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Gender Inequality, Governance, and Poverty in Sub-Saharan Africa

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This article uses panel data for 34 countries in Sub-Saharan Africa to investigate the effects of gender inequality and governance on poverty. It applied a maximum likelihood estimation of random effect models. We found that high gender inequality in Sub-Saharan Africa contributes to high poverty. The results also show that good governance in Sub-Saharan Africa may have a decisive positive impact on poverty reduction. The results are robust at country- and region-level data. It is also found that the net effect from the interaction of gender inequality and absence of good governance can have a potential impact on increasing poverty. Hence, to get out of poverty, improving human development and refining frameworks that improve institutional quality through voice and accountability, regulations, and government effectiveness on socioeconomic issues are necessary. The high gender inequality in the region should also be decreased.

KEY WORDS: gender inequality, governance, poverty, human development index, maximum likelihood, panel random effect

本文使用撒哈拉以南非洲34个国家的面板数据，调查性别不平等与治理对贫困产生的效应。本文应用了随机效应模型的最大似然估计。我们发现，撒哈拉以南非洲的高度性别不平等造成了高度贫困。研究还表明，撒哈拉以南非洲的善治可能对减贫具有决定性积极影响。研究结果对国家级和地区级数据而言是稳健的。研究还发现，性别不平等与善治缺乏之间的相互影响所产生的净效应能潜在地影响贫困增加。因此，要想以提高人类发展、对通过发言与问责提升制度质量的框架加以改进从而摆脱贫困，则有必要提出有关社会经济问题的规制和政府效力。也应减少该区域的高度性别不平等。

关键词： 性别不平等, 治理, 贫困, 人类发展指数, 最大似然, 面板随机效应

Este documento utiliza datos de panel de 34 países en África subsahariana para investigar el efecto de la desigualdad de género y la gobernanza en la pobreza. Se aplicó una estimación de máxima verosimilitud de modelos de efectos aleatorios. Descubrimos que la alta desigualdad de género en el África subsahariana contribuye a la alta pobreza. Los resultados también muestran que la buena gobernanza en África Subsahariana puede tener un impacto positivo decisivo en la reducción de la pobreza. Los resultados son sólidos a nivel nacional y regional. También se encuentra que el efecto neto de la interacción de la desigualdad de género y la ausencia de una buena gobernanza puede tener un impacto potencial para aumentar la pobreza. Por lo tanto, para salir de la pobreza mejorando el

desarrollo humano, es necesario refinar marcos que mejoren la calidad institucional a través de la voz y la rendición de cuentas, las regulaciones y la efectividad del gobierno en temas socioeconómicos. La alta desigualdad de género en la región también debería reducirse.

PALABRAS CLAVES: Desigualdad de género, gobernanza, pobreza, índice de desarrollo humano, probabilidad máxima, efecto aleatorio del panel

Introduction

Sub-Saharan Africa is a region with a population of 920 million from 49 countries. Around 60 percent of the total population of Sub-Saharan Africa live in just six countries (the Democratic Republic of Congo, Ethiopia, Nigeria, Kenya, South Africa, and Tanzania) (World Bank, 2016). On the other hand, out of the total population living in fragile and conflict-affected situations, around 54 percent live in this region (World Bank, 2018). It is a region in which almost all countries were under colonization by Western countries except Ethiopia. War, hunger, diseases, and millions of the poorest people are the main characteristics of the region still today, even if there are many opportunities and many changes. Many Sub-Saharan African countries, including Ethiopia and Rwanda, are among the fastest-growing countries in the world, with average economic growth of 6 percent per annum (World Bank, 2018).

Despite the rapid economic growth in Sub-Saharan Africa for the last few decades, many countries in the region are struggling with several development challenges, such as food insecurity, poverty, and inequality; loweconomic infrastructure; environmental degradation; and low regional and global economic integration (UNCTAD, 2014). The poverty level of most of the countries in the region is high (Addison, Pikkarainen, Rönkkö, & Tarp, 2017) and hence, as of the World Bank (2018) report, more than half of the global poor resided in this region in which more than 41 percent of the population live below the international poverty line. This is owing to the decline in the poverty rate being much slower than in other regions, even if there is rapid economic growth in the region. This implies that the swift economic growth in the region is less effective in reducing poverty than elsewhere due to high inequality (highincome inequality and high gender inequality) and the fact that the economic growth mostly depends on capital-intensive sectors like natural resource extraction and on infrastructure development, which needs time to reach the poor (Dormekpor, 2015; World Bank, 2016, 2018).

The ineffectiveness of the swift economic growth to reduce poverty can also be due to lack of good governance in the region. Even if Sub-Saharan Africa has abundant human and natural resources, its citizens are still living in poverty due to political and economic problems (Hyden, 2007; Kabuya, 2015). Some of the countries, including South Sudan and Democratic Republic of Congo (one of the poorest countries in the world), face high political unrest and have become fragile and home to many military groups due to their abundant natural resources, particularly natural gas (World Bank, 2018).

On the other hand, Yahie (1993) argues that the factors making poverty rise can be structural causes, which mostly comprise exogenous factors including limited resources,

lack of skills, and geographical disadvantages. Transitional causes, which are mainly due to reforms and changes in the economic policies that cause a change in price, unemployment, and so on, are also other factors that hinder the efforts in fighting poverty (Adeyemi, Ijaiya, & Raheem, 2009). Others scholars, including Asongu, Le, and Biekpe (2017), Asongu and Odhiambo (2018), and Asongu, Roux, Nwachukwu, and Pyke (2018) also argue that poor education quality, lack of technological infrastructure including access to mobile phones and ICT, and environmental degradation hinder inclusive human development in Sub-Saharan Africa. Nevertheless, most of the literature in this area focuses on either gender inequality and poverty or how governance influences the economic growth in the region separately,[1] even though both gender inequality and weak governance are existing problems in the region. In those countries in which both gender inequality and lack of good governance are major problems in fighting poverty, understanding the main and net effects of both problems is essential. It helps to comprehend the effect of gender inequality on poverty in the existence of weak governance and subsequently recommend appropriate policy and strategy measures for governments and concerned stakeholders who are involved in fighting poverty. Hence, this study examines gender inequality and governance together and aims to analyze how gender inequality and governance contribute to the high poverty in Sub-Saharan Africa by answering the following questions:

1. How does gender inequality increase poverty in Sub-Saharan Africa?
2. Does the absence of good governance in Sub-Saharan Africa increase poverty?
3. What is the interaction effect of gender inequality and governance on poverty?

