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Living Standards between 1975 and 2005 in Chocó, Colombia: A demographic approach using four (4) waves of DHS surveys

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Introduction

The last two hundred (200) years of research on living standards have been mostly focused on money income and good consumption. Intangible assets like the psychological state of the individual or the role of agency have remained hidden by statistical measures that agglomerate a distribution of income or consumption into a single number expressing the level of welfare in any society. Consequently, traditional studies on living standards discuss welfare functions, interpret poverty lines and suggest policy measures about how to guide people out of poverty as if it were a high jump competition financed by policymakers. On top of that, the data quality to base such policies is still a luxury commodity in some developing countries or at least in the regions considered to be the poorest within the poor. Thus, the insights are supported on flawed average responses, which are to represent the behavior of a typical individual or group, but people´s agency, choice or independence.

The fact that poverty is multidimensional is widely accepted. Alas, indicators such as the Basic Need Index or the Human Development Index have been partially useful at fulfilling this condition. So did the macro approach applied by social scientists to address the effects of the relationship between population and economics; neither the heterogeneity of individuals nor the timing of responses were provided, and their inferences are obscured through biased and autocorrelated estimates *(Lee, 1988)*. In contrast, the micro approach -inspired by the ideas of Malthus, one of the classical economist from the 18th century- suggests the measurement of living standards through the operation of variables as survival, nuptiality and fertility may unveil the role of agency. Bengtsson and associates compared the differences of living standards between the East and the West using demographic analysis and long historical databases. Their findings did upstage differentials, hazards and timing of responses. On top of that, they argued that this approach may be applied to contemporary populations in developing countries, particularly now that abundant data from survey exercises are available at no cost for the analyst.

Malthus (1797), the classical economist, pointed out that mortality rise is a positive check to population when prices rise; and marriage or birth delay may be preventive checks to population growth. The micro approach feeds from Malthus ideas and extends the seminal work of Sen indicating that capabilities (being healthy or educated) and functionings (do as you wish in family, at work and society in general) are influenced by prices, environmental settings or psychological states of the individual, in other words, changing conditions force individuals to make decisions on who survives, when to marry and when to give birth. If these demographic responses are to be captured, living standards are expressed as the sensitivity to changing conditions.

My purpose in this paper is to measure living standards in two (2) dimensions: infant and child survival and marriage survival rather transition to marriage. The research question asks whether living standards rise for the population of Chocó, Colombia, during the period of 1975 and 2005 while Gross Domestic Product grew continuously and faster than population growth. The hypotheses is whether the independent likelihood to survive for poor children under the age of 5 and to divorce have not changed despite the rise of GDP per head.

The paper has six (6) sections: section I reviews previous research on population studies and living standards. Section II discusses why the use of DHS data was chosen, its advantages and the building of an unbalanced panel to represent a region at the sub-national level. Section III provides features of the data, often through descriptive statistics or graphical presentations, in order to understand the process -or part of it- whereby they were generated, and if such features have anything relevant to say from the data that can be checked in theory. Section IV goes into the theoretical models based on

child and marriage survival as outcome variables and their determinants to identify responses. Section V provides the operationalisation of the empirical model based on a pooled dataset from the quinquennial Demographic and Health Surveys between 1990 and 2005 for the province of Chocó in Colombia. Section VI presents the summary and conclusions.

1. Background research

The objective in this section is twofold: the first is then to review briefly the contributions from population studies to the new concept of Living Standards, which is defined as the ability to overcome short-term economic stress; and second, it is an explanandum of Colombia´s demographic status, with a particular focus on Chocó.

1.1 A brief theoretical review

The growing body of literature relating the link between economics and populations is owed to Malthus (1797), the classical economist, who pointed out that positive and preventive checks to population growth happen when prices rise; and he stated that the concentration of deaths on the lower class families represents a decision making process at the household level. Alas, disentangling the mutual influence between economics and populations at the household level is cumbersome, and the current and most widely used set of indicators are monopolized by the role of income: the BNI, basic need index, and the HDI, Human Development Index. Both indicators, although easy to read for policy-makers, confound rather than disentangle the mutual influence: neither agency of response nor timing. For instance, the HDI is an agglomeration of education, money income and life expectancy that operates through setting arbitrary weights to each variable. Similarly, the BNI contains other useful dimensions such as housing quality, crowding, utility access and so on, but the combination is also made through arbitrary weighting. Furthermore, both indicators may suffer of omitted variable bias *(Bengtsson et al, ch. 2, 2004).*

In the same line and following the seminal work of *Amartya Sen (1985),* poverty is by nature multidimensional, and its obvious expression is given by the lack of basic capabilities. Income, although a necessary condition, confounds the measurement of living standards by capabilities. For instance, child health is a capability that allows the individual to explore her functionings and her freedoms as a member of society. The lack of income at the household level is nowadays compensated with the rising coverage of public health programmes, improvements in health technology and housing. As a result, a poor household in a developing country can enjoy access to health regardless of their level of income. To make the latter assertion more precise, many authors point out a series of environmental constraints that have a stronger impact on health status than income like disease load at the geographical level, nutrition knowledge, water access, parent´s education and so forth (*Wang, 2002; Korenkomp, Arnold, Williams, Nahlen & Snow, 2004; Bengtsson, Campbell & Lee, p. 54, 2004; Johansson, p.74, 2004)* .

The second dimension is nuptiality. It is a capability that allows the individual to decide when and how to bear children or just to have a partner. However, it is subject to environmental constraints as well as the women´s role in society, entry into and discrimination in the labor market, the role of divorce laws and so forth. Divorce or marriage survival may be responsive to changing economic and social conditions as entry into marriage is. Becker (p.15, 1993) states that divorce laws do not explain the rise of this phenomenon either in the last thirty (30) years, but the suggestion that the rise in divorce rates is due to changing economic and social conditions remains valid at least in the developed world. Many scholars studying divorce in developing countries confirmed that education,

labor force participation and urbanization are among the most relevant determinants to explain the rise of this behavior *(White, p.907, 1990; Preveti & Amato, 1993, Singh, S & Samara, R,1996*).

So far all these ideas did find momentum to generate new and alternative ways of addressing the measurement of living standards in the line of studies aimed at indicating the timing of demographic responses to changing conditions according to social class or life time, for instance, in historical population and in developing countries. Furthermore, new and alternative hypotheses on population changes and their socioeconomic determinants have been widened with new economic and sociological thinking in the last fifty (50) years*(Friedlander, Okun and Segal, 1999)* , and aggregate time series of birth and deaths have been challenged by family reconstitution data, time series of cross-sectional survey data, and event history analysis, among others, to shed light on contemporary socioeconomic issues. Fortunately, old econometric diseases such as heterokedasticity, autocorrelation and censorship have been downstaged by adopting new methods such as the Cox proportional hazard models and their time-varying covariates to express state transitions.

Building on these concepts, a micro approach was developed by Bengtsson with the aim to make the connection between people´s life and their environment. The core idea was to estimate living standards indirectly by demographic outcomes or events subject to environmental constraints such as time, place and social settings.

1.2 The new concept of Living Standards: the micro approach

The new concept of Living Standards lies between the traditional monetary approach and the capability approach of Sen. It implies the ability to overcome short-term stress regardless that the source of stress be prices, environmental factors, fixed personal characteristics or the changing psychic state of human beings. According to *Bengtsson (2004*), the sequence of responses of the individual or the household to short-term economic stress may be summarized as follows:

1. Spending of savings
2. Borrowing
3. Receive welfare
4. Changes in labor supply within the household or migration of family members
5. Postpone marriage or births *OR abandon marriage*[1]
6. Reallocate consumption within the family

It is to note that the list shown above describes the sequence of response, being mortality the last resource as a result from reallocating consumption within the family. Alas, once the first (4) four responses are exhausted subject to acute conditions, postponing nuptiality or fertility is the expected response. I go further by adding that divorce is another subresponse in option five (5). As one can see in the graph below, the boxes on the first row is a summary of Sen´s concept suggested by John Müllbauer. The boxes on the second row were enhanced by adding income , prices, personal characteristics and psychic state as the twist to come up with the new concept of Living Standards.

Figure 1. Extract from Life Under Pressure (*Bengtsson et al, p.33, 2004)*

[1] Or abandon marriage is proposed as a sub-response within nuptiality; marriage survival rather than transition into marriage is the aim.

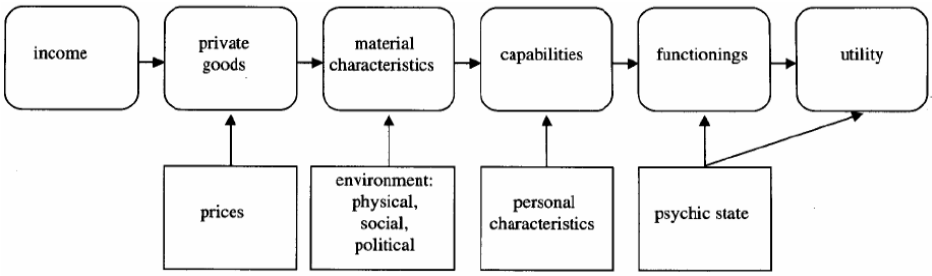


Figure 2.1
The transformation of income to utility through capabilities and functionings in the spirit of Amartya Sen

The starting point is income as a mean to purchase private goods. The consumption of private goods is affected by rising prices, which is an exogenous factor in a competitive market economy. Those two items, income and prices, use to be the key to measure living standards traditionally despite the difficulties[2] in collecting quality data. Following Sen, private goods and environment add up into material characteristics, which ought to be variables such as calories and proteins, in other words, nutrition. However, the effects of nutrition on health are subject to environmental factors, which interact with housing, clean water, absence of crime and other public goods such as public health measures. Nutrition and personal characteristics are the fuel to build a set of capabilities.

This set of capabilities and the psychic state lead to make the choice for functionings. As a result, two individuals with equal endowment of material characteristics (nutrition) may end up with different level of living standards if personal characteristics (and the psychic state) leads one to use their savings or jump straight into welfare if there are no savings. The lesser number of potential choices for the second individual accelerates the likelihood that migration within the closest family, divorce or death in the worst case, may occur. Herein comes the role of event history analysis to measure the speed at which the list of 6-responses may take place.

As noted before, current research based on this approach sheds light on hundreds of years of knowledge. Its application on historical populations provided strong evidence to the debate of differentials in living standards between the East and the West before and after the Industrial Revolution. The consensus led to think that the differentials were set before the Industrial Revolution, but this body of classical knowledge was based on aggregate evidence that supported the view of lower wages and cheaper products in Asia as an expression of low living standards. Even contemporary authors were of that view, but recent evidence – *Parthasarathi (1998), Lee &Wang (1999), Allen (2007),* indicated the opposite *(Bengtsson, p.29, 2004).* Bengtsson points out that the differentials were the result of the Industrial Revolution, and this is useful knowledge to understand events in contemporary populations in developing countries, where demographic data is more reliable than income data.

Arguing in the same vein as Bengtsson, Clark reaches a similar conclusion and states that there are three (3) interconnected problems: the persistence of the Malthusian trap before the 1800, the escape from that trap in the Industrial Revolution, and the consequent Great Divergence *(Clark, p 6, 2006).* Although both scholars reached the same conclusion, the difference lies in their approaches and auxiliary findings. Clarks uses an economic model based on the trade-off between technology and population growth, and made emphasis on the view that there is no merit in disaggregating deaths by social groups before the Industrial Revolution, because disease would not respect social class *(Clark,*

[2] Reasons for the latter is under-reporting of quantities and levels of income that is less the case in demographic events captured by censuses, vital registers and surveys

p8, 2006). Thus all social groups had on average the same living standards in terms of demographic outcomes. In contrast, the micro approach has provided interesting evidence for the period before the Industrial Revolution. For example, it can be said bluntly now that for Scania before 1815 the relative risk of deaths was indiscriminate among social classes, but after that period mortality displays a concentration on the landless *(Bengtsson, et al, p. 156, 2004).* Similarly, one can make the case for gender inequality for the odds ratio of dying for a Ou-Japanese female infants was 6,4 at the 1% level against an approximate of a non significant 0,86 if a male between the 18th and 19th century *(Bengtsson et al, p. 276, 2004).*

In sum, the new concept of Living Standards is an attempt to measure the speed at making certain responses under changing economic conditions instead of the traditional consumption of basket of goods. Indeed, the concept is decorated with a very gentle twist aimed at understanding the ability to fulfill own´s plans (e.g. surviving, getting or remaining married and giving birth) subject to short-term economic stress as an indicator of living standards. The new concept trumps the usual BNI, HDI, poverty line and similar indicators by being dynamic and not agglomerative, and as a result it ought to identify trends and timing of key demographic outcomes that are useful to policymakers to single out vulnerable groups and reduce poverty.

