

Does Gender Inequality Within a Country Increase the Burden of HIV on Females?

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Abstract

This paper evaluates the claim that the persistent burden of HIV/AIDS on females in developing countries is caused by gender inequality within those countries using OLS regression. Previous economic literature explores behavioural change in the face of HIV/AIDS, and how gender inequality may hinder the ability of females to decrease their risk. This paper deviates from previous work through both the variables used and the analysis provided, with the most lasting contribution likely being the use and analysis of the “Social Institutions & Gender Index” (SIGI) as a measure of gender inequality, particularly for low-development regions. The SIGI uniquely captures country-specific factors that should directly impact a woman’s “intra-household bargaining power”: a potential mechanism for a causal relationship between gender inequality and the HIV/AIDS burden on females. The results of this study not only provide support for the use of the SIGI as a measure of bargaining power, but also evidence that gender inequality is contributing to HIV/AIDS in female populations in some regions.

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Introduction

HIV/AIDS has taken many lives worldwide since its first appearance in human populations. In more recent years, however, The HIV/AIDS epidemic in developed countries represents a great victory of both the medical and political/social communities, as this a disease whose spread was contained through advancements in understanding the disease and medical treatments, as well as educating the public on how to drastically reduce risk of obtaining HIV/AIDS. In developed countries such as the United States, the persisting HIV/AIDS epidemic is heavily concentrated in specific groups such as men who have sex with men, intravenous drug users, and African Americans due to both the mechanisms of HIV transmission and racial health inequities (CDC, 2014). In developing nations, however, the aforementioned “victory” is far from being realized, with large numbers of the population still being affected by this disease, across all demographics. In

Sub-Saharan Africa, for example, where the AIDS epidemic is still extremely severe, 58 percent of HIV-positive adults are women (WHO, 2003). This lies in stark contrast to the small proportion of women in the U.S. making up new HIV infections, as demonstrated by Figure 1 in the Appendix. Despite the fact that countries with high socio-economic development have very low prevalence and incidence of HIV/AIDS in the female demographic, UNAIDS has identified females as a target group being “left behind” in the gains being made in combatting the HIV/AIDS epidemic (UNAIDS, 2014). Increasing or even stagnant rates of HIV transmission in females is concerning for two reasons: first, heterosexual transmission of the virus is far less likely than other methods such as homosexual intercourse and through intravenous drugs, and secondly because HIV/AIDS is a disease whose risks are very easily mitigated through fairly simple actions. The data on persistent HIV transmission rates in women suggest that women are not taking enough action or *precaution* to reduce their risk of infection.

This thesis seeks to test the sociological theory that these persistent gender differences in HIV/AIDS “...stem from...socially constructed ‘gender’ differences between women and men in roles and responsibilities, access to resources and decision-making power” (Tsafack Temah, 2008) under an economic framework. The theoretical aspect of my study is based on the idea of intra-household bargaining, and how measures of gender inequality for a particular region can reduce the bargaining power of women in marital and non-marital relationships. This theoretical background provides the justification for a potential causal relationship between a measure of gender inequality for a country and the *ratio* of female to male *incidence rate* (defined as the number of new cases per 100,000 people in a given year) within that country. The use of *incidence over prevalence*¹, is a deliberate choice as this allows us to observe the number of females that have newly acquired the virus, in an environment where individuals largely know the mechanisms of the disease, the prevalence of the disease in their society, and ways to reduce their risk. The use of incidence as the dependent variable, as well as employing the new and unique “Social Institutions & Gender Index” as the key independent variable, representing gender inequality and female bargaining power, differentiate my work from previous empirical studies on this issue.

The following paper begins by outlining the economic intuition and past work motivating the economic analysis of HIV/AIDS, with a particular focus on the impact of gender inequality on HIV/AIDS under an economic framework. After the framework is set out, there will be a description of the methods employed and the data used in the empirical component of this study. Finally, results of the empirical study are presented and analyzed, and conclusions are drawn.

¹Prevalence is used as the dependent variable in many economic studies on HIV/AIDS such as “Gender Inequality and the HIV/AIDS Epidemic in Sub-Saharan Africa” (Tsafack Temah, 2008).

1. Literature Review and Theoretical Background

HIV/AIDS in Existing Literature

Many economists have attempted to understand realities of the HIV/AIDS epidemic under a framework of microeconomics, and rational individuals making choices in response to existing conditions. Philipson and Posner (1993) focused on the risks that AIDS posed to American society at the time. They referenced a poignant shift in behaviour (from risky to safer) in homosexuals and intravenous drug users in response to the AIDS threat as a justification for using economics to analyze the spread and combatting of HIV/AIDS (Philipson and Posner, 1993, 68). The observed reduction in infection rates of both HIV/AIDS and other STI's in homosexuals at this time in addition to survey data on sexual practices demonstrates that increased prevalence of HIV (and therefore higher costs of unsafe sex), lead to a shift away from risky sex (Philipson and Posner, 1993, 69). This provides some empirical justification for the microeconomic analysis of HIV/AIDS as being useful.