The next section discusses the literature and gaps to be filled; the third section deals with sources of data, methodology, and descriptions of variables, including the rationale behind why poverty is proxied by the human development index; the estimation results and discussion are presented in the fourth section. The fifth section concludes with policy implications and recommendations for further studies.

Literature and Gaps

Notwithstanding the rapid economic growth in Sub-Saharan Africa with a more promising development route, poverty is still very high with comparatively low human development (Addison et al., 2017). The dominant factors that cause poverty to be high in Sub-Saharan Africa are malnutrition, high child mortality, lack of access to basic education, and social exclusion despite an abundance of resources (Abusomwan, 2014; Hyden, 2007). The high poverty rate in Sub-Saharan Africa is determined not only by economic factors but also by institutional and social determinants. The weak economic institutions, weak governance systems, and culture of the society are the vital roots of poverty in Sub-Saharan Africa (Kabuya, 2015).

On the other hand, gender inequality and poverty are still prime social problems in developing countries (Dormekpor, 2015). In Sub-Saharan Africa, gender inequality issues are still on the rise partly due to the traditional setting, particularly the

depraved culture of the society, which tends to discriminate between gender-assigned tasks and puts restrictions on the labor hours of women and girls due to prearranged roles (Morrisson & Jütting, 2005, as cited by Dormekpor, 2015; Mwiti & Goulding, 2018). Inequality and gender-based discrimination are not only found in traditional societies but also in modern political and economic systems. Women, who are the instrumental agents in poverty alleviation (Gökovali, 2013), are under-represented in the country's political power and workplaces, paid a lower wage compared with men, and suffer physical, psychological, and sexual violence and harassment (Anastasiou, Filippidis, & Stergiou, 2015; Datzberger & Le Mat, 2018; World Economic Forum, 2017). For instance, Wegren, Nikulin, Trotsuk, and Golovina (2017) found that tradition and custom remain strong factors in gender inequality, which means women earn less than men and ownership of land is dominated by men; hence, women are not owners in Russia's new economy. Espinoza-Delgado and Klasen (2018) and Rogan (2016), in their gender-based multidimensional poverty estimation, also argue that women are highly deprived in employment, domestic work, and social protection; hence, these contribute the most to poverty among women in developing countries. Gender inequality continues being one of the greatest blockades to reducing poverty, in which the average HDI for women is 6 percent less than that of men (UNDP, 2018).

The effect of gender inequality is not only found in roles and activities but also other fundamental socioeconomic aspects for women and girls. It affects their reproductive health, empowerment, and labor market participation (Mwiti & Goulding, 2018; Willie & Kershaw, 2019). Baliamoune-Lutz and McGillivray (2015), Chaudhry and Rahman (2009), Branisa, Klasen, and Ziegler (2013), Yumusak, Bilen, and Ates (2013), and Cooray and Potrafke (2011) also argue that gender inequality in education, which is mainly due to culture and religion, makes a high contribution to rural poverty. It makes rural women and girls unable to have better job opportunities and even makes them unable to manage their families for a better life. Gender inequality can also worsen child malnutrition in developing countries. Children from rural women are more vulnerable to diseases and death compared with those from educated and urban women in developing countries (Branisa et al., 2013; Sinha, Mcroy, Berkman, & Sutherland, 2017). This is related to the lack of opportunities and even lack of sufficient income to feed their children, which is a result of poverty indirectly. This and the above arguments reiterate that gender inequality can have an essential influence on increasing the level of poverty in Sub-Saharan Africa through its adverse impact on human development.

Aside from gender inequality, weak governance is the other factor that impacts poverty in Sub-Saharan Africa (World Bank, 2018). Most African countries are governed by undemocratic corrupt governments. Good governance promotes checks and balances in governance (accountability and transparency), decentralization, an efficient/equitable/independent judiciary, sound regulatory system, and the like. Good governance is helpful for many developing countries to reduce poverty if some essential issues like what comes first and next, what will be achieved in the short term and long term, what is feasible and what is not are considered (Grindle, 2011). Mills, Thakoor, Sobrinho, Velloso, and Hammadi (2019)

also argue that moving the average Sub-Saharan country's governance level to the global average could increase the region's GDP per capita growth by about 1–2 percentage points.

As per different sources including Transparency International, Sub-Saharan Africa is home to corrupt governments. Almost all governments of the countries in the region are corrupt, such as Sudan, South Sudan, Chad, Somalia, the Gambia, and Angola with a severe corruption record (Sassi, Sami, & Ali, 2017; Transparency International, 2013). Corruption may not lead to poverty by itself; rather, it has a huge impact on economic and governance aspects, which, in turn, produces poverty via inequitable resource allocation (Chetwynd, Chetwynd, & Spector, 2003).

In addition to corruption, political violence, a weak regulatory system, the absence of accountability and transparency, feeble implementation of the rule of law, and ineffectiveness of the government are the main factors that make governance very puny and undemocratic in Sub-Saharan Africa. The frail government cannot play a crucial role to reduce the high poverty in the region (Transparency International, 2013; World Bank, 2018). Akanbi (2015), using a two-stage least squares estimation technique, argues that in Sub-Saharan Africa, governance and infrastructure are significant determinants of poverty. Those countries with relatively better governance experience a lower level of poverty compared to countries with a weak governance institution. This argument is in line with Batniji and colleagues' (2014) argument that the efforts to improve government effectiveness and to reduce corruption in developing countries are more likely to improve health and education of the society than democratization. Joshi, Hughes, and Sisk (2015) also contend that intervention of governments and developmental organizations to improve governance and to implement pro-poor development policies at the right time is an effective way to achieve sustainable development goals.

Hyden (2007) argues that to reduce poverty through good governance in Africa, resources and public revenues should be used responsibly, accountably, and in a transparent way to satisfy basic human needs including food, shelter, health, and education. The governments should prioritize achieving these basic needs rather than achieving their own personal interest. The regulatory quality, which plays an effective political and institutional role in poverty reduction strategies, is one of the important governance indicators to enhance human development in Africa (Minogue, 2008). The absence of political violence and rule of law are the other indicators of good governance that may have a positive effect on high poverty. Political violence will increase the vulnerability of children and women to disease, hunger, and death (Addison et al., 2017; Boothby, 2019; Masten & Osofsky, 2010; Neumayer, 2004).