1.3 Criteria to choose Chocó, Colombia, as a case study

This set of ideas brings us now to try out new tools to analyze the rise and fall of living standards in developing countries. Colombia is known for experiencing one of the fastest fertility decline in the developing world from 6,7 children per woman in 1960 to 2,3 in 2005 (See graph 1) and has been ranked as a middle-income country by the World Bank since 1987. This news was supposed to be good news, but actually missed the pending redistribution agenda in the country; latest official estimates indicated that the Gini coefficient of Colombia lies around 60% within a range of +/ - 5% since the 1990 (Graph 2). Indeed, the same body of official research pointed out that mass poverty in Colombia accounts for around 45% of its population in year 2006 *(DNP: MERDP, 2007):* roughly nineteen million (19) out of forty-three (43) million of Colombians, who earn less than 94 dollars per day according to the poverty line figures back then.

The cheapness of labor mentioned by Malthus is then a daily engine of social disrupt and trouble, specially in Colombian rural areas, where risks to survival due to violence are higher than in neighboring countries. Moreover, non- compliance of minimum wages by entrepreneurs, changing food prices in a peaceless environment since the 1950´s (see graph 3) and the failure to provide social public goods in rural areas are price distorting factors that affect the living standards of Colombians and the quality of its measurement by income-based standards. Moreover, the studies so far lie in income and consumption measures of living standards at the national level, and there are no attempts to unveil how individuals, households, and communities at the sub-national level are constrained to experience and transfer passive agency lessons into their future generations.

The criteria to choose the province of Chocó, Colombia, is guided by official statistics estimates expressing one of the worst health outcomes with Infant Mortality Rates doubling the national average (see graph 4); having the highest support ratio of dependence in the country which barely doubles the national average (see graph 5); being the poorest province with 4 times the average level of BNI: 81,9% (See graph 6). Furthermore, Chocó may be characterized as a pre-modern society compared to the national average using Gosling & Taylor criterias *(2005, p.86)*: first, by 2005 more than 57% of the population still lives in rural settings as peasants working in small-scale units of production. This was Colombia´s urbanization share in 1973. Second, one of the lowest share of industrial production in the country expressed by a GDP share of 0.38 in 2005 with a declining annual growth rate of (-

1,5%)[3] since 1990. Third, although democratic elections occur, political lords have managed to remain in power and fail to provide the minimum basic public goods such as health, education and utilities *(Bonet, 2007)*.

On the other hand, there are two important features: no ethnicity bias using a data sample from Chocó for around 74% of the population is black *(DANE, Census 2005, see ethnic map & graph 7)*. This implies a similar systems of cultural values on family, support and history. Second, Chocó is in the top ten (10) of places with the highest rainfall volume (*Poveda & Mesa, 2000*). This area is known for a heavy disease load represented on respiratory diseases, malaria and diarrhea for sanitation and health policies have been historically poorly managed by local authorities. (*Minprotección Social, 2008*).

In sum, the attempt is to apply the micro approach to a contemporary population that resembles some features of historical populations. Some of these features dictate some of the variables that ought to be in the coming models. For instance, the BNI, basic need index, contains housing quality and utility services. Likewise, the support ratio is expressed by the number of members in the household available to take care of the children and the elderly.

2. Why DHS data?

First, the Demographic and Health Surveys offer wide, deep and reliable data that are cheaper than censuses, and allow to draw inferences from nationally representative samples, comparable across countries and over time *(Wang, 2002, p.281)*; furthermore, the absence of any long-run panel in the history of Colombia, and the abundance of independent cross-sectional Demographic and Health Household surveys, which have been running since 1986, are compelling arguments.

Second, demographic variables rely on a long literature based on sound historical experience on the living conditions in the East and the West, which resembles to a certain extent and in many cases to contemporary life in the Third World *(Wang, 2002; Korenkomp, Arnold, Williams, Nahlen & Snow, 2004; Bengtsson, Campbell & Lewis, p. 54, 2004; Johansson, p.74, 2004)*. Currently, more than 60 developing countries have run DHS surveys–on average- on a quinquennial basis since the 90´s: Benin, Bolivia, Brazil, Colombia, Dominican Republic, Ghana, India, Indonesia, Malawi, Mali, Morocco, Nigeria, Peru, Philippines, Senegal, Tanzania, Uganda, Zambia, Zimbabwe, among others. Third, the relationship between population and economics has brought about –among others- the wide development of family planning projects as a mean to reduce poverty, and policy makers have become better equipped to describe, relate and understand demographic data *(Daugherty & Kammeyer, ch.2, 1995)*.

As noted before, the DHS data are representative samples at the national level that were designed to be compared across and within countries. A two-stage cluster design, which in the first stage is made out of a subset of geographical clusters that are proportional to population size; indeed, the first stage for the 1990 and 1995 DHS surveys involved selecting rural and urban clusters from a national master sample taken out of the Colombian Census of 1985; the 2000 and 2005 DHS surveys were based on the Census of 1993. In the second stage, a complete household listing provides the sample size to select households not randomly in order to fulfill budget and time restrictions.

[3] Own calculations based on effective annual rate using DANE data, 2008. See data source in the annex provided by Banrepublica, Colombia:.

Alas, the (4) national surveys differ by the following: the 1990 DHS gathered information on 8.644 women aged 15-49, and 3.751 children aged less than 60 months from 7.412 households within the months of May and September of 1990. The 1995 DHS collected information on 11.140 women aged 15-49, and 5.141 children aged less than 60 months from 10.112 households in the months of March and June of 1995. It differs from the 1990 because a section on anthropometric measures (weight and height) was included for the first time. The 2000 DHS covered 11.585 women aged 15-49 and 21.267 children aged less than 60 months from 10.797 households in the months of July 2000 until January 2001. The 2005 DHS contains information on 41.344 women aged 13-49, and 71.278 children aged less than 60 months. The four surveys relate data on demographic and socio-economic characteristics for respondents and their nuclear family, but there is no chance to follow individuals over time.

As usual in survey data, two types of sampling errors are present: first, limited sample size brings about an statistical error in each survey. Second, there is a design effect due to procedures of data collecting. Fortunately, these errors are minimized with the use of identical survey instruments, and the richness of the data allows to make direct and indirect calculations in order to find any inconsistency (Korenkomp, EL,et al, 2004). For instance, the infant mortality rate can be easily calculated using the recent maternal history of the mother, and it can be disaggregated by age, rural/urban gap and socioeconomic differentials.

My pooled dataset

There exists a large body of literature based on DHS data used in various forms: cross-country data sources, cross-region data for a given country, household-level surveys including DHS and Fertility Surveys *(Wang, p.279, 2002)*. Following *Mosley and Chen (1984)* suggestion that the study of mortality needs long mortality rates for death is a rare event, this paper attempts to use an unbalanced panel by location containing a 5,8 % from DHS 1990, 15,9% from 1995, 9,8% from 2000 and 68% from 2005.

The DHS is representative at the national level. To conduct sub-national analysis over time, I pooled together four (4) DHS subsamples[4] by survey year in order to create a long-time series of data for children born between 1975 and 2005 in the department of Chocó, Colombia. The result was a pooled sample of 3.055 children and 779 women as shown in table 1 below. Since the DHS surveys don´t allow to follow individuals, but groups of the whole population by occupation or location. Likewise, a second dataset was assembled to analyze marriage survival using the same mothers involved in the exercise above.

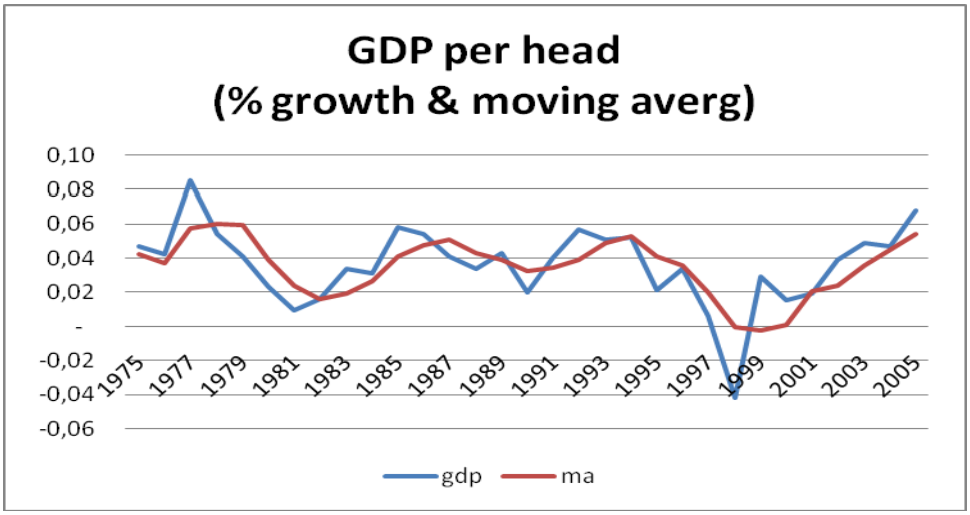
Table 1: Stata output. Number of children born from 1975 onwards

CENSUS YEAR	Freq.	Percent	Cum.
1990	180	5.89	5.89
1995	486	15.91	21.80
2000	302	9.89	31.69
2005	2,087	68.31	100.00
Total	3,055	100.00	

This is supposed to represent sub-national data for analysis, specially when sample size is relatively small as it was the case for DHS 1990 and 2000. The pooling of observations implied that observations and outcomes are independently distributed across surveys (Wang, 2002). On the other hand, the macro data was Gross National Product per capita of Colombia with 1990 as the basis year;

[4] I use from 1990 onwards for the 1986 DHS did not contain single observations for Chocó, but aggregated at the regional level.

a bad year is arbitrarily calculated by subtracting one standard deviation (0,0208) to a mean of 0,0348 per year. See graph below. The macro data was merged with the time series data by year of birth for child survival and by year of divorce for marriage survival.



Author:own calculation on data from DNP, 2008

In sum, the data is taken from the Demographic and Health Survey (DHS), a quinquennial survey with a nationally representative sample of households beginning in 1990 and ending in 2005. The attempt is then to have a subsample that represents the demographic dynamic of the Chocó population during the last thirty (30). The estimates are based on an unbalanced panel by location containing (4) four waves of cross-sectional data of a stock of female individuals, their children and partners in Chocó and secondary data such as constant GDP per head, being the latter an index of short term economic stress. In the next section, descriptive results are to make an introduction of the dynamics of life status in Chocó between 1975 and 2005 using DHS data.

3. Descriptive statistics

The research question guiding this work will be whether demographic events such as child and marriage survival describe rising living standards in the last thirty (30) years –between 1975 and 2005- in the province of Chocó subject to an exogenous constraint: Colombia´s economic growth averaged around 4% during 1970 and 2005. GDP has increased at an average rate of 3,4 % over the period 1975 – 2005 and faster than population size (see graph 8). The hypotheses for both dimensions are:

- The likelihood to survive for poor children under the age of 5 has not changed despite the rise of GDP per head.
- The likelihood to divorce has not changed despite the rise of GDP per head.

The selection of sample characteristics is then guided by a two-dimensional analysis of the New Concept of Living Standards: child and marriage survival. Child mortality is a common measure of average population health *(O´Donell, Van Doorslaer, Wagstaff & Lindelon, p.29, 2008)* and marriage mortality is an important dimension of women´s reproductive behavior with consequences for their reproductive health and social status over a life´s time *(Singh & Samara, p.148, 1996).* The sample characteristics by survey year are in table 2, but they are not exhaustive for two reasons: first, the two-dimensional analysis may have used many other available variables, but I left out those which had more than 5% of missing values. For instance, relevant variables to capture early life effects related to foetal stage such as antenatal visits for pregnancy (2654 missing out of 3055 observations) or pregnancy complications (2743 missing out of 3055). Similarlty, an asset index was not assembled for motorcycle and car/trunk had more than 80% of missing values. The other elements of the asset index like fridge, tv and radio were complete, but dependant on the availability of electricity, which is an essential utility not available widely in Chocó [5].Likewise, any correlation above 50% discovered along this section was another reason to leave some variables out.

Most of the characteristics vary marginally across surveys, but the year 2000 is unstable compared to the other survey years. For instance, the mean household size has been falling from 7,02 in 1990 to 6,02 in 2005, but an unexpected rise to 8.3 in 2000. Design effects and non-measurement errors may explain this fact. Alas, there is a clear demographic transition over the 15-year period. The number of children under five (5) and the number of eligible women in the household also follow a downward trend, but with unexpected rises in 2000.