Philipson and Posner (1995) also addressed the differences between the transmission of HIV/AIDS in developed countries and in developing countries (particularly those in sub-Saharan Africa). This paper proposes some issues specific to Sub-Saharan Africa that provide an economic explanation for the lack of behavioural changes made in response to high HIV prevalence in this region. These issues include a lack of education that decrease perceived costs of risky behaviours and benefits of safe behaviours, lower life expectancy which decreases cost of acquiring HIV/AIDS (and thus lowers cost of risky sex), and higher cost of safe practices such as condoms (Philipson and Posner, 1995, 840). In this paper, Philipson and Posner also introduced the issue of gender differences, and how unusually in Sub-Saharan Africa women's prevalence of the disease is equal to that of men, and that the predominant mode of transmission tends to be heterosexual intercourse, as opposed to homosexual intercourse and injected drug use as in the US and other developed countries (Philipson and Posner, 1995, 842). Philipson and Posner briefly discuss their intuition that these differences can largely be explained by gender inequality due to the fact that higher gender inequality increases the likelihood of women turning to sex work as they have few labour market opportunities, and also lowers their ability to negotiate safe sex practices (Philipson and Posner, 1995, 844). These issues are discussed in other economic literature related to HIV/AIDS with regards to other social issues, which I will address in the next section.

Gaffeo (2003) also provides some motivation for a microeconomic analysis of HIV/AIDS economics, as it provides a useful framework for analyzing the continued spread of the disease under "market failures." Gaffeo importantly introduces the externalities posed by the institution of marriage in many developing countries (Gaffeo, 2003, 31). The inability of women to be granted divorce, for example, reduces their ability to react to change in incentives for pursuing safe sex. If they suspect their husband of having extra marital relations for example, there is little they can do to demand safer sex or even to reject intercourse, as they do not have the ability to leave the marriage if their demands are not met.

Theoretically, economics can demonstrate how there may be a causal link between gender inequality and HIV/AIDS rates, particularly in some regions of the world. To demonstrate this concept empirically, however, can be difficult and thus there is less literature that presents empirical analysis. Richardson et al. (2014), motivates my work in that this study is a cross-country empirical analysis of the impact of gender inequality on HIV transmission. However, the variables used are very different from the methods I employ. Richardson et al.'s (2014) paper is interested in determining how gender inequality is related to the primary mode of HIV transmission within in a country: namely whether or not an epidemic is primarily driven by transmission through heterosexual transmission, or men who have sex with men and intravenous drug use transmission (Richardson et al., 2014). This paper is limited to low development areas, where the vast majority of epidemics are driven by heterosexual transmission, and instead explores the relationship between gender inequality differences in developing nations and the female to male ratio of HIV incidence. Tsafack Temah's (2008) earlier draft, "Socio-Economic Inequalities and HIV/AIDS Epidemic: Evidence from Sub-Saharan Africa" evaluates how both economic and gender inequalities are related to HIV prevalence within a country. Tsafack Temah (2008) uses a variety of variables that measure gender inequality as independent variables such as female estimated earned income and percentage of women in the labor force, instead of a single index (Tsafack Temah, 2008). The significance of employing the Social Institutions & Gender Index in this study is to evaluate entrenched social norms and institutions as a measure of bargaining power, and determine this effect on HIV/AIDS gender ratios.

These previous works of literature demonstrate how emerging gender disparities in the HIV/AIDS epidemic can be explained through economic concepts. Another crucial economic concept in analyzing this issue under an economic framework is bargaining power, particularly intra-household bargaining power, which allows us to understand how different variables affect an individual's decision-making power within relationships. This is important in analyzing the impact of gender inequality on the gender disparities within HIV/AIDS incidence because in countries where women have little social and economic power, their power to make meaningful decisions about both their sexual activity and their health (both key determinants of HIV transmission) can be reduced.

Theoretical Considerations

The concept of intra-household bargaining provides the key motivation for my research, and thus it is important to define what this means. Intra-household bargaining represents the move away from viewing household and marital decisions under a unitary model and single set of preferences. Instead, intra-household bargaining allows us to view individuals within a relationship or household as possessing competing preferences that require bargaining among the parties to achieve cooperative or non-cooperative solutions. As outlined in Katz (1997), each individual has some ability to bargain (or exercise "voice") over household decisions (Katz, 1997, 32). At least under the cooperative view, this ability is largely decided by the individual's "threat" or "fall-back" position, typically seen as their ability to "exit" the household. This position is largely impacted by social conditions, Katz argues, such as the view of divorced women in

society and their ability to earn income outside of marriage. This is important to the impact of gender inequality on HIV/AIDS, as bargaining can also be applied to sexual decisions. In the view of marriage, the prevalence of extra-marital affairs by males in gender-unequal societies places females at risk due to their inability to bargain safer sex with their husbands. Additionally, the model can be applied to non-married partners, in my opinion, more accurately under a non-cooperative model.

Luke (2005) provides some insight into the market for sex in Sub-Saharan Africa, and its implications for HIV/AIDS transmission. This paper discusses the idea of “sugar daddy” relationships, in which young women engage in sexual relationships with older more wealthy men, and a key part of this relationship entails transfer of resources from the male to female (Luke, 2005, 6). While this is not quite a case of prostitution, and likely the female is not solely dependent on the sugar daddy for income, the degree to which she relies on the transfer of resources can greatly reduce her ability to bargain safe sex practices. Luke (2005) points to the shift of resources away from females in developing countries (both from parents and the labour market), low education, and high ratio of young females as a reason for the dependence on these sorts of relationships.

This type of relationship tends to follow the “conjugal contract” model as outlined in sources such as Alderman et al. (1995). This more non-cooperative model views the household participants as having their own income to spend, yet one partner makes transfers to the other as a result of bargaining. This can be clearly applied to marriage but also transactional sexual relationships. Part of this negotiable transfer can also be seen as safe sex practices such as condom use and sexual exclusivity. Once again, bargaining over this transferable income or resources is dependent on the threat point of the women either as divorce, or ending the sexual relationship which in turn depends on sex ratios, dissolution of marriage laws, labour opportunities for females, etc.

