Multidimensional measure of social cohesion
A benchmarking analysis on a panel of countries

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ABSTRACT

This paper tries to operationalize a multidimensional measure of social cohesion. The background of the matter has initially allowed to identify a factors pedestal which may identify different dimensions of social cohesion. The principal components factor analysis allowed to extract 15 input indicators and outcome. They were used in the design of a composite index of social cohesion (**CISC**), the measurement refers to the empirical approach of fuzzy sets. Having the virtue of organizing into a hierarchy the contribution of explanatory factors in the composite index of social cohesion, this measure approach has allowed to inform on the tracks to take in order to strengthen social cohesion.

In summary, the level of social cohesion remains disparate according to the country's level of development. The highest average score of social cohesion results from brewing economic, political and institutional factors related to employability, fight against poverty, degree of happiness of population, strengthening of democracy, freedom of the press and fight against corruption. In developed countries, two factors are added, namely gender equity and good governance.

In contrast, social cohesion ferments are irreducible to income inequality. They are due to a combination of various factors, including the narrowness of investment in human capital by means of health and education policies, low confidence in economic and social security system and gender inequality. To these threats common to all countries join specific factors to their levels of development. it concerns limited participation of women in the labor market and the lack of happiness, for developed countries, the low education of women and poor governance, for their counterparts in the developing word.

The articulation of social cohesion and human development have highlighted the deficiencies of the HDI as an indicator of social progress. The focus of the debate on the only indicators of the HDI is not able to reflect the dimensions that constituting the foundation of human progress. The social cohesion should be replaced in the development model through specific policies to strengthen social equity, equal opportunities, sense of belonging, participation and good practices of governance.
Keywords : social cohesion, multidimensional measure, fuzzy logic, CISC vs HDI

Introduction

The return in vogue of the issue of social cohesion among the concerns of international, statistical and economic bodies (OCDE, PNUD, WB, etc), and ONG in the vocabulary of politicians,there are three key questions to be asked ; what is the multidimensional nature of social cohesion? How to statistically operationalize its measurement? And how can social cohesion contribute to changing social policies?

Various works have attempted to conceptualize and measure social cohesion. If the developed approaches have resulted in a base of indicators to decide on the various facets of social cohesion, research on this question have paid little attention to its multidimensional measure. Referring to different conceptual frameworks, this study assigns the following objectives: (i) construction of a composite index of social cohesion (CISC) for 140 countries and benchmarking analysis of results; (ii) breakdown of index per dimension of social cohesion by level of development of countries and regional space of belonging; (iii) comparison between CISC and HDI.

I. Methodological Framework: the background of the issue has initially identified a factors pedestal that may explain social cohesion.Series of principal components factor analysis resulted in a subset of explanatory factors, not redundant and not correlated, composed of 15 indicators of contribution /

input and result / outcome which measures different dimensions of organic solidarity. These factors were used in the design of a composite index of social cohesion of which the measurement refers to the empirical approach of fuzzy sets.

1.1. Definitions of social cohesion according to empirical approaches

The conceptualization of social cohesion refers mainly to the definitions of the Council of Europe and the International and Ibero-American Foundation of Administration and Public Policies (FIIAPP). Following these definitions, social cohesion is a transversal phenomenon icombining social, economic, political and cultural dimensions imposing the participation of all stakeholders in society to strengthen solidarity and social inclusion. It implies equal opportunities to minimize social disparities and ensure the well-being of all. In this context, the effort of public policy must be redefined in favor of inclusive development that aims to avoid unequal trends and promote social equity. In other words, the fight against the different facets of poverty and inequality, welfare and social mobility are fundamental components of social cohesion.

1.2. Methodological approach for a multidimensional measure of social cohesion

1.2.1. Designing a database on a panel of countries: This is a difficult step requiring validation of three data quality criteria: (i) the relevance of data to determine the degree of social incohesion in a given country; (ii) the availability of data for the majority of countries in the study; and (iii) the reliability and transparency of selected sources. Using these criteria has allowed us to build a database of 45 indicators covering 140 countries, 39 developed countries and 101 developing countries. These indicators come mainly from international databases for economic and social development, mentioned in the table below.