On the other hand, other household characteristics such as access to electricity, piped water in residence and flush toilet indicate an upward trend, which probably reflects improvement in sanitation. Here two notes: first, this does not necessarily have an impact on diarrhea and other infectious diseases for the quality of water is not measured. Second, an official average of the Basic Need of Index of 80.39 % for Chocó for the period 1995-2005 *(DANE, 2008)* which contains access to utilities, housing quality, among other dimensions of poverty, does not seem to capture this upward trend as an improvement for household characteristics. However, many studies do suggest strongly the potential impact of improved sanitary facilities on major water- and excreta-related diseases in the developing world (*Esrey, Roberts, Shiff, 1991).*

Fortunately, the sand floor, which may be source for disease, specially in Chocó with an average relative humidity of 90% and an average temperature of 26.4 °C, is falling continuously to barely 0.03 over the period *(Poveda & Mesa, 2000)*. The wood floor falls while cement becomes a preferred

[5] The province of Chocó belongs to the non-interconnected zones in Colombia. See the map (Superservicios.gov.co)

material in the last years according to the latest DHS available. There seems to be a worrisome substitution between cement floor and other floor materials. Growing health literature suggests that wheezing in early childhood is associated with airborne endotoxin at home, but evidence is ambiguous *(Park, Spiegelman, Gold, Burge & Milton, p.859, 2001; Benicio et al. Bull World Health Organ [online]. 2004, v. 82, n. 7)*

Table 2: Descriptive stats by survey year

mean	1990	1995	2000	2005
description				
Hh size	7,02	6,73	8,3	6,02
no. Of children in hh under 5	1,87	1,24	1,32	0,97
no. Of women in hh	1,41	1,18	1,86	1,78
Electricity	0,58	0,41	0,64	0,87
Sand floor	0,27	0,01	0	0,03
wood floor	0,62	0,62	0,5	0,41
cement floor	0	0	0	0,44
other floor	0,35	0,35	0,49	0,11
Piped water	0,21	0,35	0,32	0,49
well & rain water (public)	0,36	0,32	0,17	0,14
otherwater	0,42	0,31	0	0,01
Flush toilet	0,06	0,27	0,47	0,56
other toilet	0,93	0,72	0,52	0,43
Child sex (1=female)	0,39	0,46	0,44	0,5
birth order	3,84	3,57	3,29	3,01
first born	0,31	0,44	0,56	0,49
breasfeeding	0,25	0,24	0,07	0,14
birth interval	29,66	29,38	33,09	35,7
twin	0,02	0,01	0,03	0,02
Mother has none educ	0,05	0,13	0,08	0,08
mother has some primary educ	0,52	0,38	0,26	0,41
mother is primary graduate	0,1	0,12	0,18	0,13
mother has some secondary educ	0,35	0,21	0,13	0,23
mother has secondary educ or higher	0,01	0,26	0,41	0,22
Currently working	0,62	0,86	0,58	0,62
mother´s age at marriage	18,85	19,2	17,89	18,43
mother´s age at first birth	18,64	20,55	19,01	18,65
mother´s height in cm	na	157,9	157,5	158,8
Body mass index	na	2357	2489,8	2697
Sample size	108	243	151	2087
% share of pooled dataset	4%	9%	6%	81%

Child characteristics vary greatly by survey year. Between 1990 and 2005 the share of baby girls rises steadily from 0,39 to 0,5. Birth order falls while first born rises what adds more evidence to a probable demographic transition during the period of study. Finally, twins remained barely the same across survey years. Maternal characteristics move randomly with an upward trend between 1995 and 2005 for some primary education and primary graduates. Early marriage at 18 is common, and mother´s age at birth remains fairly the same, although in 1995 it rose temporarily by 2 years to 20,5. The question here goes into identifying far-reaching consequences on reproductive behavior and social status for early wives, who may have divorced later in life. On the other hand, data on foetal stage had more than 70% of missing values, and estimates on infant mortality rate as a proxy for disease load were avoided under the assumption that they be endogenously biased for certain years.

Alas, following the standard literature, child mortality is disaggregated in infant (between 0 and 12 months) and under-five (below 60 months of age). My focus is on infant and child mortality as the number of deaths per 1000 live births happening between their respective age intervals, but using births thirty (30) years prior to the survey as shown in the life table below.

Table 3: Life Table, Chocó, 1975-2005, Extract from Stata output

Interval		Beg. Total	Deaths	Lost	Survival	Std. Error	[95% Conf.	Int.]
0	1	3055	142	129	0.9525	0.0039	0.9443	0.9596
1	2	2784	32	129	0.9413	0.0043	0.9322	0.9492
2	3	2623	15	119	0.9358	0.0045	0.9263	0.9441
3	4	2489	1	127	0.9354	0.0045	0.9259	0.9437
4	5	2361	4	130	0.9338	0.0046	0.9242	0.9422
5	6	2227	4	111	0.9321	0.0047	0.9223	0.9407
6	7	2112	3	125	0.9307	0.0047	0.9208	0.9394

The interpretation is straightforward: there are 3.055 children born in the last thirty (30) years, and 142 of them die during the first year of life. 129 are censored, eg, they were not fully exposed to death for they are newly born by the time of the interview. As a result, the IMR equals (between 0 and 12 months) is 47,5 per 1000; and the U5MR is 66 per 1000. See graph 9 to see timing of the probability of a child dying before her/his first birthday.

Malnutrition is prevalent in Chocó (*ENSIN, 2005*), and it is associated with mother´s health and child death. Height and body weight for children are proxies of their nutritional level, but unfortunately the number of observations available only account less than 17% of survey samples, and the 1990 DHS has no anthropometric data. Height has been used as a measure for genetics *(Kabubo-Mariara, Karienyeh & Mwangi, 2008).* Alas, it is to note that there is a marginal difference in mother´s height for 2005 while weight does show a continuous upward trend. Finally, at the national level, GDP per head was included as a measure of national well-being and is measured at the year of birth for child survival and at the year of divorce for marriage survival. A 3-year moving average captures lags. (See graph 10)

4. Data and Theory

4.1 Child survival

Child survival is a non-metric measure of national well-being. It fits the Sen´s concept of capabilities and obviously the New Concept of Living Standards. As noted before, the New Concept outlines mortality as the last optional response of households interested in overcoming short-term economic stress. However, the fact that mortality models vary by age, place and time makes very difficult identifying the determinants for infant and child mortality in developing countries, specially in rural areas, where more than many factors interact to cause death.

To make good use of the dataset and results so far, the framework of Mosley and Chen (1984) is widely suggested. They proposed a series of premises that make a set of proxy determinants accountable to explain morbidity and mortality through the operation of socioeconomic and environmental factors such as disease, nutrition and unclean air; the premises are as follows:

1. In an optimal setting, over 97% of newborn infants are expected to survive through the first five years of life. The life table in the past section provided a IMR of 47 per 1000. In line with my sample results, official estimates leads to suggest that a Chocó IMR of 77 per 1000 in 2005 is indeed not an optimal case.
2. Reduction in the survival probability must be explained by social, economic, biological and environmental forces. My descriptive results in table 2 allowed me to test this second premise by operationalizing a hazard model[6] on the basis of the following proxy determinants proposed by Mosley and Chen as:

    - environmental conditions (access to water, bad housing, location of place at birth and injury)
    - maternal factors (age at birth, sex of the child, birth order, birth spacing)
    - nutrient deficiency (food supply plus anthropometric measures)
    - disease load (diarrhea, respiratory infections, care during pregnancy)
    - and personal illness control (medical treatment and so forth)

3. specific diseases and nutrition deficiencies are viewed as biological indicators of the operation of the proxy determinants. Official medical data in Colombia suggests that U5MR is caused by perinatal respiratory diseases (28,1%) and genetics (17,6%). Similarly, U5-15MR can be explained by accidents (19,7%), genetics (8,5%), homicides (7,5%) and respiratory diseases (6,1%) (Minprotección Social, 2008). See graph 11.

4. and a child´s death is the result of series of multiple episodes. I cannot tell from my data if this is the case, and the scope of this paper does not cover the medical knowledge to understand the road to death by disease.

In sum, an interpretation of these array of results under the light of the Mosley and Chen framework suggests that Chocó is not an optimal case neither for infant nor under-5 child mortality. However, the analytical framework is focused on both sides of the coin: dead and survivors. In other words, event history analysis and an explanation to why some survive subject to their socioeconomic determinants fits the framework´s scope. Bengtsson et al (2004) were influenced by this framework and run a model to understand infant and child survival subject to economic conditions in historical populations.

[6] Survival analysis is a method to analyze time to event or failure data. It models the risk of failure or the probability of a failure or hazard at time t+x, given that the subject is at risk at time t. The higher the hazard, the shorter the survival.

The variables they chose, although some were restricted by their availability, express a hypothesis indicating a functional relationship between child mortality disaggregated by several time intervals (0-9 days, 10-29 days and so on) and biological variables such as the interaction drawn from survival and birth spacing, sex and mother´s age; likewise this model was extended to include household characteristics such as parent´s presence, siblings, landholding, ect, and external variables such as food prices to measure the ability to overcome short-term economic stress. I rewrote their expectations on the model, leaving out the occurrence of seasonalities for they do not apply to my case study. See table 4 in the annex.

Their results advocate strongly that infant survival experience an 11% higher probability of risk of dying when influenced by a 10% rise on prices for rice[7] and that the role of the mother was central to the survival of the newborn. Indeed, the mother´s age at birth, her health condition as a proxy from age and birth spacing, and her presence in the child´s life seem to be very important. Likewise, their findings restated the increasing risk for mothers aged more than 35 years old and illustrated as well the phenomenon of death clustering at the family level (*Trusell and Hammerslough, p.12, 1983; Wang, p.278, 2003, Bengtsson et al, 2004).* Similarly, official DHS reports from 2000 (ch.4/7) and 2005 (ch.7) share the same view on mothers´s older than 35 years, birth space below 24 months, first-born individual and boys being more likely to die than girls.

Wang (2003) run a cross-country model using all DHS surveys available to find key determinants of infant and U5 mortality in developing countries. He considers the practical significance for determinants like toilet facility, water supply, access to electricity, social status, vaccination and public health in reducing infant and child mortality for developing countries. Alas, the statistical significance indicated that variables like social status measured as female education, water supply, access to electricity and vaccination coverage are not significant neither for infant nor child mortality at any level, rural or urban. Likewise, he found that income, acces to water and to electricity are of practical and statistical significance for child survival across developing countries, but little significance of health expenditure in urban areas and none in rural areas.

The work of *Soare*s on mortality in developing countries (p.276, 2007) seems to be in accordance with results for past populations: Soares states that the epidemiological transition in developing countries have had a major impact in reducing child mortality. A exhaustive list of developing countries, where common infectious diseases such as malaria, tuberculosis, yellow fever, and others, have been successfully defeated by public health policies and have brought about synergic effects with other variables at reducing child mortality. Likewise, the role of breastfeeding and nutrition is acknowledged, but with the caveat that most of infant deaths occur during the first month *(Wang, p.290, 2003; Soares, p.270, 2007).* Evidence from his study set of developing countries show that mother´s education is central in determining infant and child mortality regardless of social status. Indeed, education and preventive measures are linked what indicates a clear link with modern health institutions and how targeting interventions at particular diseases may be useful. Similarly, clean water and sanitation are important to reduce child mortality, although their effects tend to correlate.

In sum, the Mosley and Chen framework is a comprehensive guide to identify variables and their functional relationships. However, it is not clear-cut how the scope of the premises affect the results of studies, which are sub-optimal cases as in Chocó. Similarly, some scholars have tried to accommodate their work to the available data and have come with suggestive, but not conclusive

[7] For children between 2 and 9, the estimate was a highly unsignificant hazard of 1,011. This means an increased likelihood of 1,1% p. 378

model specifications, to analyze child and infant mortality. As noted before, place, time and age do play key roles, and these key roles make very ambiguous the identification of any theoretical benchmark to differentiate between statistical and practical significance.

For Bengtsson, Trusell and Soares, the mother plays a central role; her presence and education reduces the likelihood of dying for a child and invites to use prevention measures. So does income or prices, but the methods to illuminate their inner workings are more specific and clear cut within the framework of the micro approach. In contrast, Wang (p.292, 2003) gives significant and practical credit only to access to electricity in rural areas. The environmental conditions seem to play no role in urban areas of developing countries, and the role of agency is absent.

Soares and Trusell made the case for health expenditure to fight certain diseases, and Wang says it makes difference only rural areas, but not in urban areas. Finally, all studies, but Trusell, considered the role for nutrition, but it is more informative than a variable to explain mortality through the operation of a model, not even a proxy using height and weight. Personal illness control is embedded in mother´s education, and injury is not mentioned in any of the studies.