Typically, empirical work regarding intra-household bargaining power looks at how changing variables of households affects outcomes within those households. For example, how mother’s education may impact outcomes within the household such as child health, or outcomes for the female children¹. My thesis is largely differentiated from many of these works because I do not seek to examine the impact of a changing variable such as income or education on a specific outcome, but instead am motivated by the possibility of how social realities within a *country* effect the bargaining power of all women within that country to achieve safer sexual practices and sexual health. Mabsout and van Staveren (2005) provided some insight into how bargaining power of women can be greatly impacted by institutions. I use information from this paper in my analysis of how aspects of a country’s institutions, laws and customs impact overall bargaining power of the women within that country, which can translate to a disproportionately high amount of new cases of HIV (HIV/AIDS incidence for females).

¹ i.e. Maiga, Eugenie WH. *The Impact of Mother’s Education on Child Health and Nutrition in Developing Countries: Evidence from a Natural Experiment in Burkina Faso*. African Center for Economic Transformation (October 2011).

2. Empirical Methodology and Data

Data and Variables

Table 2 in the Appendix provides a detailed description of the variables considered, and those eventually used in the final model.

In order to effectively test whether or not the bargaining power of women has an impact on the gender ratios of HIV/AIDS incidence, it is important that my key independent variable is a proxy for gender inequality that incorporates those institutions, laws and customs that are likely to impact overall bargaining power of women. The “proxy” or index I have chosen for my research is the “Social Institutions & Gender Index” (SIGI) created by the OECD (2014). Table 1 in the appendix reports all 5 of the SIGI indices, and why each factor is relevant to female bargaining power. The SIGI is compiled from an average of these five indices, with each country receiving a final index value between 0 and 1, with a value closer to 1 representing higher gender inequality, and thus less female bargaining power within relationships. The reason I chose this specific index is because it seeks to incorporate factors that measure systemic and institutional discrimination within countries, such as formal and informal laws, norms and practices, which are often hard to quantify (OECD Development, 2014). This index is heavily concentrated towards developing nations, which is reasonable for my research because gender disparities of HIV/AIDS incidence and prevalence, i.e. the “feminization” of HIV/AIDS is largely concentrated in low income, less development nations.

As mentioned previously, this study critically uses HIV incidence rate (new cases) data to generate the ratio of female to male incidence, the dependent variable. The source of these data is the Institute for Health Metrics and Evaluation (IMHE, 2014)). The IMHE uses The UNAIDS Spectrum Model to produce their estimates, the methodology of which is beyond the scope of this study (Murray, 2014). Both UNAIDS (2014) and, by extension, the Institute for Health Metrics and Evaluation (2014) are presenting *estimates*, as it would not be possible to determine the exact number of people living with HIV due to the fact that people often do not know this information themselves or will not share this information (UNAIDS, 2014). UNAIDS is confident in their estimates, which incorporate all country HIV data available, information from pregnant mothers, and information in key populations in areas where epidemics are concentrated, as well as including assumptions from experts and literature. These data are provided from 1990-2013, yet only the most recent year is used, as this is a cross-sectional, non-time varying study. IMHE (2014) estimates, again drawn from the UNAIDS Spectrum model (2014), are also used for HIV prevalence, which is used as an important independent variable expected to impact the ratio of female to male HIV Incidence.

Outside of the key variables that represent the relationship between gender inequality (Bargaining power of women measured by the SIGI) and the burden of HIV on females (sex ratio of HIV Incidence measured by the IMHE data), there were many other variables considered that may also have an impact on the dependent variable. In the

section on “Methodology”, an exploration into the other independent variables that were considered and eventually chosen to model this relationship will be provided.

Evolution of Model

HIV/AIDS is clearly a very complex disease, and epidemics in different regions are influenced by both the scientific and social realities of the specific area. The first area in which my model has evolved from the beginning of this undertaking to the final product is through the form of the dependent variable. My initial research plan outlined that I would evaluate the relationship between gender inequality and HIV/AIDS through regressing *Female HIV Incidence* on a measure of gender inequality, highly related to the bargaining power of women, and then using a regression with the *Male HIV Incidence* as an imperfect control. As my research unfolded it became clear that a more feasible dependent variable would be a generated ratio between the females and males. Since the data I acquired was a cross section of countries, the variation between the incidence rates of each observation was very large and clearly many factors would be involved in describing the cause of this variation. By using the ratio, the number of variables that would have to be included in the model to avoid large omitted variable bias can be drastically reduced, because now only variables that are likely to impact this gender disparity in HIV need to be included, as opposed to all factors related to both gender inequality and HIV rates.

The key independent variable, the SIGI, representing key components of intra-household bargaining power of women within a country, was also altered slightly from how I originally intended to use it. First, as previously mentioned the SIGI is largely skewed towards including low income, low development nations, as are the focus of this study. However, there are a few very highly developed countries whose results were included in the SIGI. Since higher development countries were not adequately represented, and the analysis of my paper is focused around developing countries and the nuances of the HIV epidemic specific to this type of region, I eliminated countries that are considered “very high development”, or within the top 50 ranking by the Human Development Index. Table 3 provides a list of countries initially provided by the SIGI, and highlights the countries that were dropped as a result of having a very high level of development.

Additionally, while I initially believed each of the five SIGI subindices adequately represented female bargaining power (higher score means higher inequality, and thus lower bargaining power), there is actually a valid economic argument for why one of the subindices has the opposite result on bargaining power. Subindex 3 represents “son bias”, demonstrating a preference for men in society, but also “missing women” suggesting that in countries where this value is high, there may be higher levels of infanticide, death by neglect, and abortion for female children. If there are more men in society, however, this can actually be equated with higher female bargaining power, particularly in sexual relationships, as the female can gain a new partner more easily. As a result, my final regression model generates a new variable as the index that represents female bargaining power (gender inequality) using only the other four SIGI subindices.

