Gender inequality and Growth: A new way to think the measure and the relationship

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Abstract

Using cross-country regressions, this paper investigates the negative relationship between gender inequalities and economic growth. Gender inequalities in their all dimensions- identity, health, family, education, access to economic resources and working, politic and physical integrity- reduce economic growth directly through their negative impact on human capital accumulation. Moreover, using seemingly unrelated regressions (SUR) indirect links through demographic and institutional effect are considered.

To take into account all dimensions in which gender inequalities appear in developing countries, this paper construct a new composite index: the gender inequalities index (GII). Thanks to multiple correspondences analysis (MCA), GII goes beyond multicollinearity problem and determines endogenously the weight of each dimension.

Keywords: Economic development, economic growth, economics of gender

JEL Codes: J16, O11, O57

I. Introduction

" *On ne naît pas femme : on le devient. Aucun destin biologique, psychique, économique ne définit la figure que revêt au sein de la société la femelle humaine ; c'est l'ensemble de la civilisation qui élabore ce produit intermédiaire entre le mâle et le castrat qu'on qualifie de féminin. Seule la médiation d'autrui peut constituer un individu comme un autre* [1]" (Simone de Beauvoir, 1949).

There is a renewed attention for gender equality following papers of A.Sen (1999) which show the active and central role of women in development. At the World Economic Forum all participants recognize 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). The World Bank report "engendering development" (2001) shows the relevance of gender issue for economic development. This paper contributes to this topic in two ways. First, the Gender inequalities Index (GII) is a new alternative to measure gender inequalities in developing countries to address the shortcomings of gender relative measures through a new aggregate strategy (Multiple Correspondence Analysis: MCA). Second, thanks to GII,

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[1] "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". Translation from Simons, M.A. (1995), *Feminist Interpretations of Simone de Beauvoir* Pennsylvania State University Press.

the paper investigates how gender inequalities affect economic development directly and indirectly. Indeed, a simultaneous model estimated with seemingly unrelated regressions (SUR) highlights the negative impact of gender inequalities on economic performance. In this view, the paper studies the demographic and institutional effect of gender issue.

Gender inequality is an important issue in itself, that's why we need indicators to compare the relative situation of women and to study the relationship between gender inequality and economic growth. The societal question is how to improve the relative situation of women and how to assess the progress made over time. It is crucial to develop frameworks for capturing the magnitude of gender inequalities in order to design effective measure for reducing them (Hausmann, Tyson and Zahidi 2007). The economic question is whether more gender equality promotes or hampers growth. To analyse these issues, economist use several statistics about gender discrimination. If their findings allows a better understanding of gender issue in education (e.g. Klasen 1999, 2002, 2006; Dollar and Gatti 1999, Knowles, Lorgelly and Owen 2002), politics or corruption (Dollar, Fisman and Gatti 2001), they cannot take into account the multidimensional phenomena. Only a composite index can measure this type of concept. But poorly construction of composite index leads to misinterpretation. Therefore, to analyse gender inequality effect, a thought is needed. The GII answers this requirement in using MCA. This method goes beyond multicollinearity and data measurement problems. Moreover, MCA determines endogenously the weight of each dimension. In this way, the GII appear as a powerful tool to study the complex relationship between gender inequalities and growth.

Following Klasen (1999), this paper investigates the direct impact and the indirect impact of gender inequalities using cross-country regression. Thus, the difference of growth between regions may explain by the negative impact of gender inequalities on the investment rate, demographic transition and the institutional quality.

The paper will proceed as follows: section II presents the construction of the Gender Inequalities Index (GII); section III introduces the theoretical and empirical linkages between gender inequalities and economic growth; section IV analyses empirically this relationship; finally, section V concludes.

II. The Gender Inequalities Index (GII)

"*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).

A. A composite index to consider all dimensions of gender inequalities

1. Composite index

A composite indicator[2] is built by the aggregation of individual indicators, on the basis of an underlying model of the multidimensional phenomenon that is being measured (OECD 2003). It is useful to measure multidimensional concepts which cannot be captured in its varied dimensions by a single indicator. Composite indicators are recognized as a powerful tool because they provide simple comparisons of countries that can be used to illustrate complex and elusive issues. Economic process are more and more complex, that's why economists need a powerful tool, which take into account all dimensions of a multidimensional

[2] See Bandura (2006) who cites more than 160 composite indicators

phenomenon (OECD 2003). A composite index is used whenever a plurality of variables is needed for the evaluation of a macroeconomic dimension (Munda and Nardo 2005a). Moreover composite indicators are easier to interpret than to identify common trends across many separate indicators, and also become a powerful tool, useful in benchmarking country performance (Saltelli, 2007). Nevertheless, composite indicators can be poorly constructed and misinterpreted (Schüler 2006). Thus to be powerful and useful, a composite index should be based on a theoretical thought, which allows to select individual variables, to associate and to weight them in a manner which reflects all dimensions of the phenomenonbeing measured.

Gender inequalities in developing world are a complex and multidimensional issues that justifies the use of composite index. If eight dimensions concern women situation, a global measure of gender inequality should take them into account. More precisely, this measure should identify the weight of each dimension to reflect this crucial issue. In fact, 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 laws or in political representation, they cannot take into account all dimensions of gender discrimination (Dollar and Gatti 1999). In order to reach more definite conclusions on the relationship between gender inequalities and economic performances, a composite index is needed that combines several dimensions of inequalities (Anand and Sen 1995, Dijkstra 2002).

2. Eight dimensions where appear gender inequalities

The Workshop in The Hague has identified eight relevant dimensions in which gender inequalities appear (Wieringa 1997). Like Dijkstra (2002) we consider these eight dimensions as relevant for our purposes and include them in our composite index. Then to quantify them, we use 33 variables described above[3]. More variables are included in one dimension, better it is. Indeed this method minimizes errors of measurement and quality of data. For each dimension, only variables which are correlated together was retained.

To avoid misinterpretation or poorly construct, our eight dimensions are built in order to satisfy requirement defined by Goertz (2001). According to him, in evaluating composite indicators three concerns dominate: 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 take attention about the degree of theoretical coherence between the concept and how that becomes a concrete indicator. Indeed, all dimensions have to be measure by appropriate components. The choice of variables is crucial for the “concept-indicator validity”.

This section introduces the eight dimensions retained and variables used to quantify them.

1) IDENTITY: Gender identity describes gender roles and 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. These behaviors are defined by social norms. The latter are a vector of the gender role. Derivation from social norms is a source of psychological and social sanctions (Williams 1960). Social norms define gender identity and constrain gender behavior. According to Broom and Selznick (1963) every society has rules or norms based on cultural values specifying what is an appropriate behavior or not (World Bank 2001). They set limits within which individuals have to find ways to achieve its objectives. In this sense they constitute an economic variable because they define the role of each individual according to

[3] For more details see appendix 1

his gender and sexual division of labor (Elster 1989). Social norms and gender identity defined 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). Social expectations and behavior constraints differ for men and women. In most of countries, patriarchal and traditional customs are unfavorable to women (Bierstedt 1963).

It is very difficult to measure these dimension, especially qualitative concept. 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 being to constrain their behavior (North 1991). Moreover, social norms define standards behavior and can be consider as institutions. GID database (Gender Institution Development) includes variables about gender inequality in social institutions like family code, physical integrity, access to economic resources, *etc.* Thus, I will measure the first dimensions of gender inequalities (gender identity) with four variables: *early marriage, the CIRI indicator of women's social right, freedom of dress and freedom of movement*.

2) PHYSICAL INTEGRITY: Physical integrity refers to the absence of violence against women, control of their sexuality and access to contraception (Dijkstra 2002). This dimension describes the autonomy of the 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 can affect the physical integrity of women and sometimes there have not law against this procedure. This dimension is describes by five variables: *the prevalence and acceptance of violence against women, the prevalence of genital mutilation, the indicator of physical security of women, the contraceptive prevalence and the adolescent fertility*.

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

4) POLITICS: Political power describes political representation and decision-making (Dijkstra 2002). I use the obvious indicator for relative female political power, uses by UNDP and Dijkstra (2002): *the female share of parliament seats, the female legislator share, the female ministry share and the CIRI women's political right*.

5) EDUCATION: Access to education is measure as an arithmetic average of *male female ratio in literacy rate, net school enrolment in primary, secondary and tertiary and female share of teachers*.

