Centre d'Estudis Demogràfics

**ARE COUNTRIES ACHIEVING
THE MILLENNIUM DEVELOPMENT GOALS?**

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425

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Resum.- *Estan els països assolint els Objectius de Desenvolupament del Mil·lenni?*

L'article utilitza dues classes d'indicadors multidimensionals per mesurar l'evolució dels països envers la consecució dels Objectius de Desenvolupament del Mil·lenni (ODM) de Nacions Unides. Els resultats suggereixen que les millores en els diferents ODMs tendeixen a no estar correlacionades i que, en promig, els països no estan ben encarrilats de cara a la consecució dels ODM. Aquesta evolució ha estat molt variada entre països i dimensions. Mentre que el creixement de la població està associat negativament a la millora dels països en els ODMs, aquest darrer no està relacionat amb el creixement econòmic dels països, fet que suposa un gran repte per a les agències de desenvolupament internacional i pels diferents governs nacionals que vulguin promoure un progrés simultani en els diferents ODMs.

Paraules clau.- Medició, Objectius de Desenvolupament del Mil·lenni (ODM), creixement de la població, creixement econòmic.

Resumen.- *¿Están los países alcanzando los Objetivos de Desarrollo del Milenio?*

Este artículo utiliza dos clases de indicadores multidimensionales para medir la evolución de los países hacia la consecución de los Objetivos de Desarrollo del Milenio (ODM) de Naciones Unidas. Los resultados sugieren que las mejoras en los diferentes ODMs tienden a no estar correlacionadas y que, en promedio, los países no están bien encarrilados de cara a la consecución de los ODM. Esta evolución ha sido muy variada entre países y dimensiones. Mientras que el crecimiento de la población está asociado negativamente a la mejora de los países en los ODMs, éste último no está relacionado con el crecimiento económico de los países, lo que supone un gran reto para las agencias de desarrollo internacional y para los distintos gobiernos nacionales que quieran promover un progreso simultáneo en los diferentes ODMs.

Palabras clave.- Medición, Objetivos de Desarrollo del Milenio (ODM), crecimiento de la población, crecimiento económico.

Abstract.- *Are countries achieving the Millennium Development Goals?*

This paper uses two classes of multidimensional indices to measure countries' evolution towards the achievement of United Nations' Millennium Development Goals (MDGs). Our results suggest that improvements in the different MDGs tend to be uncorrelated among them and, on average, countries are largely off-track in their way towards MDGs achievement. This evolution has been highly uneven across countries and dimensions. While population growth is negatively associated to countries' MDGs improvement, the latter is unrelated to countries' economic growth, therefore posing a great challenge for international development agencies and national governments who aim to promote simultaneous progress in the different MDGs.

Keywords.- Measurement, Millennium Development Goals, population growth, economic growth.

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ARE COUNTRIES ACHIEVING

THE MILLENNIUM DEVELOPMENT GOALS?

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1.- Introducción

The Millennium Declaration presented by the United Nations (UN) at the dawn of the new millennium is a milestone in international cooperation inspiring development efforts in order to improve the living conditions of millions of people around the world. More specifically, it commits the world nations to a new global partnership to reduce extreme poverty and setting out a series of time-bound targets -with a deadline of 2015- by which progress in reducing income poverty, hunger, disease, lack of adequate shelter and exclusion -while promoting gender equality, health, education and environmental sustainability- can be measured. Such time-bound targets have been popularized as the Millennium Development Goals (MDGs; the complete list of goals, targets and indicators can be found in http://www.un.org/millenniumgoals).

The MDGs have been criticized for their conceptual limitations. On the one hand they risk simplifying what 'development' is about by restricting the goals to what is measurable, while many aspects of development cannot be easily measured. On the other hand, certain goals do not address some of the problems holistically. For instance, the MDG on education focuses only on primary schooling, with no reference to secondary and tertiary education, dropout rates and so on. Despite these and other problems, the MDGs have been very important to raise awareness about the great challenges that must be faced to fulfill the promise of the Millennium Declaration for a better world. In a way, this is reminiscent of what happened with the Human Development Index (HDI): despite its acknowledged shortcomings, it was very helpful to widen the perspective with which academics and policy-makers alike approached the problem of measuring countries' development levels (see Herrero et al 2010, Klugman et al 2011). Even if presented in an oversimplified

format, the MDGs have the great advantage of being easily measurable in such a way that they convey a unified and powerful message.

In this context, it seems natural to ask whether countries are on the right track in their way to achieve the MDGs by 2015 or not. In order to answer this question, the United Nations have presented several reports in which progress in different key indicators is presented separately at a regional level (see UN 2010a,b,c,d,e). Unfortunately, in these reports no information is presented concerning: (i) the relationship between the evolution experimented in different dimensions (for instance: are improvements in poverty reduction accompanied by improvements in, say, reducing the gender gap in education?), (ii) the overall improvement experienced by each country, and (iii) the macro factors that influence countries' overall performance in the MDGs. Many researchers have explored countries' evolution in different MDGs separately (see, for instance, Sahn and Stifel 2003, Haines and Cassels 2004, Sachs and McArthur 2005, Gwatkin 2005, Easterly 2009, Hogan et al 2010) but to the best of our knowledge none of them has attempted to look at the different dimensions *simultaneously*. Yet, this information is crucial for a proper assessment of countries' pathways to development. One of the main goals of this paper is to fill this important gap using multidimensional measures that allow one to track countries' overall improvement towards the MDGs. For that purpose, there are different contributions in the measurement literature that can be used as starting points. In an attempt to track countries' improvements in living standards, Kakwani (1993) proposed a single dimensional progress index that was later axiomatically characterized by Majumder and Chakravarty (1996) and extended to the multidimensional framework by Tsui (1996). While these measures are useful to measure changes in achievement levels between two points in time, in this paper we argue that they might not be very appropriate to determine whether those changes have been large enough to reach a pre-specified target or not. For this reason we will complement our analysis with a multidimensional index recently introduced by Permanyer (2012) that is designed to measure the extent to which countries' have attained the MDGs. Since both classes of indices capture plausible but alternative intuitions of the notion of 'improvement', they will be used, compared and discussed in our empirical results.

Some critics rightly argue that multidimensional indices are highly complex and somewhat arbitrary instruments and contend that in some circumstances it might be more advisable to use multiple single-dimensional indicators separately (see Ravaillon 2010). While acknowledging these limitations, in this paper we contend that an important advantage of

multidimensional indices is that the joint distribution of the different indicators is taken into account, therefore shedding light on the existing relationship between the different dimensions we are considering -which is one of the main goals of this paper. Using multidimensional indicators, we will also be able to: (i) identify those countries that have made a better job in their overall evolution towards the MDGs, and (ii) identify the macro factors that are associated with that specific performance.

Among the macro factors that might be related to success in achieving the MDGs, economic performance and economic growth -as measured by GDP per capita and its growth rate- are some of the most interesting ones. Because of their huge conceptual and practical relevance, it will be particularly insightful to test classical growth assumptions and explore the relationship between overall MDG success and economic performance. Previous papers dealing with the relationship between GDP per capita and non-monetary standards of living offer mixed evidence. Studies such as Dasgupta and Weale (1992), Dasgupta (1993), Kakwani (1993), Fedderke and Klitgaard (1998) and Son (2010), for instance, find a positive and statistically significant relationship between standard of living and GDP per capita. However, these authors estimate cross-sectional relationships only and do not take into account cross-time effects. The papers that have used cross-time changes (Easterly 1999, Mazumder 1999) have found little and non-statistically significant relationship between economic growth and changes in quality of life indicators. In the same line, our empirical results show no significant relationship between GDP per capita or its growth with countries' overall improvement in achieving the MDGs. Other macro factors that might be related to countries' MDG performance are the population size, population growth and population heterogeneity across religious and ethnic lines. The last variables have been recently used in economic growth regressions with surprisingly good results (see, for instance, Easterly and Levine (1997), Alesina et al (2003) and Montalvo and Reynal Querol 2005a, 2005b). The rationale for introducing these heterogeneity variables in our models is that the advancement of countries' standard of living can be hindered in those places where the population is segregated in ethnic or religious groups that feel alienated vis-à-vis each other. Overall, we contend that the ideas and results presented in this paper can shed some light to our knowledge on the advancement of countries' development levels and might have important implications for the debate on how to design more effective development strategies.

The paper is organized as follows. In section 2 we present the measures of 'progress' and 'success' that will be used in this paper. Section 3 is devoted to use the measures of the previous section to describe the observed progress and success experienced by countries in achieving the MDGs. Section 4 presents an empirical analysis that tries to identify the factors that have contributed to countries' improvements towards achieving the MDGs. We conclude in section 5.

2.- Measuring improvements

In this section, which is of technical nature, we introduce the measures that will be later used to track the evolution of countries towards the achievement of the MDGs. We are considering $n \in \mathbb{N}$ different countries and for each of them we are taking into account $k \geq 1$ dimensions. Given the fact that we want to track the timely evolution of different countries, we will designate with t_1 and t_2 ($t_1 < t_2$) any two moments in time. We start exploring the single dimensional case ($k=1$).