Methodology

In order to determine the existence and magnitude of a relationship between bargaining power in a country and the relative male and female HIV incidence, I regress the SIGI on the ratio of female HIV incidence (cases per 100,000 population) to male HIV incidence (cases per 100,000 population). As previously mentioned, a strong benefit of the SIGI is that the index is split into five distinct measures of discrimination/inequality, and thus I can also use the measure generated that discludes subindex 3, “Son Bias”, creating an even more accurate measure of female bargaining power. I believe the gender ratio of incidence is a good indicator because it demonstrates a “feminization” of HIV/AIDS incidence in the region if females are disproportionately represented in the new cases of HIV within a country. This analysis can provide a strong case for the global community to intervene in these types of systemic gender discrimination. I prefer incidence to prevalence because as demonstrated by the research of UNAIDS (2014) and other organizations, the emergence of higher prevalence of HIV in women is a more recent phenomenon with the gap between men and women narrowing in recent years (WHO, 2003). Prevalence measures include many people who were infected early in the epidemic when knowledge about the disease was low and the ability for individuals in developing countries to attempt to change their behaviour or the behaviour of their spouse/sexual partner was low. In today’s landscape, people even in the developing world are equipped with the knowledge and tools to protect themselves, and thus incidence rates increasing for females indicates that a market failure is occurring and that females are not taking an efficient level of precaution against this fatal disease. My **hypothesis** is that the SIGI, or more specifically the “new index” will be positively correlated with the gender incidence ratio, suggesting that gender discrimination that negatively impacts bargaining power may partially explain this market failure.

Clearly, the nuances of HIV/AIDS transmission are very complicated and dependent on both biological and social factors. Thus, I do not attempt to suggest that gender discrimination is the only factor contributing to a higher female incidence rate in many developing countries, but rather that it is one factor that can likely be addressed by global powers. In order to get an estimate with the least amount of bias, I must include other independent variables that are likely to impact the gender HIV/AIDS incidence ratio that are also expected to be correlated with the SIGI. I include **HIV/AIDS prevalence**, as Hertog (2008) describes why older, more established epidemics in the developing world are expected to tilt towards female incidence:

“In the early years of an epidemic driven by heterosexual transmission, HIV cases tend to be concentrated among female commercial sex workers and their clients such that male prevalence exceeds female prevalence. Over time, female prevalence increases as the wives and non-marital partners of those male clients become infected, eventually shifting the balance of HIV prevalence to women.” (Hertog, 2008, 3)

Prevalence works as a proxy for maturity of an epidemic as the longer an epidemic exists, the more people will be infected, particularly in the developing world where medical

breakthroughs have not had as much of an impact in curbing the epidemic. Prevalence is likely to be correlated with the SIGI as less developed countries tend to have less gender inequality as well as higher HIV prevalence.

In early regressions, I included **GDP/capita** as both gender equality and GDP per capita which are related to a country's level of development. This tends to be correlated with HIV levels and transmission rates. On the advice of my peers I eventually decided to use **GNI/Capita** as a measure of economic development in the final regression: GNI/Capita includes only production within a country, and thus can more accurately gauge the standard of living of individuals within that country. GNI/capita is likely to have an impact on the HIV gender ratios in developing countries because in poor countries where living conditions are poor, people do not have the same access to resources that will allow them to gain information and methods of protecting themselves against HIV/AIDS. Particularly, women in poor countries tend to have an even more restricted access to resources. I previously considered other variables, namely **health expenditure per capita** and dummy variable for **Muslim Majority** that were likely to contribute to the female HIV incidence, but they were both statistically insignificant and lacked a significant theoretical basis to have an impact on the *sex ratio* of HIV incidence. Finally, I considered the use of other variables frequently used as indicators of female bargaining power or gender inequality that were *not* included in the SIGI, such as the estimated earned income of females as a percentage of males earned income. Interestingly, when I included the "earned income" variable in regression, the results were not significant. Malhotra and Mather (1997) find evidence from Sri Lanka that while factors such as a woman's educational and employment history provide them greater negotiating power over household *financial decisions*, "domestic power on social and organizational issues may be embedded within more macro-level social institutions" (Malhotra and Mather, 1997, 626). In other words, when evaluating the impact of bargaining power on issues outside of financial decisions (such as money allocated to female children), including sexual decision-making, employment and educational factors of bargaining power may be less important than more institutionalized measures such as those included in the SIGI.

As a result of the above discussion, the final empirical model is as follows:

$$[\text{HIVincrat}] = B_0 + B_1 \text{SIGI (original, and with dropped subindex 3)} +$$

$$B_2 \text{HIVprevalence} + B_3 \text{GNI/capita} + e$$

Table 2 in the Appendix provides a detailed description of the variables. Once the regression results are presented, I assess both the economic and statistical significance of the key variables in order to draw conclusions.

3. Results and Discussion

Results

The following presentation and analysis of results focuses on those results produced with the data that exclude highly developed regions, and the model presented in the previous section. Initial findings that were produced with the entire SIGI data set and alternative variables contributed significantly to this final model, and thus are presented and briefly explained in Appendix B: Initial Empirical Results.

As previously mentioned, my final model yields two separate regressions, one in which the key independent variable is the full Social Institutions & Gender Index, and one in which the key independent variable excludes the third subindex representing “Son Bias”. Results from the first regression, with the full index including subindex 3, are presented in Table 1. In this first regression, the key independent variable is not statistically significant, which is expected, as one fifth of the factors making up the SIGI do not adequately reflect reduced female bargaining power.