In this study, we try to see the overall impact of gender inequality and governance on poverty (proxied by the human development index).[2] This study is different from the previous studies in at least two aspects. The first one is that a panel maximum likelihood estimation technique, which is better than the least squares estimation for inference (Myung, 2003), is used. Most of the previous studies on gender inequality and governance used ordinary least squares estimation, qualitative data analysis techniques, multiple linear regression, and

cointegration analysis. This notwithstanding, few studies have also applied logistic regression for binary variables. The second aspect is that we tried to grasp how gender inequality and the absence of good governance contribute to high poverty in Sub-Saharan Africa. Most previous studies focus on either governance and poverty or gender inequality and poverty not taken together. The net effect, computed from conditional and unconditional effects, from their interaction on poverty is here discussed. In addition, a panel data analysis in Sub-Saharan Africa on gender inequality, governance, and poverty is an added feature.

Data Sources, Methodology, and Description of Variables

In this section, the data sources, the description of variables including the rationale behind why poverty is proxied by the human development index and the estimation method to be used for the analysis are discussed.

Data Sources

The main data sources of this study are the United Nations Development Programme (UNDP) and World Bank databases. The human development index[3] and gender inequality index data are extracted from the UNDP database. The governance indicators, foreign direct investment, export, import, military expenditure, inflation, unemployment, and vulnerable employment data are extracted from the World Bank database. The data for economic freedom are extracted from the Heritage Foundation database.

More than 69 percent (34 countries out of 49) of the region is covered in the data extraction and analysis with a time span of eight years (2010–2017). Some of the countries in the region are excluded from the analysis due to the unavailability of data. The analysis starts in 2010 because many of the selected variables' data are full for most countries.

For a robustness check, country-level datasets from the round five survey data for Ethiopia undertaken by Afrobarometer between 2011 and 2013, which is a Pan-African research network that conducts public attitude surveys on democracy, governance, and economic conditions in Africa, are used. In this survey, more than 1,000 individuals were interviewed about governance, democracy, gender inequality, and their living condition. This data set is chosen as it comprises a detailed explanation about the gender inequality in leadership, education, service delivery institutions, and also about government effectiveness in providing needed services for the society. After cleaning the data, an estimation is undertaken using more than 20 variables for more than 1,000 observations. The summary statistics are attached in Table A1.

Description of Variables

In this study, the dependent variable is the human development index. This variable is used as a proxy for poverty for at least two reasons. The main reason is

that the data on poverty headcount ratio or multidimensional poverty index are not fully available to make a panel data analysis. We tried to look at all the possible databases on the poverty index, but these were not found. The second reason is that multidimensional poverty has been one of the indices of human development (UNDP, 2018) since 2010, even if the human development index measures success while multidimensional poverty (human deprivation) measures deprivation. On the other hand, the deprivation index for a country or region can be obtained by subtracting the human development index from unity (Kelley, 2017). In 2010, Alkire and Santos computed acute multidimensional poverty for more than 104 countries using education, health, and living standards as dimensions. These dimensions are also incorporated directly or indirectly in the dimensions for measuring human development index (Seth & Villar, 2017; UNDP, 2018). Hence, success in education or health or living standards implies a decrease in poverty as the proportion of deprived people in those dimensions will decrease. On the other hand, any policy interventions, programs, or projects that undertake to reduce poverty have a direct impact on human development. For example, if we take national health programs that are implemented effectively and efficiently, they will decrease poverty by improving the health status of the society and hence improve productivity. On the other hand, they will increase life expectancy, which is one of the indicators of human development index.

As of the UNDP (2018) human development report, there are four classifications in human development index value: very high (HDI $\geq$ 0.8), high (between 0.70 and 0.799), medium (between 0.55 and 0.699), and low (less than 0.55). Even if human development in Africa has been growing for the last 27 years, the average human development index is at a low level (below 0.55). This can be due to economic crises, political instability and conflicts, and epidemics. The annual human development index for the years between 2010 and 2017 for 34 Sub-Saharan African countries is used in the data analysis.

The variables of interest in this study are gender inequality and governance. In Sub-Saharan Africa, gender inequality is very high and it may have a huge socioeconomic impact on society (Yumusak, Bilen, & Ates, 2013). As per some authors including Sinha et al. (2017), Branisa et al. (2013), and Yumusak, Bilen, and Ates (2013), the high gender inequality in Sub-Saharan Africa can be a possible factor for high poverty. Their argument is that the high gender inequality in education, for example, has a tremendous and long-run effect on job opportunity, social protection, family management, and political participation, and particularly increases vulnerability to malnutrition. The gender inequality index from the UNDP database is used in our estimation.

Good governance is the other variable of interest considered in this study. According to the World Bank (2018), there are six indicators of good governance: voice and accountability, political stability, rule of law, government effectiveness, regulatory effectiveness, and control of corruption. The absence of rule of law, accountability and transparency, political instability, high levels of corruption, and weak government effectiveness play crucial roles in the high poverty in developing countries (Hyden, 2007). The absence of good governance in Sub-Saharan Africa is

one of the main reasons for high poverty and low human development in the region (Akanbi, 2015; Transparency International, 2013; World Bank, 2018). In this study, the average level of governance from six indicators, based on the World Bank measurement, is used in the estimation. The interaction between gender inequality and governance is also considered in our analysis to grasp whether the effect of gender inequality or governance on poverty will dominate in the region.

In addition to gender inequality and governance, the economic, social, and political factors of human development are included as control variables in our analysis. Export of goods and services, import of goods and services, foreign direct investment, and inflation rate are the control variables considered from the economic angle, and military expenditure and economic freedom are those which represent the political aspect. Unemployment and vulnerable employment are also other control variables considered in our study.

Sub-Saharan Africa, wherein domestic saving and capital accumulation are very low, needs foreign direct investment to fill the domestic resource gap and achieve socioeconomic goals. Even if the flow is very low and there are many push and pull factors that determine its flow, foreign direct investment is important for Sub-Saharan Africa to get out of poverty (Ajayi, 2006; Gohou & Soumare, 2009; Mold, 2004). Foreign direct investment as a ratio of GDP is used in this study.

Unemployment and vulnerable employment are also important factors that can be a potential contribution to high poverty and low human development in Sub-Saharan Africa. Unemployment is not only a potential factor for higher poverty in developing countries but also a source of mental disorder/mental health problems, depression, and crime, which affect the social, economic, and political life of the society (Adebayo, 2014; Hooghe, Vanhoutte, Hardyns, & Bircan, 2011; Paul & Moser, 2009; Weich & Lewis, 2011; Xue & Zhong, 2003). Not only unemployment but also vulnerable employment affects the socioeconomic life of the society. Compared with permanent employees, those who are employed for seasonal or in very sensitive occupations are more deprived in their social life and health status. In Sub-Saharan Africa, vulnerable employment affects women more than men and hence it increases work poverty (Gangopadhyay, 2004; Holmes, Sadana, & Rath, 2010; Maitre, Nolan, & Whelan, 2012; Vatsa, 2006). Unemployment as a ratio of the total labor force and vulnerable employment as a ratio of total employment in the countries are used in the analysis.

