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The Gender Inequalities Index (GII) as a New Way to Measure Gender Inequalities in Developing Countries *

Gaëlle FERRANT†

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†Centre d'Economie de la Sorbonne-Université Paris I Panthéon Sorbonne, 106-112 Bd de l'Hôpital, 75647 Paris Cedex 13, France, (Email: gaelle.ferrant@univ-paris1.fr)

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Abstract

The measurement of gender inequalities has become an important topic in the academic literature. First, appropriate indicators are needed to compare the relative situation of women in developing countries. Second, there is renewed attention given to the relationship between gender inequality and economic growth. Measuring gender inequalities contributes to knowing whether greater inequality promotes or hampers growth. This paper aims to develop a new methodology in order to build an aggregate index of gender inequalities in developing countries: the Gender Inequalities Index (GII). Using Multiple Correspondence Analysis (MCA), the GII aggregates different dimensions of gender inequalities in order to determine endogenously the weight of each variable.

JEL classification: J16, O11, O57, C43

Keywords: Composite index, gender inequality, development economics.

Résumé

La mesure des inégalités de genre est devenue un thème important de la littérature académique. Et ce pour deux raison : tout d'abord, des indicateurs sexospécifiques appropriés sont nécessaires pour comparer la situation relative des femmes dans les pays en développement (PED). En outre, du fait du regain d'attention concernant la relation entre inégalités de genre et performances économiques, une telle mesure permet d'analyser l'impact des inégalités de genre sur la croissance. En effet, mesurer les inégalités entre les sexes contribue à savoir si plus d'égalités favorise ou entrave la croissance. Cet article vise à développer une nouvelle méthodologie en vue de construire un indicateur composite pondéré des inégalités de genre dans les PED : l'Indicateur des Inégalités de Genre (IIG). L'analyse des correspondances multiples (ACM) est une méthode qui permet de construire un indicateur composite pondéré endogène, englobant les différentes manifestations des inégalités de genre dans les PED. Grâce à la neutralité de l'ACM, IIG est construit sans modèle inférentiel en réduisant les biais statistiques liés à la multicolinéarité et aux erreurs de mesure.

Mots clés : Indicateur composite, inégalité de genre, économie du développement

1 Introduction

"*One is not born, but becomes a woman. No biological, psychological, or economic fate determines the figure that the human female presents in society: it is civilization as a whole that produces this creature, intermediate between, male and eunuch, which is described as feminine. Only the mediation of someone else can establish an individual as an other*" De Beauvoir (1949).[1]

The Gender Inequalities Index (GII) is a new alternative to measure gender inequalities in developing countries. It is a new way of addressing the shortcomings of gender-specific measures through a new aggregate strategy using Multiple Correspondence Analysis (MCA). This composite index aims to measure all dimensions of gender inequalities, avoiding the pitfalls of aggregation. Following Sen (1999), who shows the active and central role of women in development, several attempts to quantify gender inequality have been made. However, poor definition and construction lead to misinterpretations and misuses of indicators (Schüler (2006)). Yet, development economists need a good proxy for gender inequalities to compare the relative situation of women in developing countries and to study whether more gender inequalities promote or hamper growth.

At the World Economic Forum in Geneva (2007), all participants recognized that the advancement of women is an important economic, business and societal issue with a significant impact on the growth of nations (Hausmann, Tyson, and Zahidi (2007)). Currently, 185 countries - over 90% of the members of the United Nations - have ratified the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW), adopted in 1979 by the UN General Assembly. The Convention defines discrimination against women as "...any distinction, exclusion or restriction made on the basis of sex which has the effect or purpose of impairing or nullifying the recognition, enjoyment or exercise by women, irrespective of their marital status, on a basis of equality of men and women, of human rights and fundamental freedoms in the political, economic, social, cultural, civil or any other field."[2] It may be pointed out that as Ferber and Nelson (1993) say, "gender is the social meaning that is given to biological differences between the sexes; it refers to

[1] Translation from Simons (1995)

[2] Source: UN Division for the Advancement of Women

social constructs rather than to biological givens".

Econometric models which analyze the relationship between one dimension of gender inequalities and growth are plentiful. Using cross-country and panel regression, Klasen (2002) investigates how gender inequality in education affects long-term economic growth. A large literature documents the links between gender inequality and the next generation's well-being (Murthi, Guio, and Drèze (1995), Thomas (1989), Thomas and Strauss (1997)). It shows that gender inequality in education and access to resources may prevent reductions in fertility, child mortality and expansions in education of the next generation. Hill and King (1995) find a positive and significant relationship between women's school attainment and child mortality. But statistics about gender inequalities are not enough to consider the relationship with growth. If econometric regressions can explain the lack of growth by gender inequality in education, in family law or in political representation, they cannot take into account all the dimensions of gender discrimination (Dollar and Gatti (1999)). In order to reach more definite conclusions on the relationship between gender inequalities and economic performance, a composite index is needed that combines several dimensions of inequalities (Anand and Sen (1995), Dijkstra (2002)). A composite index is used whenever a plurality of variables is needed for the evaluation of a macroeconomic dimension (Munda and Nardo (2005a)).

The UNDP's work has pioneered the construction of a gender inequalities index. It has been an important step in quantifying gender inequalities, as well as in raising attention among academics concerning the issue of measuring gender inequality (Bardhan and Klasen (1999)). The 1995 UNDP Human Development Report presents the Gender Development Index (GDI) developed by Anand and Sen (1995) and the Gender Empowerment Measure (GEM). The GDI is expected to measure well being, in analogy with the Human Development Index (HDI). The GEM is supposed to be a measure of the relative economic and political power of women. But a large literature (Dijkstra and Hanmer (2000), Dijkstra (2002, 2006), Bardhan and Klasen (1999), Jütting and Morrisson (2005), Schüler (2006), etc.) criticizes UNPD gender measures for their methodological and theoretical weaknesses. This critical literature does not consider either the GDI or the GEM as measures of gender equality as such, because they compute some combination of absolute levels of achievement

and a penality for inequality (see, for example, Dijkstra and Hanmer (2000), Bardhan and Klasen (1999)). This implies that they cannot be used for assessing the relationship between gender equality and economic performance. Other criticisms are directed at the choice of variables and the aggregation rule. These shortcomings open a door to building an alternative gender inequalities index. Several alternatives have been constructed to address the shortcomings of UNDP gender indicators (see for example Forsythe, Korzeniewicz, and Durrant (2000), Dijkstra and Hanmer (2000)). But these new alternatives have led to further criticisms. That is why Dijkstra (2002) built a new measure, the Standardized Index of Gender Equality (SIGE). The index developed here, the GII, draws on the good aspects of the SIGE, while at the same time attempting to avoid the methodological limitations of the GDI, the GEM and the SIGE, in order to advance research.

The aim of this paper is to develop a new alternative way to measure gender inequalities in developing countries: the Gender Inequalities Index (GII). Using Multiple Correspondence Analysis (MCA), the GII aggregates different dimensions of gender inequalities with endogenous weighting. This aggregation strategy using MCA minimizes statistical biases, and is a new way to address the shortcomings of existing relative gender measures.

The paper will proceed as follows: Section 2 briefly presents the main critiques of gender inequalities indexes (GDI, GEM and SIGE); Section 3 presents the methodology; Section 4 presents the Gender Inequalities Index (GII); Section 5 justifies why the GII is an essential tool; and finally, Section 6 concludes.

2 Incomplete Gender Inequality Indices

In 1995, at the Fourth World Conference on Women, the UNDP established two gender sensitive measures: the Gender Development Index (GDI) and the Gender Empowerment Measure (GEM). Widely criticized, these indicators have given rise to many measures of gender inequality and in particular to the SIGE (Standardized Index of Gender Equality) built by Dijkstra (2006). The SIGE attempts to address methodological shortcomings of the UNDP's indicators and to provide a broader vision of the phenomenon. Nevertheless, despite the advances of the SIGE, it appears

to have certain shortcomings.

2.1 The UNPD's Gender sensitive indicators: construction and shortcomings

The construction of the GDI and the GEM has helped to highlight gender inequalities in international policy debates. While the GDI assesses gender differences in terms of human development, the GEM measures gender inequalities in terms of economic and political opportunities. This sub-section reviews briefly the construction of the GDI and the GEM as a first step, before presenting their shortcomings.[3].

The Gender Development Index (GDI): The GDI was developed by Anand and Sen (1995) in analogy to the HDI (Human Development Index), taking into account inequalities between men and women. It measures the level of human development achieved using the same approach as the HDI. It includes the adjusted income (earned income), an education variable (2/3 literacy and 1/3 primary, secondary, and tertiary school enrollments), and a health variable (life expectancy). It penalizes the average obtained by the degree of inequality between men and women. The differences between sexes are more important, the lower the GDI (i.e the close to zero). Thus, the GDI of a country decreases when the levels of development of women and men drop together, on the one hand, but also when the development gap between the sexes widens, on the other hand. The greater the differences between men and women in terms of basic capabilities, the smaller the GDI in a country is, compared to its HDI. The GDI is thus simply the HDI weighted by gender inequalities.

The GDI is built using a three-step process. First, the female and male index for each variable is calculated by subtracting actual values from the minimum value, and then dividing the difference by the total range of the value (Id_i). Second, the equally distributed equivalent achievement index (EDEA) is defined as:

$$EDEA = [(p_f.Id_f^{1-\epsilon}) + (p_m.Id_m^{1-\epsilon})]^{1/1-\epsilon}$$

where: p_m, p_f are respectively male and female population shares; ϵ, the aversion to inequality factor, assumed to be two by the UNDP, indicating a social preference for

[3]For more precision about the construction of the GDI and the GEM see UNDP (1995), Bardhan and Klasen (1999).

equality. If ϵ is equal to zero, then the simple arithmetic mean of female and male achievements is calculated.

