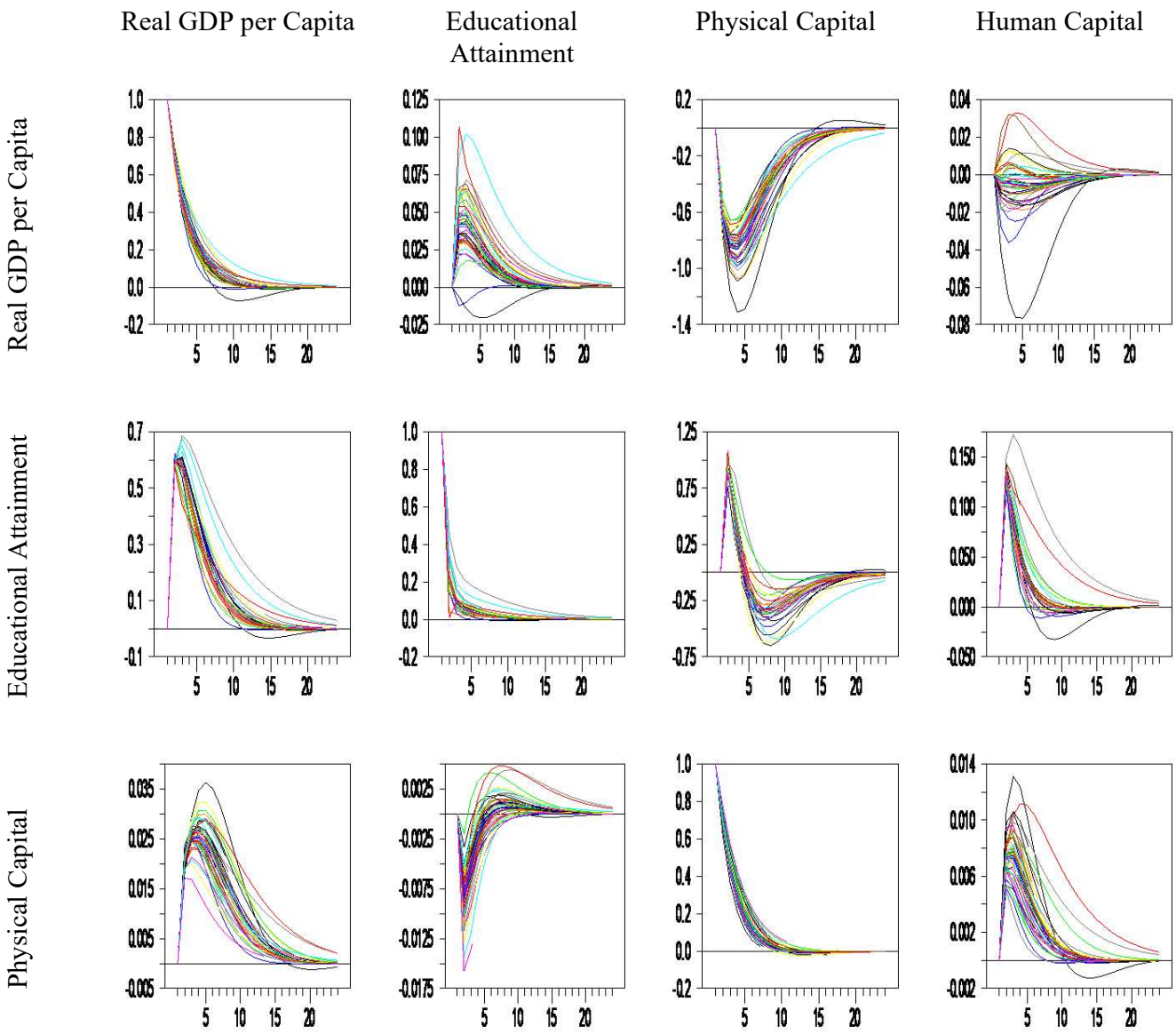
Figure 8:
Impulse Responses with Gender Gap measured by Economic Participation & Opportunity: Developing Countries





A unit shock to real GDP per capita, in figure 8, increase the value of the sub-index (increases male and female equality in wages, participation and access to high skilled employment) for 10 periods ahead barring few exceptions. On the other hand, policy measure promoting equity as captured by an unit shock to the sub-index generates up to 0.06% to 0.10% increase in real per capita output for all nations in the 4th period. However, the effect of the same shock on human capital remains ambiguous. On the other hand, a percentage point increase in human capital, will increase the economic participation and opportunity index for almost all nations and also lead to long term economic growth. Note that the literature has established a negative association between female labor force participation gap and growth while for many export oriented countries a positive association between gender wage gap and growth. Our results using the sub-index economic participation and opportunity does not capture these facts as the sub-index itself is a combination of both labor force participation gap and wage gap and the negative effect may overshadow the positive effect. Moreover, our developing country sample is not representative of export oriented economies as has been used for analyzing the effects gender wage gaps.