The other control variables used in the analysis as potential factors are economic freedom and military expenditure. There are two arguments on the effect of military expenditure on poverty. On one hand, increasing military expenditure to secure the countries' peace may increase investment from domestic and foreign companies, and hence it can be a catalyst for economic growth and poverty reduction (Busse & Hefeker, 2007; Jakobsen, 2010). On the other hand, some scholars including Chang, Huang, and Yang (2011), Hou and Chen (2013), and Dunne and Tian (2015) argue that an increment in military expenditure may override the government's budget for socioeconomic infrastructure. The government may not be able to build health centers and schools due to budget constraints. Hence, the high military expenditure may aggravate poverty. The

military expenditure as a ratio of GDP is used in our analysis to study its impact on human development.

Economic freedom positively contributes to income growth through enhancing innovation competence, makes doing business easy, and encourages investors and business companies to reimburse their money on the main economic sectors (Compton, Giedeman, & Hoover, 2014; Zhu & Zhu, 2017). It is highly important for economic growth and to reduce poverty in developing countries, and it is even more important than democracy in nurturing growth (Wu & Davis, 1999, in Lawson, 2009). The annual economic freedom index from the Heritage Foundation is used here to study its impact on poverty. The annual inflation rate, export of goods and services as a ratio of GDP, and import of goods and services as a ratio of GDP are the other control variables we used in this study.

For the country-level estimation,[4] which aims to study the determinants of living conditions in Ethiopia, self-evaluated living conditions of individuals, with a value of 1 for bad living conditions and 0 for good living conditions, is the dependent variable. The rationale behind using living conditions is that in the absence of income or expenditure, which are conventionally used as indicators for household or individual economic status (Mberu, 2006), in the data set used, a self-evaluated living condition can be used as a proxy to measure the living standard of individuals or households (Arnold, 2015; Mberu, 2006; Ootegem & Van, 1990). The standard of living is a question on the kind of life he or she is living, that is, whether the person is succeeding in doing or living (Ootegem & Van, 1990). In addition, the living condition can explain poverty more than the traditional concept of poverty, which gives emphasis to income or expenditures that are very narrow and is unable to measure poverty and living standards of an individual (Alkire & Santos, 2014; Nolan & Whelan, 2010).

The interest variables are gender inequality, government effectiveness, and political institutions.[5] Occupation, educational level of individuals, and whether the respondent lives in a rural or urban area are included in our estimation as control variables.

Conceptual Framework

Based on the reviewed literature, the relationship between poverty and its other determinants can be conceptualized in such a manner as in Figure 1. It represents that poverty is determined by governance and gender inequality in Sub-Saharan Africa. But in addition to these two factors, there are also variables which may determine poverty in the region (listed under control variables in the figure). It also signifies that the dependent variable (poverty) is proxied by the human development index.

Estimation Method

To study the impact of gender inequality and governance on poverty (proxied by the human development index) in 34 countries of Sub-Saharan Africa, the

maximum likelihood estimation with panel data model is used. The maximum likelihood estimation is preferable for nonlinear models, and it is a central tool for many statistical modeling techniques. In addition, it requires no or minimal distributional assumption and it is better than the least squares estimation by means of adequacy, reliability, efficacy, and parameterization invariance (Myung, 2003). In other words, compared to least squares estimation, maximum likelihood estimation enables researchers to have complete information about the parameter of interest and to generate the asymptotic true value of a parameter for sufficiently large samples with the lowest possible variance (Myung, 2003).

As our data are a panel for eight years, this will not fulfill the linear-form restrictions of maximum likelihood estimation (i.e., the overall log-likelihood function is not the sum of the individual log-likelihood functions). Hence, the maximum likelihood estimation, which helps to evaluate the overall log-likelihood without analytical derivatives (Gould, Pitblado, & Sribney, 2006), is used. In addition, to decide whether to use a fixed effect or random effect log-likelihood model, the Hausman specification test is used, in which the null hypothesis is that the random effect model is more efficient than the fixedeffect model estimation in panel data analysis. Hence, based on the specification test result, the maximum likelihood estimation for random effect model estimation is used in this study. The Breusch–Pagan Lagrange multiplier test is also used to decide between random effects and simple ordinary least squares (OLS)

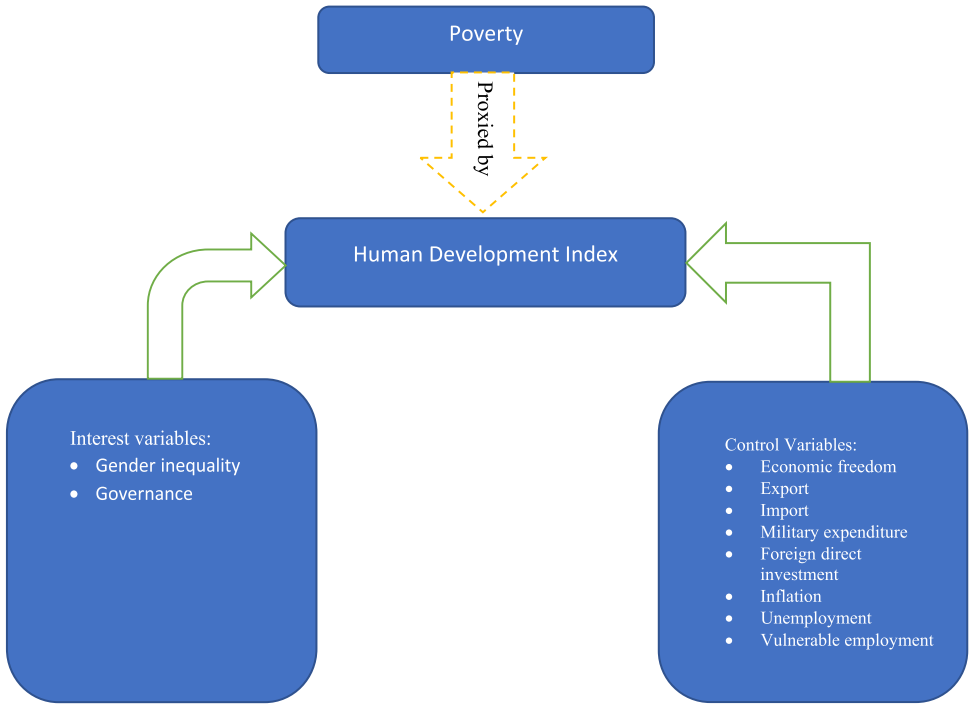

Figure 1. Conceptual Framework.

regression, and the test allows using random effect regression (the test result is attached in Table A2). The model specification of a panel log-likelihood with random effect estimation, based on Gould et al. (2006) and Lee and Nelder (2005), can be explained as follows.