2.1.- Improvement in a single dimension

We assume that the corresponding achievement indicator is measured in a positive scale and that its values are naturally bounded from above and below. In this context, the lower and upper bounds will simply be denoted by m and M respectively, with $0 \leq m < M$. We will denote by x the achievement level of a given country for time period t_1. Analogously, the achievement level of the same country in time period t_2 will be denoted by y. Clearly, both x,y are bounded between m and M, that is: $m \leq x \leq M$ and $m \leq y \leq M$. Using this notation, Kakwani (1993) proposed the following indicator [[[Endnote#1]]]:

$$p(x, y, m, M) = \frac{(M - x)^r - (M - y)^r}{(M - m)^r} \qquad (1)$$

where $0 < r < 1$. The values of p should be interpreted as the improvement in standard of living – as measured with a single indicator – experienced between times t_1 and t_2. By construction, the values of p are bounded between -1 and 1 (values that are obtained

whenever the underlying standard of living indicator moves from one of the extremes of its domain to the other, that is: from *m* to *M* or vice versa). Even if Kakwani (1993) shows that *p* is very appropriate to capture progress in standards of living, this index fails to capture the notion of 'reaching a pre-specified target' -which is of paramount importance in the MDGs context. Recall that in this context it might not be necessary for an indicator to reach its upper bound to completely attain the corresponding goal, but rather a fraction of it. For instance, the first target of MDG1 requires to halve the proportion of people whose income is less than $1 a day, or the first target of MDG5 requires to reduce by three quarters the maternal mortality ratio, so it is not required to make poverty or the maternal mortality ratio completely disappear in order to fully reach the corresponding goal. Therefore, we say that a country has fully attained the corresponding goal whenever the achievement level in time t_2 is larger than the value of the corresponding target, that is: $y \geq T$ for some target value $T \leq M$. By construction, the value of T will lie somewhere between the achievement level in t_1 (that is: x) and the upper bound M. With this notation, Permanyer (2012) defines the following indicator:

$$s(x,y,m,M,T) = \begin{cases} 1 & when & y \geq T, (x,y) \notin \{(m,m),(M,M)\} \\ \dfrac{y-x}{T-x} & when & x \leq y < T, (x,y) \notin \{(m,m),(M,M)\} \\ \dfrac{y-x}{x-m} & when & y < x, (x,y) \notin \{(m,m),(M,M)\} \\ 0 & when & (x,y) \in \{(m,m),(M,M)\} \end{cases} \qquad (2)$$

The values of *s* should be interpreted as the 'success' experienced by a given country between time periods t_1 and t_2 in its attempt to reach the desired target *T*. As before, the values of *s* are bounded between -1 and 1. When the achievement level in time period t_2 is larger than the value of the corresponding target *T*, then *s* takes its maximal possible value of 1. Whenever a country has improved from t_1 to t_2 but has not reached the corresponding target (that is: $x \leq y < T$), *s* basically compares the size of the absolute progress experienced by the country when passing from t_1 to t_2 (that is: y-x) with the margin that that country has for further improvement until reaching the corresponding target considering its initial achievement level (that is: T-x). On the other hand, whenever a country worsens its achievement from t_1 to t_2 (that is:$y<x$) *s* compares the size of that change (that is: y-x) with

the maximal margin that that country has for worsening considering its initial achievement level (that is: $x-m$). Finally, whenever $x=y$, s takes a value of zero.

It is important to highlight that the indices p and s capture plausible but alternative intuitions of the notion of 'improvement' in the single dimensional context. While p measures changes in the achievement indicator between t_1 and t_2 and compares them with respect to the whole range of values that such indicator can theoretically take (that is: its whole domain), s checks whether those changes have been large enough to reach a pre-specified target. For this reason, p and s will be called 'progress' and 'success' functions respectively (a detailed discussion on these and other related measures can be found in Permanyer (2012)). Interestingly, a country could theoretically take large values on a success function but small values on a progress one and vice versa. To illustrate: take the hypothetical case of two countries with 30 per cent poverty; one of them reducing poverty to zero and the other reducing it to 15 per cent. In this case s fails to distinguish between both countries because they have completely achieved the goal of halving poverty levels. On the other hand, p correctly assigns a larger progress value to the former country. Alternatively, consider the hypothetical case of another two countries A and B with 90 and 10 per cent of the population living in poverty respectively; A reducing poverty to 80 per cent and B to 5 per cent. In this case p fails to recognize that B has completely achieved the goal of halving poverty levels, and might even wrongly conclude that A has been more successful than B in reducing poverty.

2.2.- Improvement in multiple dimensions

In the previous subsection we presented functions to measure countries' improvements experienced over a certain period of time based on the values of a single indicator. Now we consider the more general framework in which we want to assess countries' overall success over a set of $k \geq 1$ indicators. The achievement levels in times t_1, t_2 for indicator 'i' will be denoted by x_i, y_i respectively. For each 'i', we assume that the corresponding achievement indicator is measured in a positive scale and that its values are naturally bounded from above and below. That is: we assume its values are bounded between m_i and M_i for some real numbers such that $0 \leq m_i < M_i$. Finally, we also assume that for each dimension 'i' there is a target value $x_i \leq T_i \leq M_i$ such that whenever $y_i \geq T_i$ we can say that the corresponding goal has been completely achieved. The value of each T_i will be determined by the way in

which the corresponding MDG has been spelled out. We can now define the multidimensional functions we will use to assess countries' overall improvement towards the MDGs as

$$P^{\varepsilon}(x_1,\ldots,x_k,y_1,\ldots,y_k,m_1,\ldots,m_k,M_1,\ldots,M_k) := 1 - \left(\sum_{i=1}^{k} w_i (1-p_i)^{\varepsilon} \right)^{1/\varepsilon} \qquad (3)$$

$$S^{\varepsilon}(x_1,\ldots,x_k,y_1,\ldots,y_k,m_1,\ldots,m_k,M_1,\ldots,M_k,T_1,\ldots,T_k) := 1 - \left(\sum_{i=1}^{k} w_i (1-s_i)^{\varepsilon} \right)^{1/\varepsilon} \qquad (4)$$

where $p_i := p(x_i,y_i,m_i,M_i)$, $s_i := s(x_i,y_i,m_i,M_i,T_i)$ are the 'progress' and 'success' experienced in indicator 'i' according to the single-dimensional measures p and s defined in the previous subsection, $w_i > 0$ is the weight attached to indicator 'i' and $\varepsilon \geq 1$ is an inequality aversion parameter (see Atkinson 1970 and Anand and Sen 1995). Recall that P^{ε} and S^{ε} are multidimensional generalizations of p and s respectively. P^{ε} (resp. S^{ε}) is the average progress (resp. success) experienced towards complete achievement of all MDGs: higher values correspond to higher improvements [[[Endnote#2]]]. By construction, P^{ε} takes its maximal value of 1 whenever a country improves from the lowest to the highest possible achievement level (that is: from m_i to M_i) in *all* indicators we are taking into account. On the other hand, S^{ε} takes its maximal value of 1 whenever all these indicators achieve the corresponding target T_i (that is: when a country achieves *all* MDGs). It is worth emphasizing that P^{ε} and S^{ε} capture plausible but different intuitions on the notion of 'improvement' in the multidimensional setting – none of them being clearly superior to the other –, so they will both be used in this paper.

3.- Are countries achieving the MDGs?

Having presented dimension-specific and overall MDGs improvement indices, in this section we want to assess empirically the extent to which world countries are succeeding in achieving the MDGs. This analysis requires several steps. First we will discuss the data, indicators, targets and goals used in our analysis. Second, we will explore the existing relationship between the improvements in specific dimensions before aggregating them

into a composite index. Afterwards we will present the values of the overall improvement indices at the world level and explore the extent to which the different MDG components contribute equally to those values. Finally, we will perform several robustness checks to investigate the reliability of our results.

3.1.- Data and methods

The MDGs consist of generic goals to improve the living conditions of millions of people all over the world. Within each of the goals there are different targets and each target is monitored using several indicators, so we are dealing with a hierarchical structure. According to the United Nations Statistical office there are 8 goals, 21 targets and 60 indicators (see http://www.un.org/millenniumgoals). However, there are several difficulties when it comes to incorporate these goals, targets and indicators into an overall MDGs improvement measure.

First and foremost: there are many countries that lack the appropriate resources to collect good quality data on a regular basis. Notwithstanding that limitation, the UN Statistical Office has successfully collected information coming from many different sources and made it publicly and freely available at the website: http://mdgs.un.org. This is the source of data we will use for our analysis. The second reason why we did not include all targets into our analysis is that many of them are not clearly specified and/or are hard to quantify to say the least [[[Endnote#3]]]. Third, some targets and indicators are not defined at the country level, so they cannot be incorporated in a country-basis analysis like the one we are attempting in this paper. To illustrate: Target 7D specifies: "By 2020, to have achieved a significant improvement in the lives of at least 100 million slum dwellers". There is no straightforward way of knowing how much should the number of slum dwellers be reduced in a given country to declare that it has successfully reached that target. Lastly, some targets and indicators are not defined for all countries of the world, so their inclusion would raise serious comparability issues.