Figure 9:
Impulse Responses with Gender Gap measured by Educational Attainment: Developing Countries



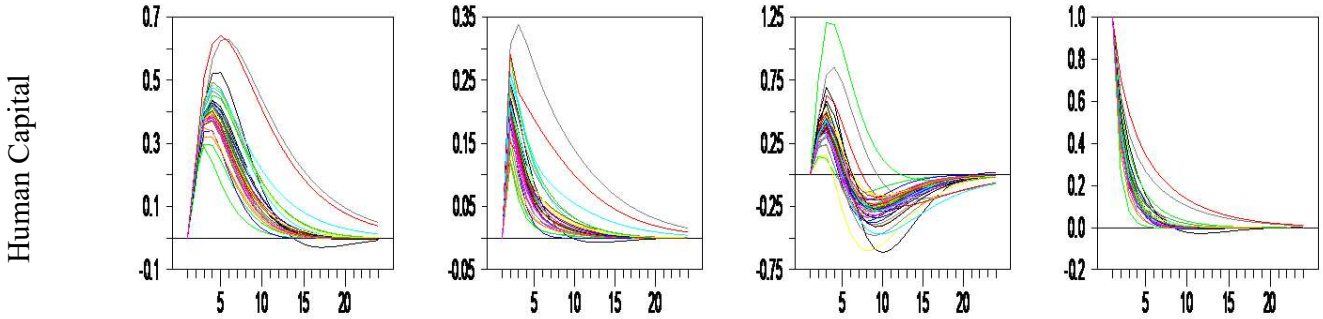
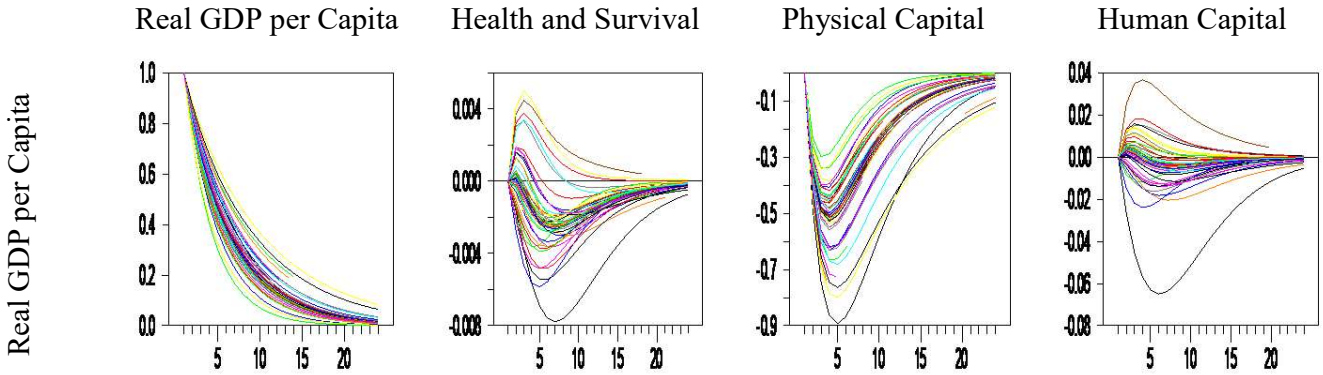


Figure 9 presents the results when gender gap is represented by educational attainment index. Educational attainment sub-index represents inequality in outcomes on access to basic and higher level education. A unit shock to real GDP per capita will encourage more education among women (represented by an increase in the value of the educational attainment sub-index). On the other hand, greater access to female education will lead to a steep rise 0.6% and more in real per capita output, third period ahead, and unambiguously increase the human capital of the economy by more than 0.11%. A percentage point increase in human capital, leads to an unambiguous rise in both the educational attainment index and real GDP per capita.

Figure 10:
Impulse Responses with Gender Gap measured by Health and Survival: Developing Countries