Third, the GDI is computed as:

$$GDI = \tfrac{1}{3}(EDEA_{le} + EDEA_{ed} + EDEA_{ei})$$

The Gender Empowerment Measure (GEM): The GEM measures gender inequalities in relation to three components of empowerment: political participation and decision-making (female share of parliamentary seats); economic participation and decision-making (female share in technical and professional, and administrative and management positions), and power over economic resources (earned income). Gender gaps are then penalized by the same 'aversion to inequality factor' (ϵ) as used in the GDI, implying that 50/50 shares should be the goal in all three components (Bardhan and Klasen (1999)).

The GEM is built in two stages. First, the Equally Distributed Equivalent Percentage (EDEP) is defined as:

$$EDEP = [p_f.I_f^{1-\epsilon} + p_m.I_m^{1-\epsilon}]^{1/1-\epsilon}$$

Second, the GEM is computed as:

$$GEM = \tfrac{1}{3}(EDEP_p + EDEP_e + EDEP_r)$$

Criticisms of the UNDP gender-sensitive indexes: A first line of criticism against the GDI and GEM concerns the choice of dimensions of gender equality. A second problem relates to the choice of variables to measure gender inequalities. Lastly, the construction of composite indicators is challenged.

1. Some relevant dimensions of gender inequalities are lacking. The first criticism made of the UNDP gender indicators is that the GDI and GEM - limited to economic and political dimensions - do not reflect certain sociological manifestations of gender inequality, such as participation in community or family decisions, in physical integrity, etc. (Dijkstra and Hanmer (2000), Dijkstra (2002)). Moreover Jütting and Morrisson (2005) denounce the omission of inequalities in social institutions, which are crucial in developing countries. Dollar and Gatti (1999) conclude that some countries can be relatively egalitarian in one dimension but relatively unequal in other dimensions, which is why a broad range of indicators is needed in order

to consider gender inequalities in all their forms. As a result, the UNDP gender indicators are not able to assess the needs of women in developing countries and to define priorities in the fight against gender inequalities. The dimensions omitted are major determinants of the relative status of women and their well-being (World-Bank (2001)). Not to take into account all aspects of gender inequalities is a limit in itself: how it is possible to describe the relationship between gender inequalities and development, if the indicator only considers the tip of the iceberg? Furthermore, the consideration of some dimensions is restrictive. The GEM focuses on national political representation and the formal economy, whereas local politics and the informal economy are the scene of feminine activity (Bardhan and Klasen (1999)). Also, this indicator does not take into account inequalities in access to credit, information, etc. for the empowerment of women (Batliwala (1994), Jütting, Morrison, and Drechsler (2006)). Moreover, the GEM includes income without any explanations. That is why, according to Dijkstra (2006), "the GEM is an odd combination of relative female and male empowerment -but softened by taking a harmonic mean of the female and male scores- and absolute levels of income per capita".

2. These indicators do not measure gender inequality as such. "One of the weaknesses of both the GDI and GEM is that they do not measure gender equality as such, but instead some combination of absolute levels of achievement and a penalty for inequality (see, for example, Dijkstra and Hanmer (2000), Bardhan and Klasen (1999)). This implies that they cannot be used for assessing the relationship between gender equality and economic performance" (Dijkstra (2002)). The main criticism regarding the GDI and GEM is that they are not a measure of gender inequality as such, because they include absolute levels of women's well-being. Inequality exists if the situation of one person can be compared to the situation of a group (Johnson (1985)). All the critical authors (Dijkstra and Hanmer (2000), Bardhan and Klasen (1999), Schüler (2006), etc.) view the GDI as a measure of human development weighted inequalities. Similarly, the GEM takes into account the wage level of each sex and not the share of each gender in the total wage (Schüler (2006)). The aim should be to focus on whether the gap between women and men in the chosen variables has declined, rather than whether women are 'winning the battle of the sexes' (Hausmann, Tyson, and Zahidi (2007)). Therefore, it seems essential to build a

gender inequality measure including only variables which describe the relative status of women. Gender exists only in the comparison between men and women. Indeed, sex usually includes three aspects: the biological sex as it is assigned at birth; the role or sexual behavior that are supposed to correspond to it, and that the socialization and education of differentiated individuals produce and reproduce, namely gender; and finally sexuality (Dorlin (2008)). Then, measuring gender inequality implies integrating only variables of comparison between men and women.

3. The income component is overweighted. The GDI and GEM are simple arithmetic averages of their component scores. According to the UNDP, there are no reasons to build weighted indicators (UNDP (1995)). Nevertheless, it can be argued that unweighted composite indicators give the strongest weight to the component with the largest variance (Munda and Nardo (2005a)). Then, if the variances of the components differ widely, weights are needed (Tepperman, Harvey, and Blakely (1990), Perrons (2005), Sugarman and Straus (1988)). According to Bardhan and Klasen (1999), the unweighted GDI overvalues the weight given to the income component: "GDI is dominated by a conceptually and empirically problematic estimate of gender gaps in earned income, while downplaying the role of the gaps in education and largely ignoring those in mortality, arguably the two most important problems confronting women in many developing countries". Also, the GDI is highly correlated to GDP per capita. The GDI minimizes the inequalities in low-income countries and overestimates them in countries with higher income, which disadvantages the Middle East and North Africa (MENA). High-income countries have a higher GDI than low-income countries with the same level of gender inequalities (Dijkstra (2002)). Gender inequality measures are designed to measure gender inequalities in individual countries rather than the levels of the available resources and opportunities in those countries. That is why they have to be independent of the level of development (Hausmann, Tyson, and Zahidi (2007)).

The UNDP gender indicators are a step forward in the quantification of gender inequalities and illustrate the international debate, as well as in raising academic attention of the issue of measuring gender inequality. However, the respective shortcomings limit their usefulness and result in very misleading international comparisons. Dijkstra (2006) proposes remedies for some of these shortcomings with her

index.

2.2 The Dijkstra's Standardized Index of Gender Equality (SIGE)

To overcome the GDI and GEM's shortcomings, Dijkstra (2002) built an alternative measure: the Standardized Index of Gender Equality (SIGE). This index tries to meet three requirements: i) the index should take into account all relevant dimensions of gender equality; ii) it should be a relative measure; iii) it should have appropriate weights (Dijkstra (2002)).

The Human Development Report (UNDP (1995)) provides some concrete illustrations of the inequality of women and men in many countries:

- the right to nationality: in much of West Asia and North Africa, women married to foreigners cannot transfer citizenship to their husbands, though men can;
- the right to manage property: married women are under the permanent guardianship of their spouses and have no right to manage property in Botswana, Chile, Lesotho, Namibia, and Swaziland;
- the right to income-earning opportunities: husbands can restrict their wives' employment outside the home in Bolivia, Guatemala, and Syria;
- the right to travel: in some Arab countries, a husband's consent is necessary for a wife to obtain a passport, but not vice-versa. Women cannot leave the country without their husband's permission in Iran, etc.

All these issues require consideration. In this way, Dijkstra (2002) defines the forms of gender inequality which should be included in gender sensitive indexes. She uses eight dimensions identified by the Workshop in The Hague (Wieringa (1997)). The expertise conferred to this Workshop is justified by the fact that "the explicit aim of the Workshop was to define important aspects of gender inequality that may hold in different cultures" (Dijkstra (2002)). To do this, researchers from many different cultures and from different disciplines participated in the identification of

the main dimensions of gender inequality that should be included in a new measure and a comparison of countries.

The eight dimensions identified are as follows:

1. Gender identity, which describes gender roles defined by socialization and education;
2. Autonomy of the body;
3. Autonomy within the household;
4. Political power;
5. Social resources, which refer to the access to health and education;
6. Material resources, which refer to access to land, housing, and credit;
7. Employment and income;
8. Time, which includes the relative access to leisure and sleep.

To quantify all of these dimensions, the SIGE includes 5 ratios of female attainment relative to males:

- Access to education (with the following weights: 2/3 for the literacy ratio and 1/3 for combined primary and secondary school enrollment);
- Access to health (life expectancy ratio);
- Labor market participation (ratio of female/male economic activity rates);
- Economic representation (female share in technical and professional, and administrative and management positions);
- Political representation (female share in parliament).

The SIGE is a standardized and unweighted index. Standardization (subtracting the mean then dividing by the standard deviation) avoids the limitations of unintended weighting. This methodology assumes that the variables follow a normal distribution. Otherwise, the variables are normalized. However, Dijkstra (2002)

does not provide information about the distribution or the normalization of the data (Bérenger and Verdier-Chouchane (2007)). This creates a lack of transparency and makes the measure much more opaque (Klasen and Schüler (2009)). Furthermore, if standardization is a response to weighting problems, it is not a methodology to determine weights endogenously. All dimensions of gender inequalities do not discriminate against women in the same way. All dimensions do not have the same importance. According to Dijkstra (2002), the "relative access to education is perhaps the most important and universal indicator for gender equality". Nevertheless, Dijkstra gives an equal weight to the five dimensions taken into account in the SIGE. Statistical analysis is needed to identify appropriate weights endogenously. Statistical information indicates which dimensions are the more constraining in gender discrimination worldwide. Furthermore, if the objective of a composite indicator is to describe a global trend, statistical bias and redundancy have to be corrected by an appropriate methodology (Bazillier (2004)).

The main criticism concerns the aggregate method. The SIGE is a linear index. Linear indicators admit total compensation among the various forms of discrimination. But, inequalities related to gender correspond to deprivation experienced by the women affected. According to Branisa, Klasen, and Ziegler (2009), when inequality rises deprivation expands proportionally more. Indeed, Dollar and Gatti (1999) point out that some societies can be relatively egalitarian in one dimension but relatively unequal in other dimensions; then women experience great deprivation. That is why partial compensation - which implies that high inequality in one dimension can only be partially offset by low inequality in another dimension - provided by a non-linear indicator is preferred. This aggregate methodology takes into account complementarity and substitutability, so that inequalities are penalized in every dimension (Munda and Nardo (2005b)).