6) HEALTH: Access to health is measure by *life expectancy ratio, maternal mortality rate and Klasen's missing women indicator*.

7) ECONOMIC: Economic resources include *access to land, credit and property other than land*.

8) WORK: Employment and income refers to the distribution of paid and unpaid work, wage differentials, formal and informal labor (Dijkstra 2002). This dimension is measure with the following variables: *the CIRI women's economic right, the female share in technical and*

professional, and administrative and management positions[4]*, the female male ratio of earned income, of economic activity rate and the female share in active population*.

One of the requirements defined by Dijkstra (2002, 2006) is that a gender inequality index will be a relative measure. GII (Gedner Inequalities Index) has to measure gender inequality and not include absolute female level of well-being. Indeed, inequality exists if the situation of one can be compared to the situation of a group (Johnson, 1985). However, many variables listed below may be the subject of criticism. Female share and male female ratio don't ask problem. For the other entire variable, I consider 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 totally applied. 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 of men, who have 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, it is not the reality. Credit rationing is common in developing countries, but I assume 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 women are outperforming men in particular variables (Hausmann, Tyson and Zahidi 2007).

Within our sample 109 countries[5] have information for all 33 variables. The choice is guided by the availability of information so that as many countries as possible can be ranked.

B. MCA: an alternative method to construct composite index

Correspondence analysis is a descriptive and exploratory technique designed to analyze multi-way 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 1960's and 1970's (e.g., see Benzécri, 1973, Lebart, Morineau, and Piron 2000). Multiple correspondence analysis (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, one usually analyzes the inner product of such a matrix, called the Burt Table in an MCA (Lebart, Morineau and Piron 2000). MCA is a correspondences analysis of Burt table. The results provide information which is similar in nature to those produced by factor analysis techniques, and they allow one to explore the structure of categorical variables included in the table. If Principal Component Analysis (PCA) is adapted for quantitative and continuous variables, MCA is uses 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 (Bazillier and Gouret 2004). The main advantage of MCA in comparison to PCA is the non-linear analysis between variables.

[4] Administrative and managerial workers Includes legislators, senior government administrators, traditional chiefs and heads of villages and administrators of special interest organizations. It also includes corporate managers such as chief executives and general managers as well as specialized managers and managing supervisors, according to the International Standard Classification of Occupations (ISCO-1968). HDR 1995.

[5] As the indicators primarily measure gender inequalities that pose problems in the developing world, we exclude OECD countries.

Multiple Correspondence Analysis (MCA) analyses discrete variables by projecting on different axis the common information contained into these different variables, in order to reduce the number of dimensions minimizing the loss of information (symbolized by the total inertia, which represents the global dispersion of the new scatter) (Greenacre 2004, Escofier and Pagès 1997).The distances between different profiles are calculated thanks to the Khi-2, contrarily to other tools of data analysis:

$$d^2(i_1, i_2) = \sum_{j=1}^{n} \left(\frac{fi1j}{fi1} - \frac{fi2j}{fi2}\right)^2$$

I use MCA as an aggregate strategy because MCA take into account the relative weights of the different variables. After encoding continuous variables, I apply MCA in order to avoid heterogeneity and symmetry problems that I could have in PCA (Bazillier and Gouret 2004). MCA define endogenously the weight of each dimension in the scalar index (Benzécri 1979). This scalar index is the first axis which has the highest inertia and will define our composite index GII (Benzecri 1992, Greenacre 1984). This aggregation method improves qualitatively the index, because MCA minimizes the statistical bias or imperfection of the data.

C. GII

Aggregate strategy used tries to go beyond methodological limits often reproached to composite indicators. Thanks to Multiples correspondences Analysis (MCA), I build the Gender Inequalities Index (GII) for 109 countries with dimensions' weight defined endogenously.

1. Four families of countries appear

MCA define different axis explaining different aspects of gender inequalities. To know how many axes to retain in order to have a good description of the whole phenomena, I study the inertia of the singular values. If the percentage of explanation of the total inertia by the first singular value has to be sufficient -more than 50% (Escofier and Pagès 1997)- I retain only the first factor. Then, this first axis will be our composite index GII. One justification is that the first axis has the highest inertia (Benzecri 1992, Greenacre 1984) and contains highest common information.

Table 1: Eingenvalue and inertia from MCA (Spad V.7)
Source: Own computation

axis	eigenvalues	Inertia	Cumulate percentage
1	0.2581	74.16	74.16
2	0.0344	9.88	84.04

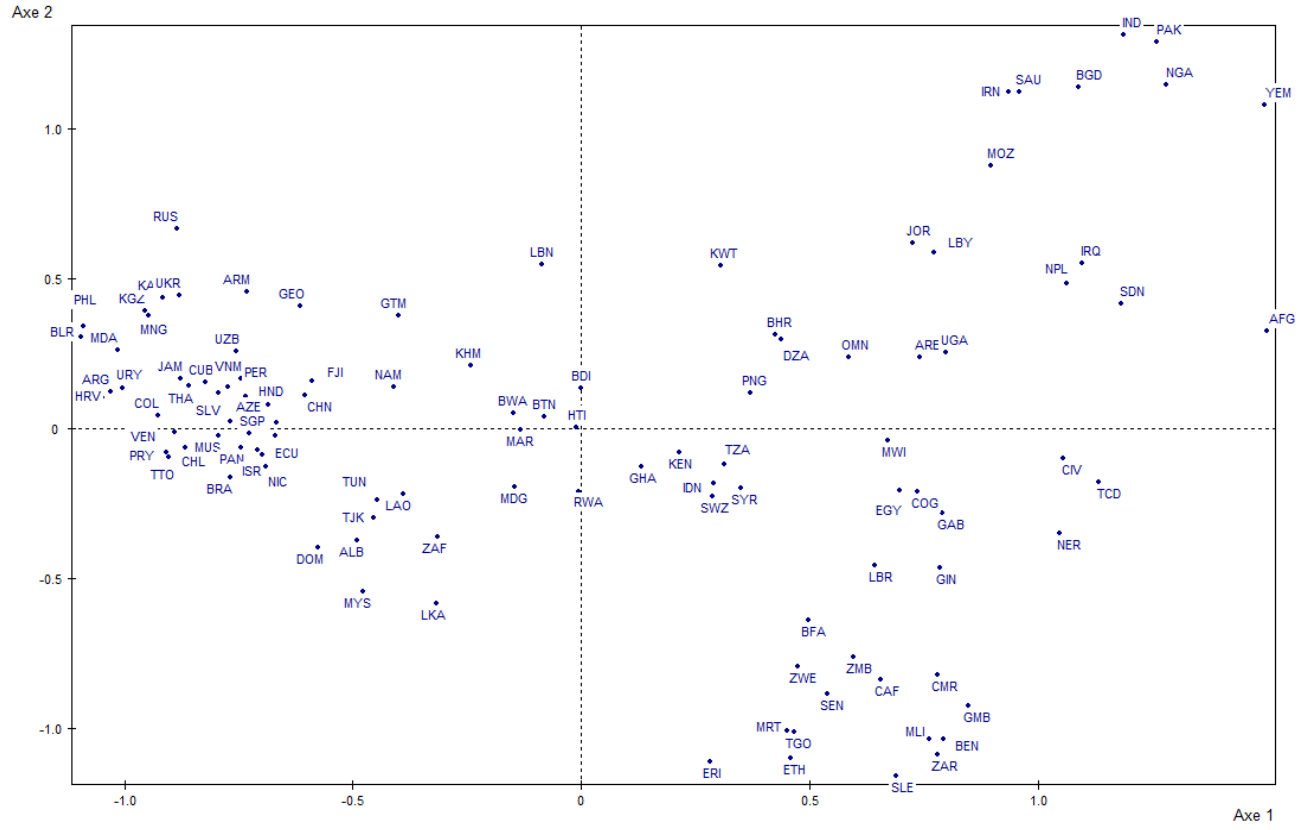
Table 1 presents the main results of the MCA (the eigenvalues and the proportion of variance they explain). First, I identify the first principal component as corresponding to the best summary information provided by the initial variables (identity, physical integrity, family, politic, access to economic resources, health, education, and employment). The first factor explains 74.16% of the total inertia, which is more than satisfactory. I assume it is enough to retain only this axis. It is legitimate to consider it as our composite indicator because it synthesizes nearly 3 / 4 of the variance of initial variables (Escofier and Pagès 1997).