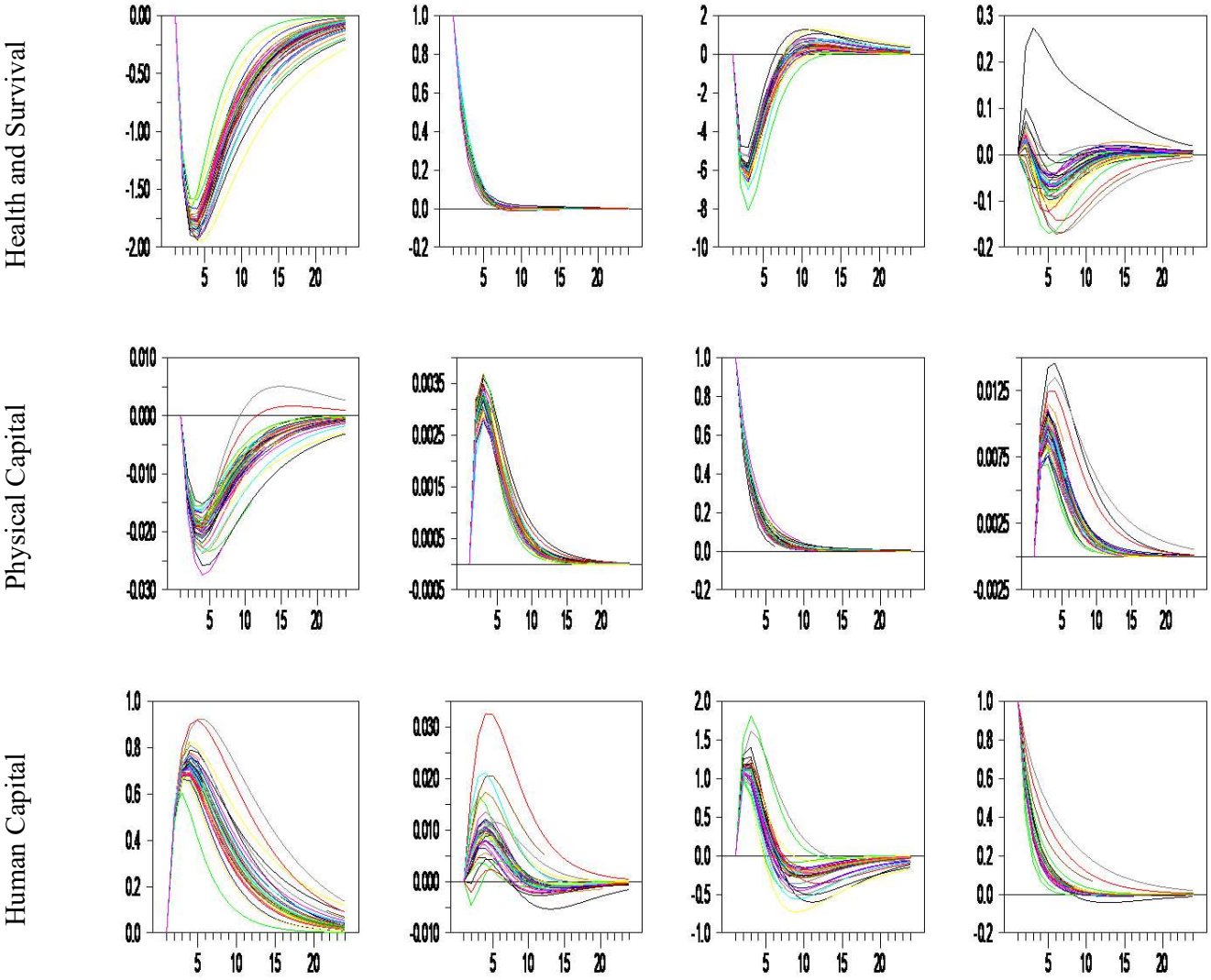
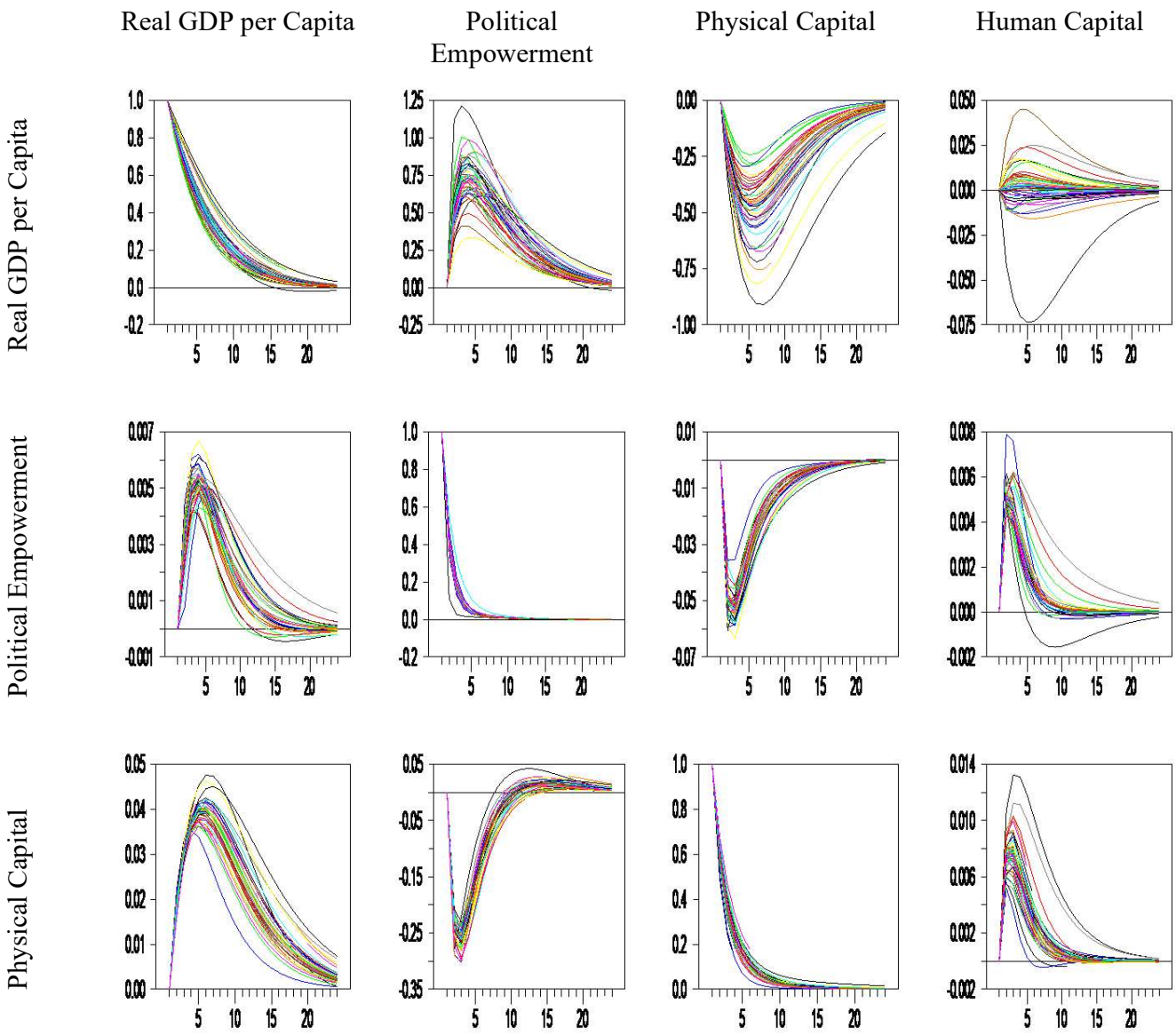