Given a panel model with random effect:

$$y_{it} = x_{it}\beta + u_i + e_{it} \tag{1}$$

$$u_i \sim N(0, \sigma_u^2)$$

$$e_{it} \sim N(0, \sigma_e^2)$$

where y_{it} is the dependent variable for entity/group i and time t, x_{it} is a matrix of explanatory variables, β is a vector of coefficients or parameters to be estimated, u_i is the entity effect, and e_{it} is the error term.

And a log-likelihood function:

$$\log(L) = \sum_{i=1}^{N} \log(L_i) \tag{2}$$

Then, after the necessary derivatives and substitutions, the log-likelihood function for the group in the panel random effect model will be

$$\text{llog}(L_i) = -\frac{1}{2}\left\{\frac{\sum_{t=1}^{T} z_{it}^2 - \alpha_i\left(\sum_{t=1}^{T} z_{it}\right)^2}{\sigma_e^2} + \log\left(T*\frac{\sigma_u^2}{\sigma_e^2} + 1\right) + T*\log\left(2\pi\sigma_e^2\right)\right\} \tag{3}$$

where T is the number of observations for each group and $z_{it} = y_{it} - x_{it}\beta$ and $\alpha_i = \frac{\sigma_u^2}{(T*\sigma_u^2 + \sigma_e^2)}$.

In this study, the dependent variable y_{it} is "hdi_{it}" (human development index), and the matrix of explanatory variables x_{it} includes gender inequality index and governance as interest variables and economic freedom, foreign direct investment as a share of GDP, unemployment as a share of total labor force, vulnerable employment as a share of total employment, export as a share of GDP, import as a share of GDP, military expenditure as a share of GDP and annual inflation rate as control variables. In other words, we can write z_{it} as

$$z_{it} = y_{it} - x_{it}\beta - c_{it}\gamma \tag{4}$$

where x_{it} stands for the matrix of interest variables (gender inequality and governance), and c_{it} stands for a matrix of control variables (mentioned above) for i number of groups and t number of years. β and γ are the vectors of the coefficients of interest and control variables, respectively, to be estimated.

Hence, the parameters or coefficients, which maximize the log-likelihood function in equation (3), are estimated to see the effect of gender inequality and governance on poverty in Sub-Saharan Africa.

As a robustness check, we used exploratory factor analysis and the binary logistic estimation technique to study the effect of gender inequality and government effectiveness on living conditions of the society in Ethiopia at the country level, based on survey data from Afrobarometer. An exploratory factor analysis, which is the simplest and most widely used type of multivariate analysis (Decancq & Lugo, 2012; Luzzi, Flückiger, & Weber, 2008), is used to reduce and aggregate the number of variables used in the estimation. As explained by Lawley and Maxwell (1962) and Yong and Pearce (2013), the factor analysis estimation model is explained as follows:

$$X_j = \alpha_{j1}F_1 + \alpha_{j2}F_2 + \alpha_{j3}F_3 \; + \cdots + \alpha_{jp}F_p + e_j \tag{5}$$

where, $j = 1,2,3, \ldots, n$ and n denotes the number of actual variables ($X_1, X_2, X_2, \ldots. X_n$). p is the number of unobservable factors ($F_1, F_2, F_2, \ldots. F_p$) in which each actual/observed variable is a linear function of those unobservable factors together with residuals. The coefficients of each unobservable factor are factor loadings, which represent the correlation between the unobserved factors and observed variables and tells us how the unobserved factors and observed variables are correlated. e_j is the specific or unique factor, which is only related with the observable variables X_j.

The number of factors to be chosen depends on their eigenvalue and the percentage that they can explain. As per Decancq and Lugo (2012), the factors which have an eigenvalue of greater than or equal to 1 will be considered, and these factors should explain at least 60 percent of the total. In addition, as our variables are categorical, the polychoric correlation is used as the Pearson correlation will be biased for this kind of variable (Acock, 2013; Holgado-Tello, Chacón-Moscoso, Barbero-García, & Vila-Abad, 2009; Juras & Pasaric, 2006; Luzzi et al., 2008).

Then, after identifying the unobservable factors, a binary logistic regression technique is used to see the impact of those factors on living conditions in Ethiopia. The binary logistic regression model is explained as follows:

$$P_y = P(y = 1|x) = F\left(X'\beta\right) \tag{6}$$

where $y = \{1\text{ifyesor0ifno}\}$.

In this study, the dependent variable is the self-evaluated living conditions of individuals, with a value of 1 for bad living conditions and 0 for good living conditions. The interest variables are gender inequality, government effectiveness, and political institutions. Occupation, education level of individuals, and whether the respondent lives in a rural or urban area are included in our estimation as control variables.

Results and Discussion

In this section, the descriptive statistics, the diagnostics tests undertaken to check the suitability of the estimation result for our analysis, and the relationship between gender inequality, governance, and poverty are discussed. In the estimation results and discussion, first the region-level analysis is discussed and then, as a robustness check, the country-level analysis is discussed.

Descriptive Statistics

As we can see from Table 1, the average value of the human development index in Sub-Saharan Africa for the years between 2010 and 2017 was around 0.51, which is approximately the same as the region's human development index for the last 27 years (below 0.55) as reported by UNDP (2018). This keeps the region at a low level of human development compared with other regions. Similarly, the gender inequality index is higher in Sub-Saharan Africa with an average of 0.569, which is the same as the UNDP (2018) report. This shows that the higher the gender inequality in the region, the lower is the human development. This argument will be developed in empirical estimations and analysis. Governance is also very low in Sub-Saharan Africa with an average of −0.535. This strengthens the argument of Mills et al. (2019) that Sub-Saharan African countries are much behind in governance effectiveness, and this weak governance undermines their economic performance.