**Table 1: Regression with SIGI as Independent Variable, HIVincrat
Dependent Variable**

R Squared= 0.3312

<i>Independent Variables</i>	<i>Coef.</i>	<i>Std. Err.</i>	<i>P Val</i>
SIGI	.270096	.2701611	.320
HIVprev	1.41e-07	4.30e-08	.002
GNIcap	-.0000307	6.44e-06	.000

While the above regression has an acceptable R squared, suggesting that the variables jointly explain 33.12 percent of the variation in the sex ratio of HIV incidence, this model does not allow us to draw meaningful conclusions. The SIGI appears to be “economically significant” as a coefficient of .270096 suggesting that when the SIGI increases by 1 unit (increasing inequality measure by 100 percent), the female to male ratio of HIV incidence will increase (shift burden further to females) by .27, which is significant considering the range of values for the dependent variable are approximately .15-1.67. Unfortunately, however, this is not a statistically significant result, and we cannot confidently make the conclusion that the SIGI has any impact on the sex ratio of HIV incidence.

Tables 2 and 3 provide regression results using indices that have dropped subindex 3, “son bias”. Table 2 presents a regression that used an index created out of an equal weighting of SIGI subindices 1, 2, 4 and 5, whereas Table 3 provides regression results that utilized an index that weighted subindices 2 and 4 more heavily. The justification for

such weighing subindices 2 and 4 more heavily is found in Appendix B, where the initial empirical work demonstrated that these indices were significant on their own in explaining sex ratios of HIV incidence. The results from both of these regressions represent the most significant findings of this paper, as we have found a way to adequately measure female bargaining power in developing countries, capturing social institutions and norms.

Table 2: Regression with NewIndex1 (Index with Equal Weighting of SIGI Subindices 1, 2, 4 and 5) as Independent Variable, HIVincrat as Dependent Variable

R Squared= 0.4268

<i>Independent Variables</i>	<i>Coef.</i>	<i>Std. Err.</i>	<i>P Val</i>
NewIndex1	.1055749	.0296745	.001
HIVprev	1.41e-07	4.05e-08	.001
GNIcap	-.0000387	5.59e-06	.000

Table 3: Regression with NewIndex2 (Index with Unequal Weighting of SIGI Subindices 1, 2, 4 and 5) as Independent Variable, HIVincrat as Dependent Variable

R Squared= 0.4336

<i>Independent Variables</i>	<i>Coef.</i>	<i>Std. Err.</i>	<i>P Val</i>
NewIndex2	.1610752	.0430784	.000
HIVprev	1.41e-07	4.02e-08	.001
GNIcap	-.0000374	.0537534	.000

The above tables represent regression results that allow us to draw more meaningful conclusions. The R-squared value has improved as compared with the first regression, allowing us to conclude that the model which uses “New Index 1” or an equal weight average of SIGI subindices 1, 2, 4 and 5 explains 42.68 percent of the variation in sex ratios of HIV Incidence, and the model with the unequally weighted “New Index 2” explains 43.36 percent of the variation. In both of these models, HIV prevalence has a small positive effect on sex ratios of HIV incidence, reiterating the previously mentioned idea that older HIV epidemics (that should result in higher prevalence in a region) tend to shift the burden slightly towards females (Hertog, 2008, 3). Additionally, GNI per capita

has a slightly negative effect on sex ratios of HIV incidence, which was predicted, as we expect more developed and wealthy nations to have less inequality in their healthcare practices, allowing women to be less disadvantaged. The most interesting result in Tables 2 and 3 are clearly the findings regarding the gender inequality index, represented by NewIndex1 and NewIndex 2. Both indexes result in a significant positive effect on sex ratios of HIV incidence, indicating that gender inequality (or reduced female bargaining power) has the expected result of a higher female burden of HIV. When the index is calculated using an unequal weighting scheme, the coefficient shifts from .1055749 to .1610752, suggesting that subindices 2 and 4, Restricted Physical Integrity and Restricted Access to Resources & Assets, do in fact have a more significant impact on female bargaining power over sexual decision making, and as a result the female burden of HIV incidence in a region.

These results demonstrate a statistically and economically significant correlation between both the equally and unequally weighted average of four SIGI subindices (Discriminatory Family Code, Restricted Physical Integrity, Restricted Access to Resources & Assets and Restricted Civil Liberties) and the HIV incidence sex ratio in the countries studied. Due to the literature such as that presented by Mabsout and van Stavaren (2005), I believe there is significant evidence to suggest that the SIGI is a measure of factors that have significant impacts on the bargaining power of females within a specific country and embodies the following: “Institutions affect individual level bargaining power, for example, by limiting women’s access to resources, and household level bargaining power...”(Mabsout and van Stavaren, 2005). I believe this way of thinking provides a strong start in thinking about the causative factors of gender inequality on the feminization of HIV/AIDS incidence. Once again, the brief explanations in Table 1 of Appendix A provide evidence towards why this index is compelling: Subindices 1, 2, 4 and 5 negatively contribute to the threat point of all women in society or the ability of women to make decisions regarding their sexual behaviour.

Limitations

The complex relationship between gender inequality and the burden of HIV on females is one that should continue to be studied in the face of increasing data quality. Since this study is largely confined to low development regions with limited governmental resources, many variables that I would have liked to include were excluded because of the large number of countries that would have to be excluded due to missing data. Examples of variables that were not available for many of the countries stated are education gender ratios (especially as the level of education increased past primary) and female literacy rate. As this data largely becomes available in more developing nations, the model used in this study can be reevaluated and expanded to include more variables that may increase its explanatory power.