4.2 Nuptiality – Marriage Survival

Malthus (1803) based his theory of population on the assumption that human beings were incapable of controlling their sexual needs. As such, marriage is the moral response to control sexual needs, and he stated that preventive checks as delay of marriage would keep population growth at bay in the face of acute conditions. Consequently, living standards would improve. Although many scholars attempted to assess Malthus hypotheses using European historical populations and large-scale famines, the West European pattern of marriage was weak to support the validity of the argument *(Lee, p.12, 1990)* Bengtsson et p.54, 2004).

Schofield (p.2/p15, 1985) argues that for historical England marriage responsiveness to changes in the living standards seems to remain unaffected despite the transformation of the economic structure before and after industrialization. *Hajnat (p.108, 1965)* states that the West European pattern is a unique process in the world, which is expressed in a mean age of marriage of 31 years on average for men, and 28 for women in the 18th century; this pattern remained well stable until the 1940´s. Unfortunately, there is no data for countries where the marriage pattern is non- European. However, in the annex table #5 presents the increasing number of singles in several countries at the onset of the 20th century, specially in developing countries. Countries like India showed in table # 6 in the annex that only 5% of its population remained single at age 20-24 in 1900; in 1992 a round estimate of 30% of its population remained single.

On the other side of the coin, divorce rates are an inflow into singleness. The question is then twofold: why some marriages are more likely to fail than others, and is it that single individuals are avoiding the potential failure of marriage and embracing cohabitation or similar ways for controlling sexual needs and keep population growth at bay; the latter would cover divorcees as well. Looking at my data, descriptive results in the second section of this paper noted that early marriage and early birth are common patterns for women in Chocó. In the same line, neo Malthusian scholars have argued that the role of early marriage to high birth rates is a common feature of traditional societies, specially in rural settings. In Chocó, before becoming 20 years, 96% of women had been married, 75 % remained married by the time of the interview and only 5 out of 779 had NOT being pregnant. Later on, 21.4%

of women had divorced what added to the 3% of single individuals results in 24%. In other words, 3 out of 10 people in Chocó are either single or divorced.

European historical evidence states that Sweden of the 18 and 19th century has a proportion of 80% of single aged 20-24, when the economy was still rural. Actually, the number of people ever married in contemporaneous Sweden is higher today than in the past. India in 20th century still has a very high rate of marriage the rates of marriage would be low for countries experiencing the West European pattern. The existence of this pattern can be traced since the 18th century till 1940 (Hajnat, 1965). Moreover, finding of *Lee and Wang (1999)* on China suggests that early marriages would not lead to higher birth rates; and infanticide was a more common check on population size than famines and other mechanisms. However, *Schofield (p.2/p15, 1985)* warns not to confound population changes with nuptiality unless fertility remains constant as was the case for historical England and added that marriage responsiveness to changes in the living standards seemed to remain unaffected despite the transformation of the economic structure before and after industrialization

In sum, the debate on the responsiveness of marriage to economic conditions seems not to have sound historical ground. Table # 6 in the annex indicates that the share of married people is falling in the world, and Becker (ch. 10, 1993) argues that many studies relate this change to educational attainment, labor force participation, differentials in human capital stocks, urbanization, divorce laws, among others, but no one can refute the fact that marriage mortality is subject to changing economic conditions. He makes emphasis on the fact that consensual marriages tend to be less stable than formal marriages, with two consequences: first, divorce is strongly influenced by the loss or gain in economic terms; this implies that a housewife is less eager to divorce than a currently working mother. Second, less children within consensual unions and due to marriage breakup can be understood as preventive checks.

Arguing in this vein, there are several theoretical contributions to build upon the argument that marriage survival is responsive to social and economic changes. First, it would be interesting to extend then Weir´s idea that changing economic conditions influence the prospect of ever marrying rather than the timing *(Schofield, p.3, 1965*) to the prospect of remaining married. Second, economic cycles are supposed to affect the likelihood of divorce, but evidence is ambiguous if prosperity or depression is the adequate setting to trigger this effect *(White, p.905, 1990).* Third, the gender roles have changed with the access of women to the labor market, and this may have changed family values somehow as women gain more economic independence *(Kitson, p.914).* Fourth, divorce by ethnicity suggests that black people in America divorce more than Hispanos and Whites *(Kitson, p.916).* Fifth, the life cycle theory suggests that demographic variables such as marriage order, presence of stepchildren, early marriage, lower education, intergenerational parental divorce, and the disappearance of the firstborn effect on keeping a marriage together after a second child, have – more and less - a say on explaining divorce rates *(White, p.907, 1990; Kitson, p.917)*

In other words, Malthus would be happy to see that changing economic conditions may reduce fertility through divorce or consensual unions. Likewise, the New Concept, which feeds on life theory and focuses on the transition into marriage as the ability to overcome short term economic stress, must widen the conclusion that delay of marriage, consensual unions or divorce are mechanisms to postpone consumption (Bengtsson, p.35, 2004) . As such, divorce is as an indicator of the inability to remain married subject to short-term economic stress what fosters the woman´s participation into the labor market to compensate forgone consumption in the household.

5. Modelling two dimensions of the New Concept: child and marriage survival

Infant and child mortality have been falling in Colombia since the 1950´s despite under-reporting *(Dane 1998; Florez, C. 2000; Jaramillo L. et al. 1998, Medina M. Et al. 1999; DHS Profamilia 1986, 1990, 1995, 2000, 2005; Medina M., Martínez M., 2007).* Yet, according to the latest DHS reports, the 2005 Infant Mortality Rate in the province of Chocó is still the highest in the country with 77 per 1000, being over 3 times the national average: 22,5 per 1000. Following the literature on determinants of infant and child mortality noted in the past section, the set of models is an attempt to capture the practical and statistical significance of variables which may explain to a certain extent infant and child mortality in Colombia. The question then is if a bad year increases the likelihood for infant and child survival by influencing interdependent covariates such as social class, current employment, housing quality, among others.

On the other hand, singleness and consensual unions have a rising trend in Colombia. The DHS surveys since 1995 points out that the national mean age of marriage is around 21 years old, but the number of married women has been falling from 25% in 2000 to 22% in the last 6 years prior to the survey of 2005 while the number of consensual unions is rising by the same share; and the number of divorced women has climbed up from 13 to 15% in the same period *(COL-DHS, ch.7, p. 140-141, 2005*). In other words, consensual unions or marriage break up affect fertility making harder to disentangle the relationship between nuptiality and economics. The question here is poor couples are more prone than their rich counterparts to embrace divorce as a mechanism of postponing consumption in bad years.

Before I go into the models, it is to note that interpretations of explanatory variables always takes into account the sign and size of the estimate, its significance and the fact that its reading is based on controlling the other determinants. There was a huge willingness to make some interactions, because they exist: the simple counting suggests that at least using the combinations of fifteen (15) variables before disaggregation by categories would result in 210 taking taking two at a time. Yet, to test the ability to overcome short-term economic stress, I chose to run an interaction of good/bad year with social class for child survival and another one using currently working to test child and marriage survival:

5.1 Child Survival

Dependant variable

The dependant variable contains dead and alive children, who were born at most 30 years prior to each survey. The maternal history of the 779 mothers is complete, and using the pooled dataset with 3055 children, I calculated the hypothetical age for each child from the year of census, the survival time and made a dummy to differentiate timing of death for modelling the infant and U5 mortality models.

After looking at the survival function in the section of descriptive statistics, I made the decision to use an standard Weibull model to fit the dataset. The (4) four cross-sections studies are not linked by identification, so there is certain probability that some children, who are below 1 years, died after the last interview of the survey, but event history analysis allows to correct censorship biases. Moreover, hazard models avoid any downward bias in estimation of mortality rates, and the maximum likelihood estimator yields asymptotically unbiased, normally distributed and efficient results for censored data *(Allison, p.26, 1984)*

Explanatory variables

Based on the conclusions from the theoretical part, there are several determinants linked to the mother: age at birth, sex of the child, birth order, birth spacing and education are likely to increase the

probability of survival. Arguing in this vein, Schultz (1984) adds that above all mother education leads to greater benefits from using health services and preferences to child health and family size *(Kabubo – Mariara, Karienyeh & Mwangi, 2008, p.14).* Some studies add height of the mother to capture genetics resulting from family background, but our dataset missed 1990 completely and other survey observations have missing values above 5%.

Choco has an BNI of 81% , and as noted before, the Basic Need Index contains a set of environmental conditions such as sanitation, access to water, bad housing, and crowding that influence child survival. Some authors add location of place at birth and injury as additional and strong determinants of child mortality (*Trusell and Hammerslough, 1983; Wang, 2002, Mosley and Chen, 1984).* Indeed, a dirty environment enables the spread of disease such as diarrhea and respiratory systems diseases as key causes of child mortality *(Mosley & Chen, 1984).* I tried to identify a set of basic mechanisms common to all diseases of interest and through which all socioeconomic determinants work[8]. Diarrhea is linked to water access; respiratory diseases to floor quality; and the complete set of biological variables attached to birth such as birth order, birth interval and mother´s age. Not following *Johannson (2004),* disease load was not measured as the annual infant mortality rate may be biased in some years due to the nature of a very unbalanced panel: note that 1990 DHS has a share of roughly 4% and 2000 DHS of 6%. Furthermore, descriptive results indicate that there is some sort of bias in the results provided by the 2000 DHS.

At the subnational level, the Gross Domestic Product per head is an exogenous measure for good and bad years. A good year is above an absolute bar of growth : 0,0132. The likelihood of survival is higher for good years, and the opposite would happen in a bad year. Still, estimates accounting for higher death for poor children in good years indicates the tacit operation of the other socio-economic determinants in the models. There must be a lag, but moving averages are to capture this effect; and these variables are measured only at the year of birth of the child with the hope that the same set of covariates may shed light on early life consequences despite the absence of complete and related foetal stage data such antenatal care, tetanus take-up, place of delivery and so forth.

Historical demography provides a series of theoretical papers to set mortality models. However, conditions have changed since then, even for developing countries, where public health has being the target of government efforts and cooperation aids over years. Infant and children mortality rates have been dropping steadily in the developing world, although population aging still looks distant compared to developed countries. See below my table of expectations.

Table 6: Expected effects of individual, household and intermediate variables on mortality by stages of life

	Less than 1 year	Less than 5 years
Male	Ref	Ref
Female	-	-
Birth order 0-1	Ref	Ref

[8] The other approach is out of the scope of this work for it entails a detailed classification of all know causes of sickness and death in every individual so that inferences about the social factors may become possible.

2-3	-	-
4-6	+	+
+7	+	+
Short birth length	Ref	Ref
Long birth	-	-
First birth before 20	Ref	Ref
After 20	-	-
Women in hh	-	-
Electricity	-	-
Rain water	Ref	Ref
Piped water	-	-
Well water	+	+
River water	+	+
None toilet	Ref	Ref
Trad. toilet	+	+
Flush toilet	-	-
Other floor	Ref	Ref
Sand floor	+	+
Wood floor	-	-
Cement floor	+	(+/-)
High class	-	-
Medium class	Ref	Ref
Low class	+	+
None educ	Ref	Ref
Some primary	+	+
Primary grad	-	-
Some secondary	-	-
Secondary grad &	-	-
higher	-	-
Currently working		
	Ref	Ref
Bad year	-	-
Good year	-	-
I goodyear*high class	+	+
I goodyear*lowclass		
	Ref	Ref
Good year	+	+
Bad year	Ref	Ref
I badyear*working	+	+
I badyear*not working		

+= higher risk; -=lower risk; /=var. not included () or +/-= uncertainty about the direction of the effect

Results

I estimated a full sample model for IMR and U5MR using the same correlates to identify any common correlates for mortality. The mortality models by age suggest that biological variables are highly significant at explaining survival for infants and children under-five. Similarly, the direction of my estimates seem to confirm my expectations fully.

- **Biological variables**

Sex seems to be significant at the 10% level for both models by reducing the likelihood of girls to die by 24% and 23%compared to boys. In fact, 60% of the dead were boys in the DHSurveys. (See table 7. in the annex). On average, a birth space above 24 months reduces the likelihood of child mortality by 51% for infants below 1 year of age and 53% for children under 5 years of age at the 5% level. Indeed, a nested model out of the full model allows me to disaggregate by shorter intervals and a birth

interval between 0-13 has the highest hazard of 3,6 compared to intervals above 25 months; likewise, an interval between 14-24 months has a hazard of 1,7. This trend reaffirms my initial results.