The other thing here is that the average vulnerable employment in the sample population is very high (0.644), which implies that out of the total employment, more than 64 percent of the people are employed in vulnerable jobs. This can also have another implication from a policy point of view that most of the governments in Sub-Saharan Africa are focused on short-term solutions and probably for their sake of acceptance by society. Unemployment as the ratio of the labor force is relatively low (around 8.9 percent) even though there is high unemployment in the region. This can be related to the population structure as most of the population in the region is young and are either in school or unproductive, as the labor force includes only the employed and unemployed who are seeking jobs. The level of import is higher than the export of goods and services, which is true up to this time in that there is a trade imbalance in the region. The last column shows the VIF value for each explanatory variable for the multicollinearity test and shows that there is no problem of multicollinearity.

Table 1. Summary Statistics of the Data Used in the Estimation

Variable	Mean	Std. Dev.	Min.	Max.	VIF
Human Development Index (hdi)	0.509	0.101	0.318	0.79	–
Governance	−0.536	0.549	−1.698073	0.853	3.8
Gender Inequality Index (gii)	0.569	0.081	0.353	0.682	1.91
Economic Freedom (ef)	55.329	8.141	21.4	77	2.56
Export/GDP ratio (exgr)	0.317	0.149	0.062	0.873	1.75
Import/GDP ratio (Impgr)	0.449	0.198	−0.062	1.085	1.36
Military Expenditure/GDP ratio (mexgr)	0.016	0.0102	8.07e−06	0.071	1.33
Foreign Direct Investment/GDP ratio (fdigr)	0.073	0.172	−0.013	1.597	1.09
Inflation_annual (infdr)	0.059	0.068	−0.297	0.417	2.75
Unemployment/Labor Force ratio (unemr)	0.089	0.079	0.003	0.282	1.80
Vulnerable Employment/Total Employment ratio (vemr)	0.644	0.244	0.088	0.926	1.97
Total observations		264			

Source: Own computation.
Note: VIF, variance inflation factor.

Table 2. Diagnostic Tests, Region Level (Sub-Saharan Africa)

Regression Assumptions	Test	We Seek Values
1. No heteroskedasticity problem	Breusch–Pagan test $\chi^2(1)$: .133 p-value: .716	>0.05
2. No multicollinearity problem	Variance inflation factor	<5.00
3. Residuals are normally distributed	Shapiro–Wilk W normality test z: .442 p-value: .329	>0.01
4. No specification problem	Linktest t: −1.987 p-value: .048	>0.05
5. Appropriate functional form	Test for appropriate functional form $F(3, 250)$:1.870 p-value: .135	>0.05
6. No influential observations	Cook's distance: no distance is above the cut-off	<1.00
7. Wooldridge test for autocorrelation	No first-order autocorrelation Prob > F = .0000	<0.05

Source: Own computation.

Diagnostics Test

Table 2 shows seven diagnostic tests that are undertaken to study the suitability of our data for the analysis. Based on the results from the diagnostic tests, there is no heteroskedasticity problem, no multicollinearity problem, no specification problem, and no functional problem, and the residuals are normally distributed. In addition, to see whether the fixed effect or random effect model is appropriate or suitable for the estimation, we used the Hausman test (with a value of $\chi^2 = 10.6$ and p-value = .477). Based on this test, the random effect estimation is suitable, which implies that the variation across entities is random and uncorrelated with the explanatory variables included in the model. The Breusch–Pagan Lagrange multiplier test is also used to decide between random effect and simple OLS regression, and the random effect regression is suitable for the analysis.

In addition, as Table 3 shows, four diagnostic tests (pre- and post-estimation) were undertaken to study the suitability of our data for the factor and logistic analyses. Based on the results from the diagnostic tests, all satisfy the minimum threshold.

Estimation Result and Discussion[6]

After the necessary diagnostic tests are checked, the impact of gender inequality and governance on poverty in Sub-Saharan Africa is estimated using a maximum likelihood estimation technique for random effect models. Table 4 shows the estimation results with their level of significance with and without time effects. Gender inequality can contribute to high poverty in Sub-Saharan Africa depending on the level of governance. This finding is in line with Sinha et al. (2017), Branisa et al. (2013), and Yumusak, Bilen, and Ates (2013), who argue that gender inequality makes women unable to gain access to education, and hence they cannot compete in the job market and face difficulties in

Table 3. Diagnostic Tests, Country Level (Ethiopia)

Regression Assumptions	Test	We Seek Values
1. Factor test-suitable for factor analysis	Kaiser–Meyer–Olkin measure of sampling adequacy KMO = .866 Bartlett test of sphericity $\chi^2(1)$: 5,313.026 *p*-value: .00	>0.6 <0.05
2. No multicollinearity problem	Variance inflation factor	<10.00
3. No specification problem	Linktest *t*: .972 *p*-value: .331	>0.05
4. No influential observations	Cook's distance: no distance is above the cut-off	<1.00

Source: Own computation.

family management and childcare, including nutrition. In addition, their decision-making power in their family and in society will be low. Hence, gender inequality can have an adverse impact on women's and children's health, women empowerment, and labor market participation, through which poverty increases. Particularly in

Table 4. Estimation Result, Region Level (Sub-Saharan Africa)

Variable	Model I (Without Time Effect)	Model II (With Time Effect)
Governance	0.0856***	0.0290**
	(3.07)	(1.99)
Gender Inequality	−0.515***	−0.0635**
	(−9.95)	(−1.97)
Ln (Economic Freedom)	0.0670***	0.0203***
	(5.82)	(3.43)
FDI/GDP	−0.00411	0.00838***
	(−0.78)	(3.20)
Export/GDP	−0.0134	0.00820
	(−0.84)	(1.00)
Import/GDP	−0.0126	−0.00384
	(−1.20)	(−0.71)
Inflation Rate	−0.0413***	−0.00795
	(−3.47)	(−1.30)
Military_Expenditure/GDP	0.364**	0.341***
	(2.42)	(4.57)
Unemployment	−0.115*	0.0682*
	(−1.81)	(1.92)
Vulnerable Employment	−0.259***	−0.00222
	(−7.36)	(−0.08)
Interaction term(gov*gi)	−0.154***	−0.0118
	(−3.35)	(−0.49)
Net effects	0.002	
Years	No	Yes
Intercept	0.713***	0.443***
	(11.93)	(11.99)
N	264	264

Source: Own computation.
Note: The *t* statistics are in parentheses. *$p < .1$, **$p < .05$, ***$p < .01$.

multidimensional poverty measurement, as education and health are the main dimensions considered, the nutrition level of children and adults and the child mortality and education level of women, which high gender inequality may adversely affect, can increase the level of poverty in the region.