Area of life	Measurement indicators	Data source
Welfare of the population	-Poverty rate	**- World Bank Report of the Happy Planet Index (2012) United Nations Development Programme (UNDP, 2012, 2013) - "Components of Population Growth for Region Summary" Database (2012) Encyclopedia "Britannica" (2012)**
	-gross national product per capita	
	-refuge population	
	-Incarceration rate	
	- happiness composite index	
	-Welfare	
	-Satisfaction regarding the community	
	-Satisfaction regarding government	
	- trust between individuals	
	-Work satisfaction .	
	-Violation of humain rights	
	-Intensity of civil war	
	Population growth rate	
	- Net number of migrants	
	-ethnic differences	
	-linguistic differences	
	-religious differences	
Socio-economic and social c context of the social cohesion policy	-Growth rate of PIB	**-World Bank Website -United Nations Development Programme (UNDP, 2012, 2013) - "World Health Organization" Report -Ranking of reporters without borders -Report of the Happy Planet Index**
	-Inflation rate	
	-Unemployment rate	
	-Public expenditure on education	
	-Dropout rate in primary education	
	-Average number of years of education	
	-Public spending on health	
	-democracy	
	- freedom of press	
	-governance	
	-corruption	
	-citizens' political engagement	
	-Density of physicians per 10,000 inhabitants	
	-Infant mortality rate	
	-Life expectancy at birth	
	-Life expectancy at the age of 60	
	-Fertility rate	
	-Share of rural population	
inequalities	-Life expectancy index adjusted for inequality	

-Education index adjusted for inequality	-United Nations Development Programme (UNDP) (2012 and 2013)
-Income indexes adjusted for inequality	
-Activity rates for both genders	- "Gender, Institutions and Development" Database
-Gender Inequality Index	
-Female population with at least secondary education	- "World Health Organization " Report
-Male population with at least secondary education	
-Proportion of female parliamentarians	
-Index of violence against women	

1.2.2. Factor analysis of dimensional indices

The main components analysis allowed to extract the most relevant dimensions to measure social cohesion: 15 indexes able to capture the multidimensional structure of the social cohesion of the country. These indices are: unemployment, poverty, income inequality, welfare (happiness), economic and social security, corruption, gender inequality, women's activity, female education, public expenditures in health, public expenditures in education, democracy, governance, freedom of press, and language differences.

1.2.3. Multidimensional measure of social cohesion : fuzzy set approach
Method of calculation of CISC

The CISC is a synthetic indicator for which the calculation is based on a weighted average of 15 dimensional indices mentioned above. It gives the score of each country on a standardized scale, the minimum and maximum values indicate respectively the least cohesive country and that the more cohesive among the sample of 140 countries.

The CISC is calculated using the approach of fuzzy sets. This approach has the virtue of treating problems for which there is no consensus on factors to classify an observation unit in a given set. Compared to the measurement of social cohesion, this approach allowed to assess to what extent a country is more cohesive than another. Therefore, it is more appropriate for the need to establish a beinchmarking of countries according to the degree of social cohesion.

The computational mode of dimensional indices: choice of mode of standardizationnormalisation

The computational method is to standardize all indicators of the database to bring them on the same scale.to that ends, the indices showing a positive relationship with social cohesion are normalized as follows:

$$MinMax\ 1: X_i \quad X_i^{0,1} = \left[X_i - min\ (X)\right] / \left[max\ (X) - min\ (X)\right]$$

For negatively correlated indices with CISC, they are standardized using the following

$$MinMax2: X_i \quad X_i^{0,1} = \left[max\ (X) - X_i\right] / \left[max\ (X) - min\ (X)\right]$$

transformation:

Aggregation function and weighting system

Now it is a question of synthesizing dimensional indices built into a single composite index measuring the degree of social cohesion. In this context, the approach of Chiappero-Martinetti.E (1994) indicates that we can, in general, perform aggregation operation by the function

h : $[0,1]^k$ for k 2, such as : $\mu_c(i) = h_\delta\ (\mu_{\Theta 1}(i), \dots, \mu_{\Theta 15}(i)) = \left[\sum_{j=1}^{15} w_j\ (\mu_{\Theta j}(i))^\delta\right]^{1/\delta}$:

An aggregation function of the 15 components of the CISC by country i with: $\delta \neq 0$ is a parameter that determines the type of average; when $\delta \rightarrow 0$, we obtain a geometric mean, when $\delta = -1$, a harmonic average, and When $\delta = 1$, an arithmetic average is obtained.

$$\mu_{\Theta j}(i) = \begin{cases} MinMax\ 1 & \text{for positively correlated indices with CISC} \\ MinMax2 & \text{for negatively correlated indices with CISC} \end{cases}$$