Higher births order reduces the likelihood of mortality sequentially for all categories at the 10% level . My expectations suggest that this trend would end by birth order between 2 and 3. It seems that more experience on childbearing decreases the risk of dying, and the first child is valued as much as the last. Similarly, pregnancy after 20 is highly significant, and reduces the likelihood of death by almost 50% in both models. Early pregnancy and early marriage are common in Chocó, but delaying first birth rises the odds of child survival.

In sum, as expected both mortality models share the same pattern of direction of the estimates of the biological variables at the 5% level, although sex seems to be significant at the 10% level. Girls have a 23/24% less probability to experience death. In the same line, first pregnancy above 20, which is uncommon, has lower infant risk of dying by 44%, but higher birth order seems to have no impact even after parity four (4) onwards .

- **Household characteristics**

The characteristics of the household present a more random picture. First, household size was replaced by women in household to avoid any endogeneity associated with mortality; the higher the mortality the smaller the size of the household *(Kabubo – Mariara, et al 2008)*. My expectation was then that more available women in the household would reduce the likelihood of child mortality. Note that the support ratio of Chocó is the one of the highest in the country with 1,22 for individuals under 20 years. The signs are as expected for both models, and statistically significant at the 5% level. For each additional woman in the household, the probability of dying falls by 21% for infants and children below 5 years.

Second, Wang (2002) makes reference of the role of electricity as a mean to reduce child mortality. The estimate for electricity stands out for reducing probability of dying by 59% for infants and 54% for children under at the 5% level. It is to note that electricity is used as a proxy for the asset index because the latter is composed by three out of five objects, which need electricity to function, such as radio, tv and fridge. The other two are car/trunk and bike, which had more than 80% of missing values. Consequently, it was not wise to build an asset index with so many missing values when electricity already covers more and less 60% of the asset index.

Third, Chocó is known as one of the regions in the world with the highest rain volume (Poveda & Mesa, 2000). Rain water and river water are common sources for drinking water and household chores. I was expecting that piped water in residence will have a clear trend of positive impact in reducing infant and child mortality. Alas, my estimates, although insignificant, indicate an unstable picture. Well water, which comes out of wells through the use of pumps and public taps, seem to reduce the probability of dying for both mortality models by 58% (IMR) and 14% (U5MR). The lower likelihood for piped water fits the common untrust towards water quality in Chocó. People still prefer to boil the water from the river or from wells functioning with pumps because these sources offer non-contained water. Although children at the age of breastfeeding barely drink water, access to well water is significant at the 5% level and reduces infant mortality by 58% compared to rain water. Piped water reduces the likelihood by a mere 3%, although its coverage has been increasing steadily to around 50%. In sum, there is no clear evidence to make any correlation between diarrhea and water access. Well water might be less dirty only if the mother´s education has enough knowledge to do it successfully.

Fourth, flush toilet compared to no toilet reduces the likelihood of infant and child mortality by 20% and 17%, respectively. Fortunately, their stock has been growing from 6% of the households in 1990 to 56% of the households in 2005. Similarly, traditional toilet has a positive influence to increasing mortality regardless of age group by 36% and 16%, respectively. These tend to be letrines at the river shore, but their stock has been losing ground to flush toilet and is at the brink of disappearing. However, there is still a large scope of work to do for households without any kind of toilet facility.

Number of households	No toilet
1990	96%
1995	69%
2000	42%
2005	38%

Source: Author using DHS data by survey year

Fifth, the quality of floor poses health problems. Estimates on sand floor have the wrong sign, but they have a marginal share of the stock of housing floor: less than 3% during the period of study. Wood floor, which is more common in the area, indicates the reduction of child mortality in both models, although there is no statistical significance at any level. It seems that in the last years the stock of wood floor is losing ground to cement floor, which is supposed to be an indicator of improved economic condition. Cement may cause health problems for children growing up in Chocó. Official reports of the local government suggest that respiratory diseases are linked to cement floors, which are difficult to keep clean, and raise airborne toxins during the night. Estimates seem not to have the expected sign.

- **Mother´s characteristics**

Other socio-economic indicators that affect mortality models have been captured by the mother´s education, social status of the household head, and labor force participation. Education has a more consistent pattern that confirms the need to raise mother´s education as a mean to reduce infant and child mortality. The signs show a pattern based on lower risk of dying correlated to higher levels of education. However, only after some secondary education there is a fall in the likelihood of infant and child mortality. Primary graduates seem not to offer their children higher survival rates. Similarly, labor force participation ought to reduce mortality for access to income is associated with better health.

Survey year	Currently working	Currently working and secondary graduate
1990	63%	2%
1995	86%	23%
2000	58%	29%
2005	62%	16%

Source: Author using DHS data by survey year

The table above shows that the female labor force has remained stable over time, but the number of secondary graduates working has been increasing. My results suggest that working mothers do not seem to experience higher risks of dying for infants and children. This assertion must be completed looking at the interaction of goodyear and currently working, which indicates that high-class households experience lesser risks of losing their infants and children than medium and low class. Yet, as follows below poor households still are the focus of death in good years.

The social status of the household head is categorized using occupation as the indicator to aggregate the categories as follows: low class contains agricultural employees, domestic servants and unskilled workers; middle class contains skilled workers, clerks and sales; and rich, professionals, managers and agro-self employed. Note that the latest Gini coefficient for land in Colombia is around 0.86, so that self employed individuals in the agricultural sector tend to enjoy high rents and low taxes. Alas, only one of our estimates is significant at the 5% level, but follows the pattern of non- expected signs; for instance, the interpretation would suggest that lower classes have lesser likelihood of infant mortality by 41% less than the middle class while the higher class is supposed to experience a 3% lesser likelihood of infant mortality. When considering the single estimates, lower classes displayed a lower risk of child mortality than high classes. This sounds a bit like the pattern in historical populations when urban mortality was higher than the rural one. However, the interaction terms indicates that in good years the likelihood of dying is 36% higher for poor households while rich households experience 44% less risk. The last assertion is revised by using an interaction of bad years and currently working. In the same vein, the likelihood to experience death is higher in bad years, and it becomes specially worst if the mother is not working. See table 6b.

In sum, the New Concept is said to be the ability to overcome short-term economic stress and survive. My results fulfill more than less my expectations. Under the age of 12 months, good years seems to reduce the likelihood of dying for the rich, but not for the poor. It seems that low classes are more exposed to other interacting mechanisms that affect their survival such as household characteristics, but my models do not account for this interaction. In constrast, one of the two interactions suggests that unemployment of the mother makes bad years become more risky for infant and children under five. Finally, the covariates indicate that on average the ability to survive for infants and children under 5 is enhanced if:

- Being a girl
- Not being first born
- It is advisable for the mother to have a waiting time of at least 24 months between births
- The mother should be older than 20
- Women in the household seem to be supportive of new members, in other words, expect them to do free child care
- Electricity at home seems to be an advantage for survival
- Well water seems to be an adequate source for water compared to other sources, including piped water in residence, which seems to be increasing its coverage, but not its influence on survival.
- Social class seems to matter, but specially in bad years unemployment makes the risk of dying higher.
- And working women with at least secondary education may have better chances to keep their children alive.

Table 6b: Results

	IMR		U5MR			IMR		U5MR	
number of subject	2949		2949		number of subject	2949		2949	
failures	158		196		failures	158		196	
time at risk	402647,5		396553		time at risk	402647,5		396553	
log likelihood	-960,06		-1129,34		log likelihood	-961,49		-1129,4	
Prob > chi2	0	p-value	0	p-value	Prob > chi2	0	p-value	0	p-value
Sexdum (female=1)	0,76	0,09	0,77	0,07	Sexdum (female=1)	0,76	0,09	0,77	0,07
Birth order 2-3	0,65	0,07	0,74	0,15	Birth order 2-3	0,65	0,07	0,75	0,15
Birth order 4-6	0,54	0,01	0,56	0,01	Birth order 4-6	0,54	0,01	0,56	0,01
Birth order 7 plus	0,57	0,08	0,6	0,08	Birth order 7 plus	0,57	0,08	0,6	0,08
Birth length (long=1)	0,49	0	0,47	0	Birth length (long=1)	0,49	0	0,47	0
Pregnancy after 20	0,56	0	0,66	0,02	Pregnancy after 20	0,56	0	0,66	0,02
Women in hh	0,79	0,03	0,79	0,01	Women in hh	0,79	0,03	0,79	0,01
Electricity (dummy=1)	0,41	0	0,46	0	Electricity (dummy=1)	0,41	0	0,46	0
Piped water	0,97	0,91	1,05	0,77	Piped water	0,97	0,91	1,05	0,77
Well water (with pump, public tap	0,42	0,02	0,86	0,62	Well water (with pump, public tap)	0,42	0,02	0,86	0,62
River water	0,9	0,7	1,01	0,95	River water	0,9	0,7	1,01	0,95
Flush toilet	0,8	0,31	0,83	0,36	Flush toilet	0,8	0,31	0,8	0,27
Traditional toilet	1,36	0,35	1,16	0,64	Traditional toilet	1,36	0,35	1,21	0,56
Sand floor	0,3	0,1	0,61	0,37	Sand floor	0,3	0,1	0,61	0,37
Wood floor	0,72	0,17	0,91	0,69	Wood floor	0,72	0,17	0,91	0,69
Cement floor	0,71	0,19	0,95	0,83	Cement floor	0,71	0,19	0,98	0,6
High class	0,97	0,95	0,7	0,37	High class	0,97	0,95	0,64	0,09
Low class	0,59	0,12	0,58	0,05	Low class	0,59	0,12	0,77	0,15
Some primary educ	1,09	0,76	1,1	0,67	Some primary educ	1,09	0,76	1,1	0,67
Primary grad	1,24	0,488	1,08	0,77	Primary grad	1,24	0,488	1,1	0,7
Some secondary	0,91	0,77	0,88	0,65	Some secondary	0,91	0,77	0,88	0,6
Secondary grad + higher	0,81	0,58	0,7	0,3	Secondary grad + higher	0,81	0,58	0,57	0,3
Currently working	0,97	0,88	1,1	0,52	Currently working	1,05	0,79	1,1	0,4
Good year	0,8	0,48	0,62	0,09	Bad year	1,05	0,79	1,19	0,3
Interaction highclass*goodyear	0,56	0,28	0,91	0,86	Interaction badyear*not working	1,28	0,48	1,2	0,5
Interaction lowclass*goodyear	1,36	0,42	1,52	0,22					
ln_p	-1,42		-0,22		ln_p	-1,42	0	-1,29	0
p	0,24		0,79		p	0,24		0,27	
1/p	4,15		1,2		1/p	4,16		3,6	

5.2 Nuptiality – Marriage Survival

Dependant variable

The dependant variable is divorce as the event of study, which covers a total of 716 women between married and divorced women in the pooled dataset. The initial dataset contained 779 women, but 63 single women have been subtracted. The duration of marriage is survival time, and it is the difference between age at marriage and time of the divorce if this is the case. The GDP data is merged with the year of divorce, and the bar to differentiate a good from a bad year remains the same as for child survival: 0,0132.

Explanatory variables

Based on the conclusions from the theoretical part, there are several theoretical contributions linked to the determinants of divorce: first, the role of changing economic conditions influence the prospect of remaining married. It is not apparent to what extent economic cycles are supposed to affect the likelihood of divorce. Second, the access of women to the labor market has had impacts on family values and divorce decision. Women with income gained through labor have a stronger say in household decisions. Third, demographic variables such as early marriage, early pregnancy, lower education, the disappearance of the firstborn effect on keeping a marriage together after a second child, have – more and less - a say on explaining divorce rates *(White, p.907, 1990; Kitson, p.917).*

Table 7: Expected effects on divorce
(Marriage Survival)

Early marriage, before 20 years	+
Between 20-25	Ref
After25	-
Age at first birth below 20	+
Between 20 - 25	Ref
From 25 years onwards	-
Birth order 0-1 (First-born effect)	Ref
2-3	-
More than 4	+
High class	+
Medium class	Ref
Low class	-
None educ	-
Some primary	-
Primary grad	-
Some secondary	Ref
Secondary grad & higher	+
Currently working	+
Good year	Ref
Bad year	+
I badyear*working	Ref
I badyear*not working	+

+= higher risk; -=lower risk; /=var. not included () or +/-= uncertainty about the direction of the effect

Results

A full sample model was estimated using the covariates mentioned in the table above. Unexpectedly, early marriage, which has a median of 18 over the period, reduces the likelihood to divorce by 33% compared to marrying between 20 and 25 years of age. Meanwhile, marriage after the 25 years of age increases the likelihood by 2%. Alas, this set of estimates is not significant at no level. In contrast, early pregnancy estimates suggests a higher likelihood for divorce by 8% while late pregnancy – after 25 years- indicates a lesser likelihood by 53%.