Our choice of targets and indicators has been constrained by the aforementioned limitations and because of the existing trade-offs between geographical coverage and inclusion of further indicators. We have computed the overall MDGs improvement levels for a total of 131 countries [[[Endnote#4]]]. For each of these countries we have been able to collect

information on 18 indicators that have been used to monitor the evolution corresponding to 12 targets covering the 8 MDGs. The inclusion of further indicators would have greatly reduced the number of countries with available data. All in all, we are confident that this subgroup of targets and indicators can offer a reasonably faithful portrait of countries' evolution towards the achievement of the MDGs because the eight goals have been incorporated into the analysis. Table 1 shows the goals, targets, indicators and corresponding weights that have been chosen.

To keep things simple we have adopted an equal weighting scheme. Therefore, each goal weighs 1/8 and all success indicators within the same goal are weighted equally. Recall that different values of ε lead to different degrees of complementarity / substitutability between the different components of P^ε and S^ε. Since the choice of values for ε is not particularly clear, we have performed some sensitivity analysis working with different values of that parameter. Table 1 also shows the values of the lower and upper bounds (m_i and M_i) corresponding to each indicator.

3.2.- Relationship between dimensions

In this subsection we explore the pair-wise relationships between the improvements that countries have experienced in the eight MDGs. Learning about the relationships between improvements in different dimensions can help policy-makers to design development policies that invest scarce resources more efficiently. Moreover, given the fact that we want to summarize dimension-specific improvements into an overall improvement measure, it is very important to learn about its internal structure and the existing relationships between its individual subcomponents. The well-known Human Development Index has been criticized among other things because of the high degree of (positive) correlation between its three subcomponents (see McGillivray, 1991). Such high levels of correlation, McGillivray argues, lead to a composite index that is highly *redundant*, that is: the information conveyed by the composite index is essentially the same as the one that can be obtained from any of its subcomponents.

In order to measure improvements for each MDG we have computed the corresponding average using the multidimensional indicators P^ε, S^ε restricted to the suitable individual indicators *within* each goal.

Table 1.- Millennium Development Goals, targets and indicators, weights and minimum and maximum values used for normalization

Goal	Target	Indicator	Indicator Weight	m_i	M_i
MDG1: Eradicate extreme poverty and hunger	Halve, between 1990 and 2015, the proportion of people whose income is less than one dollar a day	Proportion of population below $1/day	1/16	0	1
	Halve, between 1990 and 2015, the proportion of people who suffer from hunger	Proportion of population below minimum level of dietary energy consumption	1/16	0	1
MDG2: Achieve universal primary education	Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete full course of primary schooling	Net enrolment ratio in primary education	1/16	0	100
		Proportion of pupils starting grade 1 who reach last grade of primary	1/16	0	1
MDG3: Promote gender equality and empower women	Eliminate gender disparity in primary and secondary education, preferably by 2005, and in all levels of education no later than 2015	Ratio of girls to boys in primary education	1/24	0	1
		Ratio of girls to boys in secondary education	1/24	0	1
		Ratio of girls to boys in tertiary education	1/24	0	1
MDG4: Reduce child mortality	Reduce by two-thirds, between 1990 and 2015, the under-five mortality rate	Under-five mortality rate	1/8	Sample Minimum	Sample Maximum
MDG5: Improve maternal health	Reduce by three quarters, between 1990 and 2015, the maternal mortality ratio	Maternal Mortality Ratio	1/8	Sample Minimum	Sample Maximum
MDG6: Combat HIV/AIDS, malaria and other diseases	Have halted by 2015 and begun to reverse the spread of HIV/AIDS	HIV prevalence among population aged 15-24 years	1/16	Sample Minimum	Sample Maximum
	Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases	Prevalence rates associated with tuberculosis	1/16	Sample Minimum	Sample Maximum
MDG7: Ensure environmental sustainability	Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources	Carbon dioxide emissions, total, per capita and per $1 GDP (PPP)	1/32	Sample Minimum	Sample Maximum
		Proportion of terrestrial and marine areas protected	1/32	Sample Minimum	Sample Maximum
	Halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation	Proportion of population using an improved sanitation facility	1/32	0	1
		Proportion of population using an improved drinking water source	1/32	0	1
MDG 8: Develop a global partnership development	In cooperation with the private sector, make available benefits of new technologies, especially information and communications	Internet users per 100 population	1/24	0	100
		Cellular subscribers per 100 population	1/24	0	100
		Telephone lines per 100 population	1/24	0	100

Table 2 shows the pair-wise correlation matrix between the 'progress' experienced in the eight MDGs using P^ε with ε equal to 1, 5 and 10. It turns out that most correlations are relatively low and a great majority of them (around 22 out of 28) are not statistically significant. The highest correlation just reaches 0.57 and is found between MDG4 (Reduce Child Mortality) and MDG5 (Improve Maternal Health). Somewhat surprisingly, the signs of the statistically significant correlations are negative whenever they involve MDG8 (Develop a global partnership for development) but are positive otherwise.

Table 2.- Correlation between progress in the different MDGs using P^ε with three inequality aversion parameters (ε=1,5,10). The first, second and third values within each cell correspond to the correlations obtained using P^ε with ε=1,5,10 respectively

Correlations	P_MDG1	P_MDG2	P_MDG3	P_MDG4	P_MDG5	P_MDG6	P_MDG7	P_MDG8
P_MDG1	1							
P_MDG2	0.089 0.107 0.091	1						
P_MDG3	0.087 0.117 0.142	0.181* 0.139 0.076	1					
P_MDG4	0.171 0.181* 0.179*	-0.11 -0.024 -0.03	0.144 0.103 0.064	1				
P_MDG5	0.122 0.126 0.118	0.101 0.032 -0.011	0.312** 0.333** 0.303**	0.578** 0.578** 0.578**	1			
P_MDG6	0.104 0.147 0.18*	-0.041 -0.062 -0.076	0.127 0.179* 0.207*	-0.045 -0.05 -0.058	0.136 0.144 0.139	1		
P_MDG7	0.086 0.106 0.086	-0.042 0.017 0.026	0.033 0.049 0.069	0.274** 0.238** 0.19*	0.091 0.098 0.104	-0.006 -0.041 -0.063	1	
P_MDG8	-0.164 -0.078 0.002	-0.227** -0.151 -0.067	-0.275** -0.136 -0.001	-0.272** -0.209* -0.105	-0.414** -0.413** -0.332**	-0.007 0.047 0.081	-0.264** -0.291** -0.294**	1

Author calculations using UNDP data.

**, * denote statistical significance at 1 and 5 percent levels

Table 3 shows the pair-wise correlation matrix between the 'success' experienced in the eight MDGs using S^ε with ε equal to 1, 5 and 10. Again, most of these correlations (around 23 out of 28) are not statistically significant but those that are tend to have a positive sign. Our robustness checks reveal that the relationship between MDGs improvements is

basically the same when we choose alternative values of the inequality aversion parameter ε. Additionally, it turns out that only a 2% of all possible couples of progress (resp. success) vectors do vector-dominate each other [[[Endnote#5]]], that is: there is only a probability of 0.02 that a randomly selected country experiences more progress (resp. success) in all MDGs at the same time than another randomly selected country. These results illustrate the heterogeneity of the changes experienced in different dimensions and suggests that the policies and factors influencing the improvements of the MDGs are independent and, apparently, not coordinated. This is an interesting finding with important policy implications upon which it might be necessary to reflect.