Figure 10 presents the results when gender gap is measured by health and survival sub-index which captures the differences in outcomes in male and female life expectancy and sex ratio. An increase in real GDP per capita has less definitive responses of health and survival sub-index with some nations showing positive and some showing negative responses. Also, a unit increase in the sub-indices indicating better health and life expectancy among women will reduce the per capita output of all developing nations and can also reduce human capital of many developing nations. Noticeably, a percentage point increase in human capital, leads to improved health and survival conditions among women.

Figure 11:
Impulse Responses with Gender Gap measured by Political Empowerment: Developing Countries



Human Capital

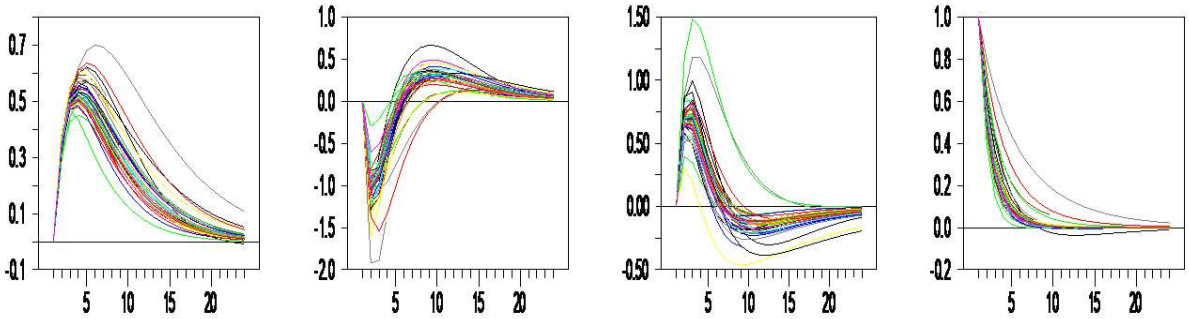


Figure 11 captures the effects when we consider the 4th sub-index 'political empowerment'. Political empowerment captures the differences in outcomes in male and female representation in decision-making process. An increase in real GDP per capita will lead to substantial increase in women representation in politics. At the same time, a unit increase in the sub-index in politics will raise the per capita output of all developing nations and can also increase human capital of many developing nations. A rise in political empowerment will also increase human capital. However, rise in human capital do not necessarily imply more female representation in the decision-making process in the short run but we do observe a favorable impact in the long run.