The first born effect states that the likelihood of divorcing tends to disappear after the first baby. My results are significant at the 1% level and indicate the opposite for the all categories: the higher the number of children, the less probability of divorcing. In the opposite vein, the education effect, which argues that educational attainment is a strong determinant of divorce, seems to sustain the argument. Late pregnancy and education are linearly correlated. The likelihood of divorce for primary graduates is 62% lower than for none education, and significant at the 5 % level; in contrast, secondary graduates and higher experience a higher likelihood for divorce by 39%, although not significant.

The effect of social class, measured by the occupation of the household head, seems to reduce the likelihood of divorce for high class members by 59% at the 5% level compared to the middle class. Lower class seem to experience a higher likelihood by a meager 5% compared to the middle class. In sum, social class may play a role to make a divorce decision, specially if a rich household is involved and living in rural areas, where wage earning labor opportunities are scarce for women. On the other hand, if a woman is currently employed, the likelihood to divorce is 53% less than to an unemployed individual; and bad years rises the likelihood of divorce by 143% at the 5% level. An interaction term

between unemployed and bad year indicates that the risk of divorce is 82% less in line with *Becker (1993)* ideas that marriage break up is responsive to economic conditions.

The New Concept is said to be the ability to overcome short-term economic stress and fulfill plans. Here, the covariates indicate that the ability to keep your marriage alive depends on:

- Age seems not to be a strong determinant of divorce. If marriage tends to occur before the age of 20 years, success in marriage is at risk. However, note that this estimate represents a social picture of the historical family values in the region.
- Pregnancy seems also not to be a strong determinant of divorce. The estimates represent the concentration of pregnancy below the age of 20 years, but it does not necessarily mean that early pregnancy raises the likelihood of marriage survival. As said above, estimates represent the value system towards marriage in Chocó.
- The first born effect seems to be the case in the region. The more kids one may have, the higher the likelihood for divorce.
- Education seems to influence the inclination for divorce and becomes more acute after becoming secondary graduate.
- High social status seems to be representative of an economic loss if divorce takes place. Likewise, being employed reduces the likelihood for divorce.

In sum, the increasing number of children in the household seem to foster divorce or at least that the male househead leaves the house honoring the migration option, specially in bad years. When bad years arrive, the chances of an unemployed woman to keep her marriage alive will not consider divorce as an option at all, but the more children in the household the more difficult it will be. This piece of evidence confirms that marriage survival may be responsive to changing economic conditions, specially if there are no other working options to make a living. Yet, the likelihood for divorce in bad years (143%) offsets any attempt not to divorce by unemployed mothers.

Table 7a: Results

number of subject	486	
failures	114	
log likelihood	-255	
Prob > chi2	0	p-value
Age at first marriage before the 20´s	0,67	0,23
Between 20 and 25 years	Ref	
After 25	1,02	0,97
Age at first birth below 20	1,08	0,8
	Ref	
Age at first birth from 20 onwards	0,47	0,32
Birth order 0-1	Ref	
Birth order 2-3	2,2	0
Birth order (more than 4)	3,5	0
None Education	Ref	
Some primary educ	0,82	0,61
Primary grad	0,38	0,05
Some secondary	0,91	0,82
Secondary grad + higher edu	1,39	0,37
Household head high status	0,41	0
Middle status	Ref	
Low status	1,05	0,81
Currently working (dummy=1)	0,47	0,22
Bad year (dummy=1)	2,43	0
I badyear*not working	0,18	0,01
ln_p	0,62	0
p	1,85	
1/p	0,53	

6. Conclusions and Summary

Conclusion

Malthus made clear the relationship between economics and population, but traditional multidimensional indexes and welfare studies confound this relationship. The process of reengineering demography in the last (60) sixty years has provided new thinking, methods and tools to address population changes and their socioeconomic determinants as indicators of living standards. My conclusion in this paper is that living standards measured by child and marriage survival have not improved despite the continuous good years of the national economy.

The poor population still experience higher likelihood of dying during good and it becomes worst during bad years what is common in good years. It seems there are other socio-economic determinants rather than income to relate to these deaths, but estimates only point out mothers with educational attainments below secondary level and the quality of toilet. In the same line, marriage survival seems to be at risk. As noted before, a declining share of GDP over time will reproduce continuously bad years even in good years for the rest of the economy, and although not currently working people will have a lower likelihood of divorce (82% less) than currently working in bad years, the probability for bad years (143%) offsets any attempt to avoid divorce. The higher number of children may speed the decision, and migration by the household head may be a response that affects marriage survival.

Summary

The research question asks whether living standards rise for the DHS survey population of Chocó during the period of 1975 and 2005 while Gross Domestic Product grew continuously and faster than population growth. A brief theoretical review made clear that there is a basis for new and alternative ways of addressing the measurement of living standards in the line of studies aimed at indicating the timing of demographic responses to changing conditions according to social class or life time, for instance. Building on these concepts, the micro approach developed by Bengtsson makes the connection between people´s life and their environment.

The new concept of Living Standards is an attempt to suggest that the ability to develop capabilities and enjoy functionings instead of the consumption of basket of goods is the true measure of living standards over a life´s time. Furthermore, the concept is decorated with a very gentle twist aimed at understanding the ability to fulfill own´s plans (e.g.survival, nuptiality and fertility) subject to short-term economic stress as an indicator of living standards. By short-term economic stress literature states that the impact of changing prices, GDP growth, harvest failure and other events that may jeopardize the access to resources in society. The new concept trumps the usual BNI, HDI, poverty line and similar indicators by being dynamic and not agglomerative, and as a result it ought to identify trends and timing of key demographic outcomes that are useful to policymakers to reduce poverty.

The criteria to choose the province of Chocó, Colombia, is guided by official statistics estimates expressing one of the worst health outcomes with Infant Mortality Rates doubling the national average; having the highest support ratio of dependence in the country which barely doubles the national average; being the poorest province with 4 times the average level of NBI: 81,9% and a declining share of 0,48% in GDP over the last 15 years. Furthermore, by 2005 more than 57% of the population still lives in rural settings as peasants working in small-scale units of production. This was Colombia´s urbanization share in 1973. Finally, although democratic elections occur, political lords have managed to remain in power and fail to provide the minimum basic public goods such as health, education and utilities. On the other hand, there are two important features: 74% of the population is black and Chocó is in the top ten (10) world places with the highest rainfall volume; consequently this

area is known for a heavy disease load represented on respiratory diseases, malaria and diarrhea for sanitation and health policies have been historically poorly managed.

Part of the data is taken from the Demographic and Health Survey (DHS), a quinquennial survey with a nationally representative sample of households beginning in 1990 and ending in 2005. The estimates are based on an unbalanced panel by location containing (4) four waves of cross-sectional data of a stock of female individuals, their children and partners in Chocó and secondary data such as GDP, being the latter an index that represents short-term economic stress. An unbalanced panel by location allows to conduct sub-national analysis, specially when sample size is relatively small as it was the case for DHS 1990/1995/2000. The pooling of observations implied that observations and outcomes are independently distributed across surveys, and the macro data was merged with the time series data by year of birth for child survival and year of divorce for marriage survival.

According to my case study, there is evidence to explain the impact of changes of economic conditions in the demographic response, mainly child survival and marriage survival. My results for infant and child survival have the right signs and specially the biological variables are highly significant. For low class infants and children, good years seem to keep the risk of dying above the middle and higher classes. The assertion is complemented using bad year as an interaction element with not currently working, and the risk of dying rises for infants and children of unemployed mothers is over 20%. In sum, the covariates indicate that on average the ability to survive for infants and children under 5 rises likelihood of survival by being a girl, not first born, a waiting time over 13 months between births, and in their mid-twenties; obviously, an additional woman in the household rises the likelihood by more than 20%. Electricity at home seems to be an advantage for survival as well, specially if a fridge, a radio and other goods can be purchased. Piped water in residence seems to not improve child survival, although its coverage is widening. Note alas that quality of water is not being measured here. Rich and middle income households guarantee child survival.

In sum, over time there has been a growing stock of many of the determinants that seem to increase the likelihood of survival in Chocó; biological variables, household characteristics and interaction terms between good/bad years, social status and current employment seem to become more pervasive in people´s life. Birth spacing, electricity and additional women in household seem to be playing an important role in reducing the risk of dying for infant and child survival.

Similarly, the second dimension of the New Concept in this paper is the ability to overcome short-term economic stress in marriage. Bad years seem to have a strong influence for divorce as women stay married, specially if they are in rich households. Covariates indicating that the ability to keep your marriage alive does not depend on age or early marriage; pregnancy seems also not to be a strong determinant of divorce. The estimates represent the concentration of pregnancy below the age of 20 years of age, but it does not necessarily mean that early pregnancy raises the likelihood of marriage survival. The first born effect seems to be the case in the region, and the more kids one may have, the higher the likelihood for divorce. Finally, education seems to influence the inclination for divorce and becomes more acute after becoming secondary graduate. In sum, Malthus would be happy to see that changing economic conditions may reduce fertility through divorce and that child survival is responsive to changing economic conditions for infant and children under 5.

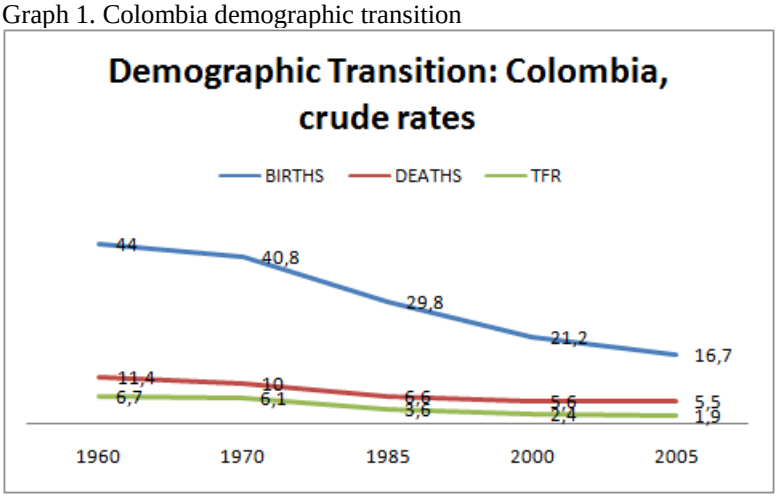
The importance of applying the micro approach lies in pointing out the vulnerable groups who suffer the economics of being poor in developing countries. Altough the attempt is to describe the process behind demographic responses under certain conditions rather than discover causal links, according to Mosley and Chen, Chocó is not an optimal case to analyze. However, it is not clear-cut how the scope of the premises affect the results of such studies. My models have tried to fit the available data and

have come with suggestive, but not conclusive model specifications, to analyze child and infant mortality and marriage survival subject to short-term economic stress, expressed by 3 year-moving averages of GDP per head. As noted before, place, time and age do play key roles, and these key roles make very ambiguous the identification of any theoretical benchmark to differentiate between statistical and practical significance.