The second factor explains 9.88% of inertia. Therefore, our factorial map (f1, f2) explains 84.04% of the dispersion of the scatter plot (graph 1).

The first axis (horizontal) opposes countries with low gender inequalities on the right and countries with high gender inequalities in the left. I assume that the first axis describes the extent of gender inequalities. Values tests (see appendix 2) allow us to confirm the visual analysis of the graph 1. High modalities of all dimensions of gender inequalities are oppose 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, politic and health on the upper[6].

Graph 1: 109 Developing countries on the factorial map (f1, f2)
Source: Own computation- Spad version 7



Four countries' families appear on the graph 1. The *North-East* part contains 22 developing countries where gender inequalities are high, especially in gender identity (age of marriage, social right and civil liberties), access to health (life expectancy, mortality, missing women, and rights social) and political power (parliament, ministries, legislature and political rights). In these countries, being a women means to have restrictive social role. In public, women haven't the same right and the same opportunities than men. Politic and social rule discriminate women because they are determined by the men. A vicious circle explains the durability of this situation. These countries can be characterized as "*patriarchal*" since their social norms convey a traditional image of women and deny equal access to health and political power. Patriarchy is the structuring of family units based on the man, as father figure, having primary authority over the rest of the family members. Patriarchy also refers to the role of men in society more generally where men take primary responsibility over the welfare of the community as a whole. This authority often includes acting as the dominant figures in

[6] For confirmation see test values in Appendix2.

social, economic, and political procedures, including serving as representatives via public office. In these countries, women have not the same right 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 the Middle East and the Indian Subcontinent.

In the *South-east* part, there are 31 countries where gender inequalities are strong, principally in access to education (primary, secondary, tertiary, teacher 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 indicator). These countries can be characterized as *"traditional"*. They do not grant that women have an economic role. The lack of access to education and economic resources for women constrains their economic activity and their empowerment. In these countries, women activity is always dependent of men, household, extended family or community. Furthermore, in these countries, damages to women physical integrity are frequent. Geographically these countries are mainly located in Sub-Saharan Africa.

Other countries are characterized by low gender inequalities.

2. Endogenous determination of weights

After analyzing of graphic representation, MCA determine endogenously the weight of each variable in the aggregated gender inequalities index (GII). The weight of each dimension corresponds to its relative contribution to the variance of the aggregate indicators. The weight of a variable is the sum of the absolute contribution (to the inertia of the first axis) for each modality (Escofier and Pagès 1997).

This contribution can be calculated as a linear combination of weights associated with the principal components (Berr and Combarnous 2004). Contributions are calculated as follows: the relative contribution of a modality to the first axis is equal to the square of its coordinate 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 2: Contributions and weights (Spad v.7).
Source: Own computation

Dimension	Contribution	Weights in GII
Family	18,1	0,181
Identity	15,6	0,156
Health	15,6	0,156
Economiques Resources	14,6	0,146
Physical Integrity	11,6	0,116
Education	11,8	0,118
Work	6,8	0,068
Politic	6	0,06

Table 2 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. These dimensions contribute more than any other dimensions to the discrimination of women in developing countries. These weights describe a hierarchy between dimensions: gender inequality in family, identity, health and access to economic resources are the most relevant. Not the most relevant for descriptive

statistics. Not the most relevant because the most frequent. These four dimensions are the most restrictive for women in developing countries. They create more constraints for women than any other kind of discrimination. They are the heavier for the women situation. Indeed women discrimination in family generates discrimination in social norms and then inequality in the role of each gender carried by societies. Then, in developing countries where resources are sparse, trade-off promote the sex which seems to be more important: men. Logic brings us to encourage the person who is more appropriate to have a greater role in society: men.

The other dimensions are relevant for the situation of women but are less heavy. This affirmation doesn't mean that politic for equality in education doesn't matter, but that gender inequalities in family, identity, health and economic resources are the first target to promote women in developing countries.

3. Aggregation rule and presentation of 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 2003). In this context the determination of the weight of each component of the composite indicator is crucial: highest weight is given to the most significant dimension (Podinovskii 1994). Therefore, the weight of a linear function corresponds to substitution rates between the components (Munda and Nardo 2005a). This implies logic of total compensation between the various components of the composite indicator. One means compensation as an opportunity to correct a disadvantage in one of the dimension by a sufficient advantage in another, taking into account substitution rates (Munda and Nardo 2005a). Yet, total compensation is not an appropriate logic for gender inequalities (Branisa, Klasen and Ziegler 2009). As I have argued before, linear function is not allowed here. That's why GII is a non-linear weighted composite indicator. Then, GII does not allow full compensation between dimensions, but only partial compensation. In this way, GII take attention to complementarities and substitutability between dimensions (Munda and Nardo 2005a).

Our composite index (GII) is defined by the following formula[7]:

$$\mathbf{GII = 0.181\ family^2 + 0.156\ Identity^2 + 0.156\ Health^2 + 0.146\ Economic\ Resources^2 + 0.118\ Education^2 + 0.116\ Physical\ Intergrity^2 + 0.068\ Employment^2 + 0.06\ Politic^2}$$

The formula is inspired by the Foster-Greer-Thorbecke (FGT) poverty measures (Foster, Greer and Thorbecke 1984), where Y is the vector containing all incomes, y_i i = 1, ..., n is the income of individual i, z is the poverty line, and $\alpha > 0$ is a penalization parameter.

$$FGT\ (Y,\alpha, z) = \frac{1}{n} \sum_{i=1}^{n} \left(\frac{z - yi}{z}\right)^{\alpha}$$

In our formula, the value 2 chosen for α has the advantage of easy interpretation, as it leads to the square function. This aggregation rule satisfies Sen (1976) requirements: i) the FGT poverty measure is a normalized weighted sum of the income shortfalls of the poor. In the same way, GII is a normalized weighted sum of the equality shortfalls. Contrary to FGT, in GII a value zero can be thought of as a poverty line (Ravallion, 1994; Deaton, 1997; Subramanian, 2007): deprivation depends on the equality shortfall which is measured by distance from zero; ii) Weights are based on a notion of relative deprivation: the magnitude of deprivation is precisely the equality shortfall.

[7] The weights remain fixed across time allowing the reader to track individual country progress in relation to an ideal standard of equality.

Additionally, the FGT poverty measure and their formula have a sound theoretical basis in the poverty literature as it assures that the index fulfills the transfer principle. $\alpha > 2$ is the boundary between poverty measures that satisfy both the transfer principle and transfer sensitivity (Foster et al., 1984). Moreover, FGT formula satisfies monotonicity principle for $\alpha > 0$ (Kolm 1976). Lastly, this non linear aggregation rule takes properties which are requires[8], especially for compensation. Weighting rule means that the more significant dimension of the composite index corresponding to the most important criterion (Podinovskii 1994). Yet, this concept of symmetrical importance is incompatible with a linear aggregation rule (Vincke 1992), contrary to the FGT formula.

4. Results by country and regions

The GII is built for 109 developing countries. In appendix 3, the results for the GII are presented. On the top, Afghanistan, Yemen, Chad, Sudan and Pakistan have the higher levels of gender inequality. Nigeria, Bangladesh, Niger and India follow and have a major problem with gender inequality too. At the bottom, Belarus, Moldova, Croatia, Argentina and Uruguay have the lowest levels of gender inequality. Note that, if 21 OECD[9] countries are included in the GII ranking, these low gender inequality countries take the 20° rank ahead of Portugal and Greece. Indeed these low inequality countries have OECD standard of living. If ranking are observed with details at the individual indicators levels, Afghanistan, Yemen and Chad have a score of 1 for 6 of 8 dimensions. On the contrary, Belarus and Argentina have a score of 0 for 6 of 8 dimensions.