4. CONCLUSION

In this paper, we answer how gender gap is related to output with a focus on countries at various stages of development, namely, developing countries, OECD countries, as well as Latin American and African countries. Panel Granger causality test shows that significant causality exists from gender gap to economic growth as well as output, and vice versa. Our Panel VAR results confirm that reducing gender gap leads to long-run economic growth. The same is true for developing countries as well as African and Latin American countries but not for OECD countries. Our results support the work of Alesina and Rodrik (1994), Persson and Tabellini (1994), Larrain and Vergarra (1998), Blackden and Bhanu (1999), Siegel (2005), as well as Stotsky (2006). Our second main result is that achieving high growth can help close the gender gap. The literature still has not converged on this given that gender inequalities are outcomes of historically existing societal norms and ideologies, which may not change with high income

(Kabeer, 1996). Our results hold robust to all the samples analyzed and confirm the significant role that output plays in reducing the gender gap of a society.

We further analyze the relation between per capita output and different sub-indices of gender gap for the sample of developing countries, which will help in formulating highly effective policies by targeting specific dimensions of gender gap. The results confirm that closing gender gap in education has the most significant effect on increasing per capita real GDP followed by gender equality in economic participation and opportunity as well as political empowerment. The affirmative role of good female education is also supported by Hill and King (1995), Klasen (1999; 2002), as well as Klasen and Lamanna (2009). Knowles, Lorgelly, and Owen (2002) confirmed that a 1% increase in female education would increase GDP per worker by 0.37%, whereas, in our model, it will cause a significant increase of 0.6% in real per capita output. Moreover, Klasen (1999; 2002), as well as Klasen and Lamanna (2009) also confirmed a positive role of reduction in gender gap in labor force participation on growth. Their results are similar to ours captured by economic participation and opportunity index. However, Baliamoune-Lutz and McGillivray (2007) found the opposite results for gender gap in labor force participation in SSA and Arab countries. The economic participation and opportunity index also capture inequality in wages. Numerous studies, such as Seguino (1997; 2000a,b), Blecker and Seguino (2002), as well as Mitra-Kahn and Mitra-Kahn (2008), have established that gender wage gap increases economic growth particularly for export-oriented economies. However, our study for the sample of developing countries does not support the views presented in these studies that were based on very selective samples.

An increase in per capita output contributes the most to the political empowerment of women followed by high gender equality in women's economic participation and opportunity as well as education. Our results are in line with Kapsos (2005) who corroborated that growth increases female labor force participation as well as Dollar and Gatti (1999) who asserted that growth reduces gender gap in secondary educational enrollment. By contrast, Baliamoune-Lutz (2006) confirmed that economic growth has a mainly negative impact on female literacy rates in SSA and insignificant effect in other countries. Seguino (2003), Gaddis and Klasen (2011), as well as Braunstein and Seguino (2012) confirmed a weak or negative association between female

labor force participation and GDP growth. Seguino (2000c) and Oostendorf (2009) proved that gender wage gap increases with high growth for poor countries.

When gender equality is measured using the health and survival index, a reduction in the gap reduces per capita output on the one hand. An increase in per capita output, on the other hand, can cause a decline in the health and survival prospects of women. This scenario is consistent with that of Seguino (2006a) who verified that growth has a significantly negative effect on female to male population ratio and a positive effect on the ratio of female to male mortality rates. Accordingly, increasing human capital by increasing investment in female education promises greater effectiveness than policy measures. The health and survival status of women is, thus, uplifted, which will naturally occur with increased female education and awareness. Our results confirm that human capital can be the main and most successful way to close the gender gap while achieving long-run growth for developing countries in line with Seguino (2016b).

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Appendix

A-Table 1: Structure of Global Ge4nder Gap Index

Subindex	Variable	Source
Economic Participation and Opportunity	Ratio: female labour force participation over male value	International Labour Organisation (ILO) *Key Indicators of the Labour Market (KILM)* database, 6th edition; ILO estimates, 2013
	Wage equality between women and men for similar work (converted to female-over-male ratio)	World Economic Forum *Executive Opinion Survey (EOS) 2015*
	Ratio: female estimated earned income over male value	World Economic Forum calculations based on United Nations Development Programme methodology (refer to *Human Development Report 2007/2008*)
	Ratio: female legislators, senior officials and managers over male value	International Labour Organisation *ILOStat* database, 2014 or latest available data; United Nations Development Programme *Human Development Report 2009*, most recent year available between 1999 and 2007
	Ratio: female professional and technical workers over male value	International Labour Organisation *ILOStat* database, 2014 or latest available data; United Nations Development Programme *Human Development Report 2009*, most recent year available between 1999 and 2007
Educational Attainment	Ratio: female literacy rate over male value	United Nations Educational, Scientific and Cultural Organization (UNESCO) Institute for Statistics *Education indicators* datababase, 2015, or latest available data; United Nations Development Programme *Human Development Report 2009*, most recent year available between 1997 and 2007; and *Human Development Report 2008*, most recent year available between 1999 and 2006
	Ratio: female net primary enrolment rate over male value	UNESCO Institute for Statistics *Education indicators* database, 2014 or latest data available
	Ratio: female net secondary enrolment rate over male value	UNESCO Institute for Statistics *Education indicators* database, 2014 or latest data available
	Ratio: female gross tertiary enrolment ratio over male value	UNESCO Institute for Statistics *Education indicators* database, 2014 or latest data available
Health and Survival	Sex ratio at birth (converted to female-over-male ratio)	Central Intelligence Agency *The CIA World Factbook*, 2015 (data updated weekly)
	Ratio: female healthy life expectancy over male value	World Health Organization *Global Health Observatory* database, 2013
Political Empowerment	Ratio: females with seats in parliament over male value	Inter-Parliamentary Union *Women in Politics: 2015*, reflecting elections/appointments up to 1 June 2015
	Ratio: females at ministerial level over male value	Inter-Parliamentary Union *Women in Politics: 2015*, reflecting elections/appointments up to 1 June 2015
	Ratio: number of years of a female head of state (last 50 years) over male value	World Economic Forum calculations, 30 June 2015