Table 3.- Correlation between success in the different MDGs using S^ε with three inequality aversion parameters (ε=1,5,10). The first, second and third values within each cell correspond to the correlations obtained using S^ε with ε=1,5,10 respectively

Correlations	S_MDG 1	S_MDG 2	S_MDG 3	S_MDG 4	S_MDG 5	S_MDG 6	S_MDG 7	S_MDG 8
S_MDG1	1							
S_MDG2	0.12 0.117 0.102	1						
S_MDG3	0.027 0.1 0.118	0.091 0.059 0.021	1					
S_MDG4	0.098 0.098 0.104	-0.038 0.000 0.016	0.094 0.077 0.102	1				
S_MDG5	0.071 0.078 0.076	-0.051 -0.029 -0.013	0.217* 0.193* 0.192*	0.502** 0.502** 0.502**	1			
S_MDG6	0.050 0.043 0.041	-0.012 -0.049 -0.060	0.142 0.115 0.104	0.135 0.061 0.041	0.239* 0.182* 0.164	1		
S_MDG7	0.245** 0.181* 0.109	-0.038 -0.136 -0.183*	0.02 0.128 0.112	0.206* 0.124 0.089	-0.057 0.011 0.027	-0.092 -0.126 -0.098	1	
S_MDG8	-0.126 0.092 0.145	0.027 0.150 0.131	-0.053 0.071 0.089	0.296* 0.267** 0.217*	0.048 0.132 0.135	0.244** 0.075 -0.007	-0.079 -0.04 -0.024	1

Author calculations using UNDP data.
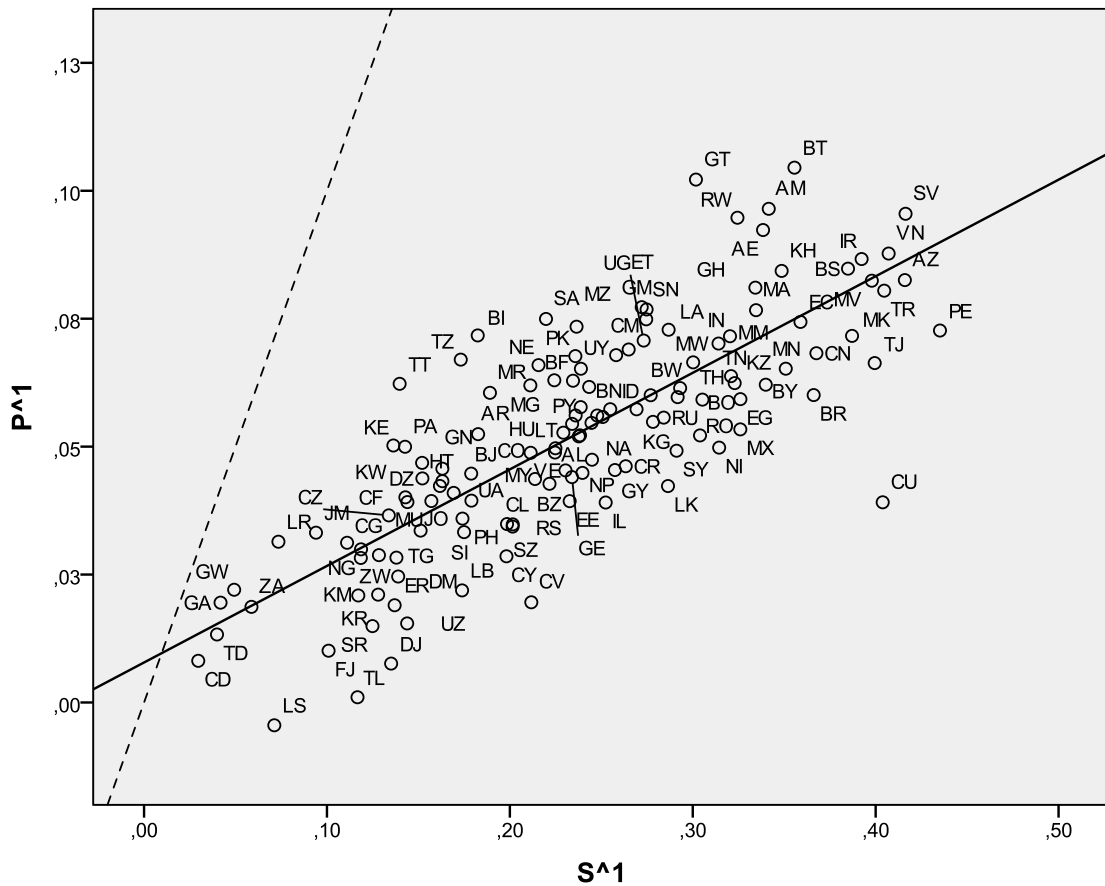**, * denote statistical significance at 1 and 5 percent levels.

Comparing the levels of correlation between components we have found in this paper with respect to the ones reported by McGillivray (1991) in his criticism to the HDI we can see

that ours are much lower than his. The highest correlation we have found in this context is even lower than the lowest correlation McGillivray reported between the HDI components. Therefore, we can conclude that there is no risk of redundancy when aggregating our components of improvement for each goal into the overall improvement indices P^ε, S^ε.

3.3.- Assessing countries' improvements

In this subsection we present the overall improvement measures P^ε, S^ε for the 131 countries with necessary data. We have decided to choose the values of ε =1,5 and 10 (representing null, intermediate and high inequality aversions respectively) when reporting our empirical results. Figure 1 compares the values of the overall MDGs progress and success indices P^ε, S^ε for the case ε=1. It turns out that the relationship between both variables is fairly strong and linear (the correlation coefficient equals 0.8). This suggests that those countries that have made larger progress in terms of P^1 have also been more successful in their attempt to reach the MDGs in terms of S^1, a highly plausible result. Interestingly, the values of S^1 are much larger than those of P^1: while the former range between 0.03 and 0.43, the later range between 0 and 0.1. This is an expected result because P^1 compares observed improvements with respect to the whole range of values in the corresponding indicators' domain while S^1 compares these improvements with respect to the margin for improvement that is feasible given the attainment levels observed in time t_1. The top five performers in terms of S^1 are Peru (0.43), El Salvador (0.42), Azerbaijan (0.41), Viet Nam (0.41) and Turkey (0.4), while the five worst performers are South Africa (0.06), Guinea-Bissau (0.05), Gabon (0.04), Chad (0.04) and the Democratic Republic of the Congo (0.03). Therefore, in terms of S^1, the countries that have experienced larger overall *success* have only covered 40% of their way towards complete achievement of the goals and all the countries have positive average success values. On average, countries have only bridged about 23% of the gap. Recall, however, that the original Millennium Declaration states that the goals should be achieved by 2015, while here we have only measured the success so far until 2010. On the other hand, the top five performers in terms of P^1 are Bhutan (0.104), Guatemala (0.102), Armenia (0.096), El Salvador (0.095) and Rwanda (0.094), while the five worst performers are Fiji (0.01), Democratic Republic of the Congo (0.008), Djibouti (0.007), Timor-Leste (0.001) and Lesotho (-0.004). Therefore, the countries that have experienced larger overall *progress* have covered around 10% of the different indicators' domain.
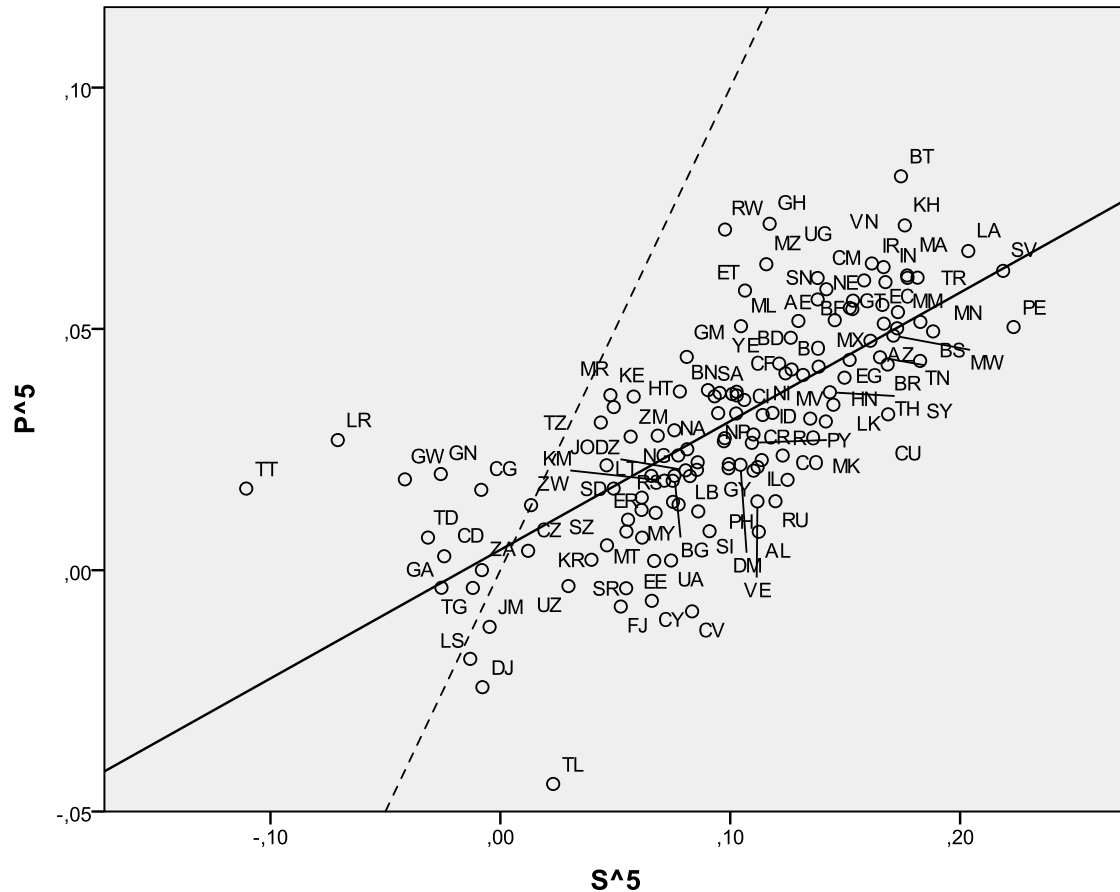
Figure 1.- Scatterplot with the values of S^1 and P^1, together with best linear fit and equality line. Abbreviations of country names follow the ISO 3166 Country Codes

Authors' calculations using UNDP data.