Fig.1 GII per regions
Source: Own computation

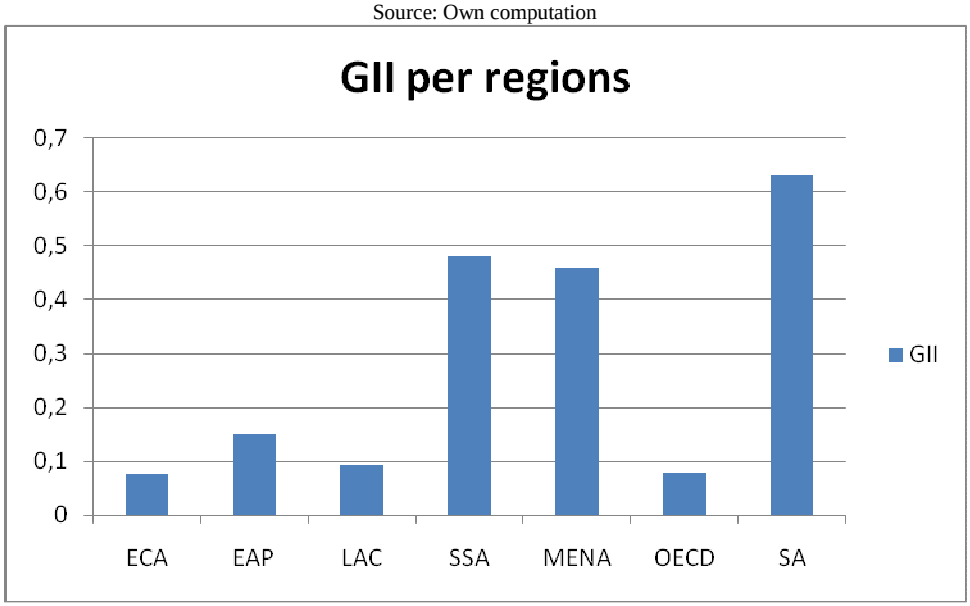


Figure 1 presents GII per regions (Appendix4 presents countries by regions and income groups). Large gap between regions are observed. South Asia (SA) has the worst score with an average of 0.63. Four of the seven countries of SA belong to the top 10 ranking. These results can be explained especially by the high level of discrimination against women in identity, health and family dimensions. And yet, these dimensions have a high weight in the GII. In SA, women public role is restrictive by a patriarchal organization of society. As a consequence, their public role constrain their economic opportunities. Then to promote an

[8] See annex6 for more precision about GII properties
[9] Note that this sample contains only European OECD countries. For more details see appendix4.

economic emancipation of women and integrate those in an economic growth process presume to reduce inequalities in 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 high discrimination in physical integrity and access to education and economic resources. Results from graphic analysis are also confirmed. In SSA, women's economic roles are constrained by a restrictive access to physical and human capital. This situation can create distortion: less able men than women can have an 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 performances. Then women's economic role is restrictive to domestic and home production. Moreover, in SSA damage to women physical integrity reduce their productivity and affect the rate of fertility through genital mutilation, violence, and limited access to contraceptive.

In MENA, gender inequalities are high especially in politic and employment dimensions. Women representation in economic and political power is almost nonexistent. Women situation in education and access to health was improve by growth performance of these middle income countries. But high discrimination in identity and patriarchal institutions limit the involvement of women in economic and political activities. Regarding economic activities it can create distortions: more able women than men are ruled out the labor market. Regarding political representation, issue about corruption can be raised.

East Asia and Pacific (EAP), Latin America and 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 politic persist; in LAC, women are still discriminate in employment and earning.

III. Empirical and theoretical links between gender inequalities and economic growth

The eight dimensions of gender inequalities identified in the previous section affect directly or indirectly economic growth. The growth theory suggests that economic growth depends on capital accumulation (including human capital), on the yield of such capital, on the efficiency of their use and on the institutional framework of production. By affecting all these determinants, gender inequalities have an impact on economic growth. Indeed, gender inequalities influence both the accumulation of economic resources (both physical and human), the return of these assets, the technical progress and the efficiency with which capital is used to produce income and the institutional framework. Therefore all dimensions of gender inequalities affect economic growth directly or indirectly.

This section describes first the direct linkage, and second, the indirect impact through investment, population growth, labor force growth and institutional quality.

A. Direct impact

The literature about gender inequalities and economic growth focuses on inequalities in employment and education. Nevertheless all dimensions affect economic growth in reducing the output. This paper assumes that the multidimensional phenomenon of gender inequalities creates distortion in analogy of a distortionary tax. Indeed, less able men than women have a better access to economic activities. Thus productivity, capital accumulation, technological

progress and the institutional framework of production are affected by gender discrimination. Each dimension is concerned.

1. The direct effect of gender inequality in education

First, gender inequalities in education are analyses. Following Klasen (1999), this paper assumes that gender inequalities in education reduce the average quality of human capital and therefore the productivity of workers and economic growth.

Dollar and Gatti (1999) describes this negative impact as a selection distortion effect. If we assume a similar distribution of innate abilities between girls and boys, gender inequalities in education mean that less able boys than girls have access to education. Thus the average of innate ability of those who get educated is lower than it could be without gender discrimination. Therefore the level of human capital accumulation and its quality is reduced.

Moreover according to Lucas (1988), the accumulation of human capital is an increased function of its stock and its quality. Higher the level of human capital is, higher the rate of accumulation is. Also, gender inequalities in education reduce the stock of human capital, its quality and its accumulation rate.

Lastly, Murthi, Guio and Drèze (1995) show the positive externalities of the mother's education, especially on the education of the next generation. Gender inequalities in education reduce the incentive of mother to educate their offspring and also the human capital accumulation.

Lesser human capital associated with gender inequalities in education reduces growth directly by reducing the productivity of workers.

2. The direct effect of gender inequality in the labor market

Gender inequalities in employment and income generate distortion in analogy of gender inequalities in education. Indeed, more productive women than men are excluded from the labor market. Therefore, the pool of talent in which firms can choose its employees is reduced by gender discrimination, thus the allocation of talent is not optimal. Gender inequalities in employment hinder economic growth (Esteve-Volart 2004).

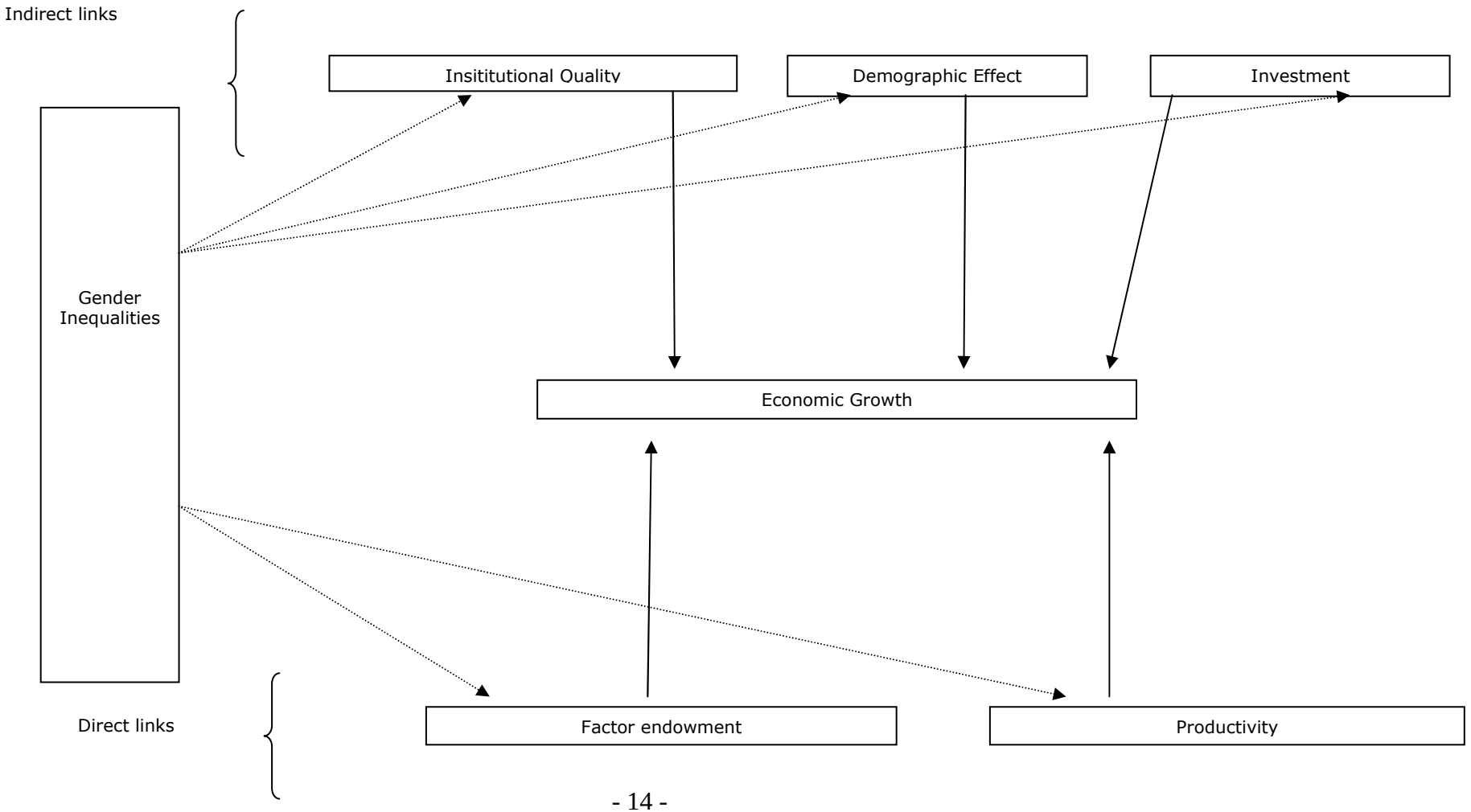
Moreover, the gender inequalities in earnings reduce the bargaining power of women in the family sphere. But women have a different behavior than men. Thomas (1997) shows that when a woman increases her bargaining power within household in raising her income, the household's investments are more productive, notably concerning childcare. A higher income for women leads to a higher bargaining power within household and therefore to more investment in education and health of the offspring's that increase the human capital of the next generation and the economic growth.