The h_δ function takes intermediate values between the maximum and minimum values, reflecting thus opportunities for interaction between the various indicators:

$$\min (\mu_{\Theta 1}(i),\ldots, \mu_{\Theta k}(i)) \quad h_\delta (\mu_{\Theta 1}(i), \ldots, \mu_{\Theta k}(i)) \quad \max (\mu_{\Theta 1}(i),\ldots, \mu_{\Theta k}(i))$$

In the expression of the agregation function h_δ , w_j represents the weight that specifies the relative importance given to each dimensional index of social cohesion. As part of this work, we propose the following weighting system:

$$w_j = \frac{\bar{\mu}_j}{\sum_{j=1}^{15}\bar{\mu}_j} \quad (w_j \quad 0 \text{ et } \sum_{j=1}^{15} w_j = 1) \quad \bar{\mu}_j \text{ is the average of the dimensional indice j}$$

This weighting is designed in a way that the chosen aggregation function fulfills the conditions for monotonicity, continuity and symmetry.
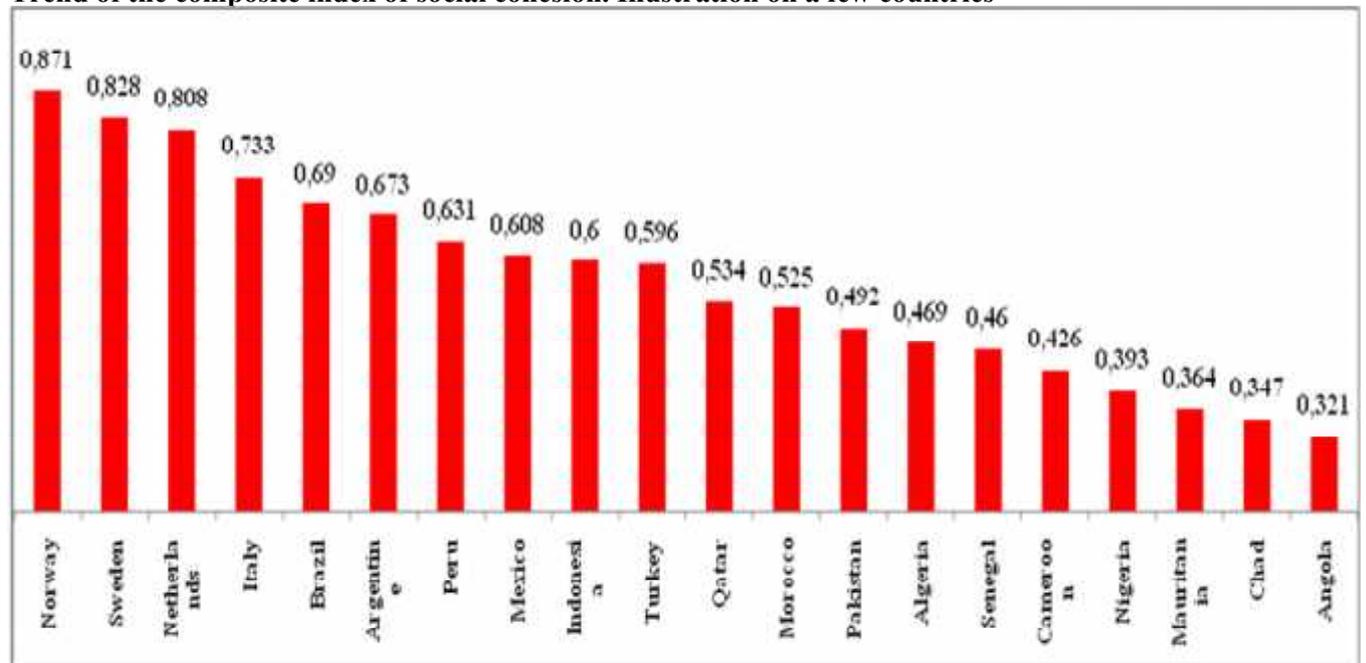
After defining the aggregation function and the weighting scheme, the construction of a composite index of social cohesion for all countries is possible is defined as the arithmetic mean of "social cohesion ratios" of each country:

We have CISC = 0 if and only if $\mu_c(i) = 0$ for all countries,i.e in the complete absence of social cohesion. CISC = 1 if and only if $\mu_c(i) = 1$ For all countries,i.e, when the conditions are met for social cohesion. The most common cases (intermediate case) is that where 0 <CISC< 1 i.e Ic is an increasing function of the degree of social cohesion in each country. This is a ratio that expresses the share of social cohesion explained by the factors identified in its definition; more this value tends towards 1, more this society is cohesive, and vice versa.