It is important to point out that the previous results assume perfect substitutability between improvements in different dimensions when constructing our average improvement indicators (that is: $\varepsilon=1$). We also present our results when the inequality aversion parameter ε takes an intermediate value of 5 (see Figure 2). Again, the relationship between P^5 and S^5 is quite strong and linear (with a correlation coefficient equal to 0.73). However, the values of those indicators are clearly smaller than before: the range of values for S^5 is [-0.11, 0.22] and for P^5 is [-0.05, 0.08]. This suggests that progress and success in the different MDGs are unequally distributed (if the improvements in the different dimensions were the same, the values of P^5 (resp. S^5) would be equal to those of P^1 (resp. S^1)).

Figure 2.- Scatterplot with the values of S^5 and P^5, together with best linear fit and equality line. Abbreviations of country names follow the ISO 3166 Country Codes
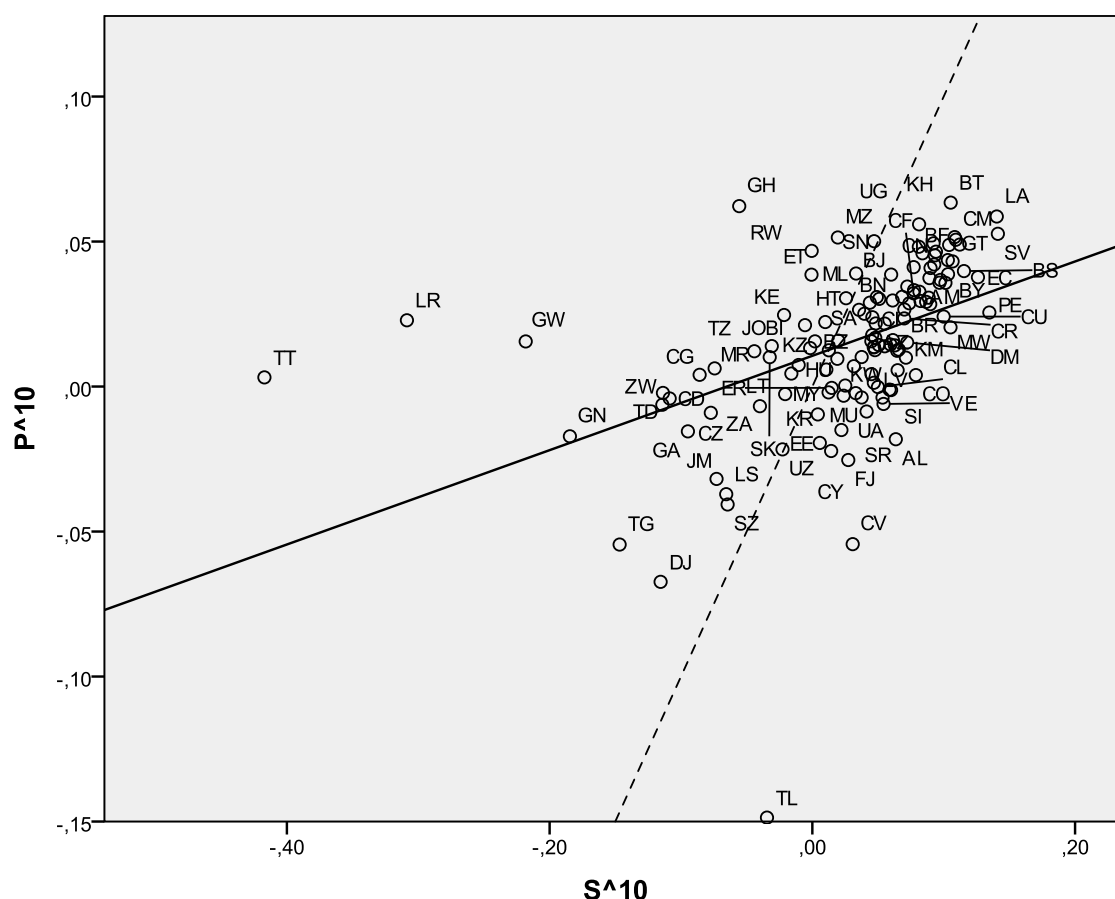

Authors' calculations using UNDP data.

When the inequality aversion parameter is further increased to 10, the relationship between P^{10} and S^{10} is still positive but not as strong as before (the correlation coefficient equals 0.47; see Figure 3). The values of both indicators are further reduced (the range of values for S^{10} is [-0.41, 0.14] and for P^{10} is [-0.14, 0.06]), thus indicating the sensitivity of our overall MDGs improvement indicators to the choice of the inequality aversion parameter. The previous results suggest that progress and success in the different MDGs are unequally distributed. In order to quantify the extent of that inequality, for each of our 131 countries we have computed a Gini index applied to the eight contributions of the corresponding MDGs improvements to the aggregate value of P^I (resp. S^I). Lower values of the Gini

index for a given country indicate that the contributions of the different MDG components are more equilibrated and vice versa [[[Endnote#6]]].

Figure 3.- Scatterplot with the values of S^{10} and P^{10}, together with best linear fit and equality line. Abbreviations of country names follow the ISO 3166 Country Codes

Authors' calculations using UNDP data.

Figures 4 and 5 show the distribution of those Gini for the case of the progress and success indices respectively. In both cases the values of those Gini indices are relatively high - ranging from 0.2 to 0.8 approximately with an average above 0.5-, thus indicating that the contribution of the different MDG components to the aggregate P^1 and S^1 values are fairly irregular. As in the previous subsection, these results suggest that the contextual factors and policies influencing improvements in the MDGs are apparently disconnected from each other.

Figure 4.- Histogram with the values of the Gini index applied to the contributions of the different components to the aggregate value of $P\varepsilon$

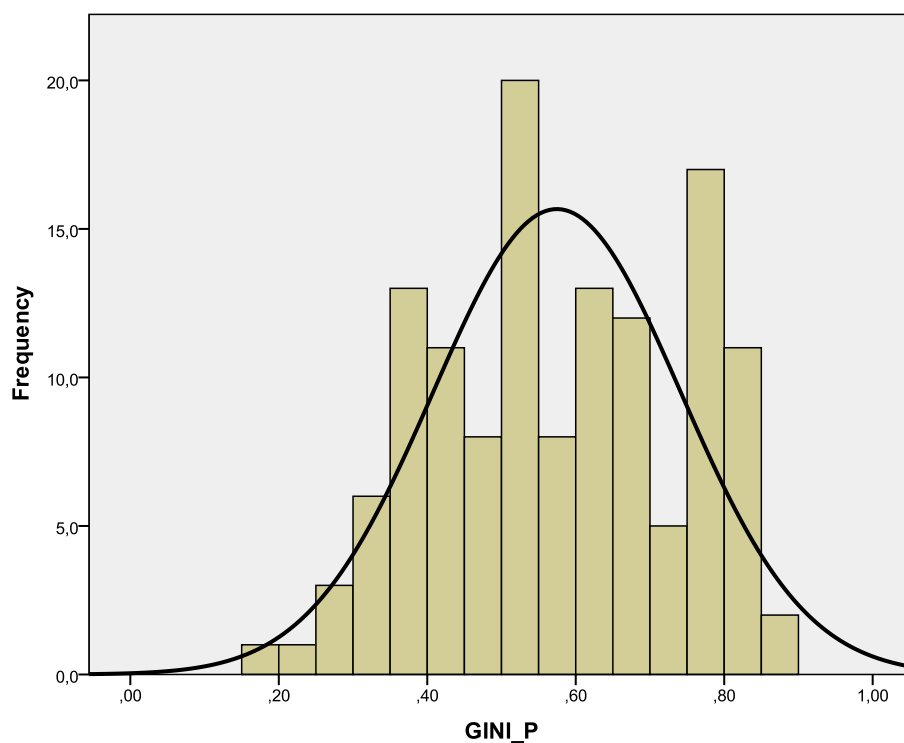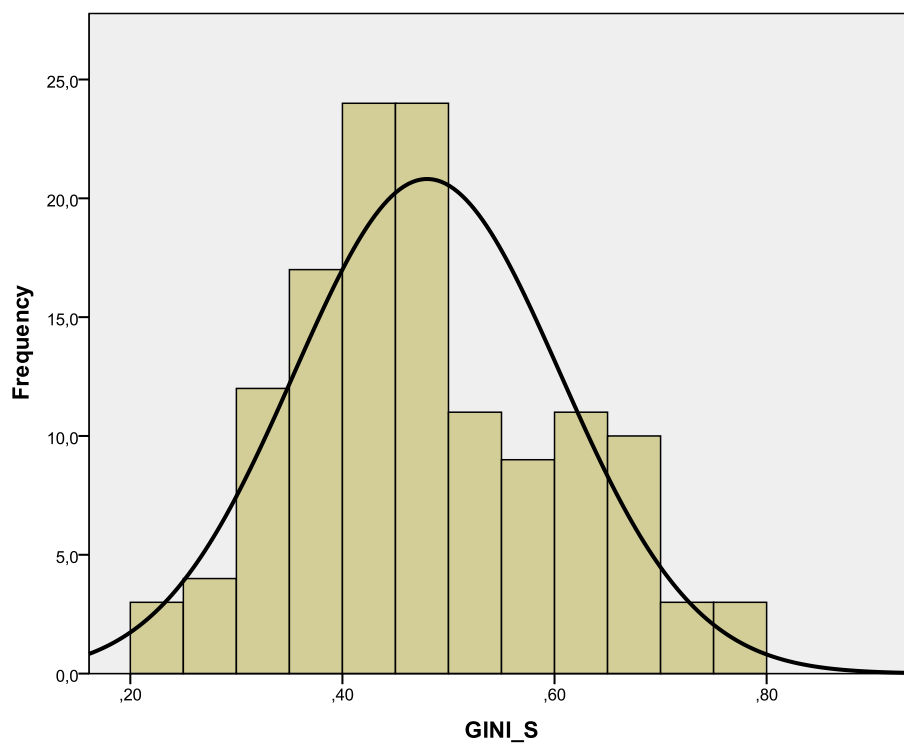**Figure 5.- Histogram with the values of the Gini index applied to the contributions of the different components to the aggregate value of S^ε**