3. The direct effect of gender inequality in access to economic resources

One believes that men and women have different and separate productive activities. Gender inequality in access to economic resources means that women activities are undercapitalized and men activities are overcapitalized. Gender inequality in access to economic resources leads to misallocation of this resources. It creates distortion in the extent where the aggregate yield is reduced (Udry 1996) and technological progress shrinks (Von Braun and Webb 1989; Jones 1986). In Kenya, if gender equality occurs in the access to economic resources and education, the productivity of workers could increase by 22% (Quisumbig, 1996). Production losses may also be generated by a non-optimal distribution of resources within the family. In Cameroon, due to gender inequality in the access to economic resources, farm women prefer to work on their small plot of sorghum, which they control the income, rather than rice, which

they control nothing (Jones, 1986). However, if these women worked in the rice instead of sorghum, family income may increase of 6%. In Burkina Faso, gender inequality in the distribution of fertilizer and labor force to plots of land managed by men or women are sources of misunderstanding and inefficiency, which reduce the global productivity. The productivity increases of 6 to 20% if resources are distributed more equitably between men and women (Udry et al. 1995; Udry, 1996).

Fig. 2 The direct and indirect impact of gender inequalities on economic growth



4. The direct impact of gender inequality in physical integrity and access to health

Gender inequality in physical integrity and in the access to health reduces the productivity of women and the factor endowment. Indeed, productivity and human capital accumulation depends on education and health investment.

B. Indirect impact

1. The indirect impact of gender inequality in education

The selection distortion effect of gender discrimination in education leads to a lesser human capital accumulation. And yet, the investment rate is higher in countries with higher human capital. Thus, gender inequalities in education affect economic growth indirectly in reducing investment.

Moreover, the positive externalities of mother's education (Murthi, Guio and Drèze 1995) affect indirectly growth through their demographic effects. First, in reducing fertility rate (Lagerlöf 1999) an equal access to education for men and women promote growth. Reducing fertility rate leads to lower dependency burden and therefore leads to higher saving rate. In association with higher investment rate, gender equality in education may boost growth (Bloom and Williamson 1997). Lastly gender equality can promote the "demographic gift" given by the demographic transition (Bloom and Williamson 1997). Indeed a lower fertility rate brings to a lower population growth rate and to increase the share of the working age population in the total population. If all the growth in the labor force is absorbed in increased employment, then per capita economic growth will increase even if wages and productivity remain the same. This is due to the fact that more workers have to share their wages with fewer dependents, thereby boosting average per capita incomes. This effect is believed to have contributed considerably to the high growth rates in East and South East Asia (Young, 1995; Bloom and Williamson, 1998; ADB, 1997, see below). In fact, Bloom and Williamson estimate that between 1.4-1.9% of high annual per capita growth in East Asia (and 1.1-1.8% in South-East Asia) was due to this demographic gift. To the extent that high female education was among the most important causal factors bringing about this fertility decline, it could account for a considerable share of the economic boon generated by this demographic gift.

2. The indirect effect of gender inequality in the labor market

If woman's bargaining power is determined notably by her equal access to the labor market, also gender inequalities affect economic growth indirectly through investment, population growth and institutional quality.

First, more productive labor force - generated by an equal access to labor market- leads to higher investment rate and higher yield. Moreover, artificial barriers to female employment in the formal sector may contribute to higher labor costs and lower international competitiveness, as women are effectively prevented from offering their labor services at more competitive wages (Seguino 2000). In this context, it may be important to point out that a considerable share of the export success of South East Asian economies was based on female-intensive light manufacturing.

Second, an equal access to work conveys to lower fertility rate (Lagerlöf 1999) and promote the demographic gift defined by Bloom and Williamson (1997).

Lastly, more women have access to employment less corruption occurs (Swamy, Knack, Lee and Azfar 2001). In fact, women appear to be less likely to condone corruption and less involved in bribery.

3. The indirect effect of gender inequality in access to economic resources

Reducing the access of woman to economic resources reduces her economic activities, her income and therefore her bargaining power. This situation generates the same negative effects describe above.

4. The indirect impact of gender inequality in political power

According to Swamy, Knack, Leea and Azfar (2001) and Dollar, Fisman and Gatti (2001), women are less inclined to corruption. Their empirical works show that more equality in political representation leads to less corruption and better quality of institution. And Rodrik, Trebbi and Subramanian (2001) have shown the primacy of institutional quality for economic growth. That's why, one believes that gender inequality in political power may reduce growth indirectly in reducing institutional quality.

Moreover, women have a different behavior in political decision making than men. They invest more in infrastructure and have more productive investment choice (Duflo and Chattopadhyay 2004).

5. The indirect impact of gender inequality within family

Gender inequality within family means inequality in bargaining power and therefore in decision making. One believes that women decisions within family are more productive than men (Thomas 1997). Indeed, women decision encourages education and health and therefore economic growth (Hoddinott and Haddad 1995). In the same way, women have a different behavior with regard to loans (Pitt and Khander 1998). Higher bargaining power for women leads to increase the number of micro-loans and reduce the credit constraint existing in the developing world and therefore raise economic performance.

6. The indirect impact of gender inequality in physical integrity and access to health

Gender inequality in physical integrity raises fertility rate in the one hand, and reduces productivity in the other hand. In a similar way, gender discrimination in the access to health reduces the productivity of women. Reducing productivity and raising fertility rate impact negatively on economic growth through reducing investment and impeding demographic transition.

7. The indirect impact of gender inequality in identity

This dimension is central in gender inequality issue. Indeed, if the social norms describe women as the fairer sex, gender inequality in education, employment, access to economic resources, political representation, family, health and physical integrity are justifies in a world of scarcity. This paper deals with developing countries where constraint are frequent and scarcity universal. In this context, choice should be taken between male and women and the fairer sex is discriminated. It impacts negatively on the economic role of women and hinder economic growth.

IV. Empirical model

A. Empirical strategy

Ordinarily, economic phenomena are described one linear equation. But complex phenomena need to be described by a model which includes more than one relationship. In this paper direct and indirect effects are considered. Thus, to study this complex relationship describes in our purposes, we construct a simultaneous equations model.

To estimate this type of model, OLS estimations are biased. This model may contain multiple equations which are independent of each other on the surface: they are not estimating the same dependent variable, *etc*. But in simultaneous model, a dependent variable may be an explanatory variable in another equation. Indeed, simultaneity involves correlation between the explanatory variable and error term. Also OLS estimation produces a non-BLUE estimator, what justifies the use of seemingly unrelated regressions (SUR[10]). A SUR system is composed of several individual relationships that are linked by the fact that their error terms are correlated. There are two advantages of SUR[11]. The first one is to gain efficiency in estimation by combining information on different equations. The second one is to require and check restrictions that involve parameters in different equations (Moon and Perron 2006).