The SIGE allows gender inequalities to be understood more clearly. However, the GII (Gender Inequality Index) seeks to deal with the GDI, GEM and SIGE's shortcomings.

3 A New Way to Measure Gender Inequality in Developing Countries

"*Thus, whereas a gender statistic provides factual information about the status of women, a gender-sensitive indicator provides direct evidence of the status of women, relative to some agreed normative standard or explicit reference group*" (Johnson (1985)).

3.1 Multiple Correspondence Analysis (MCA) to determine weightings endogenously

Correspondence analysis is a descriptive and exploratory technique designed to analyze multi-dimensional tables containing some measure of correspondence between the rows and columns. These methods were originally developed primarily in France by Jean-Paul Benzécri in the early 1960s and 1970s (see Benzecri (1992), Lebart, Morineau, and Piron (2004)). MCA may be considered to be an extension of simple correspondence analysis to more than two variables. MCA is a correspondence analysis carried out on an indicator matrix with cases as rows and categories of variables as columns. Actually, the inner product of such a matrix, called the Burt Table is usually analyzed: MCA is the correspondences analysis of the Burt table. The results provide information which is similar in nature to that produced by factor analysis techniques, and they allow the structure of categorical variables included in the table to be explored. If Principal Component Analysis (PCA) is adapted for quantitative and continuous variables, MCA is used to analyze qualitative, discrete and ordinal variables. Contrary to PCA, MCA studies the set of relative frequencies of each modality and not their absolute weight. The main advantage of MCA in comparison to PCA is the non-linear analysis between variables (Bazillier and Gouret (2004)).

MCA analyses discrete variables by projecting on different axes the common information contained in these different variables, in order to reduce the number of dimensions, thus minimizing the loss of information, symbolized by the total inertia, represented by the overall dispersion of the new scatter (Greenacre (1984), Escofier and Pagès (1998)). The distances between different profiles are calculated using a

Khi-2, in contrast to other tools of data analysis:

$$d^2(i_1, i_2) = \sum_{j=1}^{n} (\frac{f_{i1j}}{f_{i1}} - \frac{f_{i2j}}{f_{i2}})^2$$

After encoding continuous variables,[4] MCA is applied in order to avoid the heterogeneity and symmetry problems likely in PCA (Bazillier and Gouret (2004)). MCA defines endogenously the weight of each dimension in the scalar index (Benzecri (1992)). This scalar index is the first axis which has the highest inertia and will define our composite index GII (Benzecri (1992), Greenacre (1984)). This method of aggregation improves the index qualitatively, because MCA minimizes the statistical bias or imperfection of the data. Given its statistical advantages, MCA is preferred.

From a normative point of view, the use of MCA is justified because it does not predefine any economic model, and lets the data speak for itself. Thus, the pre-existence of an egalitarian norm is not assumed *a priori*. Instead the analytical framework is developed to capture gender inequalities. This framework does not define a single model of gender inequalities which is optimal, whatever the level of development or the cultural and religious heritage. The method is neutral in the sense that it requires no prior modeling of the relationship between gender inequalities and economic growth, and does not presuppose any standard in terms of efficiency. However, some configurations either block or foster economic convergence. Given this indisputable advantage, MCA was adopted in this research.

3.2 Database

According to Goertz (2001), in evaluating composite indicators three concerns dominate: external validity, reliability and 'concept-indicator validity'. The latter describes the link between the theoretical structure of the concept and "the structure of its operationalization in the form of an indicator". This requirement takes care of the degree of theoretical coherence between the concept and how that becomes a concrete indicator. Indeed, all dimensions have to be measured by appropriate components. The choice of variables is crucial for the 'concept-indicator validity'. The quality of the database and its definition is crucial to this study: to go beyond the shortcomings of gender specific measures, the GII has to be based on a database

[4]For more details see appendix B

which describes all dimensions of gender discrimination and includes appropriate variables.

This database introduces some dimensions omitted by well-known gender specific measures. As Dijkstra (2002), the GII considers the eight dimensions of gender inequalities identified by the Workshop in The Hague (Wieringa (1997)). Several variables are used to quantify them. The more variables included in one dimension, the more informative it is. Indeed this method minimizes errors of measurement and quality of data. After identifying the dimensions retained and their proxy, subindexes are constructed.[5]

Following Branisa, Klasen, and Ziegler (2009), subindexes are constructed to produce a summary measure for each dimension of gender inequalities. Every subindex is a sum of n variables that are associated statistically.[6] To validate this statistical association, the same method as Branisa, Klasen, and Ziegler (2009) is used here: the 'Kendall Tau b rank correlation'. This is a non-parametric statistic used to measure the degree of correspondence between two variables and assessing the significance of its correspondence. Only variables which have a significant positive value of Kendall tau b are retained.[7]

The data retained are the following:

1. *Gender identity* describes cultural issues such as the socialization of girls and boys, the rigidity of the sexual division of roles (Dijkstra (2002)). This dimension describes social behavior conveyed by society and internalized by individuals in the process of socialization. This behavior is defined by social norms which are a vector of the gender role, by defining gender identity and constraints. Deviation from social norms is a source of psychological and social sanctions (Bierstedt (1963)). According to Broom and Selznick (1963), every society has rules or norms based on cultural values specifying what appropriate behavior is or not. They set limits within which individuals have to find ways to achieve their objectives. In this sense they constitute an economic variable

[5]In this section, I describe only variables retained to construct subindexes. For more details about data definition and sources see Appendix A.

[6]This aggregate strategy is justified by the close variance of each variable. Moreover, the endogenous weights defined by MCA are not significantly different.

[7]The Kendall Tau b tests the strength of association when both variables are measured at the ordinal level. It makes adjustment for ties and are most suitable for Square tables (Agresti (1984)).

because they define the role of each individual according to his/her gender and the sexual division of labor (Elster (1989)). Social norms and gender identity define economic and social activities of men and women (Bierstedt (1963)). In developing countries, where community laws dominate individual laws, men and women behave according to these constraints (Coleman (1990)). In most of the countries, patriarchal and traditional customs are unfavorable to women (Bierstedt (1963)).

It is very difficult to measure these dimensions, as they are qualitative concepts. However, if we consider these social norms as social institutions, the new OECD database can be used. Indeed, institutions are a set of formal and informal rules established by human beings to constrain their behavior (North (1991)). Thus, social norms define standard behavior and can be considered as institutions. The GID database (Gender Institution Development) includes variables about gender inequality in social institutions like family codes, physical integrity, access to economic resources, etc. Thus, the 'gender identity dimension' is measured here with four variables: *the female-male ratio of early marriage, the CIRI indicator of women's social rights,*[8] *gender inequality in terms of freedom of dress and freedom of movement.*[9]

2. Physical integrity refers to the absence of violence against women, the control of their sexuality and access to contraception (Dijkstra 2002). This dimension describes the autonomy of women over their bodies. It is a form of gender discrimination to the extent that the biological and physical differences between the sexes are reflected in the balance of power within social relationships. Men

[8]"A score of 0 indicates that there were no social rights for women in comparison to men in law and that systematic discrimination based on sex may have been built into law. A score of 1 indicates that women had some social rights under law, but these rights were not effectively enforced. A score of 2 indicates that women had some social rights under law, and the government effectively enforced these rights in practice while still allowing a low level of discrimination against women in social matters. Finally, a score of 3 indicates that all or nearly all of women's social rights were guaranteed by law and the government fully and vigorously enforced these laws in practice", taken from CIRI coding variables.

[9]"Freedom of movement measures the freedom of women to move outside the home. The following elements were considered: freedom to travel; freedom to join a club or association; freedom to do the groceries (and other types of shopping) without a male guardian; freedom to see one's family and friends. A score of 0 means no restrictions on women's movement outside the home in comparison to men; 0.5 indicates that some women can leave home sometimes, but with restrictions and 1 means that women can never leave home without restrictions" Source: Coding GID Jütting, Morrison, and Drechsler (2006)

can affect the physical integrity of women without suffering legal penalties. Indeed, sometimes there are no laws to protect physical integrity. This dimension is described by five variables: *the prevalence and acceptance of violence against women; the prevalence of genital mutilation; the indicator of physical security of women; the prevalence of contraception; and adolescent fertility*. In this dimension, it is assumed that men do not have any problems concerning their physical integrity. So, it is assumed they do not suffer from domestic violence and physical insecurity like rapt or honor killings and that men always have choice in sexual relationships. Moreover, it is assumed that female genital mutilation is not equivalent to the male circumcision. Unlike male circumcision, which is not an attempt to inhibit the ability, desire or sexual pleasure, one of the reasons most often put forward to justify female circumcision is the control of sexuality (Tauzin (1988)). That is why it is assumed that genital mutilation is not the counterpart of male circumcision and is indeed a form of gender discrimination.

3. Autonomy within the household describes the inequalities within the household in terms of the right to divorce, inheritance rights and decision-making (Dijkstra (2002)). The following four variables are used to measure this aspect of gender inequalities: *the indicator of gender inequality in family law, in parental authority, in inheritance rights and the percentage of households headed by women*.

4. Political power describes political representation and decision-making (Dijkstra (2002)). The obvious indicator for relative female political power are used: *the female share of parliamentary seats, the proportion of women legislators, the proportion of women holding ministerial positions and the CIRI indicator of women's political rights*.

5. Access to education is measured as an arithmetic average of *male-female ratio in literacy rate, in net school enrollment, in primary, secondary and tertiary education and the female share of teachers*.