With regard to the relationship between good governance and poverty, the average of all good governance indicators is used. The results show that good governance in Sub-Saharan Africa has a negative impact on poverty depending on the level of gender inequality. This negative relationship between good governance and human development can come from the effect of government effectiveness, voice and accountability, and rule of law.[7] When governments provide basic health service and education needs for the society effectively and with responsibility, they will have a constructive impact to decrease poverty. This argument is in line with Ahmad and Saleem (2014), Joshi (2013), Oluwatobi and Ogunrinola (2011), and Prasetyo and Zuhdi (2013) that government effectiveness and accountability play a vital role in the effectiveness of government service provision for the society. Depending on the quality and quantity of government expenditure, the government can decrease the level of poverty through infrastructural development, including schools, health centers, and social security institutions.

The other interesting fact here is that the interaction between gender inequality and good governance shows a positive relationship with poverty, even if it is insignificant in the second case (with time effects). The net effect from the interaction between gender inequality and governance is 0.002 ($[(0.154 \times 0.569) + (-0.0856)]$).[8] This may imply that the positive impact of gender inequality can override the negative impact of good governance on poverty if governments donot take effective measures which help to decrease gender inequality and increase good governance. This implies that the weaker the governance is, the higher the contribution of gender inequality for higher poverty in Sub-Saharan Africa. More than half of the control variables are significant and have the expected sign except unemployment, which has an unexpected sign in the second model (random effect with time effects). Economic freedom, inflation rate, and vulnerable employment have a negative, positive, and positive relationship with poverty, respectively, while military expenditure has a negative relationship, which is in line with the argument given by Jakobsen (2010) and Busse and Hefeker (2007).

To see the consistency of the results at the countrylevel, the impact of gender inequality and government effectiveness is examined.[9] The living condition in Ethiopia is estimated using exploratory factor analysis and the binary logistic estimation technique. Before the estimation of the logistic regression, exploratory factor analysis for 21 variables is applied regarding gender inequality, government effectiveness, and political institutions. Based on the criteria given by Decancq and Lugo (2012), three factors (unobservable variables) are identified, namely, gender inequality, government effectiveness, and political institutions (see Table A2).

The following table shows the binary logistic estimation result based on the results from exploratory factor analysis. Table 5[10] shows government effectiveness and gender inequality are both significant at the 1 percent level of significance. Gender inequality can worsen the life of individuals through its negative impact on living conditions. The results show that gender inequality and bad living conditions have a positive

Table 5. Estimation Result, Country Level (Ethiopia)

Model Used	Binary Logit
Explanatory Variables	Living Condition
Government Effectiveness	−0.827***
	(−5.99)
Political Institutions	0.24
	(1.39)
Gender Inequality	0.426***
	(3.23)
Primary Education	−0.474**
	(−2.31)
Secondary Education	−0.242
	(−1.04)
Tertiary Education	−0.562*
	(−1.88)
Unemployed	0.178
	(1.01)
Urban-Rural	0.047
	(0.24)
Intercept	0.914
	(1.46)
Number of observations	1,047

Source: Own computation.
Note: The t statistics are in parentheses. *$p < .1$, **$p < .05$, ***$p < .01$.

relationship through lack of access to women empowerment and labor market participation. However, the effectiveness of governments through managing the economy; improving the health, water, and sanitation; and improving the electricity supply and access to education can improve the lives of individuals.

On the other hand, Table 6 shows the marginal effects of each explanatory variable on living conditions based on the binary logistic estimation technique. The better the government effectiveness, the more likely the individuals will have better living conditions; while the higher the gender inequality, the more likely it is for individuals to have bad living conditions. Those individuals who have a primary and tertiary education level are also more likely to live a better life compared with those who have no education.

Table 6. Marginal Effects

	dy/dx	Std. Err.	z	$P > z$	[95% Conf. Interval]	
Gov't Effectiveness	−.1773917	.0290313	−6.11	.000***	−.234292	−.1204913
Political Institutions	.0513906	.0369747	1.39	.165	−.0210785	.1238596
Gender Inequality	.0913654	.0279898	3.26	.001***	.0365065	.1462244
Primary Education	−.1016262	.0439429	−2.31	.021**	−.1877527	−.0154998
Secondary Education	−.0520069	.050007	−1.04	.298	−.1500187	.046005
Tertiary Education	−.1205762	.0639214	−1.89	.059*	−.2458597	.0047074
Unemployment	.0381739	.0377	1.01	.311	−.0357167	.1120646
Urban-Rural	.0100729	.0413075	0.24	.807	−.0708883	.0910342

Source: Own computation.
Note: *$p < .01$, **$p < .05$, ***$p < .01$.

In general, in Sub-Saharan Africa, we can argue that gender inequality has a decisive impact on human development and can increase poverty. However, if governments can improve their effectiveness, it will help in decreasing poverty. This argument is also in line with the ideas of Mills et al. (2019) in that the improvement of governance in Sub-Saharan Africa will enable their economy to grow more and hence poverty will decrease.

Conclusion

We estimate the impact of gender inequality and governance on poverty (proxied by the human development index) in Sub-Saharan Africa using panel data from UNDP and the World Bank and the maximum likelihood estimation for random effect models. We found that gender inequality contributes significantly to high poverty in Sub-Saharan Africa, while the average level of good governance in the region may remarkably help to reduce poverty through government effectiveness, voice and accountability, and rule of law. This argument is also in line with the ideas of Mills et al. (2019) in that the improvement of governance in Sub-Saharan Africa will enable their economy to grow more and hence poverty will decrease.

We also tried to see the net effects from the interaction between gender inequality and good governance on poverty. We found that unless governments implement effective and remarkable policies to improve the level of good governance and also to decrease the high gender inequality in the region together, the high impact of gender inequality may override the progressive impact of good governance on poverty and, hence, it may allow poverty to remain high in the region.

A robustness check using country-level data and the binary logistic estimation technique is also analyzed to see how consistent our results are. The effect of gender inequality and government effectiveness on the self-evaluated living conditions of individuals in Ethiopia is estimated based on the country-survey data from Afrobarometer. From this robustness check, it is found that gender inequality has an outstanding negative impact on living conditions, while government effectiveness through managing the economy, improving the water and sanitation, and providing and improving health and education services and social security has a notable positive impact on the living conditions of individuals.

For policy's sake, we argue that policy interventions should be able to decrease gender inequality in line with improving good governance to overcome the negative effect of high gender inequality on poverty.