Robustness checks

Before moving forward to analyse the relationship between the overall measures of MDGs improvement with other contextual explanatory variables, it is highly recommended to perform certain robustness checks. This is particularly necessary when, like in this paper, one defines a composite index which is inevitably constructed under a host of more or less arbitrary assumptions. Given the fact that our results are contingent upon the choice of specific indicators, normalization methodology, axioms, weighting schemes, aversion to inequality parameters and so on, it is important to explore what would happen under alternative specifications of our measures. The relevance of these robustness checks has been highlighted in Nardo et al (2005), where it is claimed that they should be a common practice for this kind of exercises.

We have performed several robustness checks for the choice of alternative weighting schemes (w_i) and aversion to inequality parameter (ε) but they will not be presented here to avoid burdening the text too much (they are available upon request). Overall, these robustness checks warn us that the results we are obtaining are highly sensitive to the specification of the weights and the inequality aversion parameter. Therefore, and if one is not particularly confident of the appropriateness of our particular choice of the w_i and ε, the empirical analysis that will be shown in section 4 should be taken with certain caution. Nevertheless, it might be worth pointing out that: (i) several studies have emphasized the importance of keeping the equal weighting assumption in this kind of analysis (see, for instance, Chowdhury and Squire 2006, Stapleton and Garrod 2007) and (ii) the empirical analysis performed in sections 3 and 4 are repeated for $\varepsilon =1$, 5 and 10.

4.- The empirics of improvement

In this section we discuss the empirical performance of our indices of overall MDGs improvement P^ε, S^ε. More specifically, we explore the effects that several macro contextual factors have had on the improvement experienced by countries towards MDGs achievement. The conceptually related literature that investigates the relationship between economic performance and quality-of-life indicators typically distinguishes between cross-section and cross-time perspectives (for example: Easterly 1999). Both approaches are interesting on their own right and they are both needed to have a more complete

understanding of the process towards MDGs achievement, so both of them will be used here. Given the fact that the improvement functions introduced in this paper are cross-time variables (they measure changes between t_1 and t_2) they cannot be used as dependent variables in cross-section analysis. In their place, we introduce the following cross-sectional variables

$$DEV2000_i = \sum_{j=1}^{18} w_j \tilde{x}_{ij} \qquad\qquad DEV2010_i = \sum_{j=1}^{18} w_j \tilde{y}_{ij}$$

where the w_j are the weights associated to the 18 indicators used in this paper (see Table 1) and $\tilde{x}_{ij}$ (resp. $\tilde{y}_{ij}$) is the achievement level of country 'i' according to indicator 'j' for the year 2000 (resp. 2010) normalized in a [0,1] scale using the transformation $(x_{ij} - m_j)/(M_j - m_j)$ (resp. $(y_{ij} - m_j)/(M_j - m_j)$). Table 1 shows the values of the lower and upper bounds m_j, M_j for each indicator. The value of *DEV2000$_i$* (resp. *DEV2010$_i$*) should be interpreted as the average achievement level of country 'i' according to MDG indicators in year 2000 (resp. 2010), so it can be seen as a "development index" that averages the achievement levels of country 'i' across our 18 MDGs indicators.

The macro explanatory variables influencing countries' MDGs improvements considered in this paper are very common and have been incorporated in recent studies investigating the relationship between economic growth and quality-of-life indicators (for example: Easterly 1999) and the relationship between economic growth and population heterogeneity indicators (for example: Montalvo and Reynal-Querol 2005b). They are defined as follows.

LNGDP$_t$ is the log of the GDP per capita in year t. Despite its well-known shortcomings (see, for instance, Herrero et al 2010), the GDP per capita has been widely used as a proxy for the economic resources available to individuals. *LNGDP$_t$* is positively correlated to several of the relevant aspects of development. The logarithm is taken to account for the marginally decreasing returns that an increase of the GDP per capita is expected to have on the improvement of countries' well-being levels (this is also the approach used in a myriad of other papers and in the construction of well-known indices like the HDI). In line with the existing literature, we hypothesize that larger values of *LNGDP$_t$* should increase the values of the dependent variable in cross-sectional analysis: a priori, richer countries can invest

more resources in their citizens' quality of life. Source: UNPD Human Development Reports 2000, 2010.

GDPGRW is the compound annual growth rate of the GDP per capita between 2000 and 2010. By definition, it has been computed as the number *g* that satisfies the relationship *GDP2000*=$(1+g)^{10}$*GDP2010*. Therefore, whenever the GDP per capita in 2000 is smaller (resp. greater) than in 2010, *g* is positive (resp. negative). We want to explore whether economic growth has been accompanied by increases in well-being. Recent studies (for example: Easterly 1999, Mazumder 1999) report that cross-time correlations between GDP per capita and changes in quality-of-life indicators are weak and not statistically significant. In line with these studies we do not hypothesize any particular sign for the *GDPGRW* coefficient. Source: UNPD Human Development Reports 2000, 2010.

LPOP$_t$ is the log of population in year *t*. This control variable is introduced as a proxy for the cost of implementation of the MDGs. Other things being equal, larger population require larger resources and efforts to implement the MDGs, so we hypothesize a negative relationship between *LPOP$_t$* and the dependent variable. However, we do not take a firm stand on this hypothesis because of the complex and intertwined relationship between population and well-being levels. The logarithm is introduced to account for the marginally decreasing impact that larger population levels are expected to have on the improvement of people's quality of life. Source: UNPD Human Development Reports 2000, 2010.

POPGRW is the compound annual growth rate of the population between 2000 and 2010. As before, it is computed as the number *r* satisfying the relationship *POP$_{2000}$*=$(1+r)^{10}$*POP$_{2010}$*. There has been a longstanding debate on the impact of population growth on well-being in developing countries (see, for instance Ahlburg et al 1996). Following the seminal work by Coale and Hoover (1958), many authors contend that population growth impedes economic development while many others argue the opposite (see, for instance, Kuznets 1971, Boserup 1981, Simon 1990, 1996). In this context we want to explore the relationship between population growth and success towards achievement of the MDGs. Given the fact that the aforementioned debate is largely unresolved we do not hypothesize any particular sign for the coefficient on *POPGRW*. Source: UNPD Human Development Reports 2000, 2010.

ETHPOL measures the level of ethnic polarization. In some recent contributions, Montalvo and Reynal-Querol (2005a, 2005b) have presented an ethnic heterogeneity measure (called

the RQ index) defined as $RQ = \sum_{i=1}^{k} \sum_{j \neq i} \pi_i^2 \pi_j$, where the π_i are the population shares of the corresponding ethnic groups within each country. This index takes higher values for those ethnic distributions approaching the bipolar case in which two ethnic groups have the same population share. This measure turns out to be positively related to the occurrence of civil wars, armed conflicts and genocides, while it is negatively related to economic growth. *ETHPOL* is taken as a proxy for the difficulty of achieving the MDGs in ethnically confronted societies: we expect that the MDGs will be harder to achieve in highly polarized societies. The values of *ETHPOL* have been taken from Montalvo and Reynal-Querol (2005a).

RELPOL measures the level of religious polarization. This index is analogous to the previous one but taking into account the religious rather than the ethnic divide. In this case, the π_i used in the RQ formula are the population shares of the corresponding religious groups within each country. Following the same line of reasoning, we expect that those countries exhibiting higher values of religious polarization will find it harder to achieve the MDGs. As before, the values of *RELPOL* have been taken from Montalvo and Reynal-Querol (2005a).