Like Taylor (1998) and Klasen (1999, 2002, 2006) direct and indirect impacts of gender inequalities on economic growth are considered. Thus a system of equation is estimated by seemingly unrelated regressions (SUR) to capture both effects and to avoid simultaneity problem. Moreover, following Bloom and Williamson (1998) and Klasen (1999, 2002, 2006), our analysis distinguish population growth and labor force growth.

The following system of equation is estimated.

(1) $g = \alpha_1 + \beta_1 INV + \beta_2 POPG + \beta_3 LFG + \beta_4 INS + \beta_5 GII + \beta_6 X + \varepsilon$

(2) $INV = \alpha_2 + \beta_7 POPG + \beta_8 LFG + \beta_9 INS + \beta_{10} GII + \beta_{11} X + \gamma$

(3) $POPG = \alpha_3 + \beta_{12} GII + \beta_{13} X + \delta$

(4) $LFG = \alpha_4 + \beta_{14} GII + \beta_{15} X + \upsilon$

(5) $INS = \alpha_5 + \beta_{16} GII + \beta_{17} X + \sigma$

Where g: the growth rate of GDP per capita 1998,
INV: the rate of investment as a percentage of GDP 1998,
POPG: the population growth rate 1998,
LFG: the labor force growth rate 1998,
AID: the level of aid received as a percentage of GDP 1998,
INS: the institutional quality 1998,
GII: the gender inequalities index 1998,
X: other variables typically included in growth regressions (Initial GDP 1995, Openness, Geography, Government consumption) and regional dummy variables.

The first regression measures the direct effect of gender inequalities on economic growth. Thus β_6 describes the effect of gender inequalities on human capital accumulation.

Following our purposes on indirect effect of gender inequalities on economic performance through investment and their demographic and institutional effect, equation (2) – (5) are drawn. Indeed ($\beta_{10} * \beta_1$) measures indirect effect through investment; ($\beta_{12} * \beta_2$) + ($\beta_{12} * \beta_2 *$

[10] For more details see Zellner (1962).
[11] For more details see Greene (2000).

β_1) assesses the indirect effect through population growth; ($\beta_{14} * \beta_3$) + ($\beta_{14} * \beta_8 * \beta_1$) evaluates the indirect effect through labor force growth and ($\beta_{16} * \beta_4$) + ($\beta_{16} * \beta_9 * \beta_1$) estimates the indirect effect through institutional quality.

Therefore, the total effect can be assesses by the "path analysis" (Klasen 1999, 2002, 2006) as cumulative effect of direct and indirect impact of gender inequalities on economic growth and defined by the following formula:

$\beta_6 + (\beta_{10} * \beta_1) + (\beta_{12} * \beta_2) + (\beta_{12} * \beta_2 * \beta_1) + (\beta_{14} * \beta_3) + (\beta_{14} * \beta_8 * \beta_1) + (\beta_{16} * \beta_4) + (\beta_{16} * \beta_9 * \beta_1)$

B. Data

Note that the GII can be computed for only one year 1998. Indeed, GID database (OECD 2009) used to construct the GII is only available for one year. Thus, other data concerned this year. The following data[12] was used to analyze the relationship between gender inequalities and economic growth:

Data on income and growth are based on par capita income adjusted for purchasing power parity expressed in constant us dollar, as reported in the Penn World Table Version 6.3 (Alan Heston, Robert Summers and Bettina Aten, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania, August 2009).

Data on investment, population growth and openness are also drawn from the Penn World Table Version 6.3 (Alan Heston, Robert Summers and Bettina Aten, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania, August 2009).

Data on institutional quality use governance indicators, drawn from Worldwide Governance Indicators project (World Bank 2009) computed by Kaufman, Kraay and Zoido-Lobaton (1999).

Data on labor force growth, aid per capita and government expenditure are drawn from the World Development Indicators (WDI World bank 2009).

Data on geography is drawn from CEPII surveys.

Data used to construct the GII are described in appendix 1. They are drawn from GID (Gender, Institutions and Development) OECD database, Womanstats database, Wistat cd-rom v.4 (UN) and CIRI Human right database.

C. Empirical Results

Table 3 shows the empirical results of the equation (1) to (5) describe above. The system of equation is estimated by OLS[13]. All regressions satisfy requirement about heteroscedasticity and omitted variable test.

The first regression describes the direct link between gender inequalities and economic growth. Well-known findings are confirmed: the negative and significant coefficient of initial GDP (lGDP97) corroborates the hypothesis of conditional convergence (Mankiw, Romer and Weil 1992). Moreover, the ambiguous effect of demography is emphasized: the population growth has a negative impact on economic growth, while the labor force growth has a positive

[12] For more details on data see in appendix 1
[13] Results obtained by SUR estimation are not significantly different

effect (Bloom and Williamson 1998, Klasen 1999, 2002, 2006). Lastly, institutional quality seems to have a positive impact on economic growth (Rodrik, Subramanian and Trebbi 2002).

Concerning our purposes, the gender inequalities index (GII) has a negative and significant coefficient. These results confirm that gender inequalities affect growth negatively in reducing human capital accumulation. That provides some support for our theoretical links describe above. The impact of gender inequalities on economic growth is negative whatever the specification. The inclusion of control variable and regional dummies doesn't change this result.

Concerning the indirect impact of gender inequalities, regression (2) shows that gender inequalities reduce investment. High investment rates are related with low gender inequalities. Thus to promote economic growth, targeting gender equality in varied dimensions may be a efficient tool, according to the relationship between gender inequalities, investment and economic growth postulated above. These findings support the World Bank opinion of engendering development (World Bank 2001). Furthermore, regression (2) shows that the population growth reduces investments while the labor force growth and institutional quality increase it.

Regressions (3) and (4) also show that gender inequalities have the expected impact on population growth and labor force growth. The demographic effect of gender inequalities is also confirmed. Indeed, the coefficients of GII in regression (3) and (4) prove that gender inequalities affect positively the population growth and negatively the labor force growth respectively. Then demographic transition and "demographic gift", defined by Bloom and Williamson (1997) as pro-growth, are dependent on women situation.

Table 3: Results of OLS estimation
Source: Own computation

	(1) g	(2) inv	(3) popg	(4) lfg	(5) kkz98
lGDP97	-2.720**	-2.747*	-0.279**	-0.351	0.383*
	(2.53)	(2.62)	(1.99)	(1.58)	(7.17)
popg	-0.997	-0.344			
	(1.33)	(0.46)			
lfg	0.770	1.057**			
	(1.60)	(2.21)			
inv	0.014				
	(0.15)				
gii	-6.800+	-6.203+	2.432*	-0.203	-0.359+
	(1.88)	(1.73)	(4.43)	(0.20)	(1.72)
kkz98	1.266	2.817+			
	(0.83)	(1.86)			
Control	yes	yes	yes	yes	yes
Constant	23.339**	-9.284	3.456*	5.242*	-3.183*
	(2.55)	(1.01)	(2.84)	(2.71)	(6.87)
Observations	110	110	110	110	110

Absolute value of z statistics in parentheses. + denotes significance at 10%; ** significance at 5%; * significance at 1%. Ramsey test was used to test for omitted variables. White test was used to control for heteroscedasticity. Control variables are government consumption, openness, geography and regional dummies. Omitted region is East Asia.

Lastly, regression (5) demonstrates the existence of a negative relationship between institutional quality, measured by governance indicators (Kaufman et *al.* 1999), and gender inequalities. Nevertheless this coefficient is insignificant that underline the ambiguous results of study about gender and corruption (Dollar et *al.* 2001, Swamy et *al.* 2001).

Following Klasen (1999), I use the results from regressions (1) – (5) to determine to what extent economic growth differences between regions are due to gender inequalities. Using just the first equation which describes the direct effect of gender inequalities, 2.2% of the growth difference between SSA and EAP can be explain by differences in gender inequalities. Idem for MENA, where 2.1% of growth difference can be accounted for by differences in gender bias. For SA, which is the worst performer in GII, 3.2% of growth difference is due to differences in gender inequalities. In addition to these direct effects, indirect effects are considered. 0.04 % of growth difference between SA and EAP can be explain by the canal of investment, 1.16% by the canal of population, 0.07% by the canal of labor force growth and 0.2% by the canal of institutional quality. These findings about canal of transmission allow a better understanding of gender inequality consequences. Even if indirect effects seem to be smaller than expected, gender inequalities hinder development in reducing investment, institutional quality and demographic transition.