Endnotes

1. The detailed gap analysis is discussed in the next section.
2. The rationale behind the human development index as a proxy for poverty is explained in the next section.
3. The human development index is used as a proxy for poverty.
4. A robustness check is carried out for the region-level estimation.
5. It is explained under the “Estimation Result and Discussion” section about these variables.

6. The interpretation is opposite to the sign of estimated coefficients as an increase in the human development index indicates a decrease in poverty.
7. The effect of each governance indicator on poverty is checked and government effectiveness, voice and accountability, and rule of law have a negative impact on poverty. The result is attached in Table A3.
8. The calculation of net effects is based on Asongu et al. (2017) and Asongu and Nwachukwu (2018), and the sign is the opposite to the sign of estimated coefficients as an increase in human development index indicates a decrease in poverty. In addition, the mean of gender inequality is .569.
9. Here only government effectiveness and political institutions are used to study the effect of governance on living standards due to two main reasons: one is that most of the indicators of governance are not available in the data and the other is as per Audrey and Margaret (2019); Lin, Chien, Chen, and Chan (2014); and Daoud, Shailen, Bo and Bjorn (2012), government effectiveness is about how the government is capable of protecting its citizens from violence and crime, provision of basic needs and handling economic problems in the country. In addition, government effectiveness should be measured not by the policies and strategies implemented by extractive institutions, but rather by the final results in which the individual citizens benefit, as Olofin, Joseph, Taiwo, and Jooda (2015) also argue.
10. As the dummy for living condition is "bad living condition," the interpretation with a good life condition is the opposite to the sign of the coefficient.

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APPENDIX A

Table A1. Summary Statistics of the Data Used in the Exploratory Factor Analysis

Variable	Mean	Std. Dev.	Min.	Max.
Urban-Rural	0.3256925	0.4688569	0	1
Region	5.198663	2.772902	1	11
Age	34.79752	13.82052	18	90
Living condition	3.540592	0.9004061	1	5
Unsafe walk	0.2273161	0.698194	0	4
Crime/fear in home	0.1604585	0.6067206	0	4
Stolen something from house	0.112703	0.4224813	0	3
Physically attacked	0.0391595	0.2538319	0	3
Equal/unequal leadership	3.013372	1.047538	1	5
Men vs. women_leaders	3.086915	0.9899547	1	4
Women_equal right st. tradition	1.545368	0.7807403	1	5
Educ_boy vs. girls	3.247373	1.040724	1	5
Managing economy	3.019102	0.6657548	1	4
Improving living standards	2.888252	0.7277125	1	4
Creating job	2.887297	0.7242726	1	4
Makes price down	2.628462	0.8287796	1	4
Narrow income inequality	2.657116	0.8156596	1	4
Reduce crime	3.196753	0.661325	1	4
Improving health	3.197708	0.6675162	1	4
Addressing educational needs	3.30277	0.6566486	1	4
Improve water and sanitation	2.748806	0.8150919	1	4

(*Continued*)

Table A1. (*Continued*)

Variable	Mean	Std. Dev.	Min.	Max.
Ensuring enough to eat	2.687679	0.7515892	1	4
Fight corruption	2.86724	0.7385495	1	4
Resolve violence and conflict	3.152818	0.6482431	1	4
Providing electricity	2.688634	0.8748093	1	4
Employment status	2.144222	1.208329	0	3
Education level	2.733524	2.155223	0	8
Gender	0.5893028	0.4921955	0	1
No. of observations		1,047		

Source: Own computation.

Table A2. Breusch and Pagan Lagrangian Multiplier Test for Random Effects

Estimated Results		
	Var.	sd = sqrt(Var)
hdi	.0101417	.100706
e	.0000948	.0097341
u	.0019397	.0440419
Test: Var(*u*) = 0		
chibar2(01) = 602.15		
Prob > chibar2 = .0000		

Table A3. Relationship Between Poverty (Proxied by Human Development Index) and Good Governance (for Each Governance Indicator)

Human Development Index	Coef.	Std. Err.	*z*	*P* > *z*	[95% Conf.	Interval]
Voice and accountability	.0060622	.0028555	2.12	.034	.0004656	.0116588
Political violence	−.0004902	.0015075	−0.33	.745	−.0034447	.0024644
Government effectiveness	.0192476	.0036961	5.21	.000	.0120033	.0264918
Regulatory quality	−.0032113	.003285	−0.98	.328	−.0096498	.0032271
Rule of law	.00774	.0037352	2.07	.038	.0004192	.0150608
Control of corruption	−.0072017	.0031828	−2.26	.024	−.0134399	−.0009636
Gender inequality index	−.0420234	.0234554	−1.79	.073	−.087995	.0039483
Ln(economic freedom)	.0240912	.005776	4.17	.000	.0127705	.0354119
FDI/GDP	.0073879	.00248	2.98	.003	.0025273	.0122486
Export/GDP	.0121184	.0074454	1.63	.104	−.0024744	.0267112
Import/GDP	−.0040318	.0050848	−0.79	.428	−.0139977	.0059342
Inflation	−.0115636	.0058029	−1.99	.046	−.0229371	−.0001901
Military expenditure/GDP	.283317	.071809	3.95	.000	.1425739	.4240601
Unemployment	.0530791	.033425	1.59	.112	−.0124326	.1185909
Vulnerable employment	.0031493	.0275727	0.11	.909	−.0508923	.0571908

Table A4. Rotated Factor Loadings (Pattern Matrix) and Unique Variances

Variable	Government Effectiveness	Political Institutions	Gender Inequality	Uniqueness
Unsafe walk		.7789		.3773
Crime/fear in home		.8326		.2809
Stolen something from house		.5465		.6916
Physically attacked		.6819		.5265
Equal/unequal leadership			.3742	.8362
Men vs. women_leaders			.5190	.7140
Women_equal right st. tradition			−.4445	.7971
Educ_boy vs. girls			.4058	.7992
Managing economy	.7623			.4047
Improving living standards	.8184			.3160
Creating job	.6842			.5115
Makes price down	.6525			.5573
Narrow income inequality	.7415			.4240
Reduce crime	.5487			.5884
Improving health	.4727		.3454	.6368
Addressing educational needs	.4573		.4004	.6103
Improve water and sanitation	.5181		.3221	.6277
Ensuring enough to eat	.7208			.4699
Fight corruption	.6395			.5655
Resolve violence and conflict	.5458			.6046
Providing electricity	.4168			.7348

Source: Own computation.

Note: Blanks represent abs(loading)<.3.