Source: The Global gender Gap Report 2015, World Economic Forum

A-Table 2: Variable definitions and sources

Variable	Definition
GDP growth rate	Average annual growth for ten years of GDP (Constant US$ 2010). *Source:* World Bank - World Development Indicator
DGP per capita growth rate	Average annual growth for ten years of GDP per capita (Constant US$ 2010). *Source:* World Bank - World Development Indicator

Human Capital (School enrollment)	School enrollment, primary and secondary (gross), gender parity index (GPI), Gender parity index for gross enrollment ratio in primary and secondary education is the ratio of girls to boys enrolled at primary and secondary levels in public and private schools. *Source:* World Bank - World development Indicator
Physical Capital (Gross capital formation)	Gross capital formation (% of GDP), *Source:* World Bank - World development Indicator
GGGI	Global Gender Gap Index from the World Economic forum, The global Gender gap report (2015)
OECD sample	Australia, Austria, Belgium, Canada, Chili, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Luxemburg, Mexico, Netherland, New Zeeland, Norway, Poland, Portugal, Slovak Republic, Turkey, United Kingdom, United States
Developing sample	Albania, Algeria, Angola, Argentina, Armenia, Azerbaijan, Bangladesh, Belize, Benin, Bolivia, Botswana, Brazil, Bulgaria, Burkina Faso, Cambodia, Cameroon, China, Colombia, Costa Rica, Cuba, Dominican Rep., Ecuador, Egypt, El Salvador, Ethiopia, Fiji, Georgia, Ghana, Guatemala, Guyana, Honduras, India, Indonesia, Iran, Jamaica, Jordan, Kazakhstan, Kenya, Kyrgyz Republic, Lesotho, Macedonia, Madagascar, Malawi, Malaysia, Maldives, Mali, Mauritania, Mauritius, Moldova, Mongolia, Morocco, Mozambique, Namibia, Nepal, Nicaragua, Nigeria, Pakistan, Panama, Paraguay, Peru, Philippines, Romania, Russian Federation, Senegal, South Africa, Sri Lanka, Suriname, Swaziland, Syria, Tanzania, Thailand, Tajikistan, Tunisia, Uganda, Ukraine, Vietnam, Yemen, Zambia, Zimbabwe
Developing sample (Small)	India, Bangladesh, Nepal, Pakistan, China, Thailand, Indonesia, Albania, Argentina, Azerbaijan, Belize, Bolivia, Bulgaria, Burkina Faso, Cameroon, Costa Rica, Cuba, Dominican Rep., Ecuador, Egypt, El Salvador, Ghana, Guatemala, Honduras,Iran, Jordan, Kyrgys Republic, Lesotho, Madagascar, Malawi, Mali, Mauritiana, Mauritius, Moldova, Morocco, Mozambique, Panama, Paraguay, Peru, Romania, Russian Federation, South Africa, Suriname, Tjikistan, Uganda,Ukraine
African Sample	Algeria, Angola, Benin, Botswana, Burkina Faso, Cameroon, Egypt, Ethiopia, Ghana, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritiana, Mauritius, Morocco, Mozambique, Namibia, Nigeria, Senegal, South Africa, SWAZILAND, Syria, Tanzania, Tunisia, Uganda
Latin American Sample	Argentina, Belize, Bolivia, Brazil, Chili, Colombia, Costa Rica, Dominican Rep., Ecuador, El Salvador, Guatemala, Guyana, Honduras, Jamaica, Mexico, Nicaragua, Paraguay, Peru

A-Table 3: Granger Causality Test: P-Values

Developing Countries (Output Variable causing Gender Gap (GGGI))								
	Real GDP		Real GDP per Capita		Real GDP Growth		Real GDP per Capita Growth	
	Lag 1	Lag 2	Lag 1	Lag 2	Lag 1	Lag 2	Lag 1	Lag 2