V. Conclusion

The contribution of this paper is twofold. First, this paper deals with the measurement of gender inequalities. Second the relationship between gender inequalities- in their all dimensions- and economic growth is thinking in another way to consider direct and indirect impact.

The gender inequalities index (GII) is a new tool to measure gender inequalities in developing countries. Thanks to multiple correspondence analysis (MCA), the GII computes 33 variables and 8 dimensions in order to take into account all forms of discrimination against women in developing countries. The aggregation strategy drawn from MCA results allow to identify the weight of each dimensions endogenously. Gender inequalities in family, identity, health and access to economic resources appear to be the more restrictive for women in the developing world. Thus to promote women emancipation and “engendering development” -and therefore economic growth- measures should affect specially gender inequalities in family, identity, health and access to economic resources.

Empirical results of SUR (seemingly unrelated regression) estimation confirm the theoretical and previous findings about the relationship between gender inequalities and economic growth. Indeed, gender inequalities impede economic growth directly and indirectly through reducing investment and through their demographic and institutional effects. Thus, using just the direct effect, 3.2% of growth difference between South Asia and East Asia may be accounted for by differences in gender inequalities (2.2% for Sub-Saharan Africa; 2.1% for Middle East and North Africa). Direct and indirect linkages are confirmed. Therefore, gender inequality should be considered as an explanation of growth difference and lack of convergence, especially for South Asia. Targeting gender equality may help to promote economic growth directly in increasing human capital accumulation and indirectly in raising investment, in promoting the demographic gift (defined by Bloom and Williamson 1997) and in improving institutional quality.

Nevertheless, correlation is not causality. If this paper concludes the existence of a strong linkage between gender inequalities and economic growth, issue about causality are not

resolved. Econometric limits may be due to omitted variables, measurement errors or misspecified model. Only micro-econometric analysis can go beyond these restrictions.

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Appendix 1: Data

Table 3. Variables names, definitions and Data 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 a 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 existing of 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	Ratio female/ male of percentage 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 adolescent (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 share of parliaments seats	WISTAT.4 UN
LEGI	Women share of legislators	WISTAT.4 UN
PRIM	Ratio of female / male of primary school enrolment rates	WISTAT.4 UN
SEC	Ratio of female / male of secondary school enrolment rates	WISTAT.4 UN
TER	Ratio of female / male of tertiary school enrolment rates	WISTAT.4 UN
LIT	Ratio of female / male of 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 rate	WISTAT.4 UN
TECH	Percentage of female in technical managerial and administrative positions	WISTAT.4 UN
EARN	Ratio of female / male earned income	WISTAT.4 UN
G	Growth rate of GDP per capita at purchasing power parity	PWT 6.3**
GDP95	Initial GDP in 1995	PWT 6.3
INV	Investment share of GDP per capita at PPP	PWT 6.3
POPG	Population growth rate	PWT 6.3
OPEN	Exports plus imports divided by GDP	PWT 6.3
LFG	Labor force growth	WDI ***(World Bank 2009)
AID	Aid per capita	WDI (World Bank 2009)
GOV	Government consumption expenditure (% of GDP)	WDI (World Bank 2009)
GEO	Distance from equator (lat/90)	CEPII
KKZ	Governance indicators	WGI† (World Bank 2009)

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

** Alan Heston, Robert Summers and Bettina Aten, Penn World Table Version 6.3, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania, August 2009

*** WDI is abbreviation for the report World Development Indicators

† WGI is abbreviation for Worldwide Governance Indicators project

Appendix 2: Results of MCA

Test Values

The values tests describe the extent to which a modality participates significantly to the construction of an axis (Lebart, Morineau and Piron 2000). A test value is significant if it exceeds 2. Here, all values exceed 2. Thanks to these tables, we can interpret the two axis.

Axis 1

ID.	V.TEST	LIBELLE MODALITE	LIBELLE DE LA VARIABLE	POIDS	NUMERO
m1	-6.25	1	ECO	37.00	1
m2	-5.50	2	FAM	27.00	2
m2	-5.34	2	ID	27.00	3
m1	-5.12	1	SANTE	21.00	4
m1	-4.74	1	EDU	20.00	5
m1	-4.70	1	FAM	17.00	6
m1	-4.65	1	PHY	20.00	7
m2	-4.62	2	SANTE	30.00	8
m1	-3.93	1	ID	18.00	9
m1	-3.63	1	POL	26.00	10
			Z O N E C E N T R A L E		
m4	3.87	4	SANTE	22.00	31
m4	3.91	4	ID	24.00	32
m4	4.53	4	FAM	20.00	33
m5	4.96	5	PHY	18.00	34
m5	5.08	5	SANTE	10.00	35
m5	5.17	5	EDU	19.00	36
m5	5.27	5	EMPLOI	20.00	37
m5	5.87	5	ID	13.00	38
m4	5.88	4	ECO	26.00	39
m5	6.19	5	FAM	21.00	40