6. Access to health is measured by *the female-male ratio of life expectancy*[10] *and*

[10]Following Anand and Sen (1995) in the life expectancy component, it is assumed that, given

Klasen's missing women indicator.[11]

7. Economic resources include *indicators of gender inequality in terms of access to land, credit and property other than land.*

8. Employment and income refers to the distribution of paid and unpaid work, wage differentials, formal and informal labor (Dijkstra (2002)). This dimension is measured with the following variables: *the CIRI indicator of women's economic rights, the female share in technical and professional and administrative and management positions, the male-female ratio of earned income, of economic activity rate and the female share in the active population.*

One of the requirements is that the GII (Gender Inequality Index) is a relative measure. The GII has to measure gender inequality and does not include absolute level of female well-being. Indeed, inequality exists if the situation of one person can be compared to the situation of a group (Johnson (1985)). However, many variables listed above may be the subject of criticism. Female shares and female to male ratios do not pose any problems. For the other integer variable, it is considered the male's situation as the absolute reference. It is assumed that the prevalence of these types of discrimination against men is invalid and men's rights are applied totally. For example, the indicator of women's freedom of movement is coded 0 if women have no restrictions to move outside the home; 0.5 - Some women can leave home sometimes, but with restrictions; 1 - Women can never leave home without restrictions (i.e. they need a male companion, etc.). This indicator describes the relative situation of women in comparison to men, who face no movement restrictions. Similarly, indicators of law (economic, political and social) assume men's rights are respected; indicators of access to economic resources assume no restrictions for men. Of course, this is not the reality. Credit rationing is common in developing countries, but it is assumed that it affects more women than men.

Moreover, the index rewards countries that reach the point where outcomes for women equal those for men, but it neither rewards nor penalizes cases in which

equal treatment and an apparent biological advantage of females, women would outlive men by an average of five years (Waldron (1983), Johannson (1991)). If female life expectancy exceeds male life expectancy by less or more than five years, a gender gap is held to exist.

[11] This indicator takes into account the two recent controversies surrounding the levels and trends in the number of 'missing women' in the world. See Klasen (2008).

women are outperforming men in particular variables (Hausmann, Tyson, and Zahidi (2007)).

Within the sample used here 109 developing countries provide information on all the 32 variables. The choice is guided by the availability of information so that as many countries as possible can be ranked. As the indicators primarily measure gender inequalities that pose problems in the developing world, the OECD countries are excluded in the first part of the factor analysis.

4 The Gender Inequalities Index: GII

The strategy for aggregating data used here seeks to go beyond the methodological shortcomings named above. Using Multiple Correspondence Analysis (MCA), the Gender Inequalities Index (GII) was constructed for 109 countries, with dimension weights defined endogenously.

4.1 Four clusters of countries appear

MCA defines different axes explaining different aspects of gender inequalities. To know how many axes to retain in order to have a good description of the whole phenomena, the inertia of the singular values was studied. If the percentage of the explanation of the total inertia by the first singular value has to be sufficient -more than 50% (Escofier and Pagès (1998)) - meaning that the first axis contains greatest amount of common information, then only the first factor is retained here in the composite index (the GII).

The first principal component explains 74.16% of the total inertia, which is more than satisfactory (nearly 3/4 of the variance of initial variables). The second factor explains 9.88% of inertia. Therefore, the factorial map (f1, f2) explains 84.04% of the dispersion of the scatter plot (Figure 1).

The first axis (horizontal) opposes countries with low gender inequalities on the right and countries with high gender inequalities on the left. Value tests allow the visual analysis of Figure 1 to be confirmed. High modalities of all dimensions of gender inequalities are opposed to low modalities. This confirms that axis 1 describes the extent of gender inequalities.

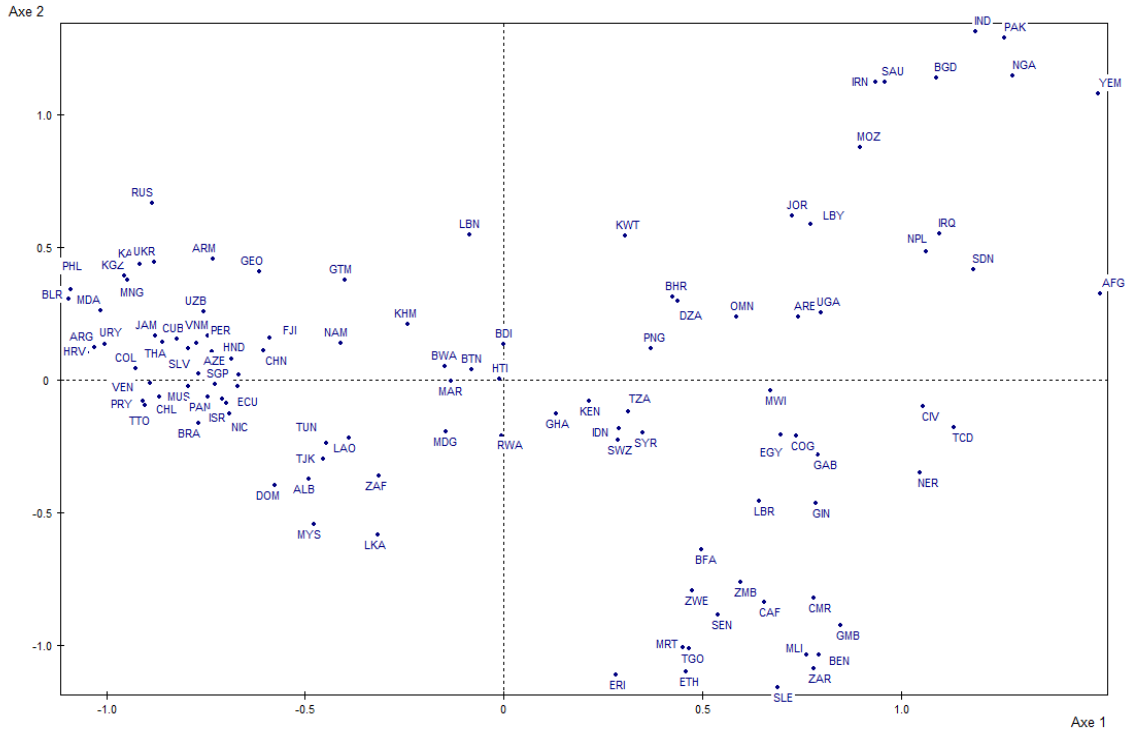
The second axis (vertical) contrasts the strong inequalities in the dimensions of education, physical integrity and access to economic resources on the bottom, with strong gender inequalities in the dimensions of gender identity and politics on the higher part of the axis. The interpretation of the second axis requires care. This means that in the multidimensional phenomenon of gender discrimination in the countries concerned, women suffer more in this type of inequality than in others. This is not to say that inequalities in other dimensions do not appear or are weak, but that they are less strong within the overall picture. So, the second axis opposes countries where women are principally victims in the access to the determinants of economic opportunities, to countries where women suffer mainly from discrimination in sociopolitical representation.

Four country clusters appear in Figure 1. The top-right quadrant contains 22 developing countries where gender inequalities are high, especially for sociopolitical representation, i.e. in gender identity (age of marriage, social rights and civil liberties) and political power (political representation and political rights). In these countries, being a women means having a restricted social role. In public, women do not have the same rights and the same opportunities as men. Political and social rules discriminate against women because they are set by men. These countries can be characterized as 'patriarchal', since their social norms convey a customary image of women and deny equal access to sociopolitical power. Patriarchy is the structuring of family units based on the man, as a father figure, having primary authority over other family members. Patriarchy also refers to a system of government by males, and to the dominance of men in social or cultural institutions. In such countries, men take primary responsibility over the welfare of the community as a whole. Indeed, sociopolitical power is reserved for men. This authority often includes acting as the dominant figures in social and political procedures, including serving as representatives in public office. In these countries, women do not have the same rights in terms of identity and political power. One might think that these forms of discrimination are complementary, insofar as the gender identity conveyed by social norms and internalized by individuals, constrains their role in society. These countries are mainly localized in South Asia and in the Middle East.

In the bottom-right quadrant, there are 31 countries where gender inequalities

are strong, principally concerning the access to determinants of economic opportunities, i.e. in access to education (primary, secondary, tertiary education, teaching and literacy), to economic resources (access to land ownership, credit and other forms of property), and in physical integrity (genital mutilation, adolescent fertility, access to contraception, violence and physical security indicators). Women's economic role is ignored: they have unequal access to human and physical capital and then have an unequal access to economic opportunities. These countries can be characterized as 'traditional'. They do not grant women any economic role. The lack of access to education and economic resources for women constrains their economic activity and their empowerment. In these countries, women's activities are always dependent on men, households, the extended family or the community. Furthermore, in these countries, the violation of women's physical integrity is frequent. This impacts directly on their productivity and has economic consequences. But this form of discrimination impacts on confidence too. Women who suffer from genital mutilation, rape, violence or women who are aware of the threats to their physical integrity are less confident. This can have an indirect impact on women's economic activities and performances. Geographically these countries are mainly located in Sub-Saharan Africa.

Figure 1: 109 Developing Countries in the Factorial Map(f_1, f_2)



Source: Author's calculations. Spad v.7

The top-left quadrant includes 33 countries characterized by low gender inequality, except in the political dimension. In these countries, women have a restricted political role, and executive power is reserved for men.. These include, in particular, the countries from the former Communist bloc (the Commonwealth of Independent States CIS: Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Turkmenistan, Tajikistan, Ukraine, and Uzbekistan). In these countries, gender inequalities are principally found in the political dimension. While improvements occurred with the collapse of the USSR, inequality in the political power remains. Indeed, the social and educational dimensions have begun being feminized, while the functions of government remain male preserves.