Similarly, improved data collection and analysis in developing regions as time progresses can also help with the reliability of the Social Institutions & Gender Index. Since the SIGI has only provided results for one year (2014), the methods used to determine values, and thus a sort of ranking of the studied countries, are in their infancy. As this index

becomes more established, we can only hope that the reliability of the index as a measure of bargaining power will increase.

Causality

While the STATA results demonstrate that there is clear correlation between the Social Institutions & Gender Index, which serves as a measure of female bargaining power, and the sex ratios of HIV Incidence in a country, this does not necessarily imply causation. The two main possibilities that could result for this correlation without bargaining power *causing* higher burden of HIV on females are: 1) There is a factor outside of the model that is correlated with the SIGI that is actually causing the increase in relative female HIV incidence; or 2) There is reverse causality and HIV burden on females is actually causing a higher SIGI score. The nuances of this relationship tend to disqualify the possibility of employing a random experiment in which one can attribute changes in the dependent variable to a program or policy that randomly assigned values of the independent variable (a method used in papers such as Orfei, 2012). Since the particular aspects of bargaining power I am interested in are related to institutions and social norms that are entrenched within a society and the individuals that live there, one cannot simply use a program to change these norms. This, however, does not mean that I do not suspect causality from my results.

As previously mentioned, the two main issues I am concerned about potentially causing “correlation without causation” are that an unobserved variable is the true explanation for the increase in female burden of HIV or reverse causality. Reverse causality does not seem theoretically likely in this situation, as the SIGI attempts to measure factors that have been entrenched in society for a very long time, and thus are unlikely to be a factor of changing HIV ratios. Additionally, it is hard to imagine another factor that would be highly associated with gender inequality that also has an impact on the sex ratios of HIV incidence. In Hertog’s (2008) paper, female STI rates are noted as an indicator of higher female: male ratios of HIV prevalence. This is not a concern for this study however, as even with female STI rates likely being associated with gender inequality, the mechanisms by which females are more at-risk for other STI’s are the same as those that put females at higher risk for HIV. While there may be unaccounted factors that also contribute to the composition of sex ratios of HIV incidence, there is a strong theoretical justification to support the fact that female bargaining power in developing countries, as demonstrated by the SIGI, is a *determinant* of HIV incidence sex ratios.

As mentioned several times throughout this paper, in developing regions such as Sub-Saharan Africa, the HIV burden is not significantly concentrated in at-risk populations such as men who have sex with men and intravenous drug users, but frequently acquired through heterosexual intercourse, often when the individual is in a relationship or marriage (Gerritson, 2014, 1). While susceptibility to infection in this demographic (heterosexual couples) is low in Western countries, the high rates of infection in low development/low income countries demonstrates that women may lack the power to take sufficient precaution against acquiring HIV. Intra-household bargaining refers to a model of household decision-making that can be extended to both married and non-married

couples, such as those in developing countries. An important determinant of female bargaining power in this model, the power of women in these types of partnerships to affect decisions, is the “threat-point” of the woman, or the point at which she would be better off leaving the relationship or marriage. As I have previously described, the SIGI subindices (apart from subindex 3) very accurately reflect the ability of women to achieve favorable outcomes outside of a partnership with a male in terms of economic attainment, political/community participation, physical safety and family status. The fact the higher SIGI scores of a country represent this reduced threat point suggest that women in regions of this high inequality and high SIGI score have a reduced ability to bargain over decisions that benefit them, including safer sexual practices within a relationship such as condom use and monogamy. The statistical and economic significance of the “newindex” generated from the SIGI, then, likely represents this causal mechanism of bargaining power.

4. Conclusion

This paper has drawn significant conclusions regarding the relationship between female bargaining power and the burden of HIV on females in developing countries, through demonstrating an economically and statistically significant correlation between the Social Institutions & Gender Index, and the female to male ratio of HIV incidence in 98 countries. Nuances of intra-household bargaining theory, and the ability of women to influence decisions within relationships in developing countries, allow us to hypothesize that the observed positive relationship of gender inequality (signifying decreased bargaining power) on the female burden of HIV (represented by the female to male ratio of HIV incidence) is causal. These findings have implications for future research, and future developmental work in the studied regions.

Much of the significance of this study’s results lies in the potential for the SIGI, particularly an average or weighted average of the SIGI subindices excluding subindex 3, to represent an adequate measure of bargaining power in developing countries for future economic work. In previous work regarding this gender and HIV relationship as well as other relationships involving bargaining power, the focus has largely been on measures of more measurable indicators of female empowerment such as labor and economic outcomes, education, etc. The SIGI is fairly new and unique in taking an approach that focuses on gender inequality on a systemic and institutional level, and the overall position of women within a society.

Since the SIGI measures gender inequality on a macro and institutional level, the policy recommendations from the results are not as simple as increasing women’s labour or educational opportunities in developing regions. These results suggest that the *view* or *opinion* of a woman’s position in society, and the cultural *norms* and *practices* impact the ability of women to effectively bargain over decision making, particularly regarding their sexual autonomy, in relationships. An investigation into how this can be improved in a country or region is well beyond the scope of this paper, however it is clear that as a country improves the environment for women, not only in terms of legal rights but also

with more informal mechanisms of empowerment, there will likely be a positive effect on health outcomes of women.