DEMOC is an index of democracy. It measures the general openness of the political institutions in a 0-10 scale (0=low, 10=high) as indicated in the Polity III dataset (http://privatewww.essex.ac.uk/~ksg/polity.html). This variable has also been incorporated in other similar specifications that try to capture the determinants of economic growth or the occurrence of civil wars (see, for instance, Collier and Hoeffler 1998, Fearon and Laitin 2003, Montalvo and Reynal-Querol (2005a, 2005b). Other things being equal, we expect more democratic governments to be more successful in their attempts to achieve the MDGs.

Results

Table 4 presents some results of our cross-section and cross-time regression analysis applied to the 131 countries when the overall success index S^ε is used as dependent variable. In the first two columns we show the results of cross-section regressions for years 2000 and 2010 – where the dependent variables are *DEV2000* and *DEV2010* respectively.

Table 4.- Regression Coefficients, absolute t-statistics between parenthesis. ***, **, * denote statistical significance at 1, 5 and 10 percent levels

Variables	(1) DEV_{2000}	(2) DEV_{2010}	(3) S^1	(4) S^5	(5) S^{10}	(6) S^1	(7) S^5	(8) S^{10}
Constant	-0.436***(-5.9)	-0. 153**(-2.09)	0.35***(8.8)	0.181***(8.1)	0.121***(5.6)	0.204(1.47)	0.186**(2.61)	0.101 (1.42)
LNGDP	0.138***(15.1)	0.102***(12.04)	—	—	—	0.000 (0.01)	-0.013(-1.58)	-0.009 (-1.11)
GDPGRW	—	—	0.24(0.91)	0.088(0.57)	0.15(1.07)	0.161 (0.63)	0.091 (0.69)	0.148 (1.13)
LPOP	0.01***(3.57)	0.012***(3.53)	—	—	—	0.022***(4.55)	0.015***(5.99)	0.014***(5.67)
POPGRW	—	—	-5.84***(-6.5)	-2.66***(-5.3)	-2.16***(-4.4)	-3.074***(-2.70)	-1.201** (-2.04)	-0.686 (-1.17)
ETHPOL	0.042 (1.41)	0.097***(2.94)	-0.011(-0.27)	-0.043*(-1.81)	-0.055**(-2.39)	0.065 (1.48)	0.023 (1.00)	0.004 (0.163)
RELPOL	-0.028 (-1.05)	-0.069**(-2.35)	0.033 (1.01)	0.023(1.24)	0.004(0.24)	-0.045 (-1.16)	-0.046**(-2.29)	-0.057***(-2.86)
DEMOC	-0.006***(-4.77)	-0.003**(-2.09)	0.001(0.61)	0.002*(1.97)	0.002*(1.93)	-0.000 (-0.01)	0.002*(1.78)	0.002 (1.62)
Adj. R^2	0.86	0.81	0.37	0.24	0.21	0.5	0.49	0.49
N	131	131	131	131	131	131	131	131

Author calculations using UN data.

In line with the existing cross-sectional literature (for example: Dasgupta and Weale 1992, Dasgupta 1993, Kakwani 1993, Fedderke and Klitgaard 1998 and Son 2010), *LNGDP* turns out to have a strong and statistically significant impact on countries' development levels. Contrary to our intuitions, the population size of a country is positively associated to its development level, even if the size of the coefficient is fairly small. Concerning the population heterogeneity variables they have the expected negative sign for religious polarization but not for ethnic polarization. In 2000 none of the coefficients is statistically significant, but in 2010 both of them are, an issue that goes against our initial expectation, therefore deserving further exploration. Lastly, democracy levels are negatively and significantly associated with development levels, but the size of the coefficient is very small. Recall that the values of *ETHPOL*, *RELPOL* and *DEMOC* are used in the cross-sectional regressions of years 2000 and 2010 indistinctly. This is justified on grounds of the relatively small changes that these variables experience after ten years (Montalvo and Reynal-Querol 2005a,2005b keep the value of these variables fixed for periods of thirty and forty years in their analysis).

Table 4 also shows the results of different cross-time models where the dependent variable is the MDGs success index S^{ε}. Columns 3, 4 and 5 show the results of the same model when picking S^1, S^5 and S^{10} as dependent variable. In line with Easterly (1999) and Mazumder (1999), economic growth is not strongly related to countries' MDGs success, an extremely important finding with enormous implications upon which it will be necessary to reflect. Interestingly, population growth has the expected negative sign and the coefficient is statistically significant. In other words, it seems that countries that have experienced larger population increases during the period 2000-2010 have performed worse in the achievement of the MDGs. A naïve explanation for this relevant finding is that countries experiencing population growth might find it harder to cope with an increasing demand for health, education and living standards, thus scoring poorly in the success indices. Moreover, it is important to recall that some of the MDGs are defined so as to reduce the percent of population (a relative concept) living in deprivation: if the total population (an absolute concept) is increasing over time, it becomes even more difficult to reduce the relative figures. Concerning ethnic and religious heterogeneity (*ETHPOL* and *RELPOL*) we find mixed results. The coefficients associated to *RELPOL* are always positive, very low and non-significant, while the coefficients for *ETHPOL* are always negative and statistically significant (except for the case of S^1). As expected, highly ethnically polarized

countries have experienced lower success in achieving the MDGs. On the other hand, the religious divide does not seem to play any significant role. A priori, we would have expected to find negative coefficients everywhere, so the performance of religiously polarized countries in their progress towards the MDGs should be explored in further detail [[[Endnote#7]]]. Some robustness checks have been carried out using alternative population heterogeneity measures, like ethnic and religious fractionalization [[[Endnote#8]]]. Substituting polarization by the corresponding fractionalization measures does not change significatively any coefficient in our regressions. Finally, the coefficients associated to *DEMOC* have the expected sign (so more democratic countries tend to show larger MDGs improvements) but their size in absolute terms is very small.

Lastly, columns 6,7 and 8 show the regression results when the baseline variables $LNGDP_{2000}$, $LPOP_{2000}$ are added to the previous cross-time models for the three specifications of our dependent variable: S^1, S^5 and S^{10}. In this case, neither GDP per capita in 2000 nor its growth in the following decade had a significant impact on countries' overall success to achieve the MDGs. Turning to the demographic variables included in our model we find interesting results as well. The signs for $LPOP_{2000}$ are always positive and highly significant for S^1, S^5 and S^{10}, so overall, those countries with larger populations in 2000 have made a better job in their progress towards the achievement of the MDGs. Interestingly, from a dynamic perspective, the signs of *POPGRW* turn out to be negative and statistically significant for the cases of S^1 and S^5. Like in the previous models, it seems that countries that have experienced larger population increases during the period 2000-2010 have performed worse in the achievement of the MDGs. The coefficients of the population heterogeneity and democracy variables tend not to be statistically significant, but when they are significant they have the expected sign (negative for polarization and positive for democracy).

In order to test the robustness of our results, we have repeated the same cross-time model specifications substituting the overall success measure S^ε by the overall progress measure P^ε as dependent variable. The results, which are shown in Table 5, are basically the same. The models specified in columns 1, 2 and 3 show – once again – that GDP growth is *not* related to MDGs progress in a statistically significant way, no matter if the dependent variable is P^1, P^5 or P^{10}. On the other hand, the impact of population growth is negative and significant in all three cases. As before, ethnic polarization does have the expected negative (and significant) sign but religious polarization does not.

Table 5.- Regression Coefficients, absolute t-statistics between parenthesis. ***, **, * denote statistical significance at 1, 5 and 10 percent levels

Variables	(1) P^1	(2) P^5	(3) P^{10}	(4) P^1	(5) P^5	(6) P^{10}
Constant	0.075***(9.5)	0.063***(7.2)	0.056***(6.36)	0.11***(3.77)	0.116**(4.21)	0.101***(3.67)
LNGDP	—	—	—	-0.006*(-1.96)	-0.01***(-3.4)	-0.01***(-3.19)
GDPGRW	-0.021(-0.38)	-0.054(-0.9)	-0.046(-0.76)	-0.001 (-0.013)	-0.023 (-0.46)	-0.02 (-0. 39)
LPOP	—	—	—	0.003***(2.66)	0.005***(5.3)	0.006***(5.68)
POPGRW	-0.722***(-4.05)	-0.67***(-3.43)	-0.64***(-3.22)	-0.592**(-2.47)	-0.38*(-1.67)	-0.277 (-1.22)
ETHPOL	-0.012(-1.37)	-0.026***(-2.81)	-0.034***(-3.69)	0.005 (0.52)	0.003 (0.35)	-0.005 (-0.56)
RELPOL	0.007 (1.05)	0.018**(2.44)	0.015**(2.09)	-0.011 (-1.3)	-0.013*(-1.73)	-0.016**(-2.1)
DEMOC	0.000(0.62)	0.000(0.38)	0.000(0.62)	0.000 (0.65)	0.000(0.37)	0.000 (0.57)
Adj. R^2	0.13	0.14	0.17	0.23	0.44	0.47
N	131	131	131	131	131	131

Author calculations using UN data.