There are 23 countries in the bottom-left quadrant. These countries are mostly located in Latin America and the Caribbean. They are characterized by low inequality except in the employment dimension. In these countries, the economic role of women is restricted. Women are increasingly present in the production sector and the job market in general, but professional segmentation on the basis of gender and wage inequality persists. Unemployment among women is rising, and the situation of women in rural areas is even more precarious. Economic power is reserved for men and women suffer discrimination.

4.2 The endogenous determination of weights

After analyzing the graphic representation of the MCA, the latter also determines endogenously the weight of each variable in the aggregated Gender Inequalities Index (GII). This corresponds to its relative contribution to the variance of the aggregate indicator and it is computed as the sum of the absolute contribution to the inertia of the first axis for each modality (Escofier and Pagès (1998)). This contribution can be calculated as a linear combination of weights associated with the principal components (Escofier and Pagès (1998), Berr and Combarnous (2004)): the relative contribution of a modality to the first axis is equal to the square of its coordinates on this axis, divided by the eigenvalue of this axis. For each axis, the sum of the relative contributions of the variables is equal to 100%.

Table 1 presents weights defined endogenously by the MCA. The results give a higher weight to dimensions of family, identity, health and access to economic

resources and a lower weight to gender inequalities in politics and employment. The former contribute more than any other dimension to the discrimination of women in developing countries. These weights describe a hierarchy between dimensions: gender inequalities in family, identity, health and access to economic resources are the most relevant. This is not because they are the most relevant for descriptive statistics, nor because of their frequency, but because they put more constraints on women: the burden of discrimination is principally due to these dimensions. Indeed, discrimination against women in families generates discrimination in social norms and then inequality in the role of each gender within society. Then, in developing countries where resources are sparse, economic trade-offs promote the sex which seems to be more important and more appropriately to have a greater role in society, namely men.

The other dimensions are relevant to the situation of women, but are less restrictive. This assertion does not mean that policy for equality in education does not matter, but that gender inequalities in the family, identity, health and economic resources should be targeted first to promote women's rights in developing countries.

Table 1: Weights of each Dimension in GII

Dimension	Weights in GII
Family	0.181
Identity	0.156
Health	0.156
Economic Resources	0.146
Physical Integrity	0.116
Education	0.118
Work	0.068
Politics	0.06

Source: Author's calculations with Spad v.7

4.3 The aggregation rule and the presentation of the GII

Although many forms of aggregation have been developed (Diewert (1976)), the standard practice considers a composite indicator as a weighted linear function of a set of variables (OECD (2005)). In this context, the determination of the weight of each component of the composite indicator is crucial: the highest weight is given to the most significant dimension (Podinovskii (1994)). Therefore, the weight of a lin-

ear function corresponds to substitution rates between the components (Munda and Nardo (2005b)). This logically implies total compensation between the various components of the composite indicator. The total compensation allows any disadvantage in one dimension to be compensated by a sufficient advantage in another dimension. Yet, a total compensation and a linear function are not the appropriate logic for dealing with gender inequalities (Branisa, Klasen, and Ziegler (2009)). That is why the GII is a non-linear, weighted composite indicator. The GII thus does not allow full compensation between dimensions, but only partial compensation. In this way, the GII pays attention to complementarity and substitutability between dimensions (Munda and Nardo (2005a)).

The GII is defined by the following formula:

$$GII = 0.181Family^2 + 0.156Identity^2 + 0.156Health^2 + 0.146EconomicResources^2 +$$

$$0.118Education^2 + 0.116PhysicalIntegrity^2 + 0.068Work^2 + 0.06Politic^2$$

The quadratic form is justified by: 1) the partial compensation requirement; 2) the desire to obtain a measure that is sensitive to the distribution of values between dimensions; and 3) marks an aversion to the particularly low values of the indicators used in each dimension. This quadratic form is analogous to a parameter ϵ which reflects the degree of aversion in terms of gender inequality (Gajdos (2001)). Moreover, the value 2 has the advantage of easy interpretation, as it leads to the square function.

Finally this aggregation rule satisfies the requirement of the axiomatics of inequalities: 1) the GII is a normalized, weighted sum of the equality shortfalls. A value zero can be thought of as a goal and the distance from zero describes the extent of gender inequality; [12] 2) the value 2 satisfies both the transfer principle and transfer sensitivity principle (Kolm (1976)).

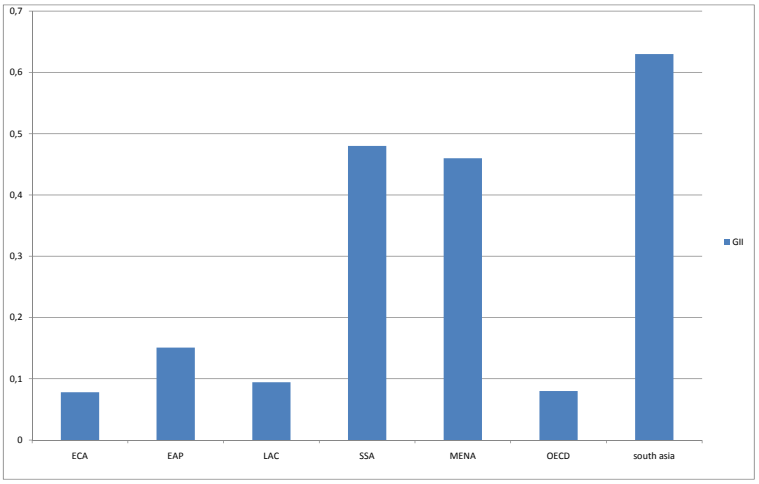
4.4 Results by country, region and income group

The GII is built for 109 developing countries. In Appendix C, the results for the GII are presented. At the top of the list, Afghanistan, Yemen, Chad, Sudan, Pakistan, Nigeria, Bangladesh, Niger and India have the highest levels of gender

[12] The magnitude of deprivation is precisely the shortfall in equality.

inequality. At the bottom, Belarus, Moldova, Croatia, Argentina and Uruguay have the lowest levels of gender inequality.

Figure 2: The GII per Region



Source: Author's calculations

If rankings are observed with details at the individual indicator's levels, then Afghanistan, Yemen and Chad have a score of 1, for six out of eight dimensions. In contrast, Belarus and Argentina have a score of 0, for six out of eight dimensions.

Figure 2 presents the GII per region. Large variations between regions are observed. South Asia (SA) has the worst score with an average of 0.63. Four of the seven countries of SA are in the top 10 of the ranking. These results can be explained especially by the high level of discrimination against women in the identity, health and family dimensions. These dimensions have a strong weight in the GII. In SA, women's public role is restricted by the patriarchal organization of society. As a consequence, their public role constrains their economic activities. To promote the economic emancipation of women and integrate them into an economic growth process assumes reducing inequalities in the identity and family dimensions.

Sub-Saharan Africa (SSA) and Middle East and North Africa (MENA) follow with an average of 0.48 and 0.46 respectively. Women's situation in SSA is characterized by strong discrimination in physical integrity, as well as poor access to education and economic resources. Results from graphic analysis are also confirmed. In traditional SSA, women's economic roles are constrained by the restricted access

to physical and human capital. This situation can create distortions: less able men rather than women may have access to education and economic resources. Productivity and (physical and human) capital accumulation are lower than their potential levels. In SSA, gender inequality seems to have a relationship with low economic performance, as women's economic role is restricted to domestic and home production. Moreover, in SSA, violation of women's physical integrity reduces their productivity and affects the rate of fertility through genital mutilation, violence, and limited access to contraception.

In MENA, gender inequalities are especially high in politics and employment. Women's representation in economic and political power is almost non-existent. Their situation in education and access to health has been improved by growth in these middle income countries. But strong discrimination in identity and patriarchal institutions limits the involvement of women in economic and political activities. Gender discrimination in economic activities can create distortions: more able women than men are excluded from the labor market. Regarding political representation, the issue of corruption can be raised (Dollar, Fisman, and Gatti (2001)).

East Asia and the Pacific (EAP), Latin America and the Caribbean (LAC) and Europe and Central Asia (ECA) precede OECD countries with an average of 0.15, 0.09, 0.07 and 0.008 respectively. In these regions gender inequalities are low. Nevertheless, some dimensions can be improved: in EAP and ECA, gender inequality in politics persists; in LAC, women are still discriminated against in employment and incomes.

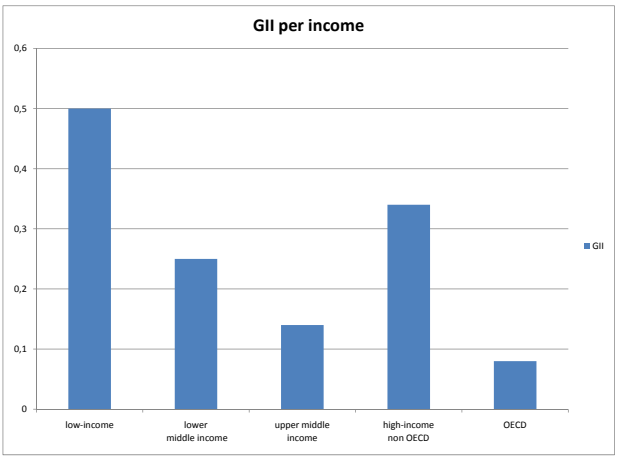
According to the literature, whatever the direction of causality between gender inequalities and economic growth, a correlation exists (Forsythe, Korzeniewicz, and Durrant (2000), Becker (1985), Oneill and Polachek (1993), Boserup (1970), Marchand and Parpart (1995)). Figure 3 which presents the GII per income group,[13] describes a negative relationship between the GII and the development level measured by income.[14]Only high-income, non-OECD countries (Bahrain, Israel, Kuwait, Oman, South Arabia, Singapore, Trinidad and Tobago, and the United Arab Emi-

[13]Income group: Economies are divided according to 2008 annual GNI per capita, calculated using the World Bank Atlas method. The groups are: low income countries, $975 or less; lower middle income countries, $976 - $3,855; upper middle income countries, $3,856 - $11,905; and high income countries, $11,906 or more. Source: World Bank definition.