ANNEX

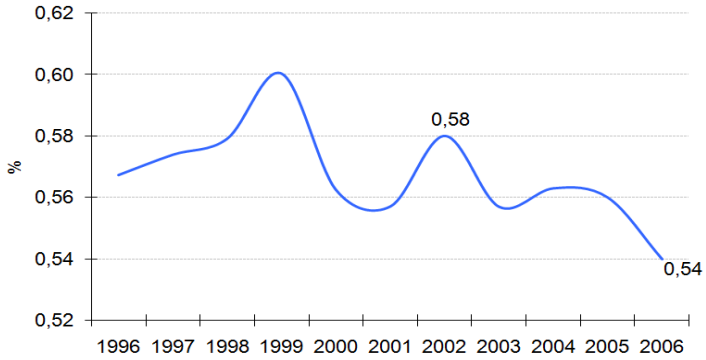
1. List of graphs

Graph 1. Colombia demographic transition



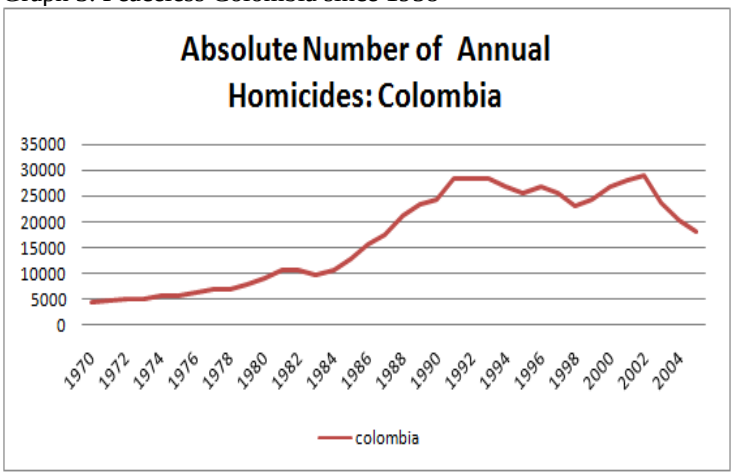
Source. UN, 2009

Graph 2. Gini Coefficient of Colombia



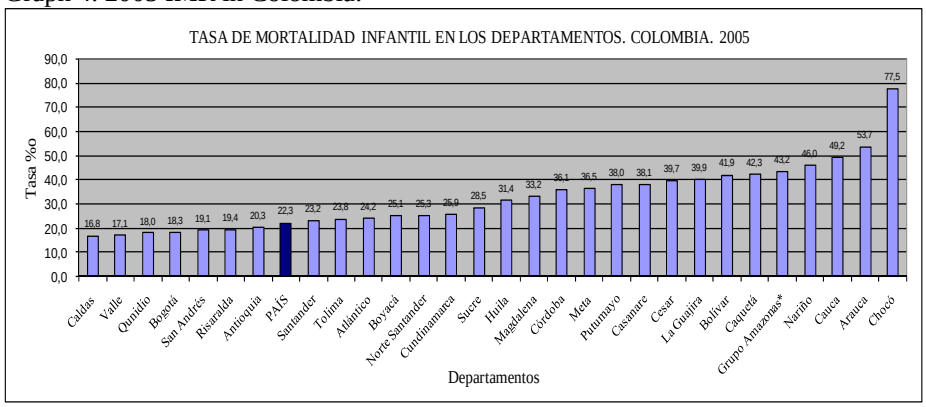
Source. Minproteccion Social Colombia, 2005

Graph 3. Peaceless Colombia since 1958



Source.Policia Nacional, 2005

Graph 4. 2005 IMR in Colombia:



Source. Minproteccion Social Colombia, 2005

Graph 5. Colombia´s Support Ratio

CONTRIBUCIÓN DE LA POBLACIÓN MENOR DE EDAD A LA DEPENDENCIA ECONÓMICA
COLOMBIA 2005

DEPARTAMENTO	<20	65+	20 a 64	Razón de dependencia por edad	Razón de dependencia >64	Razón de dependencia < 20
Antioquia	2.211.468	366.770	3.102.964	83,1	11,8	71,3
Atlántico	861.735	129.946	1.181.482	83,9	11,0	72,9
Bogotá, D.C.	2.418.900	380.057	4.055.771	69,0	9,4	59,6
Bolívar	818.190	108.193	953.491	97,2	11,3	85,8
Boyacá	510.317	103.756	622.429	98,7	16,7	82,0
Caldas	353.613	76.913	526.018	81,8	14,6	67,2
Caquetá	208.760	19.404	190.193	120,0	10,2	109,8
Cauca	548.501	89.555	630.807	101,1	14,2	87,0
Cesar	427.524	42.321	432.131	108,7	9,8	98,9
Chocó	237.208	24.018	194.426	134,4	12,4	122,0
Córdoba	668.030	85.891	722.752	104,3	11,9	92,4
Cundinamarca	917.421	162.158	1.194.285	90,4	13,6	76,8
Huila	453.124	61.355	498.394	103,2	12,3	90,9
La Guajira	349.377	31.026	304.992	124,7	10,2	114,6
Magdalena	527.997	61.094	558.762	105,4	10,9	94,5
Meta	341.092	39.783	396.537	96,1	10,0	86,0
Nariño	663.141	102.609	775.711	98,7	13,2	85,5
Norte de Santander	522.865	75.601	638.507	93,7	11,8	81,9
Nuevos departamentos*	466.115	50.714	571.570	90,4	8,9	81,5
Quindio	197.774	40.493	293.876	81,1	13,8	67,3
Risaralda	335.447	63.230	494.391	80,6	12,8	67,9
Santander	763.559	133.447	1.046.197	85,7	12,8	73,0
Sucre	344.672	47.619	380.648	103,1	12,5	90,5
Tolima	554.857	107.711	694.907	95,3	15,5	79,8
Valle del Cauca	1.576.770	289.782	2.288.170	81,6	12,7	68,9
TOTAL NACIONAL	17.278.457	2.609.420	22.012.871	90,3	11,9	78,5

FUENTE: estimaciones Minprotección Social, con base en DANE, Censo nacional de población, 2005

* *Nuevos departamentos: Arauca, Amazonas, Casanare, Guainía, Guaviare, Putumayo, San Andrés y Providencia, Vichada, Vaupés

Graph 6. BNI, Basic Need Index, Chocó & Colombia

RESULTADOS CENSO GENERAL 2005
Necesidades Básicas Insatisfechas - NBI, por total, cabecera y resto, según municipio y nacional a diciembre 31 de 2008.
COLOMBIA

Código Deapartamento	Nombre Departamento	Personas en NBI					
		Cabecera		Resto		Total	
		Prop (%)	cve (%)	Prop (%)	cve (%)	Prop (%)	cve (%)
00	TOTAL NACIONAL	19,64	0,40	53,53	0,15	27,78	0,23
27	CHOCO	81,90	0,60	76,80	-	79,58	0,34

DANE, Cuentas nacionales departamentales, 2009

Graph 7. Ethnic distribution by province (=departamentos) &

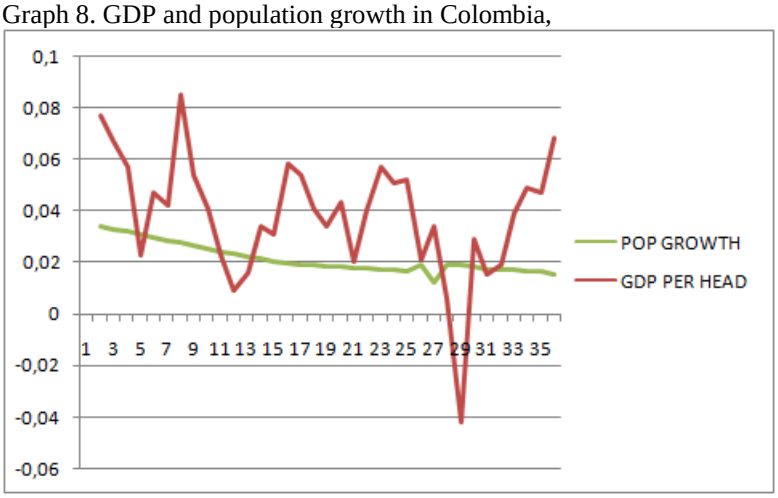
POBLACIÓN MENOR DE EDAD EN LAS MINORÍAS ÉTNICAS POR DEPARTAMENTOS
COLOMBIA 2005

DEPARTAMENTOS	Afrodescendientes		Indígenas		Otras minorías*		Sin identidad étinica		Sin información		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Antioquia	593.174	13,88	28.914	2,08	628	1,46	4.836.202	13,86	142.589	16,56	5.601.507	13,51
Atlántico	224.109	5,24	27.972	2,01	5.117	11,93	1.839.491	5,27	15.312	1,78	2.112.001	5,09
Bogotá, D.C.	96.523	2,26	15.032	1,08	1.885	4,39	6.450.329	18,48	214.922	24,96	6.778.691	16,35
Bolívar	491.364	11,50	2.066	0,15	7.214	16,82	1.301.650	3,73	34.346	3,99	1.836.640	4,43
Boyacá	16.602	0,39	5.859	0,42	58	0,14	1.174.296	3,36	14.167	1,65	1.210.982	2,92
Caldas	22.631	0,53	38.271	2,75	28	0,07	830.114	2,38	7.446	0,86	898.490	2,17
Caquetá	11.661	0,27	5.026	0,36	12	0,03	295.460	0,85	25.773	2,99	337.932	0,81
Cauca	255.839	5,99	248.532	17,85	184	0,43	648.730	1,86	28.737	3,34	1.182.022	2,85
Cesar	105.273	2,46	*44.835*	3,22	154	0,36	719.616	2,06	8.559	0,99	878.437	2,12
Chocó	285.964	6,69	*44.127*	3,17	48	0,11	18.160	0,05	40.177	4,67	388.476	0,94
Córdoba	191.797	4,49	151.064	10,85	283	0,66	1.110.321	3,18	9.444	1,10	1.462.909	3,53
Cundinamarca	73.517	1,72	7.401	0,53	164	0,38	2.105.457	6,03	42.143	4,89	2.228.682	5,37
Huila	11.516	0,27	10.335	0,74	30	0,07	962.988	2,76	16.607	1,93	1.001.476	2,42
La Guajira	91.674	2,15	278.212	19,98	100	0,23	249.149	0,71	36.808	4,28	655.943	1,58
Magdalena	110.186	2,58	9.045	0,65	164	0,38	1.003.728	2,88	13.696	1,59	1.136.819	2,74
Meta	17.911	0,42	8.988	0,65	75	0,17	675.816	1,94	10.982	1,28	713.772	1,72
Nariño	270.433	6,33	155.199	11,14	186	0,43	1.013.075	2,90	59.341	6,89	1.498.234	3,61
Norte de Santander	22.022	0,52	7.247	0,52	288	0,67	1.166.702	3,34	12.077	1,40	1.208.336	2,91
Nuevos departamentos**	37.265	0,87	113.920	8,18	23.506	54,80	689.835	1,98	53.606	6,23	918.132	2,21
Quindio	12.718	0,30	2.145	0,15	63	0,15	502.852	1,44	913	0,11	518.691	1,25
Risaralda	43.503	1,02	24.810	1,78	60	0,14	787.275	2,26	4.018	0,47	859.666	2,07
Santander	59.707	1,40	2.389	0,17	440	1,03	1.841.979	5,28	8.929	1,04	1.913.444	4,61
Sucre	121.624	2,85	82.934	5,96	173	0,40	552.270	1,58	5.262	0,61	762.263	1,84
Tolima	15.766	0,37	55.987	4,02	90	0,21	1.222.823	3,50	17.638	2,05	1.312.304	3,16
Valle Del Cauca	1.090.943	25,53	22.313	1,60	1.943	4,53	2.899.852	8,31	37.484	4,35	4.052.535	9,77
TOTAL NACIONAL	4.273.722	100,00	1.392.623	100,00	42.893	100,00	34.898.170	100,00	860.976	100,00	41.468.384	100,00

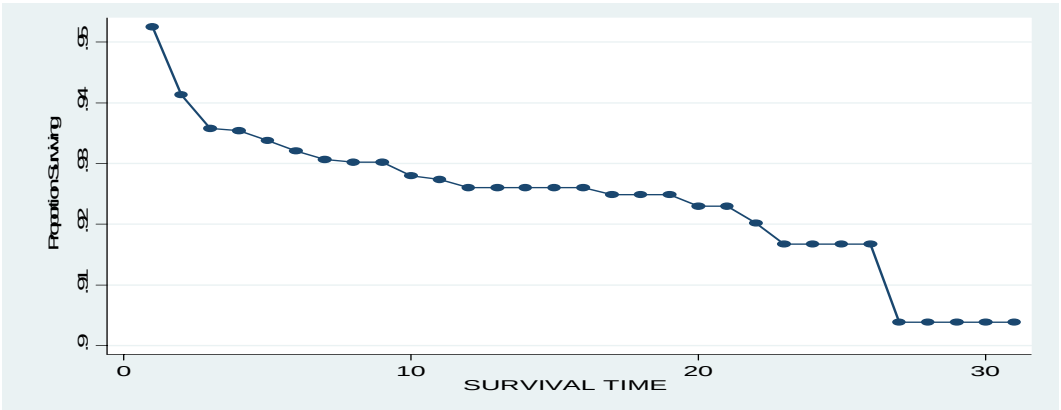
* Raizales, Rom. ** Guainía, Guaviare, Putumayo, Vichada, Vaupés, Arauca, Amazonas, San Andrés y Providencia