II. Some key results of the benchmarking analysis of social cohesion

Unevenly distributed across countries, and highly disparate between the North and the South, the CISC likely reflects the diversity in terms of human experience and hides strong variation depending on country development level. The average level of the composite index of social cohesion is 0.605. However, as an average, this value contains the relevant differences between countries or groups of countries.

Trend of the composite index of social cohesion. Illustration on a few countries
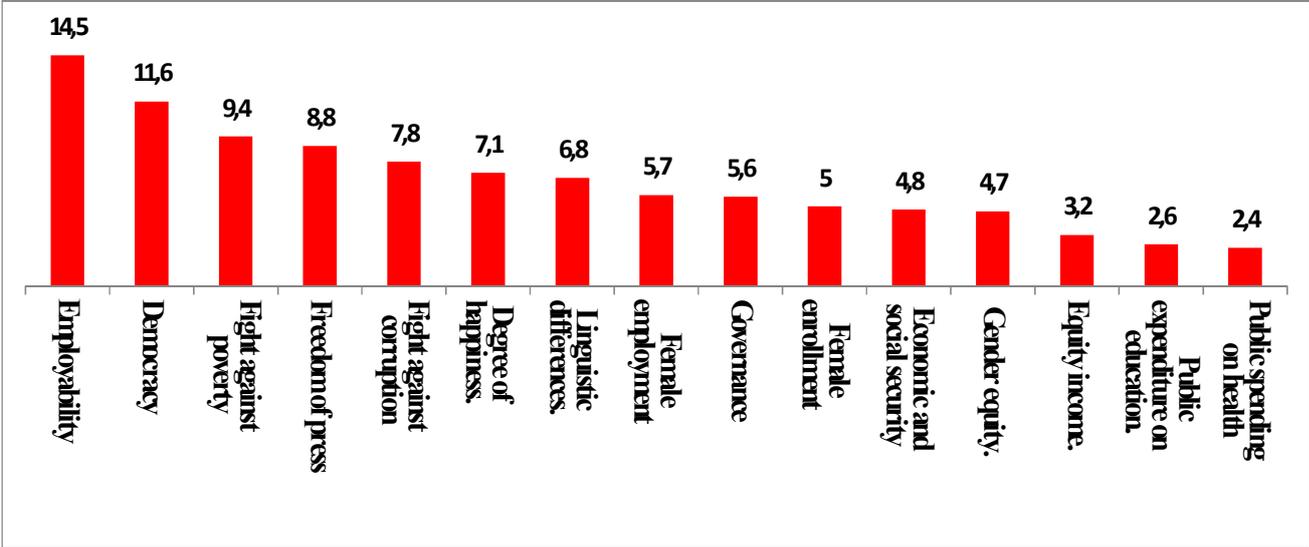

Source : our own calculations

Thus, large differences emerge from the CISC comparison among countries: Norway has CISC the highest CISC (0.871), followed by Iceland (0.831), Sweden (0.828), Denmark (0,825) Austria (0.821), Germany (0,819). For countries with medium CISC levels, it is appropriate to include, as an indication, Tunisia (0,618), Mexico (0.608), Turkey (0.60), the Bahrain (0.584), Bhutan (0.580), and Honduras (0.579). The five countries with the lowest CISC level, they are Mauritania (0.364), Ivory Coast (0.356), Chad (0.347), Zimbabwe (0.328), Angola (0,321).

Contribution of explanatory factors of social cohesion to the CISC: opportunities and threats

Of all this study results, we retain, essentially, that the social cohesion paradigm is broader than that of human development. It is based on social justice, welfare in its qualitative and quantitative dimensions, and relies on a social inclusion approach coupled with good governance practices and participation. In addition, the slogan of social cohesion is positive discrimination to promote gender equity.

Contribution factors of social cohesion to the CISC. All countries

Source: our own calculations

In short, stimulating social cohesion seem to result from a brewing of factors: economic, political and institutional related to employability, fight against poverty, degree of population happiness , strengthening of democracy, freedom of the press and fight against corruption. In developed countries, two factors are added, namely gender equity and good governance. In contrast, social cohesion ferments are irreducible to income inequality. They are due to a combination of various factors, including the narrowness of investment in human capital through policies of health and education, low confidence in economic and social security system and inequality genre. In addition to these common threats for all countries are joining specific factors to their levels of development. It comes to the limited participation of women in the job market and the lack of happiness, for developed countries, the low education of women and poor governance, for their developing counterparts.

Social cohesion and human development: what kind of relationship?