HIV/AIDS is a disease that still poses a great threat to quality of life and development in many regions of the world. Mechanisms by which the disease is spread, and behaviours that increase an individual's risk are widely understood, but this increase in understanding has had far less of an impact on combatting the epidemic in developing countries as opposed to developed countries. Low-income nations clearly do not have the same resources to provide medical solutions to AIDS as their high-income counterparts, but the level of disparity suggests that one or more underlying social issues are exacerbating the burden of AIDS in developing countries. Particularly concerning is the fact that women are at a significantly higher risk of developing AIDS in poorer nations as compared with the more developed world. This paper and its findings have been able to demonstrate a probable link between gender inequality and an increased burden of HIV on females, with the suggested mechanism of reduced bargaining power in marital and non-marital sexual relationships as the causal link. I hope that future economic studies will be employed in the face of greater data access and resources in order to reinforce the legitimacy of this paper's findings. While the empowerment of women in both the developed and developing world has been made a priority in the West, the prevailing view in many regions of women being subordinate to men and given little opportunity to thrive outside of a relationship needs to continue to be combatted. The fact that gender inequality in societal values and institutions, as represented by the Social Institutions & Gender Index, may reduce the ability of women to make safe decisions regarding their sexual and reproductive health, clearly poses a risk to public health in developing regions, and thus these entrenched social values and customs need to be targeted by the global community.

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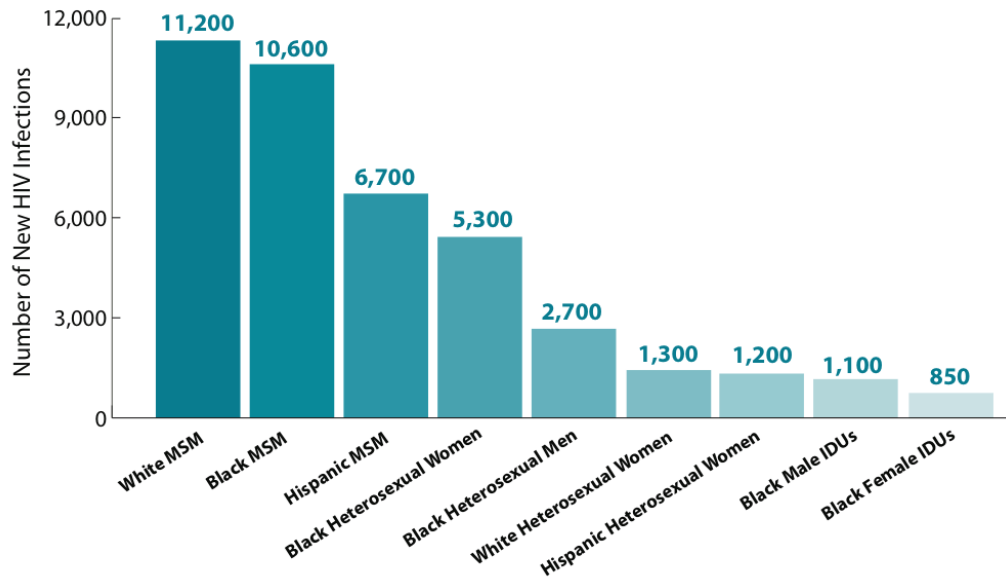
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Appendix A: Relevant Facts and Figures

Figure 1: Estimated New HIV Infections in the United States, 2010, for the Most-Affected Sub-Populations



Source: CDC (2014).

Table 1: Social Institutions and Gender Index- Relevance to Female Bargaining Power

Factor	Description	Relevance
Discriminatory Family Code	<ul style="list-style-type: none"> - Legal Age of Marriage - % Early Marriage - Parental Authority (In Marriage and Divorce) - Inheritance (Widows and Daughters) 	Legal age of marriage and prevalence of early marriage can specifically relate to female bargaining rights in a marriage, as young wives tend to have less bargaining power. If women have less legal rights within the marriage and after marriage (due to divorce or death) this can also reduce their bargaining power and their “threat point”, or well-being without the marriage, is undermined.
Restricted Physical Integrity	<ul style="list-style-type: none"> - Violence Against Women (laws on domestic violence, rape and sexual harassment; attitudes towards violence; prevalence of violence in the lifetime) - Female Genital Mutilation Prevalence - Reproductive Autonomy 	Physical violence or threat of physical violence against women in marriage and other sexual relationships reduces their bargaining power, as they may agree to unsafe sexual acts out of fear of violence. Sexual violence such as rape also completely eliminates ability of women to negotiate or bargain with regards to sex. Laws regarding both acts can determine how frequently these events occur. FGM and reproductive autonomy further demonstrate how a culture views the rights of women to her own body, and thus impacts bargaining power.
Son Bias	<ul style="list-style-type: none"> - Missing Women & Fertility Preferences 	Demonstrates the unequal value of men or boys in a society compared to women, and thus can allude to attitudes that would reduce female bargaining power by way of custom.
Restricted Resources & Assets	<ul style="list-style-type: none"> - Secure access to land, non-land assets - Access to Financial Services 	These rights speak to the ability of women to function outside of a marriage and thus impact their “threat point” and ability to bargain over safe sex practices.
Restricted Civil Liberties	<ul style="list-style-type: none"> - Access to public space - Political Voice (Quotas, Representation) 	Political Rights and Representation speak to both the customary view of women which impacts bargaining power as well as the ability of women to have a meaningful life outside of marriage, which impacts their threat point.

Sources: OECD Development (2014), Mabsout and van Staveren (2005).