Sri Lanka	0.20	0.46	0.24	0.46	0.19	0.32	0.19	0.31
India	0.36	0.13	0.29	0.24	0.03*	0.65	0.03*	0.65
Bangladesh	0.42	0.20	0.38	0.15	0.33	0.00*	0.38	0.00*
Nepal	0.36	0.98	0.22	0.67	0.72	0.06	0.68	0.08
Pakistan	0.29	0.33	0.31	0.41	0.99	0.22	1.00	0.22
Maldives	0.36	0.96	0.34	0.84	0.36	0.47	0.42	0.45
China	0.78	0.17	0.76	0.16	0.91	0.15	0.91	0.16
Thailand	0.60	0.00*	0.65	0.00*	0.69	0.82	0.71	0.82
Vietnam	0.69	0.00*	0.79	0.00*	0.51	0.00*	0.49	0.00*
Malaysia	0.46	0.00*	0.43	0.00*	0.07	0.00*	0.07	0.00*
Indonesia	0.67	0.04*	0.81	0.06	0.03*	0.00*	0.04*	0.00*
Albania	0.44	0.67	0.44	0.67	0.98	0.76	0.96	0.77
Algeria	0.30	0.07	0.59	0.27	0.66	0.53	0.72	0.50
Argentina	0.36	0.03*	0.33	0.03*	0.20	0.00*	0.20	0.00*
Armenia	0.44	0.79	0.39	0.72	0.38	0.28	0.37	0.27
Azerbaijan	0.15	0.08	0.17	0.04*	0.04*	0.00*	0.03*	0.00*
Belize	0.58	0.35	0.65	0.37	0.37	0.00*	0.37	0.00*
Bolivia	0.38	0.09	0.34	0.03*	0.50	0.00*	0.50	0.00*
Brazil	0.17	0.14	0.18	0.18	0.81	0.19	0.82	0.19
Botswana	0.02	0.08	0.02*	0.10	0.32	0.00*	0.32	0.00*
Bulgaria	0.50	0.66	0.52	0.66	0.33	0.59	0.31	0.58
Burkina Faso	0.55	0.00*	0.47	0.00*	0.34	0.00*	0.34	0.00*
Cambodia	0.28	0.26	0.21	0.38	0.81	0.71	0.82	0.72
Colombia	0.60	0.00*	0.68	0.01*	0.36	0.01*	0.36	0.01*
Costa Rica	0.71	0.99	0.67	0.99	0.87	0.79	0.87	0.78
Dom. Rep.	0.40	0.91	0.41	0.90	0.32	0.51	0.32	0.51
Ecuador	0.00*	0.00*	0.00*	0.00*	0.02*	0.00*	0.02*	0.00*
Egypt	0.68	0.36	0.63	0.37	0.25	0.21	0.25	0.22
El Salvador	0.01*	0.00	0.01*	0.00*	0.02*	0.00*	0.02*	0.00*
Ethiopia	0.19	0.47	0.25	0.27	0.86	0.17	0.86	0.17
Georgia	0.08	0.00*	0.07	0.00*	0.53	0.00*	0.53	0.00*
Ghana	0.13	0.32	0.13	0.23	0.67	0.92	0.67	0.91
Guatemala	0.97	0.62	0.82	0.68	0.94	0.79	0.94	0.79
Honduras	0.77	0.09	0.73	0.09	0.79	0.00*	0.78	0.00*
Iran	0.02*	0.00*	0.02	0.00*	0.12	0.17	0.12	0.17
Jamaica	0.38	0.28	0.36	0.28	0.29	0.09	0.29	0.09
Jordan	0.66	0.16	0.78	0.21	0.57	0.72	0.52	0.66
Kazakhstan	0.99	0.43	0.97	0.36	0.41	0.18	0.38	0.09
Kenya	0.23	0.00*	0.40	0.00*	0.92	0.17	0.92	0.17
Kyrgyz Rep.	0.30	0.60	0.15	0.69	0.22	0.02*	0.19	0.01*
Lesotho	0.03*	0.00*	0.05*	0.00*	0.24	0.01*	0.25	0.01*
Macedonia	0.01*	0.16	0.00*	0.16	0.01*	0.03*	0.01*	0.03*
Madagascar	0.02*	0.26	0.01*	0.20	0.25	0.05*	0.25	0.05*
Malawi	0.18	0.00*	0.70	0.00*	0.38	0.00*	0.37	0.00*
Mali	0.62	0.11	0.85	0.90	0.44	0.50	0.44	0.55
Mauritania	0.66	0.23	0.60	0.24	0.28	0.57	0.28	0.57
Mauritius	1.00	0.27	0.98	0.26	0.29	0.70	0.27	0.63
Moldova	0.34	0.60	0.34	0.62	0.64	0.77	0.64	0.77
Mongolia	0.87	0.06	0.88	0.16	1.00	0.60	0.99	0.61
Morocco	0.05*	0.04*	0.07	0.05*	0.03*	0.02*	0.02*	0.02*
Mozambique	0.35	0.72	0.43	0.62	0.03*	0.37	0.04*	0.36
Namibia	0.23	0.19	0.59	0.17	0.85	0.18	0.89	0.19
Nicaragua	0.69	0.90	0.75	0.92	0.76	0.21	0.76	0.21
Nigeria	0.03*	0.12	0.02*	0.00*	0.00*	0.16	0.00*	0.16
Panama	0.00*	0.00*	0.00*	0.00*	0.09	0.19	0.09	0.19