The impact of democracy is not statistically significant. Columns 4, 5 and 6 complement our results adding the baseline variables $LNGDP_{2000}$, $LPOP_{2000}$ to the previous cross-time models that use P^1, P^5 and P^{10} as dependent variable respectively. Interestingly, the GDP per capita in year 2000 is negatively associated to countries' MDG progress in a statistically significant way for all three model specifications. Otherwise, the signs and significativity of the coefficients are essentially the same when compared to the regression results shown in columns 6, 7 and 8 of Table 4.

5.- Summary and concluding remarks

The main goal of this paper is to track the evolution of the world countries towards the achievement of the Millennium Development Goals and investigate some macro factors that influence their performance at the global level. Given the fact that there are multiple goals whose success has to be assessed the problem is naturally multidimensional, so we have worked with multidimensional indices of improvement. We have basically proposed two alternative measures: an index of overall progress and an index of overall success. While the former essentially measures changes in MDGs achievement indicator and compares them with respect to the whole range of values that such indicators can theoretically take, the latter checks whether those changes have been large enough to reach the corresponding MDGs targets. Both measures capture valuable intuitions on the notion of 'improvement towards MDGs achievement' and – a priori – none of them is indisputably superior to the other.

In order to measure improvements in each of the MDGs we have used data from the UN Statistical Office, which in turns compiles international information coming from many different sources. Despite the various problems that plague these datasets we have been able to compute our improvement measures for 131 countries. Before aggregating the dimension-specific improvement sub-indices into an overall composite index we have explored the existing relationships between them. Interestingly, the correlation between combinations of pairs of MDGs shows little or no correlation among them, as if they were the result of disconnected policies and contextual factors. This somewhat puzzling result – a priori one could expect that improving the living conditions in one dimension might also positively influence some of the other dimensions as well – is in line with other

conceptually related results found in the literature (for example: Mazumdar 1999, p. 15). Therefore, this is an interesting finding upon which analysts and policy-makers should reflect. On the other hand, this lack of correlation among components allows us to construct composite indices of success with very low levels of redundancy (as opposed to what happens with the Human Development Index, where its three components basically convey the same ordinal information).

A comparison between our progress and success indices reveals that the relationship between both variables is fairly strong, positive and linear, an interesting finding indicating that the use of one measure or another does not make a huge difference in our empirical results. When we compute our composite indices of success at the world level we find that, generally speaking, countries are off-track on most MDGs. On average, countries have only bridged about 23% of the gap towards complete achievement of the MDGs, with the best performing countries only bridging around 40% of the gap. While these figures are relatively low it should be pointed out that: (i) according to the original Millennium Declaration the goals should be achieved by 2015, while here we have only measured the progress so far until 2010, and (ii) the distribution of improvement has been uneven between and within countries, with large improvements in some dimensions and little or negative improvements in others. As a consequence, our aggregate improvement indicators change substantially when they are made more sensitive to inequalities within countries in the distribution of dimension-specific improvements. We have also performed some sensitivity analysis tests to the values of our composite indices. These tests reveal that our improvement indicators are highly sensitive to the specification of the weights that are attached to each dimension and to the inequality aversion parameter. For this reason, we have presented our findings using different specifications of the MDGs improvement index and compared the corresponding results.

After computing our composite indices of improvement we have explored their empirical performance investigating the effects that several macro contextual factors have had on the improvements experienced by countries towards the achievement of the MDGs. Among other things, we have found that neither the GDP per capita nor its growth between 2000 and 2010 has had any significant impact on countries' overall improvement. This is partly explained by the fact that the correlation coefficients between GDP per capita and its growth during the last decade with the different MDG improvements are often very low and statistically non-significant. As before, this lack of relationship seems to suggest that

the policy instruments aiming to foster improvement in each specific dimension are independent, perhaps greatly affected by particular circumstances at the country level. As speculated by Easterly (1999), there might be long time lags between income growth and quality of life improvements that are not appropriately captured with our limited data. A preliminary conclusion that could be drawn from these results is that economic growth in itself does not seem to guarantee success in bridging the gap towards complete achievement of the MDGs, at least in the short run. In our regression analysis we have also controlled for population size at the beginning of the period and for population growth during the last decade. Keeping all other factors constant, it seems that countries that were more highly populated in 2000 tended to be more successful to achieve the MDGs. However, the opposite happened with countries experiencing larger increases in population size between 2000 and 2010. While these findings should be taken with caution, they offer interesting insights to the population growth vs development debate. When we incorporate population heterogeneity within countries according to the ethnic or religious divide into our model we find mixed results: religious and ethnic polarization do not seem to affect countries' MDGs improvement in a systematic and consistent way. However, when their coefficients are statistically significant, they tend to have the expected negative sign. Finally, countries' level of democracy seems to have very little (but positive) or no impact on their achievement of the MDGs.

Even if the results shown in this paper might be largely influenced by measurement errors, they offer a coherent picture that has been consistently repeated in its different subsections. The lack of correlation between improvement in different MDGs and the non-existing linkage between overall success and GDP per capita growth is an important finding with profound and far-reaching implications upon which it will be necessary to reflect. This is not particularly encouraging for international development agencies or national governments, as it seems that, at the moment, advances in one front are not accompanied by advances in other fronts as well (as opposed to what would happen if large correlations were observed between dimensions). In an influencing recent contribution, Myrskylä et al (2009) argue that further advances in human development levels for highly developed countries can reverse fertility declines, thereby slowing the rates of population aging and ameliorating the social and economic problems associated with low fertility. While this is consistent with the inverse relationship between population growth and MDGs improvement observed in this paper, in the light of the present contribution it remains to be

seen how the different dimensions of human development can be advanced simultaneously for those countries with lower development levels. Therefore, further research is needed to explore the existence (or lack thereof) of underlying factors that might help to understand the mechanisms promoting joint improvement in the different MDGs. Hopefully, the results presented in this paper could further stimulate the discussion on how to design and implement more efficient policies that take advantage of those factors.

Endnotes:

Endnote#1: When $r=0$, Kakwani's index is defined as $(\ln(M\text{-}x)\text{-}\ln(M\text{-}y))/\ln(M\text{-}m)$. However, this index is not well defined whenever the underlying indicator reaches its upper bound M, something very common in the MDGs context (for example: many countries achieve universal primary education, or complete gender equality in school enrolment rates). For this reason that index has not been used in this paper.

Endnote#2: More specifically, the functional form of P^ε and S^ε corresponds to a generalized weighted mean of order ε. When $\varepsilon=1$, P^1 (resp. S^1) corresponds to the weighted arithmetic mean $\Sigma_i w_i p_i$ (resp. $\Sigma_i w_i s_i$) and when $\varepsilon \to \infty$, $P^\varepsilon \to \text{Min}\{p_i\}$, $S^\varepsilon \to \text{Min}\{s_i\}$, the Rawlsian maximin criterion. The properties satisfied by these and other conceptually related measures are discussed in Permanyer (2012).

Endnote#3: Take, for instance, most of the targets included in MDG8 (Develop a global partnership for development). Target 8.A: Develop further an open, rule-based, predictable, non-discriminatory trading and financial system. Target 8.B: Address the special needs of the least developed countries. Target 8.C: Address the special needs of landlocked developing countries and small island developing States. Target 8.D: Deal comprehensively with the debt problems of developing countries through national and international measures in order to make debt sustainable in the long term.

Endnote#4: As a matter of fact, there are 23 high-income countries for which we have the necessary data to compute our indicators (Australia, Austria, Belgium, Canada, Denmark,

Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, The Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom and the United States). However, most of the MDGs were already achieved in those countries even earlier than in year 2000. This is not surprising since most MDGs reflect salient issues which are much more relevant in low- and middle-income countries. Since we are interested in investigating the macro factors that influence the performance in overall MDGs achievement, the inclusion of such high-income countries might seriously bias the econometric analysis we perform in section 4, so they have not been considered in this paper.

Endnote#5: One vector $(x_1,...,x_k)$ is said to vector-dominate another vector $(y_1,...,y_k)$ whenever $x_i \geq y_i$ for all $1 \leq i \leq k$.

Endnote#6: Recall that the Gini index is normalized between 0 and 1. A value of 0 indicates maximal equality (all dimension-specific contributions are the same) and 1 maximal inequality (there is only one dimension that contributes to the values of the aggregate measure).

Endnote#7: Interestingly, Montalvo and Reynal-Querol (2005a) report analogous results when they show that ethnic polarization is statistically significant when predicting the occurrence of civil wars, but religious polarization is not.

Endnote#8: If a population consists of k groups with population shares $\pi_1,...,\pi_k$, the corresponding fractionalization index (denoted as *FRAC*) is defined as $\sum_{i=1}^{k}\sum_{j \neq i} \pi_i \pi_j$. *FRAC* is interpreted as the probability that two randomly selected individuals belong to different groups.

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