FUENTE: estimaciones Minprotección Social, con base en DANE Censo General 2005

Graph 8. GDP and population growth in Colombia,

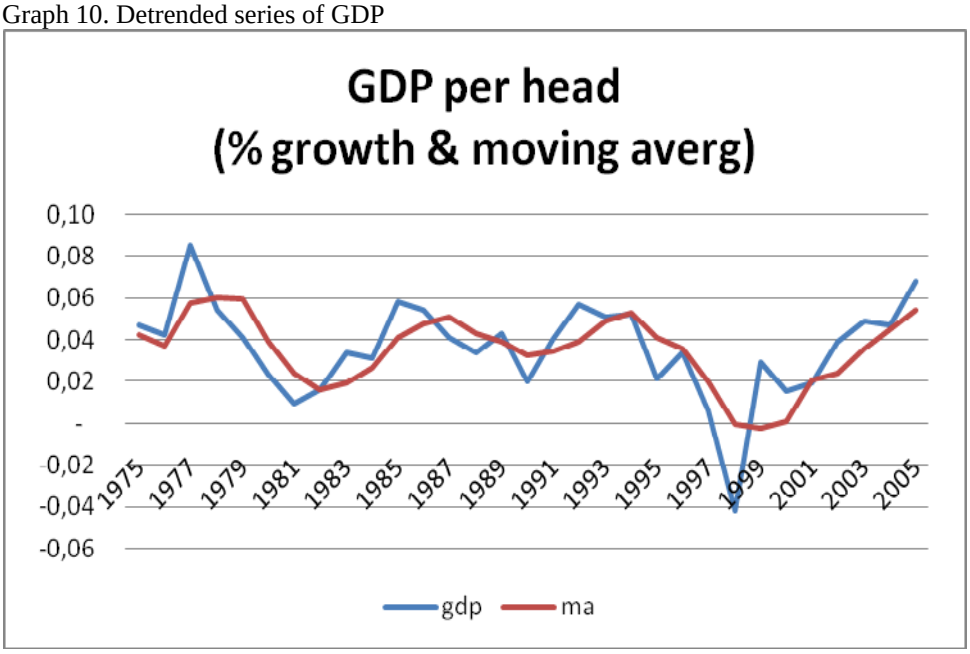


Graph 9. Life Table, Chocó, 1975-2005

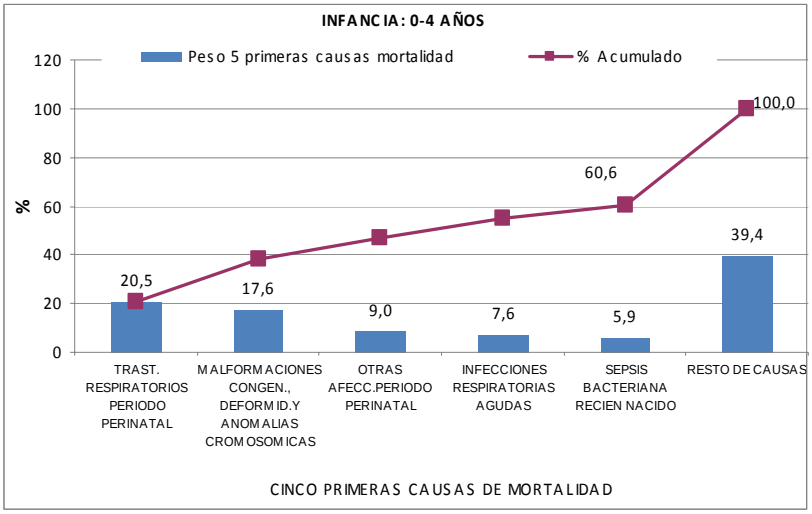


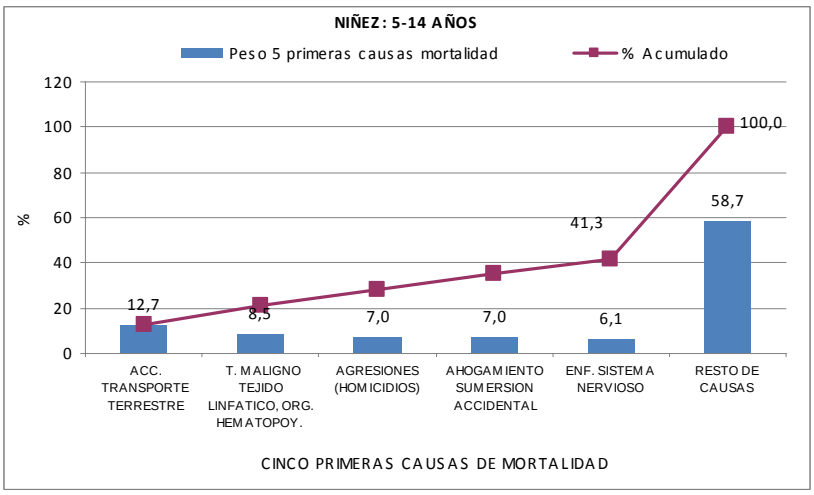
Interval		Beg. Total	Deaths	Lost	Survival	Std. Error	[95% Conf.	Int.]
0	1	3055	142	129	0.9525	0.0039	0.9443	0.9596
1	2	2784	32	129	0.9413	0.0043	0.9322	0.9492
2	3	2623	15	119	0.9358	0.0045	0.9263	0.9441
3	4	2489	1	127	0.9354	0.0045	0.9259	0.9437
4	5	2361	4	130	0.9338	0.0046	0.9242	0.9422
5	6	2227	4	111	0.9321	0.0047	0.9223	0.9407
6	7	2112	3	125	0.9307	0.0047	0.9208	0.9394
7	8	1984	1	120	0.9302	0.0048	0.9203	0.9390
8	9	1863	0	133	0.9302	0.0048	0.9203	0.9390
9	10	1730	4	126	0.9280	0.0049	0.9178	0.9369
10	11	1600	1	138	0.9274	0.0049	0.9171	0.9364
11	12	1461	2	131	0.9260	0.0050	0.9156	0.9352
12	13	1328	0	136	0.9260	0.0050	0.9156	0.9352
13	14	1192	0	128	0.9260	0.0050	0.9156	0.9352
14	15	1064	0	109	0.9260	0.0050	0.9156	0.9352
15	16	955	0	119	0.9260	0.0050	0.9156	0.9352
16	17	836	1	112	0.9249	0.0051	0.9142	0.9343
17	18	723	0	109	0.9249	0.0051	0.9142	0.9343
18	19	614	0	96	0.9249	0.0051	0.9142	0.9343
19	20	518	1	68	0.9230	0.0055	0.9115	0.9330
20	21	449	0	81	0.9230	0.0055	0.9115	0.9330
21	22	368	1	69	0.9202	0.0061	0.9073	0.9313
22	23	298	1	60	0.9168	0.0070	0.9020	0.9294
23	24	237	0	53	0.9168	0.0070	0.9020	0.9294
24	25	184	0	54	0.9168	0.0070	0.9020	0.9294
25	26	130	0	41	0.9168	0.0070	0.9020	0.9294
26	27	89	1	36	0.9038	0.0145	0.8710	0.9287
27	28	52	0	15	0.9038	0.0145	0.8710	0.9287
28	29	37	0	20	0.9038	0.0145	0.8710	0.9287
29	30	17	0	14	0.9038	0.0145	0.8710	0.9287
30	31	3	0	3	0.9038	0.0145	0.8710	0.9287

Graph 10. Detrended series of GDP



Graph 11. Primary causes of mortality by disease





2. List of Tables

Table 4: Expected effects of individual, household and intermediate variables on mortality by stages of life

	0-9 days	10-179 days	180-365 days	1-4 years
Biology				
Female	-	-	+/-	+
Male	Ref	Ref	Ref	Ref
First born	+	+	(+)	
Short & alive	+	+		
Short & dead	+	+	(+/-)	
Long & alive	Ref	Ref	Ref	Ref
Long & dead	(+/-)	(+/-)	(+/-)	(+/-)
Young mother	+	+		
Med. mother	Ref	Ref	Ref	Ref
High mother	+	(+)	(+)	
Hhold charact				
High class			(-)	-
Medium status	Ref	Ref	Ref	Ref
Low class			(+)	+
No Parents	++	++	+	+
Siblings	/	/	/	(+/-)
Food prices			(+)	+

+= higher risk; -=lower risk; /=var. not included () or +/-= uncertainty about the direction of the effect
Source: Bengtsson, Cameron & Campbell, p.372, 2004

Table 5: Percentage of women aged 20-24 who were single

Country and Census 1900	20-24	25-29	45-49
Belgium	71	41	17
Sweden	80	52	19
France	58	30	12
Greece	44	13	4
Bulgaria	24	3	1
Serbia	16	2	1
India	5	2	1
Japan	31	9	2

Sources: Hajnat, p.102-104, 1965

Table 6: Percentage of women aged 20-24 who married as adolescents, by age at marriage

Country and Survey year	Age 15	Age 18	Age 20	Median age at first marriage
Kenya, 1993	5	28	46	18,8
Tanzania 1991-93	7	37	61	17,9
Sudan, 1989-90	12	27	37	17,8
India, 1992-93	18	51	70	16,1
Sri Lanka, 1987	1	14	28	22,4
Brazil, 1996	4	22	40	21,2
Colombia, 1990	3	22	37	21,2
France, 1994	0	11	32	22,5
Japan, 1992	0	0	2	26,4

Sources: DHS in Singh & Samara, p.151, 1996

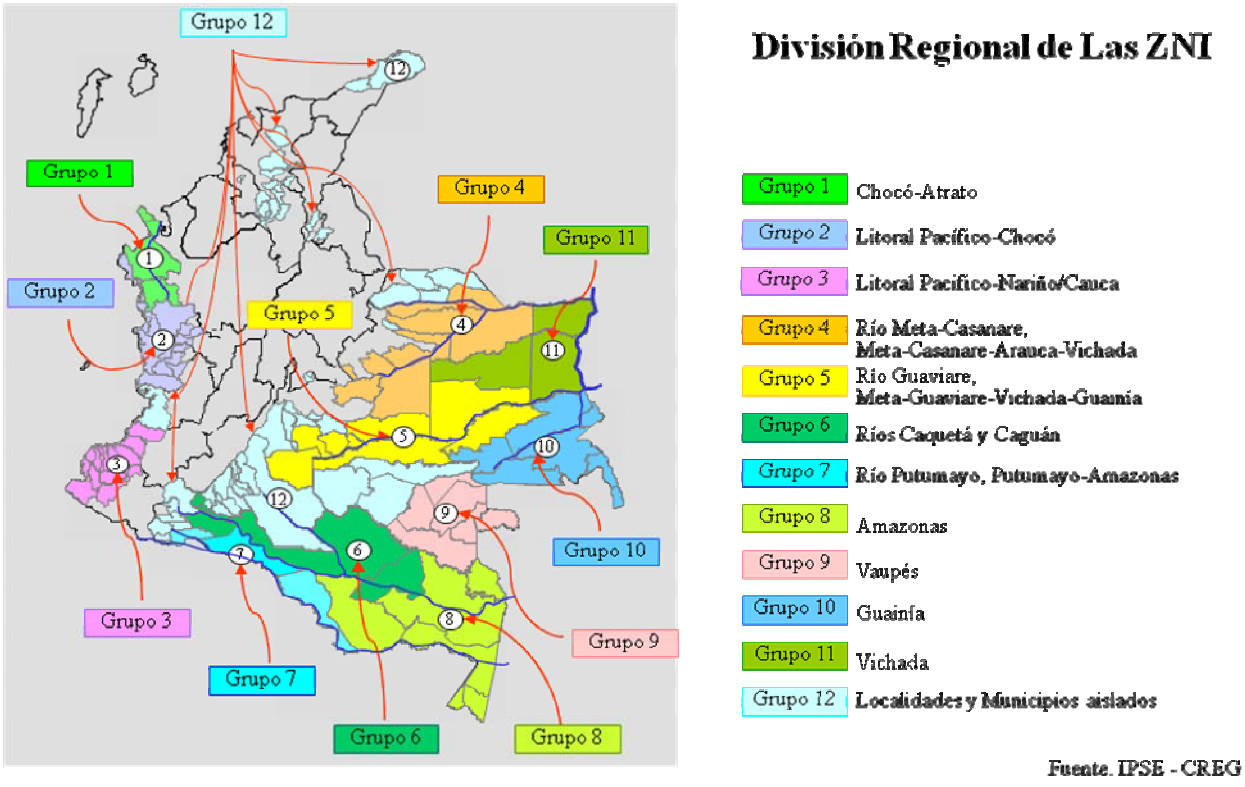
Table 7: Tabulation of dead and sex

```
tab DEAD sexdum

           |        sexdum
     EVENT |         0          1 |     Total
-----------+----------------------+----------
         0 |     1,448      1,393 |     2,841
         1 |       129         85 |       214
-----------+----------------------+----------
     Total |     1,577      1,478 |     3,055
```

3. List of maps

Map 1: Non interconnected areas (see group 1 for Chocó)



4. Dataset

year	Chocos GDP share in national GDP
1990	0,48
1991	0,43
1992	0,45
1993	0,42
1994	0,41
1995	0,42
1996	0,4
1997	0,41
1998	0,41
1999	0,4
2000	0,38
2001	0,38
2002	0,35
2003	0,37
2004	0,38
avr	0,406
annual grate	-0,01545

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