[14]Note that the OECD countries have been included to identify the consequences of their inclusion in the sample.

rates) seem to be particular, as they have a higher income and a higher GII.

Figure 3: The GII by Income



Source: Author's calculations

5 The GII: a New Tool to Understand the Situation of Women in Developing Countries

In the previous section, this paper argued why development economists need a new tool to measure gender inequalities in developing countries. Methodological and theoretical shortcomings justify the construction of the GII. This section argues why the GII is a better measure of gender inequalities in developing countries than the existing gender-specific measures. First, the section studies OECD countries, then it compares the GII with other well-known gender-specific measures, and finally it presents the GII's advantages and properties.

5.1 The "Developing world's" point of view

A statistical analysis of the OECD sample shows that weights differ between developing countries and OECD countries. This justifies the 'developing world' point of view adopted here.

Discrimination against women is an important issue in developing countries and the OECD. Nevertheless, concerns differ between the 'developing' and 'developed' world. Indeed, gender inequality appears in diverse ways. That is why, it is interesting to apply MCA to the OECD sample, to know to what extent gender inequality issues differ in importance.

Table 2: A Comparison of the Weights and Ranking between OECD and Developing World (DW)

	Weight OECD	Rank OECD	Weight DW	Rank DW	$\neq$ Rank
Politic	20	1	6	8	-7
Family	19.8	2	18.1	1	1
Work	19.2	3	6.8	7	-4
Physical Integrity	11.5	4	11.6	6	-2
Education	11.2	5	11.8	5	0
Identity	9.2	6	15.6	2	4
Health	5.4	7	15.6	2	5
Economic Resources	3.7	8	14.6	4	4

Source: Author's calculations with Spad v.7

Statistical analysis confirms this intuition in Table 2. Several points about gender discrimination can be noted. If in the developing world, gender inequality in family, identity, health and access to economic resources are the main concerns, in the OECD countries discrimination in politics, family, employment and incomes are the key concerns. Indeed, an improvement in a majority of gender equality dimensions identified here occurred in the 19^{th} century. However, preoccupations about gender inequality are still current in OECD countries. In spite of the proliferation of laws about political parity, women still suffer from political underrepresentation. The gender gap (between 3% and 25% in OCDE European countries), glass ceilings, ect. provide evidence of discrimination in the labor market. Moreover, statistics confirm an unequal sharing of household tasks.

If differences exist, similarities can be observed. Indeed, gender inequality in the family concerns the OECD as much as the developing countries. Discrimination in the family dimension appears to be a crucial issue for both samples. This assertion has to be made with some precaution: women's situations in the household decision-making process are not the same in developing and OECD countries, but have the same weight relative to gender inequalities. In fact, only 4.7% of households

are headed by women in Kuwait, compared to 42.4% in Finland; 90% of countries OECD are characterized by parity in parental authority as against 32% of developing countries. Even if the extent of discrimination in the family dimension differs substantially from OECD to developing countries, it is a crucial issue for women all around the world. Neither development nor growth change this fact: gender inequality in the family is a burden on women. If economic performance may have an impact on gender inequality, discrimination in the family dimension remains a constraint for women. Whatever the level of development, inequalities within the household, and therefore in the private sphere, are one of the most notable manifestations of gender discrimination. Thus, while economic development can reduce inequalities within the family sphere, they remain the main target in the fight against gender discrimination (being respectively the first and second rows of the GII in the developing and OECD samples).

The results presented in Table 2 show that worries about gender inequalities change with the level of development. Priorities differ and recommendations too: if gender equality in political representation seems to be crucial for OECD countries, it is secondary for developing countries. Policy against gender discrimination has to be suited to the level of development. Threshold effects exists in this area: equality in politics and the issue of empowerment may be a target from a certain level of achievement of gender equality.

Regarding these results, constructing a gender-inequalities index only for the developing world appears to be a crucial issue.

5.2 A comparison with other gender-related measures

Correlation and non-redundancy are studied here to compare the GII with the other well-known gender specific measures.[15] Correlation and the Kendall tau b coefficients test whether the index is empirically redundant, i.e. whether it provides additional information as compared to other measures. Mcgillivray and White (1992) use an empirical analysis of the statistical association between well-being measures. They propose to separate redundancy from non-redundancy by two thresholds of 0.9 and 0.7. I pursue this approach and use the 0.70 threshold as an absolute value, as

[15]See appendix D

do Branisa, Klasen, and Ziegler (2009), and conclude in favor of non-redundancy.

Moreover I check correlation between the GII, SIGE, GDI and GEM indexes. All these are correlated negatively with the GII because the larger gender inequalities are, the higher GII and lower the SIGE, GDI and GEM indexes. These results suggest a correlation between GII, SIGE, GDI and GEM, so it can be concluded that the GII measures the same phenomenon as other gender specific indexes, and is not redundant.

5.3 The Advantages and Properties of the GII

Advantages

- The GII covers a limited number of indicators, but covers as many dimensions of gender equality as possible through its database;
- The GII is available for 109 countries;
- The GII allows comparisons between countries, but also over time;
- The GII is a relative measure which measures gender inequalities;
- The GII includes appropriate weights determined endogenously and no unintended weights.
- Its non-linear form permits only partial compensation;
- Its interpretation is easy: the higher the GII is, the stronger gender inequalities are;
- Thanks to MCA, the GII is not built on a predefined economic model;
- Thanks to MCA, the GII minimizes statistical biases and problems related to multicollinearity and measurement error.

Properties. The GII satisfies several axiomatic requirements of an inequality index (Gajdos (2001), Chakravarty and Muliere (2003)).

1. *Axiom of λinvariance.* The GII is a relative inequality index because proportional change in the male and female situations does not change inequality.

2. *Axiom of population principle.* Inequality over different population sizes can be compared (Dalton (1920)). If a population is replicated several times, the inequality does not change.

3. *Axiom of Pigou-Dalton transfer principle.* A transfer of any form of discrimination from males to females should decrease inequality.

4. *Axiom of transfer sensitivity.* The magnitude of a decrease in inequality is higher, the worse women's situation is compared to men.

6 Conclusion

Over the past few decades, developing countries have made substantial progress in educating women and improving their health outcomes. Indeed, since 1970, women's life expectancy has increased by 15 years on average, while gender gaps in literacy and in primary education have decreased according to the WorldBank (2001)). Nevertheless, improvements are needed: 60% of poor people are women. This situation leads to a female poverty rate that is 1.4 times higher than the male rate. Moreover, there are still significant gaps in the job opportunities for women and in wages paid. If gender equality has become a crucial issue for development in the 21^{th} century, awareness is not sufficient. Development policy has to target the improvement of women's situations in the developing world, especially in the family, identity, and health dimensions. Depending on the country or the region concerned, the fight against *all* forms of gender discrimination is appropriate. However situations, and concerns differ from region to region.

Gender issues are crucial in development economics. Measuring gender inequalities is a first step to provide tools, in order to understand them and fight against them. The GII is obviously a new tool to characterize women's situations in comparison to men's in developing countries. Far from being a normative analysis that describes a single optimal configuration, the GII ranks countries depending on their characteristics, in terms of gender inequalities. It provides information about discrimination against women, without making value judgments.

Bibliography

Agresti, A. (1984): *Analysis of Ordinal Categorical Data. Wiley Series in Probability and Mathematical Statistics.* John Wiley and Sons.

Anand, S., and A. Sen (1995): "Gender Inequality in Human Development: Theories and Measurement.," *Human Development Report Office Occasional Paper No. 19, UNDP, New York.*

Bardhan, K., and S. Klasen (1999): "UNDP's Gender-Related Indices: A Critical Review," *World Development*, 27(6), 985–1010.

Batliwala, S. (1994): *Population Policies Reconsidered: Health, Empowerment and Rights*chap. The meaning of Women's Empowerment: New Concepts from Action. Harvard University Press.

Bazillier, R. (2004): "Core labour standards and economic growth," *Cahiers de la Maison des Sciences Economiques.*

Bazillier, R., and F. Gouret (2004): "composite index and principal component analysis, Do we use the right method ?," *mimeo.*

Becker, G. (1985): "Human Capital, Effort and the Sexual Division of Labour," *Journal of Labour Economics*, 3, 33–58.

Benzecri, J. (1992): *Correspondence Analysis Handbook.* Marcel Dekker, New-York.

Berr, E., and F. Combarnous (2004): "L'impact du consensus de Washington sur les pays en développement : une évaluation empirique," (100).

Bierstedt, R. (1963): *The social order.* McGraw Hill Book co.

Boserup, E. (1970): *Woman's Role in Economic Development.* St Martin's Press.

Branisa, B., S. Klasen, and M. Ziegler (2009): "The Construction of the Social Institutions and Gender Index (SIGI)," (184).

Bérenger, V., and A. Verdier-Chouchane (2007): "Multidimensional measures of well-being: standard of living and quality of life across countries," *World Development*, 35, 1259–1276.

Broom, L., and P. Selznick (1963): *Sociology*. Harper and Row.

Cazes, P. (1990): "Codage d'une variable continue en vue de l'analyse des correspondances," *Revue de statistique appliquée*, 38, 33–51.

Chakravarty, S. R., and P. Muliere (2003): "Welfare indicators: A review and new perspectives. 1. Measurement of inequality," *Metron - International Journal of Statistics*, 0(3), 457–497.

Coleman, J. S. (1990): *Foundations of Social Theory*. Harvard University Press.

Dalton, H. (1920): "The measurement of inequality of incomes," *Economic Journal*, 30, 348–361.