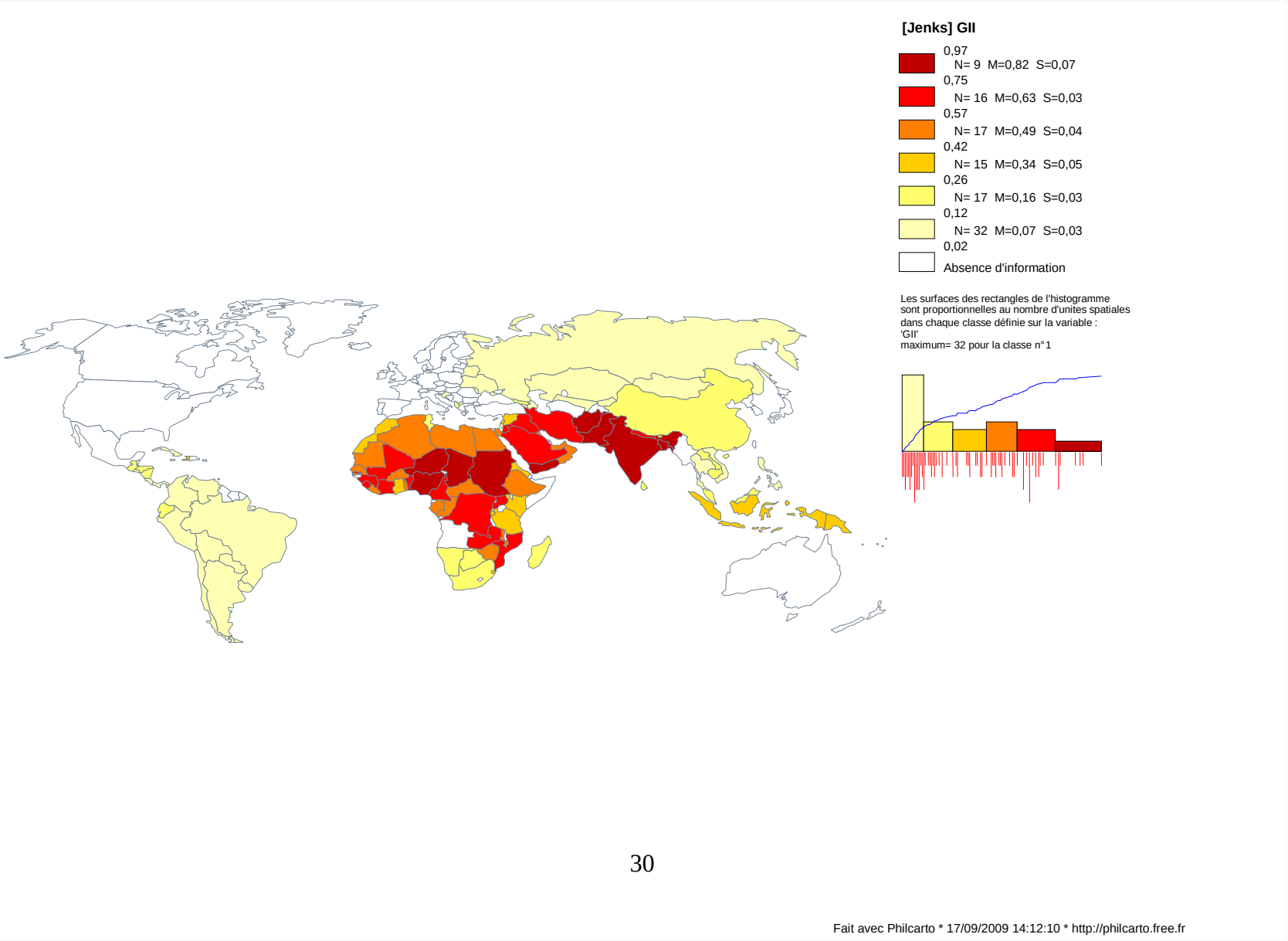
Axis 2

ID.	V.TEST	LIBELLE MODALITE	LIBELLE DE LA VARIABLE	POIDS	NUMERO
m5	-4.94	5	EDU	19.00	1
m3	-4.41	3	EMPLOI	21.00	2
m5	-4.32	5	PHY	18.00	3
m5	-4.11	5	ECO	13.00	4
m3	-3.98	3	ID	27.00	5
m3	-3.04	3	FAM	24.00	6
m2	-2.77	2	POL	18.00	7
m3	-2.65	3	POL	26.00	8
m3	-2.58	3	ECO	19.00	9
m2	-2.44	2	SANTE	30.00	10
			Z O N E C E N T R A L E		
m2	2.18	2	PHY	27.00	34
m1	2.50	1	SANTE	21.00	35
m4	3.76	4	ECO	26.00	36
m5	4.65	5	SANTE	10.00	37
m5	4.72	5	POL	19.00	38
m5	5.42	5	EMPLOI	20.00	39
m5	5.85	5	ID	13.00	40

Table 5: Test values and axis (Spad v.7)
Source: Own computation

Appendix 3: GII ranking

Country	Rank	Country	Rank	Country	Rank	Country	Rank
Afghanistan	130	Kuwait	91	El Salvador	52	Slovak Republic	13
Yemen	129	Senegal	90	Israel	51	Czech Republic	12
Chad	128	Algeria	89	Uzbekistan	50	France	11
Sudan	127	Bahrain	88	Macedonia, FYR	49	Iceland	10
Pakistan	126	Kenya	87	Panama	48	Ireland	9
Nigeria	125	Papua New Guinea	86	Azerbaijan	47	Netherlands	8
Bangladesh	124	Swaziland	85	Chile	46	Switzerland	7
Niger	123	Eritrea	84	Peru	45	United Kingdom	6
India	122	Syrian Arab Republic	83	Armenia	44	Denmark	5
Sierra Leone	121	Ghana	82	Costa Rica	43	Finland	4
Guinea	120	Indonesia	81	Russian Federation	42	Germany	3
Iran, Islamic Rep,	119	Tanzania	80	Brazil	41	Norway	2
Benin	118	Rwanda	79	Paraguay	40	Sweden	1
Nepal	117	Lebanon	78	Thailand	39		
Cameroon	116	Burundi	77	Cuba	38		
Saudi Arabia	115	Bhutan	76	Singapore	37		
Congo, Dem, Rep,	114	Haiti	75	Viet Nam	36		
Gambia, The	113	Morocco	74	Trinidad and Tobago	35		
Iraq	112	Madagascar	73	Colombia	34		
Mozambique	111	Sri Lanka	72	Kyrgyz Republic	33		
Uganda	110	Botswana	71	Ukraine	32		
Mali	109	Cambodia	70	Jamaica	31		
Jordan	108	Guatemala	69	Mongolia	30		
Cote d'Ivoire	107	Lao PDR	68	Venezuela, RB	29		
Zambia	106	South Africa	67	Philippines	28		
Ethiopia	105	Tajikistan	66	Kazakhstan	27		
Gabon	104	Malaysia	65	Greece	26		
Central African Republic	103	Albania	64	Uruguay	25		
United Arab Emirates	102	Tunisia	63	Argentina	24		
Togo	101	Fiji	62	Croatia	23		
Congo, Rep,	100	Namibia	61	Moldova	22		
Liberia	99	China	60	Portugal	21		
Libya	98	Nicaragua	59	Belarus	20		
Burkina Faso	97	Honduras	58	Austria	19		
Zimbabwe	96	Ecuador	57	Belgium	18		
Malawi	95	Georgia	56	Italy	17		
Egypt, Arab Rep,	94	Mauritius	55	Luxembourg	16		
Mauritania	93	Bolivia	54	Spain	15		
Oman	92	Dominican Republic	53	Hungary	14		


[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

Appendix 4: List of countries by regions and income

East Asia & Pacific

Cambodia
China
Fiji
Indonesia
Lao PDR
Malaysia
Mongolia
Papua New Guinea
Philippines
Singapore
Thailand
Vietnam

Europe & Central Asia

Albania
Armenia
Azerbaijan
Belarus
Croatia
Georgia
Kazakhstan
Kyrgyz Republic
Macedonia, FYR
Moldova
Russian Federation
Tajikistan
Ukraine
Uzbekistan

OECD

Austria
Belgium
Czech Republic
Denmark
Finland
France
Germany
Greece
Hungary
Iceland
Ireland
Italy
Luxembourg
Netherlands
Norway
Portugal
Slovak Republic
Spain
Sweden
Switzerland
United Kingdom

Middle East & North Africa

Algeria
Bahrain
Egypt, Arab Rep.
Iran, Islamic Rep.
Iraq
Israel
Jordan
Kuwait
Lebanon
Libya
Morocco
Oman
Saudi Arabia
Syrian Arab Republic
Tunisia
United Arab Emirates
Yemen, Rep.

Sub-Saharan Africa

Benin
Botswana
Burkina Faso
Burundi
Cameroon
Central African Republic
Chad
Congo, Dem. Rep.
Congo, Rep.
Côte d'Ivoire
Eritrea
Ethiopia
Gabon
Gambia, The
Ghana
Guinea
Kenya
Liberia
Madagascar
Malawi
Mali
Mauritania
Mauritius
Mozambique
Namibia
Niger
Nigeria
Rwanda
Senegal
Sierra Leone
South Africa
Sudan
Swaziland
Tanzania
Togo
Uganda
Zambia
Zimbabwe

South Asia

Afghanistan
Bangladesh
Bhutan
India
Nepal
Pakistan
Sri Lanka

Latin America & Caribbean

Argentina
Bolivia
Brazil
Chile
Colombia
Costa Rica
Cuba
Dominica
Ecuador
El Salvador
Guatemala
Haiti
Honduras
Jamaica
Nicaragua
Panama
Paraguay
Peru
Trinidad and Tobago
Uruguay
Venezuela, RB

High income: non-OECD	***Lower middle income***	***Low income***
Bahrain	Albania	Afghanistan
Israel	Algeria	Bangladesh
Kuwait	Armenia	Benin
Oman	Azerbaijan	Burkina Faso
Saudi Arabia	Bhutan	Burundi
Singapore	Bolivia	Cambodia
Trinidad and Tobago	Cameroon	Central African Republic
United Arab Emirates	China	Chad
	Colombia	Congo, Dem. Rep.
Upper middle income	Congo, Rep.	Côte d'Ivoire
Argentina	Dominican Republic	Eritrea
Belarus	Ecuador	Ethiopia
Botswana	Egypt, Arab Rep.	Gambia, The
Brazil	El Salvador	Ghana
Chile	Georgia	Guinea
Costa Rica	Guatemala	Haiti
Croatia	Honduras	Kenya
Cuba	India	Kyrgyz Republic
Fiji	Indonesia	Lao PDR
Gabon	Iran, Islamic Rep.	Liberia
Jamaica	Iraq	Madagascar
Kazakhstan	Jordan	Malawi
Lebanon	Macedonia, FYR	Mali
Libya	Moldova	Mauritania
Malaysia	Mongolia	Mozambique
Mauritius	Morocco	Nepal
Panama	Namibia	Niger
Russian Federation	Nicaragua	Nigeria
South Africa	Paraguay	Pakistan
Uruguay	Peru	Papua New Guinea
Venezuela, RB	Philippines	Rwanda
	Sri Lanka	Senegal
	Sudan	Sierra Leone
	Swaziland	Tajikistan
	Syrian Arab Republic	Tanzania
	Thailand	Togo
	Tunisia	Uganda
	Ukraine	Uzbekistan
		Vietnam
		Yemen, Rep.
		Zambia
		Zimbabwe

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