Table 2: List of Considered Variables; * indicates inclusion in final model

Variable	Description	Reason	Source
*HIVincrat “HIV Incidence Sex Ratio” (DEPENDENT)	[New female cases of HIV per 100,000 population/New Male Cases of HIV per 100,000.] If greater than 1, more females than males acquiring HIV in period, if less than 1, more males than females.	Dependent Variable: demonstrates level of feminization of HIV incidence.	Institute for Health Metrics and Evaluation
SIGI	Value for the SIGI per country. This is measured on a scale of 0-1. A higher SIGI value indicates a higher level of discrimination or inequality.	To represent gender inequality, particularly those factors that are expected to impact female bargaining power. Expect to see that this value is correlated with dependent variable	OECD Development
SIGISub1,2,3,4,5	Value for SIGI subindices 1= Discriminatory Family Code 2= Restricted Physical Integrity 3= Son Bias 4= Restricted Resources & Assets 5= Restricted Civil Liberties	Use in regression as independent variable to see if the SIGI can be altered to more accurately represent bargaining power through different weights.	OECD Development
*NEWINDEX1	Average of SIGI Subindices excluding Subindex 3: Son Bias	Son Bias can actually represent skew in sex ratios, which can increase female bargaining power	
*HIVPREV	The number of adult individuals living with HIV in a country	Independent variable in multiple regression (Reason detailed in body of paper)	Institute for Health Metrics and Evaluation
GDPCAP	GDP Per Capita		World Bank
*GNICAP	GNI Per Capita	Reason preferred over GDP outlined in body	World Bank
HEALTHEXP	Health Expenditure Per Capita		World Bank
MUSLIM	Dummy for whether or not Muslim Majority in country		Pew Research Centre ¹
EARNEDINC	Estimated Earned Income of females (% of Males)		World Bank

¹ Pew Research Center. “Muslim Majority Countries.”

<http://www.pewforum.org/2011/01/27/future-of-the-global-muslim-population-muslim-majority/>

Table 3: Countries in Initial vs. Final Empirical Analysis

* Indicates countries excluded from Final Analysis

Afghanistan, Albania, Angola, Argentina*, Armenia, Azerbaijan, Bangladesh, Belarus, Belgium*, Benin, Bhutan, Bolivia, Bosnia & Herzegovina, Brazil, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Central African Republic, Chad, China, Colombia, Democratic Republic of Congo, Republic of Congo, Costa Rica, Cote D'Ivoire, Cuba*, Czech Republic*, Dominican Republic, Ecuador, Egypt, El Salvador, Ethiopia, France*, , Gabon, Gambia, Georgia, Ghana, Guatemala, Guinea, Guinea-Bissau, Haiti, Honduras, India, Indonesia, Iraq, Italy*, Jamaica, Jordan, Kazakhstan, Kenya, Kyrgyzstan, Lao PDR, Latvia*, Lebanon, Lesotho, Liberia, Lithuania*, Macedonia, Madagascar, Malawi, Mali, Mauritania, Moldova, Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nepal, Nicaragua, Niger, Nigeria, Pakistan, Panama, Paraguay, Peru, Philippines, Romania, Rwanda, Senegal, Serbia, Sierra Leone, Slovenia*, Somalia, South Africa, Spain*, Sri Lanka, Sudan, Swaziland, Syrian Arab Republic, Tajikistan, Tanzania, Thailand, Timor-Leste, Togo, Trinidad & Tobago, Tunisia, Turkey, Uganda, Ukraine, Uzbekistan, Venezuela, Vietnam, Yemen, Zambia, Zimbabwe

Appendix B: Initial Empirical Results

Stata Output

(Dependent Variable always HIVINCRAT)

Regression 1, RSq.= .1114

<i>Independent Variables</i>	<i>Coef.</i>	<i>Std. Err.</i>	<i>P Val</i>
SIGI	.9219723	.2528573	.000

Regression 2, Rsq.= .3732

<i>Independent Variables</i>	<i>Coef.</i>	<i>Std. Err.</i>	<i>P Val</i>
SIGISub1	.0083521	.20093386	.373

Regression 3, Rsq.= .2433

<i>Independent Variables</i>	<i>Coef.</i>	<i>Std. Err.</i>	<i>P Val</i>
SIGISub2	.7936163	.1359505	.000

Regression 4, Rsq.= .0104

<i>Independent Variables</i>	<i>Coef.</i>	<i>Std. Err.</i>	<i>P Val</i>
SIGISub3	-.1831828	.1737377	.294

Regression 5, Rsq.=.1490

<i>Independent Variables</i>	<i>Coef.</i>	<i>Std. Err.</i>	<i>P Val</i>
SIGISub4	.5765528	.1338106	.000

Regression 6, Rsq.= 0.0334

<i>Independent Variables</i>	<i>Coef.</i>	<i>Std. Err.</i>	<i>P Val</i>
SIGISub5	.2888175	.1509214	.058

Regression 7, Rsq.= .1873

<i>Independent Variables</i>	<i>Coef.</i>	<i>Std. Err.</i>	<i>P Val</i>
Newindex	.8255408	.1670219	.000

Regression 8, Rsq.= .3117

<i>Independent Variables</i>	<i>Coef.</i>	<i>Std. Err.</i>	<i>P Val</i>
New Index	.8300425	.2242562	.000
HIVprev	1.09E-07	4.75E-08	.024
GDPcap	-.0000188	.0000161	.245
HealthExp	.0001393	.0001644	.399
Muslim	-.1537987	.0852894	.074

The above regressions provided valuable insight into which SIGI subindices are the most reliable indicators of female bargaining power. Additionally, they provide further evidence that variables such as Health Expenditure and Muslim Majority Dummy Variable do not belong in the final model. Interestingly, GDP/Capita did not generate a statistically significant result, yet GNI/Capita is statistically significant in the final model. These tables provide the evidence of a crucial step in arriving at the final product.