De Beauvoir, S. (1949): *Le Deuxième Sexe*. Gallimard.

Diewert, W. (1976): "Exact and superlative index numbers," *Journal of Econometrics*, 4, 115–145.

Dijkstra, A., G. (2002): "Revisting UNDP's GDI and GEM: Toward an alternative," *Social Indicators Research*, 57, 301–338.

——— (2006): "Towards a fresch start in measuring gender equality: A contribution to the debate," *journal of Human Development*, 7, 275–283.

Dijkstra, A., G., and C. Hanmer, L. (2000): "Measuring socio-economic gender equality: Toward an alternative for UNDP's GDI," *Feminist Economist*, 6, 41–75.

Dollar, D., R. Fisman, and R. Gatti (2001): "Are women really the "fairer" sex? Corruption and women in government," *Journal of Economic Behavior & Organization*, 46(4), 423–429.

Dollar, D., and R. Gatti (1999): "Gender inequality, income and growth: Are good times good for women?," *World Bank Policy Research Report Working Papers*, 1.

Dorlin, E. (2008): *Sexe, Genre et Sexualités. Introduction à la théorie féministe.* PUF.

Elster, J. (1989): "Social Norms and Economic Theory," *Journal of Perspectives Economics*, 3.

Escofier, B., and J. Pagès (1998): *Analyses factorielles simples et multiples. Objectifs méthodes et interprétation.* Dunod, Paris.

Ferber, M., and J. Nelson (1993): *Beyond Economic Man: Feminist Theory and Economics.* Chicago University Press.

Forsythe, N., P. Korzeniewicz, R., and V. Durrant (2000): "Gender Inequalities and Economic Growth: A Longitudinal Evaluation," *Economic Development and Cultural Change*, 48, 573–617.

Gajdos, T. (2001): "Les fondements axiomatiques de la mesure normative des inégalités," *Cahiers de la Maison des Sciences Economiques.*

Goertz, G. (2001): "Increasing concept-indicator validity: the case of democracy," *mimeo.*

Greenacre, M. (1984): *Theory and Applications of Correspondence Analysis.* Academic Press, London.

Hausmann, R., D. Tyson, L., and S. Zahidi (2007): *The global gender gap report.* Wold Economic Forum.

Hill, M. A., and E. King (1995): "Women's education and economic well-being," *Feminist Economics*, 1(2), 21–46.

Johannson, S. R. (1991): "Welfare, mortality, and gender," *Continuity and Change*, 2.

Johnson, D. (1985): "The development of social statistics and indicators on the status of women," *Social Indicators Research*, 16, 233–261.

Jütting, J. P., C. Morrison, and D. Drechsler (2006): "The Gender, Institutions and Development Data Base," *OECD working paper*, (16).

Jütting, J. P., and C. Morrisson (2005): "Changing Social Institutions to Improve the Status of Women in Developing Countries," *OECD working paper*, (27).

Klasen, S. (2002): "Low Schooling for Girls, Slower Growth for All? Cross-Country Evidence on the Effect of Gender Inequality in Education on Economic Development," *World Bank Economic Review*, 16(3), 345–373.

——— (2008): "Missing Women: Some Recent Controversies on Levels and Trends in Gender Bias in Mortality," (168).

Klasen, S., and D. Schüler (2009): "Reforming the Gender-Related Index (GDI) and the Gender Empowerment Measure (GEM): Some Specific Proposals," *Ibero America Institute for Econ. Research (IAI) Discussion Papers*, (186).

Kolm, S. (1976): "Unequal inequalities II," *Journal of Economic Theory*, 13, 82–111.

Lebart, L., A. Morineau, and M. Piron (2004): *Statistique exploratoire multidimensionnelle*. Dunod.

Marchand, M., and J. Parpart (1995): *Feminism, Postmodernism Development*. Routledge, London.

Mcgillivray, M., and H. White (1992): "Measuring development? : a statistical critique of the UNDP human development index," (135).

Munda, G., and M. Nardo (2005a): "Constructing consistent composite indicators: the issue of weights," *Technical Report EUR*, 21834.

——— (2005b): "Non-compensatory composite indicators for ranking countries: A defensible setting," *Technical Report EUR*, 21833.

Murthi, M., C. Guio, A., and J. Drèze (1995): "Mortality, Fertility and Gender-Bias in India," *Population and Development Review*, 21.

North, D. C. (1991): "Institutions," *Journal of Economic Perspectives*, 5(1), 97–112.

OECD (2005): "Handbook on constructing composite indicators: methodology and user guide," *OECD statistics working paper*.

Oneill, J., and S. Polachek (1993): "Why the Gender Gap in Wages Narrowed in the 1980s," *Journal of Labour Economics*, 11, 205–228.

Perrons, D. (2005): "Gender Inequalities in Regional Development," *Regional Studies*, 29(5), 465–476.

Podinovskii, V. V. (1994): "Criteria importance theory," *Mathematical Social Sciences*, 27(3), 237–252.

Schüler, D. (2006): "The uses and Misuses of the Gender-related Development Index and the Gender empowerment Measure: A review of literature," *Journal of Human Development*, 7, 161–181.

Sen, A. (1999): *Development as Freedom*. Oxford University Press.

Simons, M. (1995): *Feminist Interpretations of Simone de Beauvoir*. Pennsylvania State University Press.

Sugarman, D., and M. Straus (1988): "Indicators of gender equality for American states and regions," *Social Indicators Research*, 20, 229–270.

Tauzin, A. (1988): "Excision et identité féminine. L'exemple mauritanien," *Anthropologie et Sociétés*, 12, 29–37.

Tepperman, L., B. Harvey, E., and H. Blakely, J. (1990): "Toward an index of gender equality," *Social Indicators Research*, 22.

Thomas, D. (1989): "Intra-Household Resource Allocation: An Inferential Approach," (586).

Thomas, D., and J. Strauss (1997): "Health and Wages: Evidence on Men and Women in Urban Brazil," (97-05).

UNDP (1995): *Human Development Report*. Oxford University Press.

Waldron, I. (1983): *Sex Differentials in Mortality*chap. The role of genetic and biological factors in sex differences in mortality, pp. 141–164. Australian National University Press, Canberra.

Wieringa (1997): "Report of the Workshop on GDI/GEM Indicators, The Hague," *Institute of Social Studies*.

WorldBank (2001): *Engendering Development through gender inequality in rights, Resources and Voice*. World Bank.

Appendix

A Data definitions and sources

Data name	Definition	Data source
MOVE	Dummy variable which measures the freedom of women to move outside the home	GID OECD
DRESS	Dummy variable which measures women's obligation to follow certain dress code in public	GID OECD
AUTH	Dummy variable which measures parental authority in legal and customary practices regarding legal guardianship of a child during marriage and after divorce	GID OECD
LAND	Dummy variable which measures women's access to agricultural land	GID OECD
LOANS	Dummy variable which measures women's access to credit	GID OECD
PROP	Dummy variable which measures women's access to real property other than agricultural land	GID OECD
MISS	Missing women reflects the excess masculinity	GID OECD
VIO	Violence against women including the existence of a legal indicator and the percentage of women who are beaten by their partners	GID OECD
INHER	Dummy variable which measures equality in inheritance of spouses and daughters, and men	GID OECD
SECU	Physical security of women included domestic violence, rape and sexual assault, murder and honor killings	Womanstats
FAM	Gender inequality in family law	Womanstats
WSOC	Women's social rights	CIRI Human rights
WPOL	Women's political rights	CIRI Human rights
WECO	Women's economic rights	CIRI Human rights
MAR	Female/ male percentage ratio of persons ever married among persons ages 15-19	WISTAT.4 UN
CONTRA	% of women who have access to contraception	WISTAT.4 UN
ADO	Fertility rates of adolescents (births per 1,000 women ages 15-19)	WISTAT.4 UN
MUT	Prevalence of genital mutilation	WISTAT.4 UN
CHEF	Percentage of household headship by women	WISTAT.4 UN
MINI	Percentage of women in ministerial posts	WISTAT.4 UN
PARL	Women's share of parliamentary seats	WISTAT.4 UN
LEGI	Women's share of legislators	WISTAT.4 UN
PRIM	Ratio of female / male primary school enrolment rates	WISTAT.4 UN
SEC	Ratio of female / male secondary school enrolment rates	WISTAT.4 UN
TER	Ratio of female / male tertiary education enrolment rates	WISTAT.4 UN
LIT	Ratio of female / male literacy rates	WISTAT.4 UN
TEACH	Percentage of teachers who are female	WISTAT.4 UN
LEXP	Ratio of female / male life expectancy	WISTAT.4 UN
MORT	Maternal mortality rate	WISTAT.4 UN
POP-ACT	Female percentage of active population	WISTAT.4 UN
ACTI	Ratio of female/ male activity rates	WISTAT.4 UN
TECH	Percentage of females in technical managerial and administrative positions	WISTAT.4 UN
EARN	Ratio of female / male earned incomes	WISTAT.4 UN
HDI	Human Development Index	UN

For each dummy variable considered by the GID OECD Database, 0 means equal rights for men and women; 0.5- Some women have some rights but less than men; 1- Women have no rights.

B Discretization of continuous variables and creation of the gender inequality dimensions

Discretization of continuous variables: This article constructs a new database which includes 32 variables and covers continuous and discrete variables. Nevertheless, to use MCA, these 32 variables have to be discrete. The first step thus was to make the continuous variables discrete.[16]. There are two common ways to discretize continuous variables: (i) creating classes of the same size, (ii) creating classes of equal amplitude. This paper uses the latter, because it allows discrimination between countries to be preserved and thus avoids grouping together countries with different characteristics. For example, regarding the 'marriage' variable, the first method which proceeded to create classes of the same size, gathered together Madagascar and the Democratic Republic of Congo, which have respectively a ratio of 0.34 and 0.74. In contrast, the second method -creating classes of same amplitude- does not create artificial distance between two countries.