Paraguay	0.97	0.17	0.97	0.20	0.66	0.30	0.66	0.30
Peru	0.18	0.23	0.16	0.42	0.61	0.98	0.61	0.98
Philippines	0.99	0.79	0.81	0.85	0.82	0.84	0.85	0.81
Romania	0.14	0.01	0.11	0.02*	0.62	0.02	0.53	0.01*
Russian Fed.	0.60	0.20	0.57	0.17	0.50	0.00	0.46	0.00*
South Africa	0.31	0.00*	0.30	0.00*	0.01	0.00	0.01*	0.00*
Suriname	0.67	0.00*	0.68	0.00*	0.57	0.09	0.58	0.05*
Swaziland	0.39	0.01*	0.21	0.01*	0.61	0.19	0.36	0.21
OVERALL	0.00*	0.00*	0.00*	0.99	0.00*	0.99	0.00*	0.00*

A-Table 4: Granger Causality Test: P-Values

OECD Countries: Output Variable causing Gender Gap (GGGI)								
	Real GDP		Real GDP per Capita		Real GDP Growth		Real GDP per Capita Growth	
	Lag 1	Lag 2	Lag 1	Lag 2	Lag 1	Lag 2	Lag 1	Lag 2
Australia	0.08	0.01	0.17	0.11	0.16	0.23	0.60	A.40692
Austria	0.39	0.76	0.34	0.74	0.45	0.04*	0.44	0.05*
Belgium	0.10	0.02*	0.04*	0.01*	0.28	0.01*	0.18	0.00*
Canada	0.00*	0.01*	0.00*	0.01*	0.16	0.07	0.15	0.04*
Chili	0.41	0.00*	0.44	0.00*	0.73	0.00*	0.73	0.00*
Czech Rep.	0.98	0.71	0.91	0.69	0.37	0.65	0.34	0.58
Denmark	0.22	0.04*	0.22	0.04*	0.72	0.62	0.71	0.61
Estonia	0.32	0.00*	0.32	0.00*	0.22	0.11	0.22	0.11
Finland	0.01*	0.01*	0.01*	0.01*	0.01*	0.03*	0.01*	0.03*
France	0.07	0.69	0.06	0.77	0.27	0.00*	0.25	0.00*
Germany	0.38	0.45	0.19	0.03*	0.66	0.43	0.98	0.95
Greece	0.23	0.22	0.26	0.21	0.89	0.55	0.94	0.48
Iceland	0.58	0.02*	0.34	0.028	0.03	0.00*	0.04*	0.01*
Ireland	0.86	0.43	0.81	0.54	0.93	0.56	0.88	0.60
Israel	0.05	0.00*	0.05*	0.01*	0.00*	0.01*	0.00*	0.01*
Italy	0.40	0.84	0.50	0.84	0.76	0.83	0.80	0.80
Japan	0.10	0.21	0.11	0.20	0.05*	0.03*	0.04*	0.03*
Korea	0.15	0.43	0.13	0.38	0.99	0.01*	0.91	0.01*
Latvia	0.29	0.52	0.28	0.48	0.65	0.14	0.67	0.13
Luxemburg	0.03*	0.06	0.05*	0.08	0.12	0.30	0.12	0.30
Mexico	0.77	0.33	0.80	0.34	0.81	0.81	0.82	0.80
Netherland	0.12	0.06	0.13	0.05*	0.81	0.00*	0.79	0.00*
New Zealand	0.00*	0.49	0.01*	0.94	0.04*	0.57	0.06*	0.64
Norway	0.92	0.30	0.96	0.34	0.94	0.00*	0.99	0.00*
Poland	0.11	0.33	0.12	0.31	0.59	0.78	0.59	0.75
Portugal	0.68	0.62	0.56	0.75	0.15	0.80	0.17	0.84
Slovak Rep.	0.04*	0.10	0.04*	0.11	0.15	0.48	0.15	0.49
Turkey	0.15	0.01*	0.22	0.01*	0.30	0.00*	0.30	0.00*
UK	0.66	0.09	0.63	0.09	0.74	0.55	0.76	0.57
US	0.03*	0.00*	0.03*	0.00*	0.51	0.02*	0.52	0.02*
OVERALL	0.00*	0.00*	0.00*	0.00*	0.01*	0.00*	0.02*	0.00*