The juxtaposition of the CISC and the Human Development Index (HDI 2012) by country was used to test the degree and nature of the correlation between these two indices. Linear correlation coefficients (+ 0.832) and rank correlation (+ 0.856) show that both indices are highly correlated However, given that these two factors do not coincide with the unit (+1), this implies the existence of distortions in the ranking of countries according to CISC and HDI.
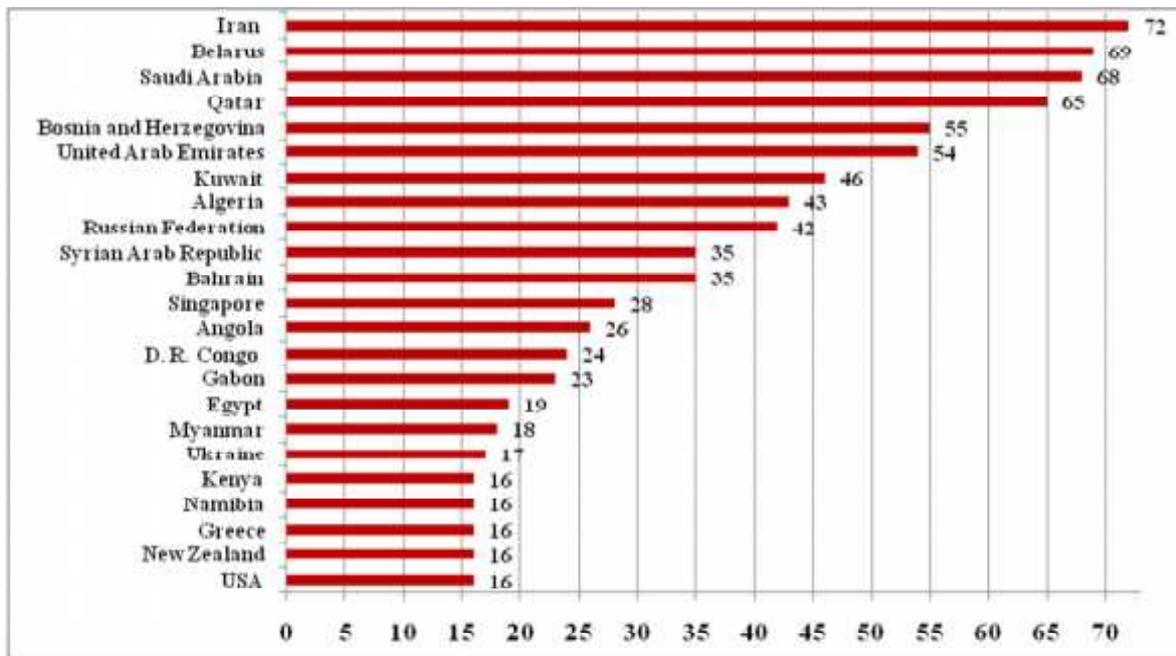
Thus, the ranking compared between the CISC and the HDI shows that many highly ranked countries according to HDI are among the latest ranked on social cohesion. This relates particularly to the

Middle East: Iran has the highest drop in ranking going from HDI (63rd) to CISC (135th), a loss of 72 places .The declination is also notable for Saudi Arabia (- 68 places), Qatar (- 65), the United Arab Emirates-(- 58), the Kuwait (- 48), Syria (- 35) and Bahrain (- 35).

However, the opposite trend shows that some countries have strong social cohesion levels without knowing well in terms of development. This trend is reflected in a gain in terms of greater ranking in CISC that HDI. It is more explicit in developing countries. Cape Verde has the highest gain in terms of ranking, it moved from the 103rd place according to HDI to 53th place according to CISC, a gain of 50 places. This significant increase also concern Kiribati (up 44 places), Ghana (44), Malawi (44), Madagascar (39), Burundi (35), Burkina Faso (+ 35) etc.

The articulation of social cohesion and human development highlighted the deficiencies of the HDI as an indicator of social progress. The focus of the debate on the only indicators of the HDI is not able to reflect the dimensions that underlie human progress. This is where social cohesion is to be seen in the development model through specific policies to strengthen social equity, equal opportunities, a sense of belonging, participation and good practices of governance.

Number of lost places between CISC and IDH ranking. Illustration on a few countries

Source: our own calculations

Conclusion
The approach of measuring social cohesion developed in this study enabled to establish average scores by country comparable internationally, has prioritized the contribution of explanatory factors in the composite index of cohesion social. The results highlight the multidimensional reality of social cohesion and inform on the tracks to take to strengthen and challenges faced by countries in its regard.

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