Then to compare the 32 variables together and standardize each measure, they are all coded in a scale from 0 to 1. A score of 0 means equality, a score of 1 total inequality.[17]

The classes are then constructed using a constant step e: [18]

$$e = (maxx_i - minx_i)/K$$

Building the eight dimensions of gender inequalities: Once the data is discretized, the research presented here built eight dimensions of gender inequalities. Each dimension is an unweighted sum of the sub-variables.[19]

[16]It should be noted that it is easier to convert continuous variables into discrete variables than the contrary (Escofier and Pagès (1998)). Even if the discretization of continuous variables is widely criticized, because it generates a loss of information, it is the best option in this case (Cazes (1990))

[17]Note that truncating the data at the equality benchmarks for each variable means assigning the same score to a country that has reached parity between women and men, and one in which women have surpassed men.

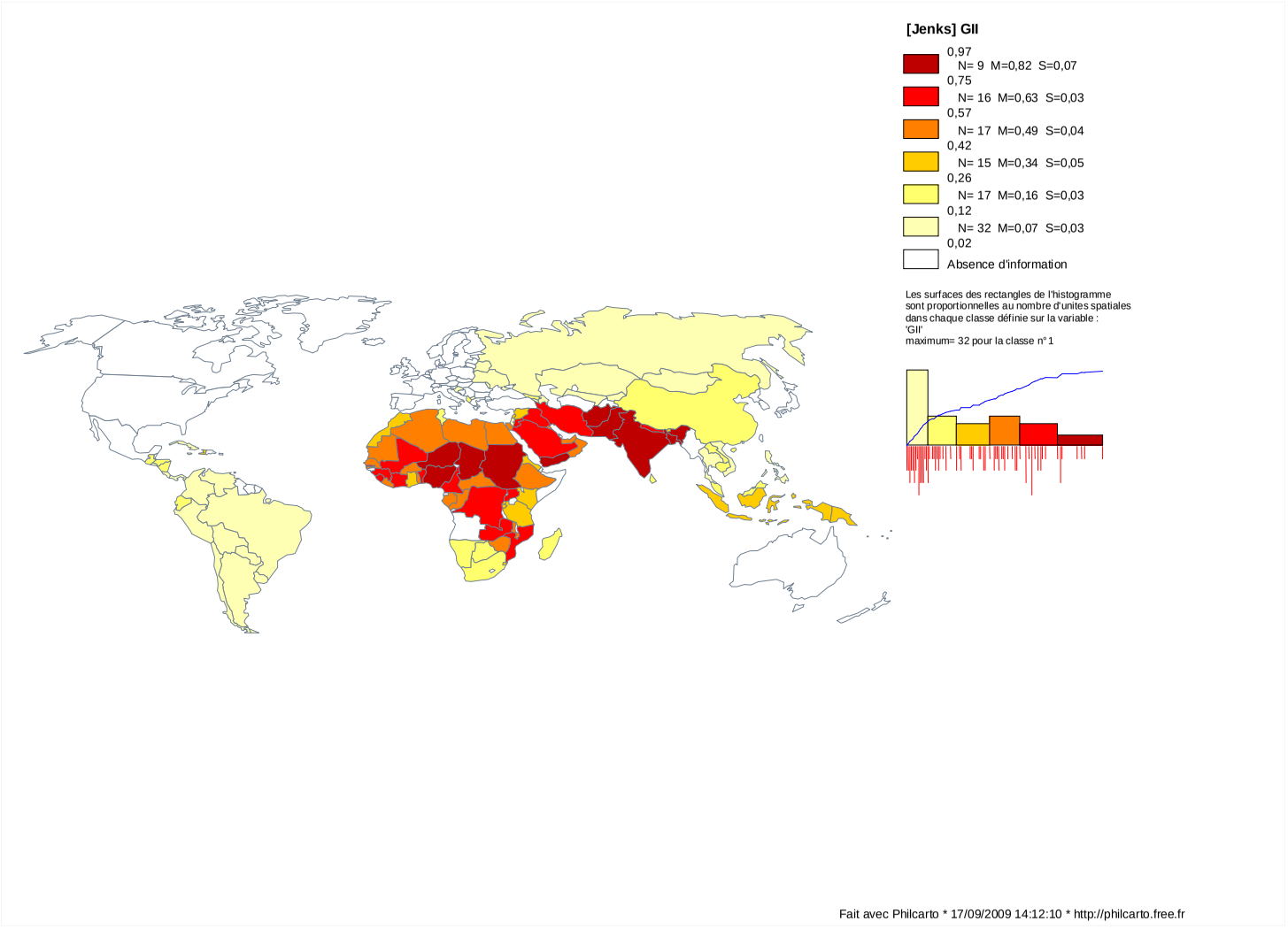
[18]Where min x_i is the minimum and max x_i the maximum of the variables x_i; K is the number of classes desired, namely five.

[19]It should be noted that the dimensions are constructed as the unweighted sum of variables and not as their average. Indeed, the average of discrete variables has no meaning: a score of two is not the double of one.

C The GII ranking

Country	GII	rank	Country	GII	rank
Afghanistan	0.975	109	Haiti	0.264	54
Yemen	0.886	108	Morocco	0.258	53
Chad	0.869	107	Madagascar	0.229	52
Sudan	0.844	106	Sri Lanka	0.213	51
Pakistan	0.772	105	Botswana	0.207	50
Nigeria	0.769	104	Cambodia	0.193	49
Bangladesh	0.769	103	Guatemala	0.179	48
Niger	0.767	102	Lao PDR	0.177	47
India	0.751	101	South Africa	0.171	46
Sierra Leone	0.691	100	Tajikistan	0.164	45
Guinea	0.677	99	Malaysia	0.164	44
Iran, Islamic Rep,	0.672	98	Albania	0.159	43
Benin	0.669	97	Tunisia	0.156	42
Nepal	0.66	96	Fiji	0.154	41
Cameroon	0.659	95	Namibia	0.145	40
Saudi Arabia	0.645	94	China	0.132	39
Congo, Dem, Rep,	0.63	93	Nicaragua	0.125	38
Gambia, The	0.629	92	Honduras	0.125	37
Iraq	0.628	91	Ecuador	0.122	36
Mozambique	0.628	90	Georgia	0.118	35
Uganda	0.61	89	Mauritius	0.114	34
Mali	0.599	88	Bolivia	0.112	33
Jordan	0.596	87	Dominican Republic	0.11	32
Cote d'Ivoire	0.596	86	El Salvador	0.104	31
Zambia	0.569	85	Israel	0.1	30
Ethiopia	0.556	84	Uzbekistan	0.099	29
Gabon	0.554	83	Macedonia. FYR	0.097	28
Central African Republic	0.547	82	Panama	0.093	27
United Arab Emirates	0.545	81	Azerbaijan	0.09	26
Togo	0.533	80	Chile	0.089	25
Congo, Rep,	0.507	79	Peru	0.085	24
Liberia	0.498	78	Armenia	0.084	23
Libya	0.497	77	Costa Rica	0.082	22
Burkina Faso	0.486	76	Russian Federation	0.081	21
Zimbabwe	0.483	75	Brazil	0.081	20
Malawi	0.468	74	Paraguay	0.08	19
Egypt, Arab Rep,	0.465	73	Thailand	0.075	18
Mauritania	0.462	72	Cuba	0.069	17
Oman	0.452	71	Singapore	0.066	16
Kuwait	0.443	70	Viet Nam	0.062	15
Senegal	0.442	69	Trinidad and Tobago	0.059	14
Algeria	0.425	68	Colombia	0.055	13
Bahrain	0.4	67	Kyrgyz Republic	0.052	12
Kenya	0.4	66	Ukraine	0.051	11
Papua New Guinea	0.392	65	Jamaica	0.048	10
Swaziland	0.389	64	Mongolia	0.043	9
Eritrea	0.378	63	Venezuela, RB	0.042	8
Syrian Arab Republic	0.374	62	Philippines	0.034	7
Ghana	0.339	61	Kazakhstan	0.034	6
Indonesia	0.338	60	Uruguay	0.031	5
Tanzania	0.337	59	Argentina	0.027	4
Rwanda	0.326	58	Croatia	0.025	3
Lebanon	0.285	57	Moldova	0.021	2
Burundi	0.28	56	Belarus	0.016	1
Bhutan	0.272	55			

Source: Author's calculations


[Jenks] GII
0,97
N= 9 M=0,82 S=0,07
0,75
N= 16 M=0,63 S=0,03
0,57
N= 17 M=0,49 S=0,04
0,42
N= 15 M=0,34 S=0,05
0,26
N= 17 M=0,16 S=0,03
0,12
N= 32 M=0,07 S=0,03
0,02
Absence d'information
Les surfaces des rectangles de l'histogramme sont proportionnelles au nombre d'unites spatiales dans chaque classe définie sur la variable : 'GII'
maximum= 32 pour la classe n° 1
Fait avec Philcarto * 17/09/2009 14:12:10 * http://philcarto.free.fr

D Correlation and Kendall tau b test

Table 3: Correlation coefficient

corr	GII
GDI	-0,7096
GEM	-0,733
SIGE	-0,7148

Source: Author's calculation

Table 4: Kendall's tau b test

	GII / GDI	GII / GEM	GII / SIGE	
Obs	97	59	72	
Kendall's tau b	-0,508	-0,3109	-0,511	
Kendall's score	-2362	-531	-1304	
SE of score	320,838	152,898	205,687	(corrected for ties)
Test of Ho:	GII and Y_i	are independent		
Prob>Z	0,00000	0,00005	0,00000	(continuity corrected)

Source: Author's calculation